

# UNIFIED FACILITIES CRITERIA (UFC)

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## DESIGN: ENGINEERING WEATHER DATA



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## UNIFIED FACILITIES CRITERIA (UFC)

### DESIGN: ENGINEERING WEATHER DATA

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER CENTER

Record of Changes (changes are indicated by \1\ ... /1/)

| Change No. | Date        | Location  |
|------------|-------------|---|
| 1          | 09 Jan 2024 | <u>Updated ASHRAE 90.1 reference in paragraph 1-1; paragraph 2-10.1.3; and Appendix A References.</u> |
|            |             |   |
|            |             |   |
|            |             |   |
|            |             |   |

## FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD \(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Center (AFCEC) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: [Criteria Change Request](#). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source: Whole Building Design Guide website <http://dod.wbdg.org/>.

Refer to UFC 1-200-01, *DoD Building Code (General Building Requirements)*, for implementation of new issuances on projects.

### AUTHORIZED BY:



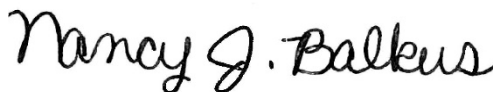
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**UNIFIED FACILITIES CRITERIA (UFC)  
REVISION SUMMARY SHEET**

**Document:** UFC 3-400-02, *DESIGN: ENGINEERING WEATHER DATA*

**Superseding:** UFC 3-400-02, dated 28 February 2003

**Description:** The purpose of this document is to provide an overview of and instructions for access to climate data available for use by engineers designing government structures. Final selection of sites was based upon availability of climate data. Most are located at military installations supporting airfield operations, or at local airports/airfields. This UFC is applicable to all service elements and contractors involved in the planning, design and construction of DoD facilities worldwide.

**Reasons for Document:**

- To update document to include new procedures for accessing weather data, new selection sites, new design values and new format.

**Impact:**

- There are no impacts.

**Unification Issues**

None.

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## **CHAPTER 1 INTRODUCTION**

### **1-1 PURPOSE AND SCOPE.**

The purpose of this document is to provide an overview of and instructions for access to climate data available for use by engineers designing government structures.

The 14th Weather Squadron (14 WS), formerly AFCCC, compiled Engineering Weather Data (EWD) at the request of the Air Force Civil Engineering Center (AFCEC). Sites were identified by AFCEC, US Army Corps of Engineers (USACE), and the Naval Facilities Engineering Command (NAVFAC). Final selection of sites was based upon availability of climate data. Most are located at military installations supporting airfield operations, or at local airports/airfields. Non-DoD requests may be satisfied from a private consulting meteorologist or from NOAA's National Centers for Environmental Information (NCEI, formally the National Climatic Data Center). Each site's EWD is presented as a PDF. To comply with 1\ ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* (Refer to UFC 1-200-02, for applicable publication date) /1/, the 14 WS has added a separate comma separated values file containing all cooling degree-day data based on 50°F for all sites. Paragraph in Chapter 2 entitled "Alternate Cooling Degree-Days Calculation" covers the use of this file in more detail. Bin Temperature Data .csv files are suitable for importing into Microsoft® Excel.

### **1-2 APPLICABILITY.**

This UFC is applicable to all service elements and contractors involved in the planning, design and construction of DoD facilities worldwide.

### **1-3 GENERAL BUILDING REQUIREMENTS.**

Comply with UFC 1-200-01, *DoD Building Code (General Building Requirements)*. UFC 1-200-01 provides applicability of model building codes and government unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, high performance and sustainability requirements, and safety. Use this UFC in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

### **1-4 REFERENCES.**

Appendix A contains a list of references used in this document. The publication date of the code or standard is not included in this document. Unless otherwise specified, the most recent edition of the referenced publication applies.

### **1-5 GLOSSARY.**

Appendix C contains acronyms, abbreviations, and terms.

## **1-6 ACCESSING EWD.**

### **1-6.1 Retrieving data for .mil domain users.**

1. Access <https://www.climate.af.mil/>.
2. A Common Access Card (CAC) is required to access the 14th Weather Squadron's web site. If you do not have one, call 828-271-4291 to request an EWD or send an email request to 14WS\_SAR@us.af.mil.
3. A CAC user can also electronically submit a Support Assistance Request by clicking on the "Request Support" tab at the top of the 14 WS website.

### **1-6.2 Retrieving Data for Non-DoD (non CAC) Users.**

Non-DoD users (e.g., contractors) may access data from the 14 WS if they are working on a DoD contract. If so, follow these instructions:

1. Fill out the Sample SAR Form in Appendix D, and send an email requesting support to 14WS\_SAR@us.af.mil. This email inbox is monitored Monday –Friday 0730-1630 with the exception of holidays.
2. Pay particular attention to the fields requesting a complete description of the information being requested (e.g., site location and coordinates), a suspense date, a statement about how the data applies to the mission and the contract number.
3. The 14 WS must be able to verify that the contractor is working on a valid DoD contract before providing the information. The 14 WS will then e-mail the appropriate PDF file for the site requested. Non-DoD contractors and vendors must contact the National Centers for Environmental Information (NCEI, formally NCDC) to purchase the Engineering Weather Data (EWD).
4. Retrieving data for unlisted sites. If a station is not in the EWD list, fill out the 14 WS Support Assistance Request (SAR) form (example in Appendix D) and pay particular attention to the fields requesting a complete description of the information being requested (e.g., site location and coordinates), a suspense date, a statement about how the data applies to the mission, and the contract number.

## CHAPTER 2 DATA DESCRIPTION AND APPLICATIONS

### 2-1 INTRODUCTION.

This chapter summarizes each page in a typical site data set and provides guidance for using the data.

### 2-2 DATA SET PAGE 1: CLIMATE SUMMARY.

Figure 2-1 is a sample of Data Set Page 1, which summarizes the site's climate.

#### 2-2.1 Location Information.

This section of Data Set Page 1 contains a summary table that includes site name, location, elevation (above mean sea level), period of record (POR), and average (atmospheric) pressure not corrected to sea level (higher elevations result in lower pressures). The POR is the time frame over which the data used to compute the statistics in this document were compiled.

#### 2-2.2 Design Values.

##### 2-2.2.1 Explanation of Design Values.

Design values are provided for dry bulb temperature, wet bulb temperature, and humidity ratio at specific percentile frequencies of occurrence. The design values of 0.4%, 1%, and 2% are based on the entire year. The winter design values of 99.6%, 99%, and 97.5% are also based on the entire year. In other words, the design values are annual values, not seasonal values. These design values were instituted for several reasons. At some locations, the warmest or coldest months of the year do not fall into the months listed above. It is easier to compare locations that are in tropical or marine climates where there is less seasonal variability. It is also more straightforward to compare southern hemisphere locations.

**Figure 2-1 Sample Data Set Page 1**

| <b>SCOTT AFB MIDAMERIC</b><br>Latitude = 38.55 N<br>Longitude = 89.84 W<br>Period of Record = 1985 To 2014 |                                  |                           |                        |                  |                             |
|--|----------------------------------|---------------------------|------------------------|------------------|-----------------------------|
| Station ID = ICAO_KBLV<br>Elevation = 459 Feet<br>Average Pressure = 29.55 inches Hg                       |                                  |                           |                        |                  |                             |
| Dry Bulb Temperature (T)   | Mean Coincident (Average) Values |                           |                        |                  |                             |
|  | Design Value (°F)                | Wet Bulb Temperature (°F) | Humidity Ratio (gr/lb) | Wind Speed (mph) | Prevailing Direction (NSEW) |
| Median of Extreme Highs  | 100                              | 77                        | 105                    | 7.8              | VRB                         |
| 0.4% Occurrence  | 95                               | 78                        | 118                    | 7.7              | S                           |
| 1.0% Occurrence  | 93                               | 77                        | 116                    | 8                | S                           |
| 2.0% Occurrence  | 90                               | 76                        | 112                    | 8.1              | S                           |
| Mean Daily Range   | 20                               | -                         | -                      | -                | NW                          |
| 97.5% Occurrence   | 18                               | 17                        | 10                     | 8.5              | NW                          |
| 99.0% Occurrence   | 11                               | 10                        | 7                      | 7.9              | NW                          |
| 99.6% Occurrence   | 7                                | 6                         | 5                      | 8.3              | N                           |
| Median of Extreme Lows   | 0                                | -1                        | 4                      | 7.6              | NNW                         |

| Wet Bulb Temperature ( $T_{wb}$ ) | Design Value (°F) | Dry Bulb Temperature (°F) | Humidity Ratio (gr/lb) | Wind Speed (mph) | Prevailing Direction (NSEW) |
|-----------------------------------|-------------------|---------------------------|------------------------|------------------|-----------------------------|
| Median of Extreme Highs           | 83                | 92                        | 153                    | 7.4              | S                           |
| 0.4% Occurrence                   | 81                | 91                        | 143                    | 7.2              | S                           |
| 1.0% Occurrence                   | 79                | 88                        | 134                    | 7                | S                           |
| 2.0% Occurrence                   | 78                | 87                        | 130                    | 7                | S                           |

| Humidity Ratio (HR)     | Design Value (gr/lb) | Dry Bulb Temperature (°F) | Vapor Pressure (in. Hg) | Wind Speed (mph) | Prevailing Direction (NSEW) |
|-------------------------|----------------------|---------------------------|-------------------------|------------------|-----------------------------|
| Median of Extreme Highs | 161                  | 87                        | 1.05                    | 6.3              | S                           |
| 0.4% Occurrence         | 144                  | 85                        | 0.94                    | 6.8              | S                           |
| 1.0% Occurrence         | 141                  | 83                        | 0.93                    | 4.9              | VRB                         |
| 2.0% Occurrence         | 134                  | 84                        | 0.88                    | 6.1              | S                           |

| Air Conditioning/<br>Humid Area Criteria | Threshold  | $T \geq 93^{\circ}\text{F}$ | $T \geq 80^{\circ}\text{F}$ | $T_{wb} \geq 73^{\circ}\text{F}$ | $T_{wb} \geq 67^{\circ}\text{F}$ |
|--|------------|-----------------------------|-----------------------------|----------------------------------|----------------------------------|
|  | # of Hours | 99                          | 1053                        | 896                              | 2050                             |

#### Other Site Data

| Weather Region                                     | Rain Rate<br>100 Year Recurrence<br>(in./hr) | Basic Wind Speed<br>3 sec gust @ 33 ft<br>50 Year Recurrence (mph) | Ventilation Cooling Load Index<br>(Ton-hr/cfm/yr) Base 75°F-RH 60%<br>Latent + Sensible |
|--|--|--|---|
| 7  | 3.3  | 90   | 3.7 + 1.1   |
| Ground Water<br>Temperature (°F)<br>50 Foot Depth* | Frost Depth<br>50 Year Recurrence<br>(in)    | Ground Snow Load<br>50 Year Recurrence<br>(lb/ft <sup>2</sup> )    | Average Annual<br>Freeze-Thaw Cycles<br>(#)   |
| 58.6   | 38   | 20   | 55  |

\*Note: Temperatures at greater depths can be estimated by adding 1.5 °F per 100 feet additional depth.

SCOTT AFB MIDAMERICA IL Page (1 of 18)

### 2-2.2.2 Dry Bulb Temperature.

#### 2-2.2.2.1 Median of Extreme Highs (or Lows).

The dry bulb temperature extreme high (or low) is determined for each calendar year of the POR along with the coincident values for wet bulb temperature, humidity ratio, wind speed, and prevailing wind direction. Median values are determined from the distribution of extreme highs (or lows).

#### 2-2.2.2.2 0.4%, 1.0%, 2.0%, 97.5%, 99.0%, and 99.6% Dry Bulb Design Values.

Listed is the dry bulb temperature corresponding to a given annual cumulative frequency of occurrence and its respective mean coincident values for wet bulb temperature, humidity ratio, wind speed, and prevailing wind direction. The dry bulb temperature listed represents the value that was exceeded for the respective percent of time over the entire POR. For example, the 1.0% occurrence design value temperature (92 °F) has been exceeded only 1 percent of the time during the entire POR. All the

observations occurring within one degree of the design value are grouped, and the Mean Coincident (Average) Values for Wet Bulb Temperature, Humidity Ratio, and Wind Speed are calculated. The prevailing wind direction (the “mode” of the wind direction distribution) is also calculated.

#### **2-2.2.2.3 Mean Daily Range.**

The mean daily range (difference between daily maximum and daily minimum temperatures) is the average of all daily dry bulb temperature ranges for the POR.

### **2-2.3 Wet Bulb Temperature.**

#### **2-2.3.1 Median of Extreme Highs.**

The Median of Extreme Highs value for wet bulb temperature is the highest annual extreme wet bulb temperature averaged over the POR. The corresponding Mean Coincident (Average) Values are determined the same way as for the respective values for dry bulb temperature.

#### **2-2.3.2 0.4%, 1.0 %, 2.0% Wet Bulb Temperature Design Values.**

The design values listed and the corresponding Mean Coincident (Average) Values are determined the same way as for dry bulb temperature, described in 2-2.2.2.2.

### **2-2.4 Humidity Ratio.**

#### **2-2.4.1 Median of Extreme Highs.**

The value for humidity ratio is the highest annual extreme averaged over the POR. The corresponding Mean Coincident (Average) Values are determined the same way as described in 2-2.2.2.2.

#### **2-2.4.2 0.4%, 1.0%, and 2.0% Humidity Ratio Design Values.**

Design values are provided for humidity ratio and the corresponding Mean Coincident (Average) Values for dry bulb temperature, vapor pressure, wind speed, and wind prevailing direction.

### **2-2.5 Air Conditioning/Humid Area Criteria.**

These are the number of hours, on average, that dry bulb temperatures of 34 °C (93 °F) and 27 °C (80 °F) and wet bulb temperatures of 23 °C (73 °F) and 19 °C (67 °F) are equaled or exceeded during the year.

### **2-2.6 Other Site Data.**

This information is provided **for general reference only, and should not be used as the basis for design**. There are some locations for which this data is not available. In these cases, that portion of the table will be left blank.

### **2-2.6.1 Weather Region.**

Eleven weather regions have been developed by the Department of Energy. They are defined by the range of cooling-degree days and heating-degree days based on 65 °F. ASHRAE/IESNA Standard 90.1 of 2001 uses annual HDD65 (Heating Degree Days based on 65 °F) and CDD50 (Cooling Degree Days based on 50 °F) to select the appropriate Building Envelope Requirements table for energy conservation design. Refer to paragraph 2-10 for further explanation of this data.

### **2-2.6.2 Ventilation Cooling Load Index.**

The Ventilation Cooling Load Index (VCLI) is a two-part index that defines the total annual cooling load for ventilation air by calculating sensible heat load separately from the latent heat load (moisture). The results are expressed in ton-hours per cubic feet per minute per year of latent and sensible load. Values for sensible heat load are calculated by comparing the outdoor temperature to indoor conditions (75 °F and 60% relative humidity [RH]), and calculating how much energy is required to bring the outdoor air to the indoor temperature. The latent load is calculated similarly. Separate calculations are made for each hour of the year and then summed to form the annual VCLI.

### **2-2.6.3 Average Annual Freeze-Thaw Cycles.**

This value is the average number of times per year that the air temperature first drops below freezing and then rises above freezing, regardless of the duration of either the freezing or thawing. The number of cycles is summed per year and averaged over the entire POR. Days with high temperatures or low temperatures at 0 °C (32 °F) are not counted for a freeze- thaw cycle. A cycle is counted only when the temperature drops below freezing (-0.5 °C [-31 °F] or colder) or goes above freezing (0.5 °C [33 °F] or warmer).

### **2-2.6.4 Other Values.**

The following values are derived from sources other than the 14 WS. Engineers and architects should review the publications listed below and contact the organizations for current values, including background information and complete guidelines for use of these data elements.

#### **2-2.6.4.1 Groundwater.**

National Ground Water Research and Educational Foundation  
601 Dempsey Road  
Westerville OH 43081-8978  
(800) 551-7379  
<http://www.ngwa.org/>

NOTE: Average groundwater temperature parallels long-term average air temperature, because soil at a depth of 15 meters (50 feet) does not undergo significant temperature

change over the course of a year. Soil temperature at 15 meters stays slightly warmer than average annual air temperature by approximately 1.4 °C (2.5 °F).

#### **2-2.6.4.2 Rain Rate.**

*International Plumbing Code*  
International Code Council  
4051 West Flossmoor Road  
Country Club Hills IL 60478  
(888) 422-7233  
<http://www.iccsafe.org/>

#### **2-2.6.4.3 Frost Depth, Basic Wind Speed, Ground Snow Loads.**

*ANSI/ASCE 7-95, Minimum Design Loads for Buildings and Other Structures*  
American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, VA 20191  
(800) 548-2723  
<http://www.asce.org/>

NOTE: Use UFC 3-301-01, *Structural Engineering*, for reference on some frost depth and ground snow load values.

### **2-2.7 Suggestions for Use.**

The dry bulb, wet bulb, and humidity ratio values in Figure 2-1 are peak load conditions and are used for sizing mechanical equipment. Design guidance determines the frequency of occurrence design is to be based upon.

#### **2-2.7.1 Dry Bulb Temperature.**

The 0.4% dry bulb temperature value is seldom used for sizing conventional comfort control systems but is sometimes appropriate for mission-critical systems where equipment failure due to high heat would be unacceptable. Using the 0.4% value for equipment sizing requires that the engineer consider its operation at less-than-peak design conditions. In the past, oversized cooling equipment has been incapable of modulating during the more common range of operating conditions, yielding comfort control problems. Also, over-sized equipment cycles on and off more frequently, increasing maintenance costs and failing to remove enough moisture to maintain humidity control.

##### **2-2.7.1.1 Design for Extreme Conditions.**

Similar special considerations apply to the extreme low dry bulb temperature. Heating equipment designed for extreme conditions must be evaluated carefully to ensure that it will modulate properly to maintain comfort at less extreme outdoor temperatures that occur in 99.6% of the hours during the year.



### **2-2.7.1.2 Design of Humidity Control Systems.**

The mean coincident value for humidity at the 0.4% peak dry bulb temperature is not the highest moisture value and must not be used for design of humidity control systems. The mean coincident value is the arithmetic average of all the moisture levels that occur when the dry bulb temperature is high; however, the highest moisture values typically occur when the dry bulb temperatures are lower.

### **2-2.7.2 Wet Bulb Temperature.**

High wet bulb temperature is used for sizing cooling towers and other evaporative equipment.

### **2-2.7.3 Peak Humidity Ratio.**

Peak humidity ratio is used for sizing dehumidification systems. Peak moisture condition usually represents a higher enthalpy (total heat) than peak dry bulb condition. Consequently, engineers use the peak moisture condition to cross-check operation of a system that may be primarily intended to control temperature.

### **2-2.7.4 Coincident Wind Speed.**

Coincident wind speed allows the engineer to accurately estimate latent loads due to infiltration of humid air in the summer and of dry air in the winter.

NOTE: The same precautions that apply to heating and cooling equipment also apply to dehumidification and humidification systems. Oversized equipment may not control properly under typical operating conditions without special attention from the engineer.

## **2-3 DATA SET PAGE 2: AVERAGE ANNUAL CLIMATE.**

Figure 2-2 is an example of Data Set Page 2, a graph summarizing the site's average annual climate.

### **2-3.1 Explanation of Graph.**

The graph on Data Set Page 2 shows the site's monthly mean temperature, dew point, and precipitation. The bar graph representing precipitation uses the scale on the right side of the chart (inches or centimeters). Lines of temperature and dew point use the scale on the left side of the chart (degrees Fahrenheit or Celsius). These charts have fixed maximum and minimum values on their axes for easy comparison between different sites. The precipitation chart is capped at a maximum of 45 centimeters (15 inches) per month. A few sites may exceed this value, but to keep the graph readable, a fixed maximum value was used. For a number of sites, no accurate precipitation data was available. In those cases, no bars appear on the chart.

## **2-3.2        Suggestions for Use.**

### **2-3.2.1      Comparisons.**

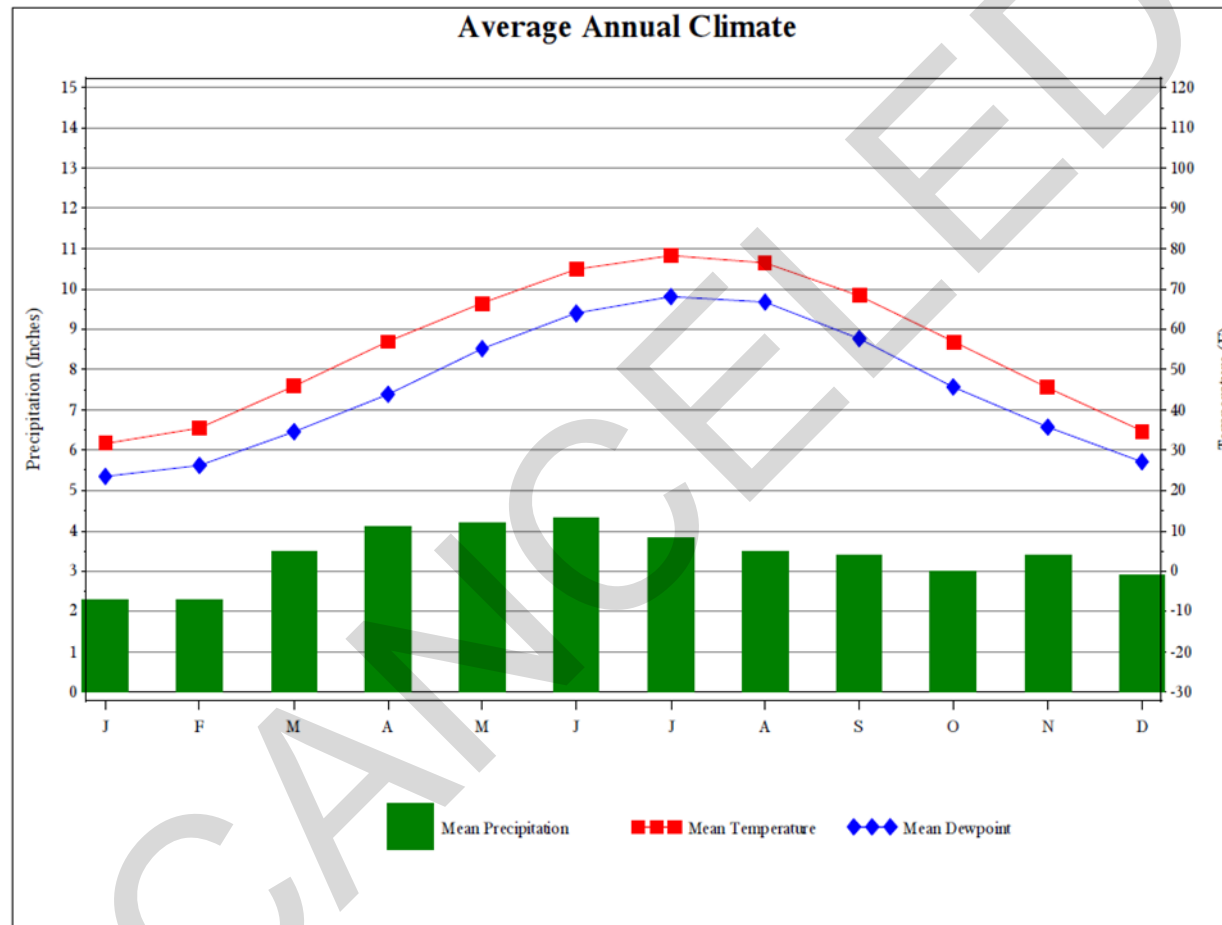
The Data Set Page 2 graph displays the average behavior of weather over a single year. An architect can compare rainfall patterns at one station with another and also the relative importance of water resistance for the exterior envelope. An engineer can compare the temperature and moisture patterns to understand the relative importance of sensible heat loads rather than latent loads at this location.

### **2-3.2.2      Seasonal Variations.**

With averages displayed by month, it is relatively easy to comprehend seasonal variation of each variable, and also to understand which specific months are likely to be hot or cold, humid or dry, or have high precipitation. This can be helpful for mission planning, as well as for planning construction and building operation.

NOTE: This graph displays averages, not design or extreme values. Data shown should not be used to determine equipment capacities or thermal characteristics of building envelopes.

Figure 2-2 Sample Data Set Page 2



## **2-4 DATA SET PAGE 3: 30-YEAR PSYCHROMETRIC SUMMARY.**

Figure 2-3 is an example of Data Set Page 3, a graph summarizing the site's psychrometric data.

### **2-4.1 Explanation of Graph.**

#### **2-4.1.1 Joint-Frequency Table.**

The graph displays the joint cumulative percent frequency of temperature and humidity ratio. Hourly observations are grouped into bins of 5 Fahrenheit degrees and 10 grains per pound (gr/lb) (or 3 Celsius degrees and 1.5 grams per kilogram [g/kg]), centered on each value of temperature or humidity ratio. For example, the 70 °F temperature bin collects all observations between 67.5 °F and 72.5 °F. The bin is depicted as a gridline on the chart; the vertical lines represent the temperature bins and the horizontal lines represent the humidity ratio bins. The intersection of temperature and humidity ratio lines represent a further subdivision of the observations into groups meeting both temperature and humidity ratio criteria. For example, the intersection of the 70 °F bin line and the 40 gr/lb bin line represent the observations when temperature was between 67.5 °F and 72.4 °F and the humidity ratio was between 35 gr/lb and 44 gr/lb. Thus, a joint-frequency table is created for all temperature and humidity ratio bin combinations.

NOTE: The psychrometric graph is intended as a visual tool only. Its purpose is to allow a quick visual comparison between climates at different locations. Extrapolation of data directly from the graph is not advised due to the approximate plotting routine used to generate the graph from the binned data. This is evident where values of humidity appear past their saturation point. This discrepancy between the actual data and the graph is the result of the plotting routine used to generate the graph and not from errors in the original hourly data used to create the binned summary.

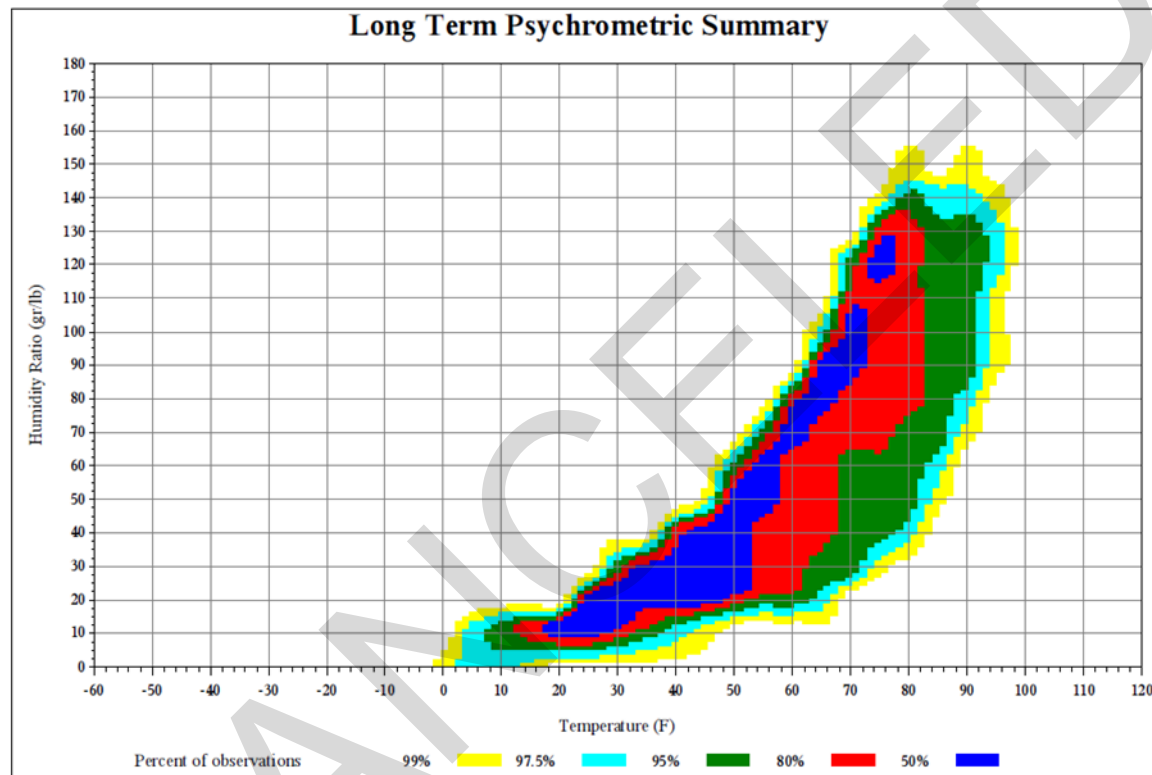
#### **2-4.1.2 Contours.**

The contours on this chart represent the areas containing 99%, 97.5%, 95%, 80%, and 50% of all observations (cumulative percent frequency or percentiles). The contours are centered on the most frequently occurring bins (50% contour), spreading outward until almost all observations (99%) are grouped. Contours are defined by calculating a percent frequency for each bin (relative to the others), and then accumulating these percent frequencies (from most frequent to least frequent) until the 50% value is passed, and thus the first set of bins is grouped. The accumulating continues until the 80% value is passed, and the second group of bins is grouped. This process continues until the 95%, 97.5%, and 99% values are passed.

#### **2-4.1.3 Least Frequent (Most Extreme) Bins.**

Consequently, the least frequent (most extreme) bins, which when accumulated amount to less than 1 percent of the total observations, are outside of the 99% contour. Any bins outside the 99% contour thus have either not occurred, or have occurred so infrequently that they should not be taken into consideration for sizing equipment.

Figure 2-3 Sample Data Set Page 3



## **2-4.2            Suggestions for Use.**

### **2-4.2.1        Most Common Temperature and Moisture Conditions.**

The Data Set Page 3 graph displays the long-term history of temperature and moisture at each station (a total of 262,800 hourly observations if the POR is 30 years and if the data is complete over that period). The engineer can use this graph to ascertain the most common temperature and moisture conditions that will be encountered over the operating life of the mechanical equipment.

### **2-4.2.2        Ensure Modulation and Control Capability.**

It is often useful to calculate the behavior of the proposed system at “most common” conditions and assess these calculations in addition to the traditional peak design calculations. This will help ensure that the selected equipment and controls are capable of modulation and control at all points of operation rather than simply at extreme conditions.

## **2-5            DATA SET PAGE 4: PSYCHROMETRIC DISPLAY OF DESIGN VALUES.**

Figure 2-4 is an example of Data Set Page 4, a psychrometric display of the site’s design values.

### **2-5.1           Saturation Curve.**

Similar to Data Set Page 3, this chart depicts the saturation curve (when RH = 100%) along with peak design values. The design values are calculated as in the table on Data Set Page 1 (Figure 2-1), but this chart shows their relationships graphically, depicting their position relative to each other and relative to the saturation curve.

### **2-5.2           Observations.**

Above and to the left of the saturation curve, RH would be greater than 100% (not possible). The area below and to the right of the curve (including the points on the curve itself) represent the area where RH is less than or equal to 100%, and thus where all observations occur. Note that since the humidity ratio is a function of pressure, and pressure varies with elevation, different sites will have different saturation curves.

### **2-5.3           Scatter Plot.**

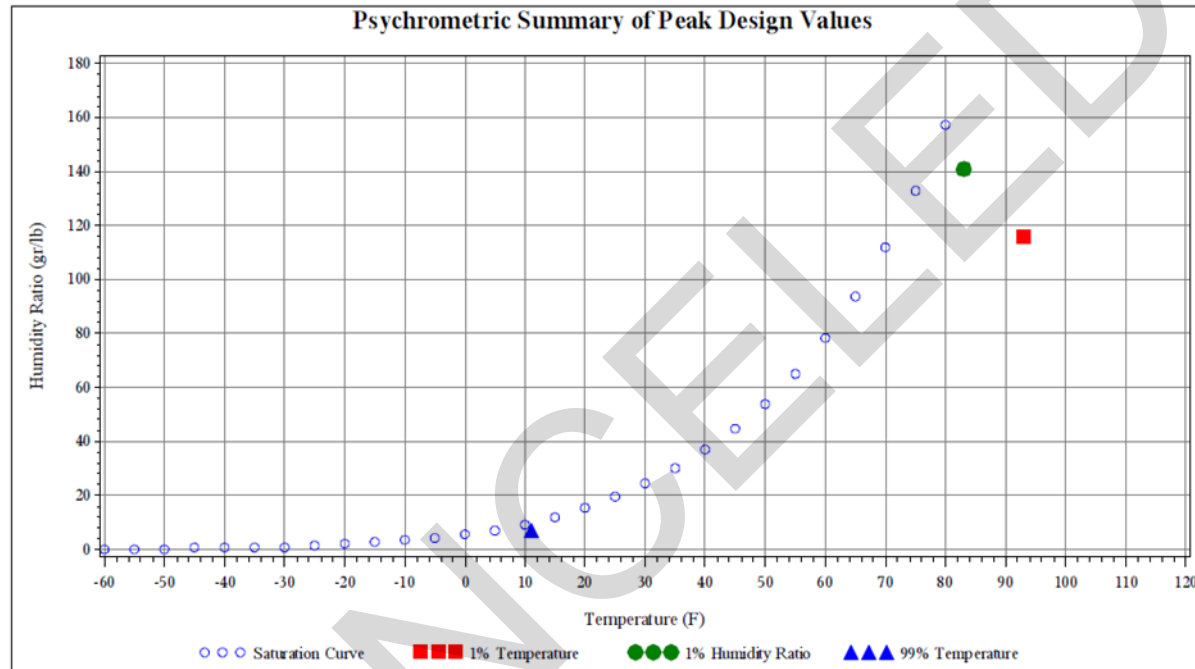
The dry bulb temperature is the horizontal coordinate on this scatter plot, and the humidity ratio is the vertical coordinate. Peak design values are depicted by the red square (1.0% Temperature [dry bulb]), the green circle (1.0% Humidity Ratio), and the blue diamond (99% Temperature [dry bulb]).

**2-5.4 Table.**

The table below the chart shows the exact values of 99% dry bulb temperature, 1.0% humidity ratio, and 1.0% dry bulb temperature, along with calculated values of enthalpy, mean coincident wet bulb temperature, and humidity ratio (as applicable). The value of enthalpy coincident to each temperature/humidity ratio is created using the psychrometric functions provided by the Linric Company, Bedford, New Hampshire. The dry bulb temperature and humidity ratio are used to calculate enthalpy using the Linric algorithms.

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Figure 2-4 Sample Data Set Page 4



|                     | (°F) /<br>(gr/lb) | MCDB<br>(°F) | MCWB<br>(°F) | MCDP<br>(°F) | MCHR<br>(gr/lb) | Enthalpy<br>(btu/lb) |
|---------------------|-------------------|--------------|--------------|--------------|-----------------|----------------------|
| 1.0% Dry Bulb       | 93.0              |              | 77           |              | 116.0           | 40.6                 |
| 99.0% Dry Bulb      | 11.0              |              |              |              | 7.0             | 3.6                  |
| 1.0% Humidity Ratio | 141.0             | 83.0         | 78.5         | 76.7         |                 | 42.1                 |



## **2-6 DATA SET PAGES 5 THROUGH 9: TEMPERATURE BIN DATA.**

Figures 2-5 through 2-9 are examples of Data Set Pages 5 through 9, respectively. These tables show the number of hours that temperatures occur in 5 Fahrenheit degree (3 Celsius degree) bins of specific 8-hour daily periods during a given month. The 8-hour periods are based upon a 24-hour clock and displayed in Local Standard Time (LST). For each month, the number of observations for each temperature bin during each of the specific 8-hour periods of the day appear in a column under the specific Hour Group (LST). The total number of observations (hours) in each temperature bin is displayed in the "Total Obs" column for the month. The mean coincident wet bulb temperature is the mean value of all those wet bulb temperatures that occur coincidentally with the dry bulb temperatures in the particular 5° temperature bin. At the upper, or warmer, end of the mean coincident wet bulb distribution, the values occasionally reverse their trend because the highest wet bulb temperatures do not necessarily occur with the highest dry bulb temperatures. There are 13 such tables, one for each month and one representing the overall annual summary (Data Set Page 9).

### **2-6.1 Suggestions for Use.**

Binned summaries are used by many different technical disciplines for different purposes. They are useful in making informal estimates of energy consumption by cooling and heating equipment, and for gaining a general understanding of patterns of temperature and moisture at different times of the day, month, and year.

NOTE: Do not use these binned summaries to calculate design moisture loads.

### **2-6.2 Comments.**

These particular binned summaries are based on the dry bulb temperature. After each observation has been placed into a dry bulb bin, the average humidity ratio is calculated for all observations in each bin. Consequently, dry bulb bins underestimate the magnitude of dehumidification and humidification loads because the averaging calculation "flattens" the peaks and valleys of humidity ratios. The amount of the underestimation varies according to the intended humidity control level.

Figure 2-5 Sample Data Set Page 5

*Dry-Bulb Temperature Hours For An Average Year*

| Temperature<br>Range<br>(°F) | January               |                       |                       |              |                          | February              |                       |                       |              |                          | March                 |                       |                       |              |                          |
|------------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|
|                              | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
| 105/109                      |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 100/104                      |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 95/99                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 90/94                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 85/89                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          | 0                     | 0                     | 0                     | 63.6         |                          |
| 80/84                        |                       |                       |                       |              |                          | 0                     |                       | 0                     | 57.3         |                          | 3                     | 0                     | 3                     | 64.5         |                          |
| 75/79                        |                       |                       |                       |              |                          | 0                     | 0                     | 0                     | 60.4         |                          | 9                     | 2                     | 11                    | 63           |                          |
| 70/74                        |                       | 1                     |                       | 1            | 58.8                     | 1                     | 0                     | 1                     | 59.3         | 1                        | 15                    | 7                     | 23                    | 60.4         |                          |
| 65/69                        | 0                     | 3                     | 0                     | 3            | 58.8                     | 0                     | 4                     | 1                     | 5            | 55.9                     | 3                     | 14                    | 13                    | 30           | 57.3                     |
| 60/64                        | 2                     | 6                     | 3                     | 11           | 55.5                     | 2                     | 10                    | 5                     | 17           | 54.1                     | 11                    | 22                    | 18                    | 51           | 54.4                     |
| 55/59                        | 4                     | 10                    | 6                     | 20           | 51.8                     | 4                     | 14                    | 9                     | 27           | 50.2                     | 16                    | 31                    | 24                    | 71           | 50.2                     |
| 50/54                        | 7                     | 13                    | 10                    | 30           | 47                       | 7                     | 21                    | 13                    | 41           | 45.6                     | 19                    | 36                    | 33                    | 88           | 45.8                     |
| 45/49                        | 7                     | 22                    | 13                    | 42           | 41.7                     | 14                    | 28                    | 22                    | 64           | 41.9                     | 36                    | 39                    | 43                    | 118          | 42                       |
| 40/44                        | 15                    | 28                    | 23                    | 66           | 38.2                     | 19                    | 28                    | 27                    | 74           | 38                       | 34                    | 29                    | 33                    | 96           | 38.1                     |
| 35/39                        | 37                    | 43                    | 43                    | 123          | 34.1                     | 35                    | 40                    | 42                    | 117          | 34                       | 47                    | 26                    | 35                    | 108          | 34.2                     |
| 30/34                        | 49                    | 45                    | 51                    | 145          | 29.8                     | 48                    | 33                    | 46                    | 127          | 29.6                     | 40                    | 16                    | 23                    | 79           | 29.5                     |
| 25/29                        | 42                    | 31                    | 38                    | 111          | 24.7                     | 43                    | 20                    | 28                    | 91           | 24.9                     | 25                    | 6                     | 12                    | 43           | 24.9                     |
| 20/24                        | 27                    | 16                    | 20                    | 63           | 20.2                     | 20                    | 11                    | 12                    | 43           | 20.1                     | 10                    | 2                     | 3                     | 15           | 20.5                     |
| 15/19                        | 24                    | 15                    | 19                    | 58           | 15.8                     | 15                    | 7                     | 9                     | 31           | 15.7                     | 5                     | 1                     | 1                     | 7            | 16.4                     |
| 10/14                        | 17                    | 9                     | 11                    | 37           | 10.8                     | 9                     | 4                     | 6                     | 19           | 10.7                     | 1                     | 0                     | 1                     | 2            | 11.1                     |
| 5/9                          | 11                    | 4                     | 5                     | 20           | 6.1                      | 6                     | 2                     | 2                     | 10           | 6                        | 1                     | 0                     | 0                     | 1            | 6.2                      |
| 0/4                          | 5                     | 1                     | 2                     | 8            | 1.1                      | 2                     | 0                     | 1                     | 3            | 0.8                      | 0                     |                       |                       | 0            | 3                        |
| -5/-1                        | 1                     | 0                     | 1                     | 2            | -3                       | 0                     | 0                     | 0                     | 0            | -3.3                     |                       |                       |                       |              |                          |
| -10/-6                       | 0                     | 0                     | 0                     | 0            | -7.4                     | 1                     | 0                     | 0                     | 1            | -7.4                     |                       |                       |                       |              |                          |
| -15/-11                      | 0                     | 0                     |                       | 0            | -13.3                    | 0                     |                       |                       | 0            | -12                      |                       |                       |                       |              |                          |
| -20/-16                      | 0                     |                       |                       | 0            | -15.5                    |                       |                       |                       |              |                          |                       |                       |                       |              |                          |

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

Figure 2-6 Sample Data Set Page 6

*Dry-Bulb Temperature Hours For An Average Year*

| Temperature Range (°F) | April        |              |              |           |              | May          |              |              |           |              | June         |              |              |           |              |
|------------------------|--------------|--------------|--------------|-----------|--------------|--------------|--------------|--------------|-----------|--------------|--------------|--------------|--------------|-----------|--------------|
|                        | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) |
| 105/109                |              |              |              |           |              |              |              |              |           |              | 0            | 0            | 0            | 0         | 71.3         |
| 100/104                |              |              |              |           |              |              |              |              |           |              | 1            | 0            | 0            | 1         | 75.1         |
| 95/99                  |              |              |              |           |              |              | 0            |              | 0         | 73           | 5            | 1            | 6            | 6         | 75.5         |
| 90/94                  |              | 1            | 0            | 1         | 70.4         | 6            | 1            | 7            | 72.9      | 0            | 34           | 9            | 43           | 43        | 75.1         |
| 85/89                  |              | 4            | 1            | 5         | 68.6         | 19           | 5            | 24           | 71.6      | 1            | 47           | 19           | 67           | 67        | 73.3         |
| 80/84                  |              | 14           | 4            | 18        | 66.1         | 1            | 39           | 15           | 55        | 69.3         | 8            | 61           | 38           | 107       | 71.3         |
| 75/79                  | 0            | 25           | 11           | 36        | 63.7         | 7            | 49           | 33           | 89        | 66.6         | 34           | 48           | 57           | 139       | 69.6         |
| 70/74                  | 6            | 32           | 23           | 61        | 60.7         | 26           | 47           | 46           | 119       | 64.4         | 72           | 26           | 58           | 156       | 67.6         |
| 65/69                  | 12           | 31           | 25           | 68        | 58.2         | 44           | 33           | 45           | 122       | 61.6         | 56           | 11           | 33           | 100       | 63.9         |
| 60/64                  | 28           | 40           | 39           | 107       | 55.3         | 57           | 33           | 44           | 134       | 57.7         | 43           | 5            | 18           | 66        | 59.7         |
| 55/59                  | 39           | 36           | 41           | 116       | 51.2         | 45           | 15           | 33           | 93        | 53           | 20           | 2            | 5            | 27        | 55.2         |
| 50/54                  | 44           | 27           | 40           | 111       | 47.1         | 39           | 6            | 18           | 63        | 49           | 6            | 0            | 1            | 7         | 50.4         |
| 45/49                  | 44           | 18           | 28           | 90        | 42.7         | 20           | 1            | 7            | 28        | 44.5         | 1            |              |              | 1         | 46.5         |
| 40/44                  | 28           | 9            | 16           | 53        | 38.3         | 7            | 0            | 1            | 8         | 40.3         |              |              |              |           |              |
| 35/39                  | 23           | 3            | 10           | 36        | 34.5         | 2            |              | 0            | 2         | 36.8         |              |              |              |           |              |
| 30/34                  | 12           | 1            | 3            | 16        | 29.9         |              |              |              |           |              |              |              |              |           |              |
| 25/29                  | 3            | 0            | 0            | 3         | 24.7         |              |              |              |           |              |              |              |              |           |              |
| 20/24                  | 0            |              |              | 0         | 21           |              |              |              |           |              |              |              |              |           |              |
| 15/19                  |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 10/14                  |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 5/9                    |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 0/4                    |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| -5/-1                  |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| -10/-6                 |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| -15/-11                |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| -20/-16                |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

Figure 2-7 Sample Data Set Page 7

*Dry-Bulb Temperature Hours For An Average Year*

| Temperature<br>Range<br>(°F) | July                  |                       |                       |              |                          | August                |                       |                       |              |                          | September             |                       |                       |              |                          |
|------------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|
|                              | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs | M<br>C<br>W<br>B<br>(°F) |
| 105/109                      |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 100/104                      |                       | 2                     | 0                     | 2            | 76.6                     |                       | 1                     | 0                     | 1            | 77.1                     |                       | 0                     |                       | 0            | 77.8                     |
| 95/99                        |                       | 18                    | 3                     | 21           | 78.5                     |                       | 14                    | 2                     | 16           | 78.2                     |                       | 3                     | 0                     | 3            | 74.6                     |
| 90/94                        | 0                     | 51                    | 16                    | 67           | 77.3                     |                       | 41                    | 10                    | 51           | 77                       |                       | 16                    | 2                     | 18           | 73.8                     |
| 85/89                        | 2                     | 59                    | 26                    | 87           | 75.1                     | 1                     | 56                    | 19                    | 76           | 74.5                     | 0                     | 26                    | 5                     | 31           | 71.4                     |
| 80/84                        | 18                    | 63                    | 56                    | 137          | 73.2                     | 8                     | 67                    | 45                    | 120          | 72.6                     | 1                     | 46                    | 15                    | 62           | 69.2                     |
| 75/79                        | 65                    | 36                    | 68                    | 169          | 71.8                     | 45                    | 45                    | 68                    | 158          | 71.3                     | 10                    | 52                    | 35                    | 97           | 67.6                     |
| 70/74                        | 85                    | 15                    | 52                    | 152          | 68.9                     | 87                    | 18                    | 62                    | 167          | 68.8                     | 36                    | 45                    | 50                    | 131          | 65.5                     |
| 65/69                        | 43                    | 3                     | 19                    | 65           | 64.7                     | 52                    | 4                     | 27                    | 83           | 64.5                     | 38                    | 24                    | 41                    | 103          | 62.5                     |
| 60/64                        | 27                    | 1                     | 8                     | 36           | 60.7                     | 38                    | 1                     | 12                    | 51           | 60.5                     | 53                    | 18                    | 42                    | 113          | 58.7                     |
| 55/59                        | 7                     |                       | 1                     | 8            | 56.6                     | 14                    |                       | 3                     | 17           | 55.8                     | 46                    | 8                     | 30                    | 84           | 54.2                     |
| 50/54                        | 0                     |                       |                       | 0            | 53                       | 3                     |                       | 0                     | 3            | 51.1                     | 34                    | 2                     | 14                    | 50           | 50                       |
| 45/49                        |                       |                       |                       |              |                          | 0                     |                       |                       | 0            | 45.1                     | 14                    | 1                     | 4                     | 19           | 45.4                     |
| 40/44                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          | 5                     |                       | 1                     | 6            | 40.5                     |
| 35/39                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          | 2                     |                       | 0                     | 2            | 36.9                     |
| 30/34                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          | 0                     |                       |                       | 0            | 31                       |
| 25/29                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 20/24                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 15/19                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 10/14                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 5/9                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| 0/4                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| -5/-1                        |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| -10/-6                       |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| -15/-11                      |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |
| -20/-16                      |                       |                       |                       |              |                          |                       |                       |                       |              |                          |                       |                       |                       |              |                          |

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

Figure 2-8 Sample Data Set Page 8

*Dry-Bulb Temperature Hours For An Average Year*

| Temperature Range<br>(°F) | October      |              |              |           |              | November     |              |              |           |              | December     |              |              |           |              |
|---------------------------|--------------|--------------|--------------|-----------|--------------|--------------|--------------|--------------|-----------|--------------|--------------|--------------|--------------|-----------|--------------|
|                           | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) | 01 To 08 LST | 09 To 16 LST | 17 to 00 LST | Total Obs | M C W B (°F) |
| 105/109                   |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 100/104                   |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 95/99                     |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |
| 90/94                     |              | 1            |              | 1         | 71.9         |              |              |              |           |              |              |              |              |           |              |
| 85/89                     |              | 5            | 0            | 5         | 69.3         |              |              |              |           |              |              |              |              |           |              |
| 80/84                     |              | 16           | 1            | 17        | 66.1         |              | 1            |              | 1         | 63.5         |              |              |              |           |              |
| 75/79                     | 1            | 28           | 7            | 36        | 64.1         |              | 4            | 0            | 4         | 61.9         |              |              |              |           |              |
| 70/74                     | 5            | 36           | 19           | 60        | 61.7         | 0            | 12           | 2            | 14        | 60.8         |              | 1            |              | 1         | 62.2         |
| 65/69                     | 13           | 34           | 24           | 71        | 59.4         | 2            | 14           | 7            | 23        | 58.8         | 0            | 2            | 0            | 2         | 59.9         |
| 60/64                     | 28           | 45           | 39           | 112       | 56           | 11           | 25           | 18           | 54        | 55.9         | 2            | 7            | 4            | 13        | 57.2         |
| 55/59                     | 36           | 37           | 46           | 119       | 51.8         | 17           | 33           | 24           | 74        | 51           | 5            | 13           | 7            | 25        | 52           |
| 50/54                     | 47           | 29           | 45           | 121       | 47.8         | 23           | 34           | 32           | 89        | 47           | 8            | 20           | 12           | 40        | 47.2         |
| 45/49                     | 49           | 15           | 35           | 99        | 43.5         | 33           | 42           | 41           | 116       | 42.6         | 15           | 32           | 22           | 69        | 42.8         |
| 40/44                     | 33           | 3            | 18           | 54        | 39.2         | 36           | 31           | 35           | 102       | 38.5         | 22           | 33           | 31           | 86        | 38.5         |
| 35/39                     | 26           | 1            | 11           | 38        | 35.3         | 43           | 25           | 38           | 106       | 34.2         | 38           | 50           | 49           | 137       | 34.4         |
| 30/34                     | 11           |              | 2            | 13        | 31.1         | 40           | 13           | 28           | 81        | 29.7         | 53           | 38           | 49           | 140       | 30           |
| 25/29                     | 1            |              | 0            | 1         | 26.8         | 21           | 4            | 10           | 35        | 25.1         | 43           | 25           | 34           | 102       | 25           |
| 20/24                     |              |              |              |           |              | 8            | 1            | 4            | 13        | 20.5         | 23           | 10           | 18           | 51        | 20.4         |
| 15/19                     |              |              |              |           |              | 4            | 0            | 2            | 6         | 16.4         | 18           | 10           | 12           | 40        | 16.1         |
| 10/14                     |              |              |              |           |              | 1            |              | 0            | 1         | 11.1         | 10           | 5            | 7            | 22        | 11.1         |
| 5/9                       |              |              |              |           |              | 0            |              |              | 0         | 7.2          | 5            | 1            | 3            | 9         | 6.4          |
| 0/4                       |              |              |              |           |              |              |              |              |           |              | 2            | 1            | 1            | 4         | 1.5          |
| -5/-1                     |              |              |              |           |              |              |              |              |           |              | 1            | 1            | 0            | 2         | -3.5         |
| -10/-6                    |              |              |              |           |              |              |              |              |           |              | 1            | 0            | 1            | 2         | -7.8         |
| -15/-11                   |              |              |              |           |              |              |              |              |           |              | 0            | 0            | 0            | 0         | -12.4        |
| -20/-16                   |              |              |              |           |              |              |              |              |           |              |              |              |              |           |              |

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

Figure 2-9 Sample Data Set Page 9

*Dry-Bulb Temperature Hours For An Average Year*

| Temperature Range<br>(°F) | Annual                |                       |                       |              | M<br>C<br>W<br>B<br>(°F) |
|---------------------------|-----------------------|-----------------------|-----------------------|--------------|--------------------------|
|                           | 01<br>To<br>08<br>LST | 09<br>To<br>16<br>LST | 17<br>to<br>00<br>LST | Total<br>Obs |                          |
| 105/109                   |                       | 0                     | 0                     | 0            | 71.3                     |
| 100/104                   |                       | 5                     | 1                     | 6            | 76.5                     |
| 95/99                     |                       | 40                    | 6                     | 46           | 77.7                     |
| 90/94                     | 0                     | 150                   | 37                    | 187          | 76.2                     |
| 85/89                     | 4                     | 216                   | 75                    | 295          | 73.7                     |
| 80/84                     | 36                    | 309                   | 174                   | 519          | 71.2                     |
| 75/79                     | 162                   | 297                   | 280                   | 739          | 69.2                     |
| 70/74                     | 317                   | 248                   | 319                   | 884          | 66.1                     |
| 65/69                     | 263                   | 176                   | 236                   | 675          | 61.8                     |
| 60/64                     | 302                   | 213                   | 250                   | 765          | 57.3                     |
| 55/59                     | 254                   | 197                   | 229                   | 680          | 52.1                     |
| 50/54                     | 236                   | 188                   | 218                   | 642          | 47.4                     |
| 45/49                     | 233                   | 197                   | 216                   | 646          | 42.7                     |
| 40/44                     | 198                   | 162                   | 186                   | 546          | 38.4                     |
| 35/39                     | 253                   | 189                   | 228                   | 670          | 34.3                     |
| 30/34                     | 254                   | 146                   | 202                   | 602          | 29.8                     |
| 25/29                     | 178                   | 86                    | 123                   | 387          | 24.9                     |
| 20/24                     | 88                    | 40                    | 57                    | 185          | 20.3                     |
| 15/19                     | 66                    | 33                    | 43                    | 142          | 15.9                     |
| 10/14                     | 38                    | 18                    | 25                    | 81           | 10.8                     |
| 5/9                       | 22                    | 7                     | 10                    | 39           | 6.1                      |
| 0/4                       | 9                     | 2                     | 3                     | 14           | 1.2                      |
| -5/-1                     | 2                     | 1                     | 1                     | 4            | -3.2                     |
| -10/-6                    | 2                     | 0                     | 1                     | 3            | -7.6                     |
| -15/-11                   | 1                     | 0                     | 0                     | 1            | -12.6                    |
| -20/-16                   | 0                     |                       |                       | 0            | -15.5                    |

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

## 2-7 DATA SET PAGE 10: ANNUAL TEMPERATURE SUMMARY.

Figure 2-10 is an example of Data Set Page 10. This chart shows a week-by-week summary of dry bulb temperatures for the given site. The observations are grouped into 7-day periods (approximate calendar weeks). For example, observations from January 1 through 7 from all years are grouped, observations from January 8 through 14 from all years are grouped, and so on, overlapping the end of one month and beginning of the next month where necessary. The following statistics are shown for each of the 7-day periods:

- *1% Dry Bulb Temp* is the dry bulb temperature that is exceeded 1% of the time during that calendar week.
- *MCWB (1% Dry Bulb)* is the mean of wet bulb temperatures coincident with 1% dry bulb temperatures during the same week.
- *Mean Max Temp* is the daily maximum dry bulb temperature, averaged by week over the POR.
- *Mean Min Temp* is the daily minimum dry bulb temperature, averaged by week over the POR.
- *99% Min Dry Bulb Temp* is the daily dry bulb temperature that is at or above this value 99% of the time, or below this value 1% of the time.

NOTE: The information in this chart is calculated on a weekly basis; information on a climate summary (Data Set Page 1) is calculated on an annual basis.

### 2-7.1 Suggestions for Use.

The weekly 1% and 99% temperatures are useful for understanding the probable temperature extremes that can occur during a given week of the year. The weekly dry bulb temperatures are useful for understanding the change of seasons at a given location. The display is helpful for mission planning and construction project planning.

### 2-7.2 Special Considerations.

#### 2-7.2.1 Designers.

The values displayed here are based on the 30-year record. It is important that designers **not** base equipment selection on the “highest” or “lowest” recorded temperature at the station. That error would result in selecting equipment extremely costly to install, which would operate inefficiently for all but the very hottest or coldest single hour in 30 years. See the Design Criteria Data section on Sample Data Set Page 1 (see Figure 2-1) in this document for appropriate maximum and minimum temperatures for sizing equipment.

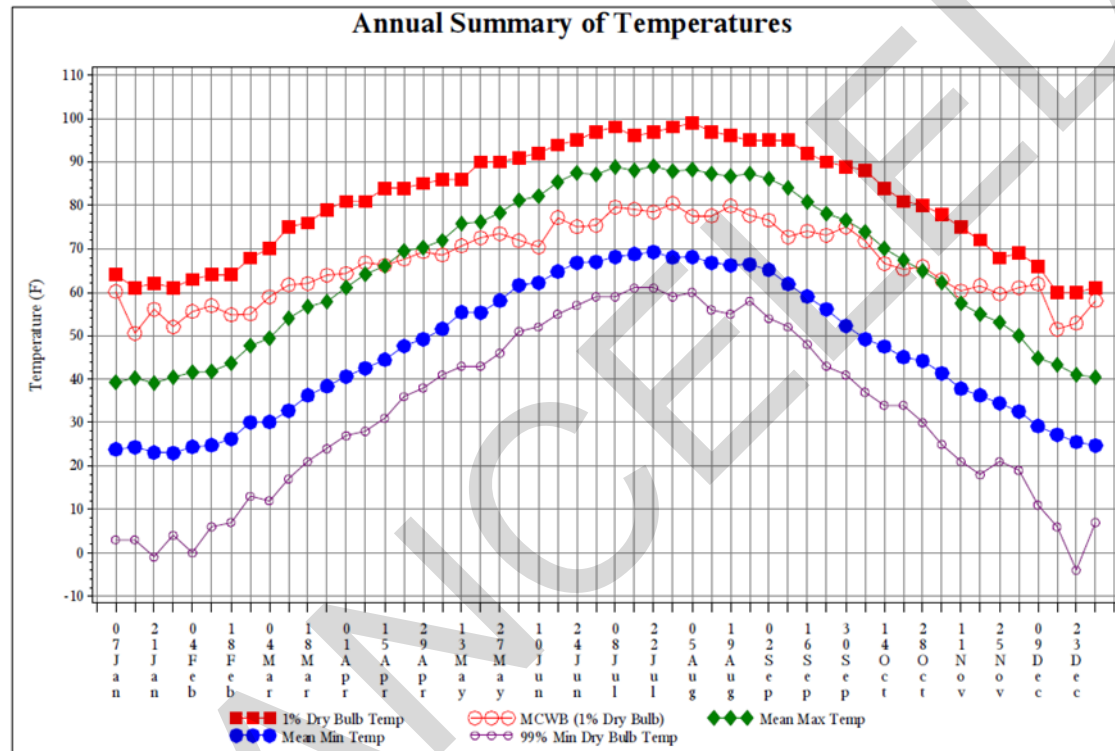
### 2-7.2.2 Construction and Operation Planners.

The mean maximum and minimum temperatures shown for each week seldom occur in the same year. Keep in mind that these are mean values that are useful for understanding the **typical** range of temperatures in a given week. The difference does **not** represent the **actual** day-night temperature swing in a given week.

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Figure 2-10 Sample Data Set Page 10



## **2-8 DATA SET PAGE 11: ANNUAL HUMIDITY SUMMARY.**

Figure 2-11 is an example of Data Set Page 11. Similar to the annual temperature summary (see Sample Data Set Page 10, Figure 2-10), this chart depicts mean maximum and minimum values of humidity ratio, plus the 1% maximum humidity ratio, along with its mean coincident dry bulb temperature, summarized by calendar week. The chart uses two vertical axes: on the left are the humidity ratio values and on the right is a temperature scale for the mean coincident dry bulb temperature.

### **2-8.1 Suggestions for Use.**

Weekly humidity ratios are useful for understanding the change of seasons at a given location and the probable high and low moisture levels during a given week of the year. The display is helpful for planning humidity- controlled storage projects and for understanding factors contributing to atmospheric corrosion. Humidity also affects the deterioration rate of building materials and the weathering of military equipment and structures exposed to the elements.

### **2-8.2 Special Considerations.**

#### **2-8.2.1 Designers.**

The values displayed here are based on the 30-year record. It is important that designers **not** base equipment selection on the “highest” or “lowest” recorded humidity at the station. That error would result in selecting oversized equipment, which would increase costs and might result in control problems at other than extreme conditions. Use design values on Data Set Page 1 (Figure 2-1) for equipment sizing.

#### **2-8.2.2 Construction and Operation Planners.**

The high and low humidity ratios shown for each week seldom occur in the same year. Keep in mind that these are mean values that are useful for understanding the typical range of humidity ratio in a given week. The difference does **not** represent the **actual** day-night humidity ratio swing in a given week.

## **2-9 DATA SET PAGE 12: ANNUAL DRY BULB TEMPERATURE AND HUMIDITY SUMMARY TABLES.**

Figure 2-12 is an example of Data Set Page 12. Data Set Page 12 consists of tables containing the values used to plot the charts on Data Set Page 10 and Data Set Page 11. The left half of the table uses Data Set Page 10 and the right half uses Data Set Page 11.

Figure 2-11 Sample Data Set Page 11

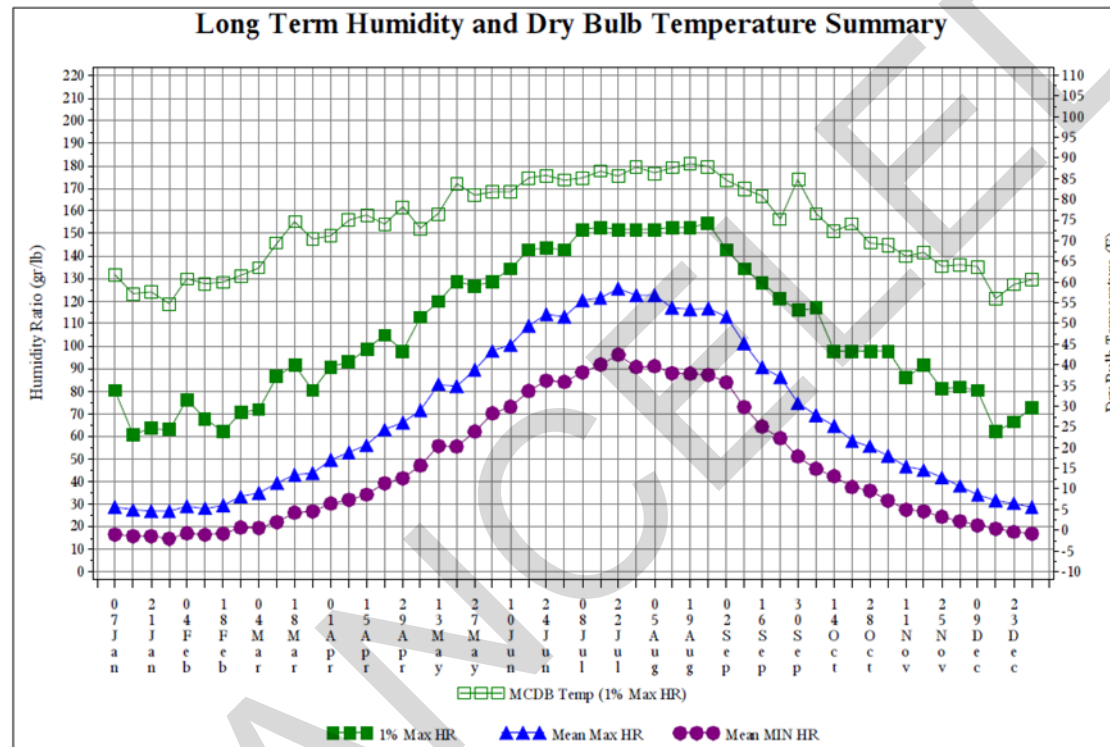


Figure 2-12 Sample Data Set Page 12

*Long Term Humidity and Dry Bulb Temperature Summary*

| Week<br>Ending | 1.0%<br>Temp<br>(°F) | MCWB@<br>1% Temp<br>(°F) | Mean<br>Max<br>Temp<br>(°F) | Mean<br>Min<br>Temp<br>(°F) | 99%<br>Temp<br>(°F) | 1.0%<br>HR<br>(gr/lb) | MCDB@<br>1% HR<br>(°F) | Mean<br>Max<br>HR<br>(gr/lb) | Mean<br>Min<br>HR<br>(gr/lb) |
|----------------|----------------------|--------------------------|-----------------------------|-----------------------------|---------------------|-----------------------|------------------------|------------------------------|------------------------------|
| 7-Jan          | 64                   | 60.2                     | 39.2                        | 23.8                        | 3                   | 80.5                  | 61.8                   | 28.9                         | 16.6                         |
| 14-Jan         | 61                   | 50.5                     | 40.2                        | 24.3                        | 3                   | 60.9                  | 57.2                   | 27.5                         | 15.8                         |
| 21-Jan         | 62                   | 56.1                     | 39                          | 23.1                        | -1                  | 63.7                  | 57.6                   | 26.9                         | 15.8                         |
| 28-Jan         | 61                   | 52                       | 40.5                        | 23                          | 4                   | 63                    | 54.8                   | 27                           | 14.8                         |
| 4-Feb          | 63                   | 55.6                     | 41.6                        | 24.4                        | 0                   | 76.3                  | 60.9                   | 29.1                         | 17.2                         |
| 11-Feb         | 64                   | 56.9                     | 41.7                        | 24.8                        | 6                   | 67.9                  | 59.6                   | 28.2                         | 16.5                         |
| 18-Feb         | 64                   | 54.8                     | 43.6                        | 26.2                        | 7                   | 62.3                  | 60.1                   | 29.5                         | 17                           |
| 25-Feb         | 68                   | 55                       | 47.7                        | 30                          | 13                  | 70.7                  | 61.6                   | 33.4                         | 19.7                         |
| 4-Mar          | 70                   | 58.9                     | 49.5                        | 30.1                        | 12                  | 72.1                  | 63.5                   | 35                           | 19.5                         |
| 11-Mar         | 75                   | 61.7                     | 54                          | 32.7                        | 17                  | 86.8                  | 69.5                   | 39.3                         | 22.1                         |
| 18-Mar         | 76                   | 62                       | 56.7                        | 36.3                        | 21                  | 91.7                  | 74.7                   | 43.1                         | 26.3                         |
| 25-Mar         | 79                   | 63.9                     | 57.9                        | 38.4                        | 24                  | 80.5                  | 70.5                   | 43.7                         | 26.9                         |
| 1-Apr          | 81                   | 64.3                     | 61.1                        | 40.6                        | 27                  | 91                    | 71.3                   | 49.7                         | 30.3                         |
| 8-Apr          | 81                   | 66.8                     | 64.2                        | 42.5                        | 28                  | 93.1                  | 75.1                   | 52.9                         | 32                           |
| 15-Apr         | 84                   | 66.2                     | 66.1                        | 44.5                        | 31                  | 98.7                  | 76.2                   | 56.1                         | 34.3                         |
| 22-Apr         | 84                   | 67.6                     | 69.6                        | 47.6                        | 36                  | 105                   | 74                     | 63.1                         | 39.3                         |
| 29-Apr         | 85                   | 69.4                     | 70.3                        | 49.2                        | 38                  | 98                    | 78.2                   | 66.1                         | 41.5                         |
| 6-May          | 86                   | 68.6                     | 71.9                        | 51.6                        | 41                  | 112.7                 | 73                     | 71.7                         | 47.2                         |
| 13-May         | 86                   | 70.7                     | 75.9                        | 55.4                        | 43                  | 119.7                 | 76.6                   | 83.2                         | 55.9                         |
| 20-May         | 90                   | 72.5                     | 76.2                        | 55.3                        | 43                  | 128.8                 | 83.8                   | 82.3                         | 55.6                         |
| 27-May         | 90                   | 73.5                     | 78.3                        | 58.1                        | 46                  | 126.7                 | 81.1                   | 89.7                         | 62.3                         |
| 4-Jun          | 91                   | 71.9                     | 81.1                        | 61.6                        | 51                  | 128.8                 | 81.9                   | 97.9                         | 70.3                         |
| 10-Jun         | 92                   | 70.4                     | 82.2                        | 62.2                        | 52                  | 134.4                 | 81.9                   | 100.5                        | 73.3                         |
| 17-Jun         | 94                   | 77.2                     | 85.3                        | 64.8                        | 55                  | 142.8                 | 85.2                   | 109.1                        | 80.2                         |
| 24-Jun         | 95                   | 75.1                     | 87.5                        | 66.8                        | 57                  | 143.5                 | 85.8                   | 114.1                        | 84.8                         |
| 1-Jul          | 97                   | 75.4                     | 87.2                        | 67                          | 59                  | 142.8                 | 84.7                   | 113.1                        | 84.3                         |
| 8-Jul          | 98                   | 79.6                     | 88.9                        | 68.1                        | 59                  | 151.9                 | 85.2                   | 120.3                        | 88.4                         |
| 15-Jul         | 96                   | 79.1                     | 88                          | 68.8                        | 61                  | 152.6                 | 86.9                   | 121.6                        | 91.9                         |
| 22-Jul         | 97                   | 78.5                     | 89.1                        | 69.3                        | 61                  | 151.9                 | 85.7                   | 125.5                        | 96.3                         |
| 29-Jul         | 98                   | 80.5                     | 87.8                        | 68                          | 59                  | 151.9                 | 87.8                   | 122.5                        | 90.9                         |
| 5-Aug          | 99                   | 77.5                     | 88.3                        | 68.1                        | 60                  | 151.9                 | 86.4                   | 122.5                        | 91.2                         |
| 12-Aug         | 97                   | 77.6                     | 87.3                        | 66.8                        | 56                  | 152.6                 | 87.7                   | 117                          | 88.1                         |
| 19-Aug         | 96                   | 79.9                     | 86.8                        | 66.2                        | 55                  | 152.6                 | 88.7                   | 116.3                        | 87.9                         |
| 26-Aug         | 95                   | 77.7                     | 87.3                        | 66.4                        | 58                  | 154.7                 | 88                     | 116.8                        | 87.3                         |
| 2-Sep          | 95                   | 76.6                     | 86.2                        | 65.2                        | 54                  | 142.8                 | 84.6                   | 113.1                        | 84.1                         |
| 9-Sep          | 95                   | 72.7                     | 84                          | 61.9                        | 52                  | 134.4                 | 82.6                   | 101.4                        | 73.1                         |
| 16-Sep         | 92                   | 74.1                     | 80.8                        | 59                          | 48                  | 128.1                 | 80.8                   | 90.8                         | 64.5                         |
| 23-Sep         | 90                   | 73.1                     | 78.1                        | 56.1                        | 43                  | 121.1                 | 75.3                   | 86.4                         | 59.3                         |
| 30-Sep         | 89                   | 75                       | 76.5                        | 52.2                        | 41                  | 116.2                 | 84.8                   | 74.8                         | 51.2                         |
| 7-Oct          | 88                   | 71.8                     | 74                          | 49.2                        | 37                  | 116.9                 | 76.7                   | 69.6                         | 45.8                         |

|        |    |      |      |      |    |      |      |      |      |
|--------|----|------|------|------|----|------|------|------|------|
| 14-Oct | 84 | 66.6 | 70   | 47.5 | 34 | 98   | 72.4 | 64.7 | 42.4 |
| 21-Oct | 81 | 65.3 | 67.4 | 45.1 | 34 | 97.7 | 74.1 | 58.2 | 37.7 |
| 28-Oct | 80 | 65.9 | 65   | 44.2 | 30 | 98   | 69.5 | 55.7 | 36.1 |
| 4-Nov  | 78 | 62.9 | 62.2 | 41.3 | 25 | 98   | 69   | 51.4 | 31.7 |
| 11-Nov | 75 | 60.3 | 57.4 | 37.8 | 21 | 86.1 | 66.3 | 46.7 | 27.6 |
| 18-Nov | 72 | 61.5 | 54.9 | 36.3 | 18 | 91.7 | 67.2 | 45.1 | 26.8 |
| 25-Nov | 68 | 59.6 | 53.1 | 34.4 | 21 | 81.2 | 63.9 | 41.8 | 24.5 |
| 2-Dec  | 69 | 61   | 50   | 32.5 | 19 | 81.9 | 64.2 | 38.1 | 22.4 |
| 9-Dec  | 66 | 61.9 | 44.8 | 29.2 | 11 | 80.5 | 63.8 | 34.2 | 20.7 |
| 16-Dec | 60 | 51.5 | 43.2 | 27.2 | 6  | 62.3 | 56   | 31.7 | 19.1 |
| 23-Dec | 60 | 52.9 | 41   | 25.5 | -4 | 66.5 | 59.5 | 30.4 | 17.8 |
| 31-Dec | 61 | 58.1 | 40.4 | 24.7 | 7  | 72.8 | 60.7 | 28.9 | 17   |

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## 2-10 DATA SET PAGE 13: BUILDING ENVELOPE LOADS.

Figure 2-13 is an example of Data Set Page 13. Data Set Page 13 consists of charts summarizing a site's mean heating and cooling degree days.

### 2-10.1 Explanation of Charts.

#### 2-10.1.1 Calculation of Cooling Degree-Days.

Cooling degree-days are derived by multiplying the number of hours that the outdoor temperature is above the base temperature of 65 °F (18 °C) times the number of degrees of that temperature difference. For example, if 1 hour was observed at a temperature of 78 °F, that observation adds 13 degree-hours to the annual total. The sum of the degree-hours is divided by 24 to yield degree-days.

#### 2-10.1.2 Calculation of Heating Degree-Days.

Heating degree-days are calculated similarly, against the base temperature of 65 °F, so a 1-hour outside temperature observation of 62 °F adds 3 degree-hours to the annual total. Heating degree-days are summed separately from the cooling degree-days. Heating and Cooling degree-hours do not cancel each other out, since both heating and cooling conditions may occur over the course of a given day.

#### 2-10.1.3 Alternate Cooling Degree-Days Calculation.

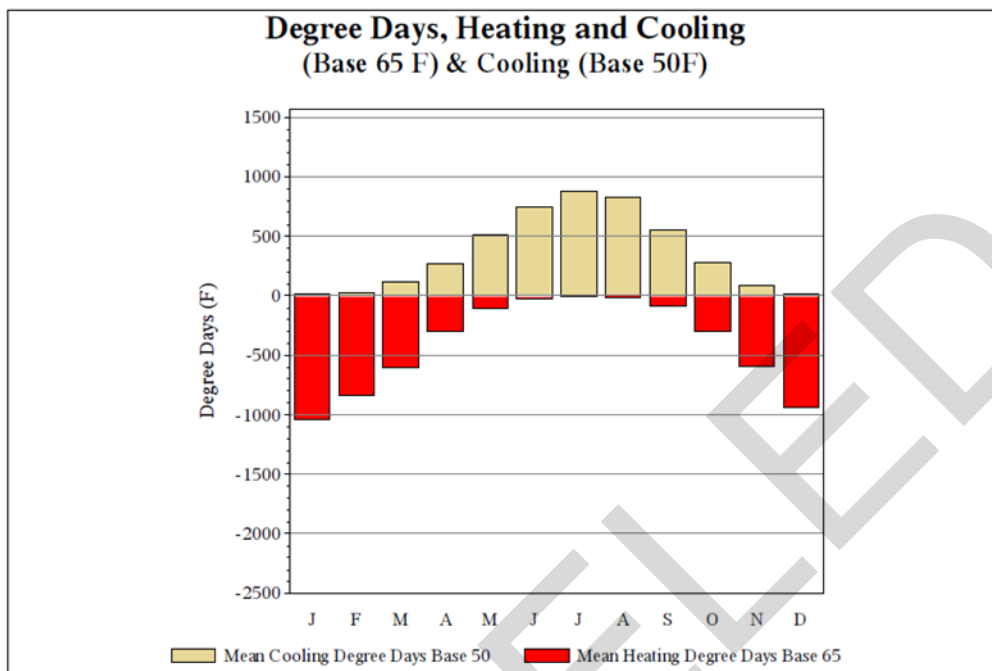
A separate file has been added to the 14 WS Web site to include the cooling degree-days based upon a base temperature of 50 °F. This file is located on the Engineering Weather Data page under the Standard EWD Package file. This data is intended to allow selection of the proper Building Envelope Requirements table from within \1\ ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* (Refer to UFC 1-200-02, for applicable publication date) /1/ for energy conservation design. The cooling degree-days based on 65 °F tabulated and graphed here are historically used to estimate loads as suggested in paragraph 2-10.2 below.

## **2-10.2      Suggestions for Use.**

Degree-days are used to estimate the sensible heat and sensible cooling loads on the building envelope. Degree-day loads can be used to estimate the annual energy consumption of a building, provided that the loads from ventilation and infiltration air are also considered (see paragraph 2-11).

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Figure 2-13 Sample Data Set Page 13



| Month | Mean Cooling Degree Days (°F) Base 50 | Mean Cooling Degree Days (°F) Base 65 | Mean Heating Degree Days (°F) Base 65 |
|-------|---------------------------------------|---------------------------------------|---------------------------------------|
| JAN   | 16.6                                  | 0.4                                   | 1032.6                                |
| FEB   | 25                                    | 1.1                                   | 832.7                                 |
| MAR   | 111.8                                 | 16.6                                  | 605.6                                 |
| APR   | 271.4                                 | 56.8                                  | 298                                   |
| MAY   | 516.1                                 | 154                                   | 110.3                                 |
| JUN   | 747.3                                 | 316.5                                 | 19.2                                  |
| JUL   | 875.4                                 | 415.9                                 | 5.6                                   |
| AUG   | 819.6                                 | 366.6                                 | 12                                    |
| SEP   | 556                                   | 188.9                                 | 88                                    |
| OCT   | 275.9                                 | 56.4                                  | 306.5                                 |
| NOV   | 90.3                                  | 8.3                                   | 592.6                                 |
| DEC   | 18.7                                  | 0.4                                   | 940.5                                 |
| ANN   | 4324.1                                | 1581.9                                | 4843.6                                |

## **2-11 DATA SET PAGE 14: VENTILATION AND INFILTRATION LOADS.**

Figure 2-14 is an example of Data Set Page 14. Data Set Page 14 consists of a graph and table that display the independent loads imposed by heating, cooling, humidifying, and dehumidifying outside air as it is brought into a building. The calculation assumes that air inside the building is maintained at conditions between 68 °F (20 °C)/30% RH and 75 °F (24 °C)/60% RH. For the purposes of these calculations, when the outside air is within that range of temperature and moisture, any incoming air is assumed not to impose any load.

These values are calculated with the methodology used to calculate the annual VCLI on Data Set Page One, except that values on this page are computed by month and the result is displayed as British thermal units per cubic foot per minute (Btu/cfm) rather than as ton-hours per CFM per year. The heating and humidifying loads are shown as negative values. Cooling and dehumidifying loads are displayed as positive values.

### **2-11.1 Suggestions for Use.**

Bringing fresh ventilation air into a building or allowing air to infiltrate into buildings through cracks imposes heating, cooling, dehumidification, and humidification loads on the mechanical system. The information on this data set page helps the architect, engineers, and operating personnel understand the nature and magnitude of those loads on an annual basis. It also shows how the loads vary from month to month throughout the year.

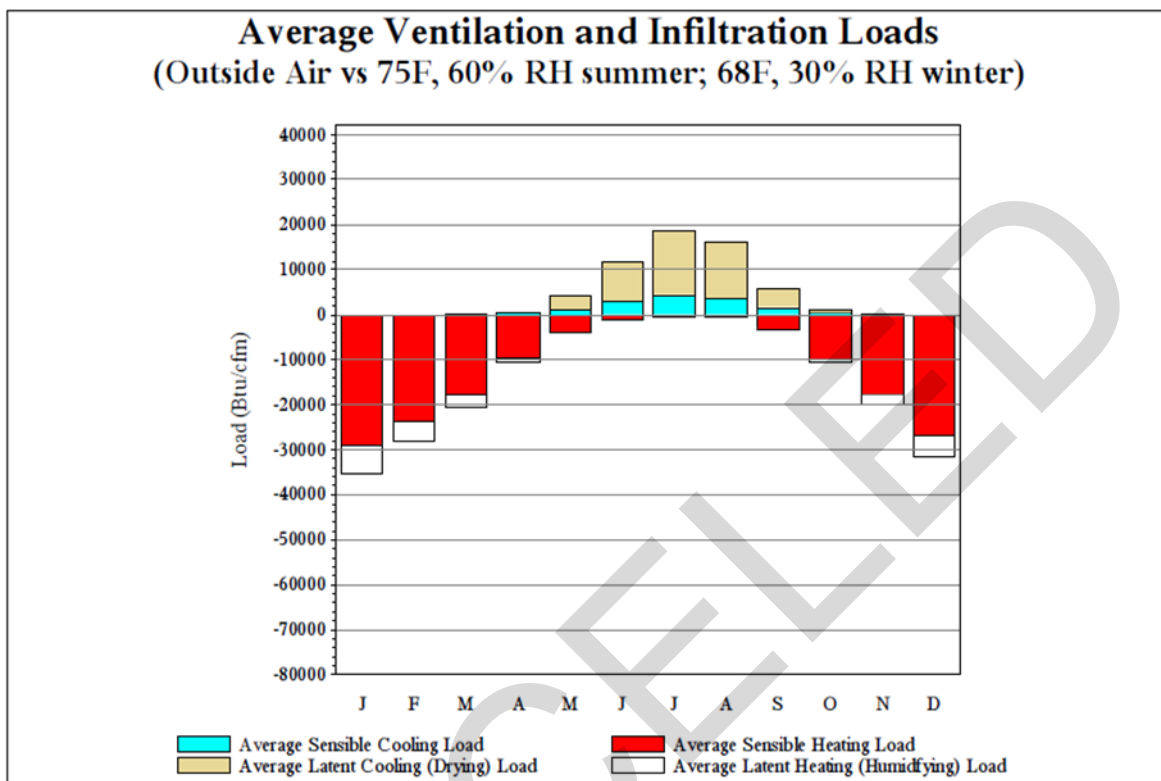
### **2-11.2 Comments.**

These calculations are based on the load created when 1 cubic foot of outside air is brought into the building each minute. The results of the calculation include the moisture load or deficit, and the sensible heat load or deficit created by that cubic foot of air during each month of the year. Note that most months have both a load and a deficit for temperature and moisture. The monthly deficit and load do not “cancel” from the perspective of the mechanical system, because temperature and moisture loads will often occur at different times of the day.

NOTE: The values displayed here assume that the inside air is maintained between 68 °F/30% RH and 75 °F/ 60% RH. If the inside conditions are held in a different range of temperature or moisture, the loads will be different. For example, in calculating loads for humidity-controlled but unheated storage, the loads vary according to the change in both temperature and humidity, since the inside temperature varies but the inside humidity is held constant. For estimating loads in that or similar applications, the engineer may obtain better results by using the average maximum weekly humidity data shown on Data Set Pages 11 and 12 (Figures 2-11 and 2-12).



Figure 2-14 Sample Data Set Page 14



| Month | Average<br>Sensible<br>Cooling<br>Load<br>(Btu/cfm) | Average<br>Sensible<br>Heating<br>Load<br>(Btu/cfm) | Average<br>Latent<br>Cooling<br>Load<br>(Btu/cfm) | Average<br>Latent<br>Heating<br>Load<br>(Btu/cfm) |
|-------|---|---|---|---|
| JAN   | 0   | -29169  | 7   | -5929   |
| FEB   | 1   | -23761  | 6   | -4543   |
| MAR   | 47  | -17927  | 101   | -2731   |
| APR   | 267   | -9536   | 420   | -867  |
| MAY   | 998   | -4073   | 3315  | -67   |
| JUN   | 2894  | -926  | 8717  | -1  |
| JUL   | 4255  | -345  | 14237   | 0   |
| AUG   | 3511  | -629  | 12438   | 0   |
| SEP   | 1434  | -3287   | 4223  | -21   |
| OCT   | 266   | -9831   | 745   | -576  |
| NOV   | 13  | -17587  | 100   | -2359   |
| DEC   | 0   | -26781  | 8   | -4742   |
| ANN   | 13686   | -143852   | 44317   | -21836  |

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## 2-12 DATA SET PAGES 15 AND 16: SOLAR RADIATION DATA.

Figures 2-15 and 2-16 are samples of Data Set Page 15 and Data Set Page 16, respectively.

### 2-12.1 Explanation of Charts.

#### 2-12.1.1 Data Source.

This data is reproduced courtesy of the National Renewable Energy Laboratory (NREL). The data were first published in the NREL's *Solar Radiation Data Manual for Buildings* (1995). The user should refer to that publication for a complete description of how to use this data. The manual can be accessed online at <http://www.osti.gov/bridge> by searching for "NREL/TP--463-7904."

#### 2-12.1.2 Site Location.

The site used in each station record is the nearest NREL-published site available within a 1.5° latitude radius from the requested location. Consequently, some sites may be several miles away, and in some cases, the NREL location may be in a neighboring state. Use caution when the nearest site available is not in the same city as the requested location, since significant differences in cloud climatology can exist over short distances.

### **2-12.1.3 Site Availability.**

When this document was prepared, the only sites available from NREL were Puerto Rico, Guam, and the 50 states. For locations where solar radiation data is not available, Data Set Pages 15 and 16 are blank. For these locations, users may wish to contact NREL directly to obtain advice concerning data not published in the NREL solar radiation data manual.

### **2-12.2 Suggestions for Use.**

The solar data presented here can be used for calculating solar radiation cooling loads on building envelopes, and also for estimating the value of solar illumination for daylighting calculations. Again, the user should refer to the *Solar Radiation Data Manual for Buildings* for a complete description of how to use this data.

NOTE: The data source for the NREL reports comes from the National Solar Radiation Database—not the data set used to calculate peak design values and other monthly temperature and moisture data in this document. The two data sets will differ for many reasons, including different POR, measurement locations, sampling methodology and frequency, and differences in calculation methodology. Consequently, the user should expect differences in degree-days, minimum and maximum temperatures, and humidity values between this data and that calculated by the 14 WS. For design criteria, use the temperature and moisture values presented on the Design Criteria Data section of Data Set Page 1 (see Figure 2-1) of this document. These were calculated more recently and used a longer POR. Also, they are taken from records at DoD locations rather than from civilian locations near—but not always identical to—the military data collection points.

Figure 2-15 Sample Data Set Page 15

Average Annual Solar Radiation - Nearest Available Site  
Source: National Renewable Energy Laboratory, Golden CO, 1995

| Station Information |                     | Shading Geometry in Dimensionless Units |       |
|---------------------|---------------------|---|-------|
| City, State, WBAN   | ST. LOUIS, MO 13994 | Window:                                 | 1.000 |
| Lat, Lon, Elev      | 38.75N 90.38W 564ft | Overhang:                               | 0.498 |
| Press, Stn Type     | 14.5psia Secondary  | Vert Gap:                               | 0.314 |

| AVERAGE INCIDENT SOLAR RADIATION (Btu/sq.ft./day) Percentage Uncertainty = 9 |          |      |      |      |      |      |      |      |      |      |      |      |      |      |
|--|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|  |          | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Year |
| HORIZ.   | Global   | 690  | 930  | 1230 | 1590 | 1860 | 2030 | 2020 | 1800 | 1460 | 1100 | 720  | 580  | 1340 |
|  | Std.Dev. | 56   | 69   | 98   | 135  | 138  | 114  | 120  | 110  | 112  | 98   | 69   | 57   | 42   |
|  | Minimum  | 550  | 800  | 1060 | 1370 | 1550 | 1830 | 1750 | 1570 | 1190 | 870  | 590  | 490  | 1280 |
|  | Maximum  | 780  | 1070 | 1430 | 1930 | 2180 | 2350 | 2240 | 1960 | 1690 | 1250 | 870  | 710  | 1480 |
|  | Diffuse  | 340  | 460  | 590  | 710  | 810  | 840  | 810  | 730  | 600  | 430  | 350  | 300  | 580  |
| Clear Day  | Global   | 950  | 1300 | 1760 | 2230 | 2520 | 2630 | 2550 | 2290 | 1870 | 1400 | 1000 | 840  | 1780 |
| NORTH  | Global   | 210  | 280  | 360  | 440  | 550  | 630  | 600  | 490  | 380  | 290  | 220  | 190  | 390  |
|  | Diffuse  | 210  | 280  | 360  | 430  | 500  | 530  | 520  | 460  | 380  | 290  | 220  | 190  | 370  |
| Clear Day  | Global   | 190  | 250  | 330  | 430  | 580  | 680  | 630  | 470  | 360  | 270  | 200  | 170  | 380  |
| EAST   | Global   | 460  | 590  | 750  | 920  | 1060 | 1140 | 1130 | 1050 | 880  | 710  | 470  | 390  | 800  |
|  | Diffuse  | 260  | 340  | 440  | 530  | 600  | 640  | 620  | 570  | 470  | 360  | 270  | 230  | 440  |
| Clear Day  | Global   | 710  | 910  | 1150 | 1340 | 1440 | 1460 | 1430 | 1340 | 1170 | 940  | 730  | 640  | 1110 |
| SOUTH  | Global   | 1080 | 1110 | 1060 | 970  | 830  | 780  | 820  | 950  | 1110 | 1220 | 1020 | 940  | 990  |
|  | Diffuse  | 370  | 440  | 500  | 540  | 560  | 570  | 570  | 560  | 520  | 440  | 360  | 330  | 480  |
| Clear Day  | Global   | 1930 | 1970 | 1770 | 1380 | 1040 | 890  | 950  | 1210 | 1580 | 1840 | 1870 | 1860 | 1520 |
| WEST   | Global   | 470  | 600  | 740  | 920  | 1040 | 1110 | 1120 | 1030 | 880  | 700  | 480  | 390  | 790  |
|  | Diffuse  | 260  | 340  | 440  | 530  | 610  | 650  | 630  | 580  | 480  | 360  | 270  | 230  | 450  |
| Clear Day  | Global   | 710  | 910  | 1150 | 1340 | 1440 | 1460 | 1430 | 1340 | 1170 | 940  | 730  | 640  | 1110 |

SCOTT AFB MIDAMERICA IL Page (15 of 18)

Figure 2-16 Sample Data Set Page 16

Average Annual Solar Radiation - Nearest Available Site  
Source: National Renewable Energy Laboratory, Golden CO, 1995

| AVERAGE TRANSMITTED SOLAR RADIATION (Btu/sq.ft./day) FOR DOUBLE GLAZING Percentage Uncertainty = 9 |          |     |     |     |      |      |      |      |      |      |     |     |     |      |
|--|----------|-----|-----|-----|------|------|------|------|------|------|-----|-----|-----|------|
|  |          | Jan | Feb | Mar | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct | Nov | Dec | Year |
| HORIZ.   | Unshaded | 450 | 640 | 870 | 1150 | 1350 | 1480 | 1470 | 1300 | 1040 | 770 | 480 | 370 | 950  |
| NORTH  | Unshaded | 150 | 190 | 250 | 300  | 370  | 410  | 390  | 330  | 260  | 200 | 150 | 130 | 260  |
|  | Shaded   | 130 | 170 | 220 | 270  | 330  | 370  | 350  | 300  | 240  | 180 | 140 | 110 | 230  |
| EAST   | Unshaded | 320 | 410 | 530 | 660  | 750  | 810  | 810  | 750  | 620  | 500 | 320 | 270 | 560  |
|  | Shaded   | 290 | 370 | 470 | 570  | 650  | 700  | 700  | 650  | 550  | 450 | 290 | 240 | 490  |
| SOUTH  | Unshaded | 810 | 810 | 740 | 630  | 510  | 470  | 490  | 600  | 750  | 870 | 760 | 700 | 680  |
|  | Shaded   | 790 | 750 | 590 | 430  | 350  | 360  | 360  | 390  | 550  | 770 | 730 | 680 | 560  |
| WEST   | Unshaded | 320 | 420 | 520 | 650  | 740  | 790  | 800  | 740  | 620  | 490 | 330 | 270 | 560  |
|  | Shaded   | 290 | 370 | 460 | 570  | 640  | 680  | 690  | 640  | 550  | 440 | 300 | 240 | 490  |

| AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS Percentage Uncertainty = 9 |          |       |      |     |     |     |      |      |     |     |     |
|---|----------|-------|------|-----|-----|-----|------|------|-----|-----|-----|
|   |          | March |      |     |     |     | June |      |     |     |     |
|   |          | 9am   | 11am | 1pm | 3pm | 5pm | 9am  | 11am | 1pm | 3pm | 5pm |
| HORIZ.  | M Clear  | 40    | 73   | 82  | 64  | 26  | 48   | 84   | 101 | 96  | 67  |
|   | M Cloudy | 23    | 45   | 52  | 40  | 16  | 32   | 61   | 76  | 71  | 49  |
| NORTH   | M Clear  | 10    | 14   | 15  | 13  | 8   | 19   | 16   | 17  | 17  | 15  |
|   | M Cloudy | 9     | 16   | 17  | 14  | 7   | 15   | 18   | 19  | 19  | 16  |
| EAST  | M Clear  | 75    | 56   | 15  | 13  | 8   | 78   | 72   | 31  | 17  | 15  |
|   | M Cloudy | 25    | 30   | 17  | 14  | 7   | 40   | 49   | 27  | 19  | 16  |
| SOUTH   | M Clear  | 40    | 73   | 82  | 64  | 26  | 12   | 31   | 45  | 41  | 19  |
|   | M Cloudy | 17    | 36   | 43  | 32  | 12  | 12   | 26   | 37  | 33  | 18  |
| WEST  | M Clear  | 10    | 14   | 24  | 67  | 64  | 12   | 16   | 17  | 53  | 78  |
|   | M Cloudy | 9     | 16   | 21  | 33  | 22  | 12   | 18   | 19  | 41  | 50  |
| M Clear (% hrs)   |          | 32    | 28   | 27  | 28  | 29  | 43   | 39   | 32  | 29  | 34  |

|                 |          | Sept |      |     |     |     | Dec |      |     |     |     |
|-----------------|----------|------|------|-----|-----|-----|-----|------|-----|-----|-----|
|                 |          | 9am  | 11am | 1pm | 3pm | 5pm | 9am | 11am | 1pm | 3pm | 5pm |
| HORIZ.          | M Clear  | 29   | 68   | 86  | 78  | 47  | 16  | 42   | 48  | 30  | 2   |
|                 | M Cloudy | 17   | 42   | 58  | 53  | 31  | 9   | 25   | 28  | 17  | 2   |
| NORTH           | M Clear  | 9    | 14   | 16  | 15  | 12  | 6   | 10   | 11  | 8   | 1   |
|                 | M Cloudy | 7    | 15   | 18  | 17  | 12  | 4   | 10   | 11  | 7   | 1   |
| EAST            | M Clear  | 65   | 70   | 28  | 15  | 12  | 42  | 39   | 11  | 8   | 1   |
|                 | M Cloudy | 23   | 36   | 23  | 17  | 12  | 11  | 18   | 11  | 7   | 1   |
| SOUTH           | M Clear  | 21   | 57   | 75  | 67  | 37  | 39  | 82   | 88  | 63  | 6   |
|                 | M Cloudy | 11   | 31   | 45  | 41  | 21  | 10  | 29   | 32  | 20  | 2   |
| WEST            | M Clear  | 9    | 14   | 16  | 54  | 74  | 6   | 10   | 22  | 50  | 9   |
|                 | M Cloudy | 7    | 15   | 18  | 35  | 35  | 4   | 10   | 14  | 17  | 2   |
| M Clear (% hrs) |          | 47   | 47   | 41  | 41  | 43  | 31  | 30   | 30  | 30  | 32  |

Figure 2-17 Sample Data Set Page 17

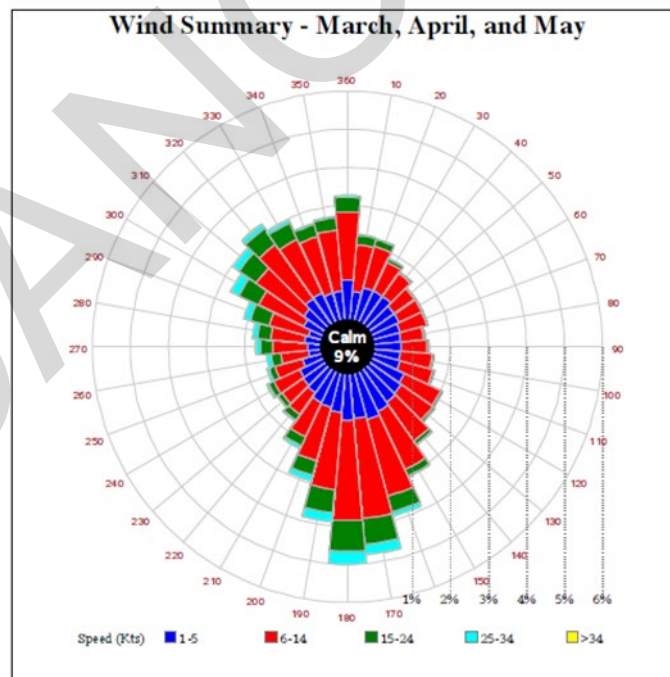
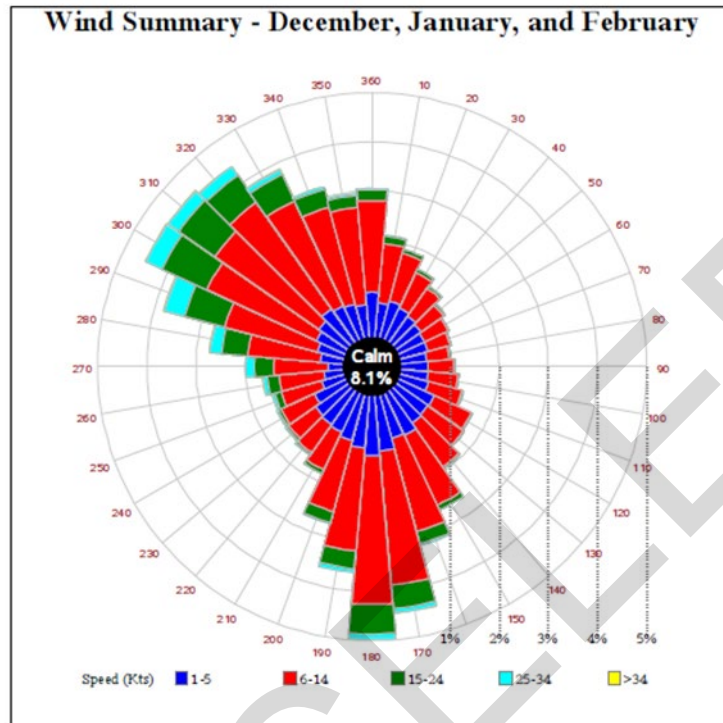
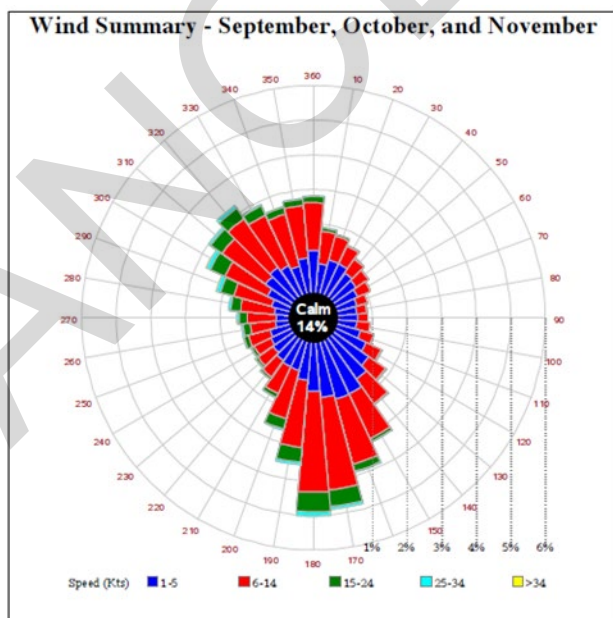
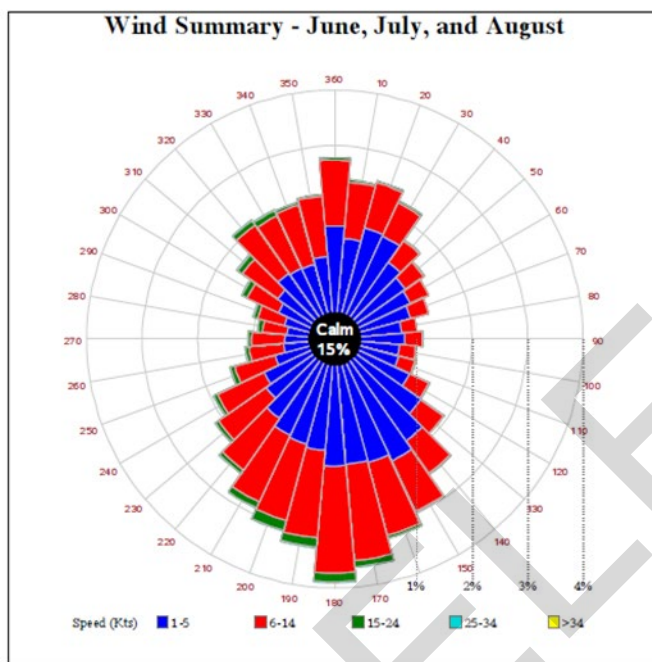


Figure 2-18 Sample Data Set Page 18



## **2-13 DATA SET PAGES 17 AND 18: WIND SUMMARY.**

Figures 2-17 and 2-18 are samples of Data Set Page 17 and Data Set Page 18, respectively.

### **2-13.1 Explanation of Charts.**

#### **2-13.1.1 Depiction.**

These charts depict the frequency of different wind direction and wind speed combinations. The observations are binned into 36 compass directions and 5 speed categories (1 to 5 knots, 6 to 14 knots, 15 to 24 knots, 25 to 34 knots, and greater than 34 knots). The frequency of direction and the tick marks indicate that values lie along each “spoke” of the wind chart. The wind speed bins for each direction are color coded by the legend at the bottom of the chart.

#### **2-13.1.2 Percent Frequency.**

To determine the percent frequency of a particular wind direction, look for the tick mark bounding the outer edge of a colored (wind speed) area. In the case of the first wind speed bin (1 to 5 knots), the percent frequency is simply the value of the tick mark on the outer edge of the 1 to 5 knot region. For the higher speed bins (6 to 14 knots or greater), subtract the earlier spoke values from the value shown to get the frequency for the speed bin in question.

#### **2-13.1.3 Total Percent Frequency.**

The values for percent frequency have been summed by direction, so to determine the total percent frequency for all speeds from a particular direction, look up the tick mark (or interpolated value) bounding the outermost colored area along that spoke. That tick mark represents the total percent frequency of wind from that direction.

#### **2-13.1.4 Calm Conditions.**

Since the calm condition has no direction, the percent occurrence of calm conditions is displayed at the center of the chart.

### **2-13.2 Wind Summary Chart Example.**

The wind summary charts are prepared by 3-month seasons, over all hours (e.g., December, January, February for northern hemisphere winter or southern hemisphere summer; March, April, May for northern hemisphere spring or southern hemisphere fall). See the December through February sample wind summary chart in Figure 2-17 for an example of determining percent frequencies.

#### **2-13.2.1 December through February.**

From the December through February sample wind summary chart, the percent frequency of wind between 1 to 5 knots and from the north (N) is about 1%. The percent



frequency of wind between 6 to 14 knots and from the south (S) is about 3% (~4.25% minus ~1.25%). The percent frequency of all wind speeds from the south (S) is about 5%. The percent frequency of all wind directions from the west through north (270° - 360°) is about 35% (2% + 2.75% + 3.875% + 4.5% + 4.5% + 4.25% + 3.875% + 3.25% + 3% + 3%, respectively – all values approximated). It is easy to determine that wind speeds greater than 34 knots almost never occur (or are such a small frequency from any direction) because the colored area (yellow) is not shown or is indistinguishable because it is extremely small.

### **2-13.2.2      Calm Wind.**

The percent of time the wind is calm is indicated in the center of the chart—in this case, 8.1%. When the outermost value from each of the 36 directions are summed and added to the percent calm, the result is 100% (allowing for rounding). Occurrences of variable wind direction are omitted from the sample before computing percent frequency by direction.

### **2-13.3          Suggestions for Use.**

Knowing the probable wind speed and direction in a particular month can be helpful in construction and mission planning as well as in designing structures that experience severe wind-driven rain or drifting snow. Engineers designing outside air intake and building exhaust vents for heating and air conditioning systems can use these data to minimize the potential for cross-contamination between supply and exhaust air streams. Also, when drifting snow accumulation on roofs is likely, the information on these data set pages can be helpful for locating inlet and exhaust ducts so they are less likely to be obstructed by snowdrifts.

NOTE: The wind currents around any building are strongly affected by the geometry of the building and the topography of the site as well as those of any surrounding buildings. The wind data used for these wind summaries are typical of flat and open airfields where there are no obstructions near the observation point.

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## APPENDIX A REFERENCES

### AMERICAN SOCIETY OF CIVIL ENGINEERS

<http://www.asce.org/>

ANSI/ASCE 7-95, *Minimum Design Loads for Buildings and Other Structures*, 1996

### AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

<http://www.ashrae.org/>

1\ ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings* (Refer to UFC 1-200-02, for applicable publication date) /1/

### INTERNATIONAL CODE COUNCIL

<http://www.iccsafe.org/>

*International Plumbing Code*, 2012

### NATIONAL GROUND WATER RESEARCH AND EDUCATIONAL FOUNDATION

<http://www.ngwa.org/>

### NATIONAL RENEWABLE ENERGY LABORATORY

<http://www.osti.gov/bridge>

*Solar Radiation Data Manual for Buildings*, 1995

### UNITED STATES DEPARTMENT OF DEFENSE

<http://www.dtic.mil/whs/directives/>

DoD Directive 4715.21, *Climate Change Adaptation and Resilience*, 14 January 2016

### UNIFIED FACILITIES CRITERIA

[http://www.wbdg.org/ccb/browse\\_cat.php?o=29&c=4](http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4)

UFC 1-200-01, *DoD Building Code (General Building Requirements)*

UFC 3-301-01, *Structural Engineering*

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## APPENDIX B BEST PRACTICES

### B-1 BEST PRACTICES.

No best practices are documented at this time.

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## APPENDIX C GLOSSARY

### C-1      ACRONYMS

|                 |  |
|-----------------|--|
| AAF             | Army Air Field   |
| AB              | Air Base   |
| AFB             | Air Force Base   |
| AFCEC           | Air Force Civil Engineer Center  |
| AFM             | Air Force Manual   |
| AFS             | Air Force Station  |
| ANGB            | Air National Guard Base  |
| ANGS            | Air National Guard Station   |
| ANSI            | American National Standards Institute  |
| ARB             | Air Reserve Base   |
| ARS             | Air Reserve Station  |
| ASHRAE/IESNA    | American Society of Heating, Refrigerating, and Air Conditioning Engineers/Illuminating Engineering Society of North America |
| Btu             | British thermal units  |
| Btu/cfm         | British thermal units per cubic foot per minute  |
| Btu/lb          | British thermal units per pound of air (enthalpy)  |
| Btu/sq. ft./day | British thermal units per square foot per day (solar radiation)  |
| C               | Celsius  |
| Cfm             | Cubic foot per minute  |
| DoD             | Department of Defense  |
| EWD             | Engineering Weather Data   |
| F               | Fahrenheit   |
| gr/lb           | Grains per pound (humidity ratio, grains of water vapor per pound of air)  |

|                    |   |
|--------------------|---|
| g/kg               | Grams per kilogram (humidity ratio, grams of water vapor per kilogram of air) |
| in. Hg             | Inches of mercury (atmospheric pressure)                                      |
| in.                | Inches (frost depth)  |
| in./hr             | Inches per hour (rain rate)   |
| klux-hr            | Thousands of lux-hours (average incident illuminance)                         |
| lb/ft <sup>2</sup> | pounds per square foot (snow load)  |
| LST                | Local Standard Time   |
| MCAS               | Marine Corps air station  |
| MCB                | Marine Corps base   |
| MC Dewpt           | Mean Coincident Dewpoint  |
| MCDB               | Mean of dry bulb temperatures   |
| MCHR               | Mean Coincident Humidity Ratio  |
| MCWB               | Mean of wet bulb temperatures   |
| mph                | Miles per hour (wind speed)   |
| NAS                | Naval Air Station   |
| NAF                | Naval Air Facility  |
| NAVFAC             | Naval Facilities Engineering Command  |
| NCDC               | National Climatic Data Center   |
| NRC                | Naval Reserve Center  |
| NREL               | National Renewable Energy Laboratory  |
| NS                 | Naval Station   |
| NSA                | Naval Support Activity  |
| POR                | Period of record  |
| RH                 | Relative humidity   |
| ton-hr/cfm/yr      | Ton-hours of load per cubic foot per minute per year (Btu÷12,000)             |



|         |  |
|---------|--|
| USACE   | US Army Corps of Engineers   |
| VCLI    | Ventilation Cooling Load Index   |
| WBAN No | Weather Bureau Army Navy number, an identification number for solar radiation data stations in NREL's <i>Solar Radiation Data Manual for Buildings</i> |
| WS      | Weather Squadron   |
| BIA     | Bilateral Infrastructure Agreement   |
| DoD     | Department of Defense  |
| HQUSACE | Headquarters, U.S. Army Corps of Engineers   |
| HNFA    | Host Nation Funded Construction Agreements   |
| SOFA    | Status of Forces Agreements  |
| UFC     | Unified Facilities Criteria  |
| U.S.    | United States  |

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## APPENDIX E LIST OF AVAILABLE EWD SITES

### E-1 REGULARLY UPDATED SITES.

Table E-1 is a list that consists of the Site Name, 4-letter Station ID, Latitude/Longitude, and Country for each Engineering Weather Data (EWD) site available at the 14th Weather Squadron. Note that the sites are regularly updated and the latest list should be retrieved at <https://www.climate.af.mil>.

**Table E-1 List of Available EWD Sites**

| Site Name                             | Station ID | Lat    | Lon    | Country             |
|---------------------------------------|------------|--------|--------|---------------------|
| BAGRAM                                | KQSA       | 34.94  | 69.26  | AFGHANISTAN         |
| BASTION AIRFIELD/SHORABACK            | OAZI       | 31.85  | 64.22  | AFGHANISTAN         |
| HERAT                                 | OAHR       | 34.21  | 62.23  | AFGHANISTAN         |
| JALALABAD                             | KQL5       | 34.4   | 70.48  | AFGHANISTAN         |
| KABUL INTL                            | OAKB       | 34.57  | 69.21  | AFGHANISTAN         |
| KALAT                                 | OAKT       | 32.12  | 66.9   | AFGHANISTAN         |
| KANDAHAR AIRPORT                      | 40990      | 31.5   | 65.85  | AFGHANISTAN         |
| KUNDUZ                                | 40913      | 36.67  | 68.92  | AFGHANISTAN         |
| MAZAR I SHARIF                        | OAMS       | 36.71  | 67.21  | AFGHANISTAN         |
| EL GOLEA                              | DAUE       | 30.57  | 2.86   | ALGERIA             |
| HOUARI BOUMEDIENE                     | DAAG       | 36.69  | 3.22   | ALGERIA             |
| TAMANRASSET                           | DAAT       | 22.81  | 5.45   | ALGERIA             |
| TINDOUF                               | DAOF       | 27.7   | -8.17  | ALGERIA             |
| BASE MARAMBIO (CENTRO MET. ANTARTICO) | 89055      | -64.23 | -56.72 | ANTARCTICA          |
| V C BIRD INTL                         | TAPA       | 17.14  | -61.79 | ANTIGUA AND BARBUDA |
| MINISTRO PISTARINI                    | SAEZ       | -34.82 | -58.54 | ARGENTINA           |
| POSADAS                               | SARP       | -27.39 | -55.97 | ARGENTINA           |
| RESISTENCIA                           | SARE       | -27.45 | -59.06 | ARGENTINA           |
| RIO GALLEGOS                          | SAWG       | -51.61 | -69.31 | ARGENTINA           |
| ROSARIO                               | SAAR       | -32.9  | -60.78 | ARGENTINA           |
| REINA BEATRIX INTL                    | TNCA       | 12.5   | -70.02 | ARUBA               |
| ADELAIDE INTL                         | YPAD       | -34.94 | 138.53 | AUSTRALIA           |
| ALICE SPRINGS                         | YBAS       | -23.81 | 133.9  | AUSTRALIA           |
| BRISBANE AIRPORT                      | YBBN       | -27.42 | 153.07 | AUSTRALIA           |
| CANBERRA                              | YSCB       | -35.31 | 149.2  | AUSTRALIA           |
| DARWIN INTL                           | YPDN       | -12.41 | 130.88 | AUSTRALIA           |
| LEARMONTH                             | YPLM       | -22.24 | 114.09 | AUSTRALIA           |
| MELBOURNE INTL                        | YMML       | -37.67 | 144.84 | AUSTRALIA           |

| Site Name                       | Station ID | Lat    | Lon     | Country                        |
|---------------------------------|------------|--------|---------|--------------------------------|
| PERTH INTL                      | YPPH       | -31.94 | 115.97  | AUSTRALIA                      |
| SYDNEY INTL                     | YSSY       | -33.95 | 151.18  | AUSTRALIA                      |
| TOWNSVILLE                      | YBTL       | -19.25 | 146.77  | AUSTRALIA                      |
| SALZBURG                        | LOWS       | 47.79  | 13      | AUSTRIA                        |
| NASSAU INTL                     | MYNN       | 25.04  | -77.47  | BAHAMAS                        |
| BAHRAIN INTL                    | OBBI       | 26.27  | 50.63   | BAHRAIN                        |
| HAZRAT SHAHJALAL INTL           | VGHS       | 23.84  | 90.4    | BANGLADESH                     |
| ZHITCKOVICHI                    | 33027      | 52.22  | 27.87   | BELARUS                        |
| BRUSSELS NATL                   | EBBR       | 50.9   | 4.48    | BELGIUM                        |
| CHIEVRES AB                     | EBCV       | 50.58  | 3.83    | BELGIUM                        |
| FLORENNES                       | EBFS       | 50.24  | 4.65    | BELGIUM                        |
| CADJEHOUN                       | DBBB       | 6.36   | 2.38    | BENIN                          |
| BERMUDA INTL                    | TXKF       | 32.36  | -64.68  | BERMUDA                        |
| EL ALTO INTL                    | SLLP       | -16.51 | -68.19  | BOLIVIA                        |
| TTE AV JORGE HENRICH ARAUZ      | SLTR       | -14.82 | -64.92  | BOLIVIA                        |
| VIRU VIRU INTL                  | SLVR       | -17.64 | -63.14  | BOLIVIA                        |
| CONGONHAS                       | SBSP       | -23.63 | -46.66  | BRAZIL                         |
| DEPUTADO LUIS EDUARDO MAGALHAES | SBSV       | -12.91 | -38.33  | BRAZIL                         |
| EDUARDO GOMES INTL              | SBEG       | -3.04  | -60.05  | BRAZIL                         |
| GALEAO ANTONIO CARLOS JOBIM     | SBGL       | -22.81 | -43.24  | BRAZIL                         |
| GUARARAPES GILBERTO FREYRE INTL | SBRF       | -8.13  | -34.92  | BRAZIL                         |
| PINTO MARTINS INTL              | SBFZ       | -3.78  | -38.53  | BRAZIL                         |
| PRESIDENTE JUSCELINO KUBITSCHEK | SBBR       | -15.86 | -47.91  | BRAZIL                         |
| SALGADO FILHO                   | SBPA       | -29.99 | -51.17  | BRAZIL                         |
| SANTOS DUMONT                   | SBRJ       | -22.91 | -43.16  | BRAZIL                         |
| VAL DE CANS INTL                | SBBE       | -1.38  | -48.48  | BRAZIL                         |
| DIEGO GARCIA NSF                | FJDG       | -7.31  | 72.41   | BRITISH INDIAN OCEAN TERRITORY |
| BURGAS                          | LBBG       | 42.57  | 27.52   | BULGARIA                       |
| SOFIA                           | LBSF       | 42.7   | 23.41   | BULGARIA                       |
| VARNA                           | LBWN       | 43.23  | 27.83   | BULGARIA                       |
| OUAGADOUGOU                     | DFFD       | 12.35  | -1.51   | BURKINA FASO                   |
| MINGALADON                      | 48096      | 16.9   | 96.18   | BURMA                          |
| ARGENTIA (AUT)                  | 71807      | 47.3   | -53.98  | CANADA                         |
| ARMSTRONG (AUT) ONT             | 71841      | 50.28  | -88.9   | CANADA                         |
| CALGARY INTL                    | CYYC       | 51.11  | -114.02 | CANADA                         |
| CAMBRIDGE BAY                   | CYCB       | 69.11  | -105.14 | CANADA                         |
| CAPE DYER                       | CWFD       | 66.65  | -61.38  | CANADA                         |
| CAPE PARRY A                    | CZCP       | 70.17  | -124.72 | CANADA                         |
| CHAPPAIS                        | CYMT       | 49.77  | -74.53  | CANADA                         |

| <b>Site Name</b>               | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b> |
|--------------------------------|-------------------|------------|------------|----------------|
| CHARLO AUTO NB                 | 71315             | 47.98      | -66.33     | CANADA         |
| CHURCHILL A UA MAN             | 71913             | 58.73      | -94.07     | CANADA         |
| CHURCHILL FALLS                | CZUM              | 53.57      | -64.1      | CANADA         |
| COLD LAKE                      | CYOD              | 54.4       | -110.28    | CANADA         |
| COMOX                          | CYQQ              | 49.71      | -124.89    | CANADA         |
| EDMONTON/NAMAO(MIL)            | CYED              | 53.67      | -113.47    | CANADA         |
| ESTEVAN A                      | CYEN              | 49.22      | -102.97    | CANADA         |
| FORT NELSON                    | CYYE              | 58.83      | -122.6     | CANADA         |
| FORT SMITH                     | CYSM              | 60.02      | -111.96    | CANADA         |
| FREDERICTON                    | CYFC              | 45.87      | -66.53     | CANADA         |
| GANDER INTL                    | CYQX              | 48.94      | -54.57     | CANADA         |
| GOOSE BAY                      | CYYR              | 53.32      | -60.42     | CANADA         |
| GRANDE PRAIRIE                 | CYQU              | 55.18      | -118.88    | CANADA         |
| HALIFAX INTL                   | CYHZ              | 44.88      | -63.51     | CANADA         |
| HALL BEACH                     | CYUX              | 68.78      | -81.24     | CANADA         |
| HOPEDALE (AUT) NFLD            | 71900             | 55.45      | -60.22     | CANADA         |
| INUVIK MIKE ZUBKO              | CYEV              | 68.3       | -133.48    | CANADA         |
| IQALUIT                        | CYFB              | 63.76      | -68.56     | CANADA         |
| KAMLOOPS                       | CYKA              | 50.7       | -120.44    | CANADA         |
| KAPUSKASING                    | CYYU              | 49.41      | -82.47     | CANADA         |
| KUGLUKTUK                      | CYCO              | 67.82      | -115.14    | CANADA         |
| LESTER B PEARSON INTL          | CYYZ              | 43.68      | -79.63     | CANADA         |
| LYNN LAKE                      | CYYL              | 56.86      | -101.08    | CANADA         |
| NORMAN WELLS                   | CYVQ              | 65.28      | -126.8     | CANADA         |
| NORTH BAY                      | CYYB              | 46.36      | -79.42     | CANADA         |
| OTTAWA MACDONALD CARTIER INTL  | CYOW              | 45.32      | -75.67     | CANADA         |
| PIERRE ELLIOTT TRUDEAU INTL    | CYUL              | 45.47      | -73.73     | CANADA         |
| POND INLET                     | CYIO              | 72.68      | -77.97     | CANADA         |
| PORT HARDY                     | CYZT              | 50.68      | -127.37    | CANADA         |
| PRINCE GEORGE                  | CYXS              | 53.89      | -122.68    | CANADA         |
| RANKIN INLET                   | CYRT              | 62.81      | -92.12     | CANADA         |
| RESOLUTE BAY                   | CYRB              | 74.72      | -94.97     | CANADA         |
| SANDSPIT                       | CYZP              | 53.25      | -131.81    | CANADA         |
| SASKATOON J G DIEFENBAKER INTL | CYXE              | 52.17      | -106.7     | CANADA         |
| SEPT ILES                      | CYZV              | 50.22      | -66.27     | CANADA         |
| SHEPHERD BAY A                 | CYUS              | 68.82      | -93.43     | CANADA         |
| SHERBROOKE                     | CYSC              | 45.44      | -71.69     | CANADA         |
| SIOUX LOOKOUT AIRPORT          | CYXL              | 50.12      | -91.9      | CANADA         |
| ST JOHNS INTL                  | CYYT              | 47.62      | -52.75     | CANADA         |
| STEPHENVILLE A                 | CYJT              | 48.53      | -58.55     | CANADA         |

| Site Name                                  | Station ID | Lat    | Lon     | Country                     |
|--|------------|--------|---------|-----------------------------|
| SUDBURY                                    | CYSB       | 46.63  | -80.8   | CANADA                      |
| SYDNEY A                                   | CYQY       | 46.17  | -60.05  | CANADA                      |
| TERRACE                                    | CYXT       | 54.47  | -128.58 | CANADA                      |
| THE PAS AIRPORT                            | CYQD       | 53.97  | -101.1  | CANADA                      |
| THUNDER BAY A                              | CYQT       | 48.37  | -89.33  | CANADA                      |
| TIMMINS VICTOR POWER A                     | CYTS       | 48.57  | -81.38  | CANADA                      |
| VANCOUVER INTL                             | CYVR       | 49.19  | -123.18 | CANADA                      |
| WHITEHORSE INTL                            | CYXY       | 60.71  | -135.07 | CANADA                      |
| WINNIPEG INTL                              | CYWG       | 49.91  | -97.24  | CANADA                      |
| YARMOUTH                                   | CYQI       | 43.83  | -66.09  | CANADA                      |
| YELLOWKNIFE                                | CYZF       | 62.46  | -114.44 | CANADA                      |
| AMILCAR CABRAL INTL                        | GVAC       | 16.74  | -22.95  | CAPE VERDE                  |
| BANGUI M POKO                              | FEFF       | 4.4    | 18.52   | CENTRAL AFRICAN<br>REPUBLIC |
| NDJAMENA HASSAN DJAMOUS                    | FTTJ       | 12.13  | 15.03   | CHAD                        |
| ARTURO MERINO BENITEZ INTL                 | SCEL       | -33.39 | -70.79  | CHILE                       |
| CARRIEL SUR INTL                           | SCIE       | -36.77 | -73.06  | CHILE                       |
| CERRO MORENO INTL                          | SCFA       | -23.44 | -70.45  | CHILE                       |
| ANQING                                     | 58424      | 30.62  | 116.97  | CHINA                       |
| ARXAN                                      | 50727      | 47.17  | 119.93  | CHINA                       |
| BAITA                                      | ZBHH       | 40.85  | 111.82  | CHINA                       |
| BAYTIK SHAN                                | 51288      | 45.37  | 90.53   | CHINA                       |
| BEIJING - CAPITAL INTERNATIONAL<br>AIRPORT | ZBAA       | 40.08  | 116.58  | CHINA                       |
| BENGBU                                     | 58221      | 32.85  | 117.3   | CHINA                       |
| BOXIAN                                     | 58102      | 33.78  | 115.73  | CHINA                       |
| CHANGLE                                    | ZSFZ       | 25.94  | 119.66  | CHINA                       |
| DA-QAIDAM                                  | 52713      | 37.85  | 95.37   | CHINA                       |
| EJIN QI                                    | 52267      | 41.95  | 101.07  | CHINA                       |
| FUJIN                                      | 50788      | 47.23  | 131.98  | CHINA                       |
| GAOPING                                    | 57411      | 30.75  | 106.13  | CHINA                       |
| GARZE                                      | 56146      | 31.62  | 100     | CHINA                       |
| HAIKOU                                     | 59758      | 20     | 110.25  | CHINA                       |
| HAILAR                                     | 50527      | 49.25  | 119.7   | CHINA                       |
| HALIUT                                     | 53336      | 41.57  | 108.52  | CHINA                       |
| HARBIN                                     | 50953      | 45.93  | 126.57  | CHINA                       |
| HECHI                                      | 59023      | 24.7   | 108.05  | CHINA                       |
| HEZUO                                      | 56080      | 35     | 102.9   | CHINA                       |
| HONGQIAO INTL                              | ZSSS       | 31.2   | 121.34  | CHINA                       |
| HOTAN                                      | 51828      | 37.13  | 79.93   | CHINA                       |
| HUADE                                      | 53391      | 41.9   | 114     | CHINA                       |



| Site Name                           | Station ID | Lat   | Lon    | Country                             |
|-------------------------------------|------------|-------|--------|-------------------------------------|
| HUOSHAN                             | 58314      | 31.4  | 116.33 | CHINA                               |
| JI'AN                               | 57799      | 27.12 | 114.97 | CHINA                               |
| KASHI                               | ZWSH       | 39.54 | 76.02  | CHINA                               |
| KUQA                                | 51644      | 41.72 | 82.95  | CHINA                               |
| LANZHOU                             | 52889      | 36.05 | 103.88 | CHINA                               |
| LAOHEKOU                            | 57265      | 32.43 | 111.73 | CHINA                               |
| LIANGJIANG                          | ZGKL       | 25.22 | 110.04 | CHINA                               |
| LIJING                              | 56651      | 26.83 | 100.47 | CHINA                               |
| LINDONG                             | 54027      | 43.98 | 119.4  | CHINA                               |
| LIUTING                             | ZSQD       | 36.27 | 120.37 | CHINA                               |
| OTOG QI                             | 53529      | 39.1  | 107.98 | CHINA                               |
| RUOQIANG                            | 51777      | 39.03 | 88.17  | CHINA                               |
| SANJIAZI                            | ZYQQ       | 47.24 | 123.92 | CHINA                               |
| SHENYANG                            | 54342      | 41.73 | 123.52 | CHINA                               |
| SHUANGLIU                           | ZUUU       | 30.58 | 103.95 | CHINA                               |
| WUJIABA                             | ZPPP       | 24.99 | 102.74 | CHINA                               |
| WUSU                                | ZBYN       | 37.75 | 112.63 | CHINA                               |
| XIN BARAG YOUQI                     | 50603      | 48.68 | 116.82 | CHINA                               |
| YANCHI                              | 53723      | 37.8  | 107.38 | CHINA                               |
| YICHANG                             | 57461      | 30.73 | 111.37 | CHINA                               |
| ZHOUSHUIZI                          | ZYTL       | 38.97 | 121.54 | CHINA                               |
| ALFONSO BONILLA ARAGON INTL         | SKCL       | 3.54  | -76.38 | COLOMBIA                            |
| ELDORADO INTL                       | SKBO       | 4.7   | -74.15 | COLOMBIA                            |
| ERNESTO CORTISOZ                    | SKBQ       | 10.89 | -74.78 | COLOMBIA                            |
| NDJILI INTL                         | FZAA       | -4.39 | 15.44  | CONGO,<br>DEMOCRATIC<br>REPUBLIC OF |
| JUAN SANTAMARIA INTL                | MROC       | 9.99  | -84.21 | COSTA RICA                          |
| ABIDJAN FELIX HOUPHOUET BOIGNY INTL | DIAP       | 5.26  | -3.93  | COTE D'IVOIRE                       |
| GUANTANAMO BAY NS                   | MUGM       | 19.91 | -75.21 | CUBA                                |
| JOSE MARTI INTL                     | MUHA       | 22.99 | -82.41 | CUBA                                |
| LARNACA                             | LCLK       | 34.88 | 33.62  | CYPRUS                              |
| PAFOS INTL                          | LCPH       | 34.72 | 32.49  | CYPRUS                              |
| RUZYNE                              | LKPR       | 50.1  | 14.26  | CZECH REPUBLIC                      |
| FLYVESTATION AALBORG                | EKYT       | 57.09 | 9.85   | DENMARK                             |
| KASTRUP                             | EKCH       | 55.62 | 12.66  | DENMARK                             |
| CAMP LEMONNIER                      | KQRH       | 11.55 | 43.16  | DJIBOUTI                            |
| DJIBOUTI AMBOULI                    | HDAM       | 11.55 | 43.16  | DJIBOUTI                            |
| LAS AMERICAS INTL                   | MDSD       | 18.43 | -69.67 | DOMINICAN<br>REPUBLIC               |
| MARISCAL SUCRE INTL                 | SEQU       | -0.14 | -78.49 | ECUADOR                             |

| <b>Site Name</b>          | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b>                 |
|---------------------------|-------------------|------------|------------|--------------------------------|
| SIMON BOLIVAR INTL        | SEGU              | -2.16      | -79.88     | ECUADOR                        |
| ALEXANDRIA INTL           | HEAX              | 31.18      | 29.95      | EGYPT                          |
| CAIRO INTL                | HECA              | 30.12      | 31.41      | EGYPT                          |
| LUXOR INTL                | HELX              | 25.67      | 32.71      | EGYPT                          |
| ILOPANGO INTL             | MSSS              | 13.7       | -89.12     | EL SALVADOR                    |
| CHUUK INTL                | PTKK              | 7.46       | 151.84     | FEDERATED STATES OF MICRONESIA |
| POHNPEI INTL              | PTPN              | 6.99       | 158.21     | FEDERATED STATES OF MICRONESIA |
| YAP INTL                  | PTYA              | 9.5        | 138.08     | FEDERATED STATES OF MICRONESIA |
| NADI INTL                 | NFFN              | -17.76     | 177.44     | FIJI                           |
| HELSINKI VANTAA           | EFHK              | 60.32      | 24.96      | FINLAND                        |
| KAJAANI                   | EFKI              | 64.29      | 27.69      | FINLAND                        |
| ARNAGE                    | LFRM              | 47.95      | 0.2        | FRANCE                         |
| BRON                      | LFLY              | 45.73      | 4.94       | FRANCE                         |
| CHATEAUBERNARD            | LFBG              | 45.66      | -0.32      | FRANCE                         |
| COTE D AZUR               | LFMN              | 43.66      | 7.22       | FRANCE                         |
| LE TUBE                   | LFMI              | 43.52      | 4.92       | FRANCE                         |
| MONT DE MARSAN            | LFBM              | 43.91      | -0.51      | FRANCE                         |
| ORLY                      | LFPO              | 48.73      | 2.36       | FRANCE                         |
| PROVENCE                  | LFML              | 43.44      | 5.21       | FRANCE                         |
| ROCHAMBEAU                | SOCA              | 4.82       | -52.36     | FRENCH GUIANA                  |
| TAHITI FAAA               | NTAA              | -17.55     | -149.61    | FRENCH POLYNESIA               |
| LEON M BA                 | FOOL              | 0.46       | 9.41       | GABON                          |
| BANJUL INTL               | GBYD              | 13.34      | -16.65     | GAMBIA                         |
| TBILISI / LOCHINI AIRPORT | UGGG              | 41.75      | 44.77      | GEORGIA                        |
| YEREVAN/YEREVAN-ARABKIR   | 37789             | 40.13      | 44.47      | GEORGIA                        |
| ANSBACH AHP               | ETEB              | 49.31      | 10.64      | GERMANY                        |
| AUGSBURG                  | EDMA              | 48.43      | 10.93      | GERMANY                        |
| BAD KREUZNACH AAF         | ETEH              | 49.85      | 7.88       | GERMANY                        |
| BAMBERG                   | 10675             | 49.88      | 10.92      | GERMANY                        |
| BREMEN                    | EDDW              | 53.05      | 8.79       | GERMANY                        |
| BREMERHAVEN               | 10129             | 53.53      | 8.58       | GERMANY                        |
| BUHEL                     | ETSB              | 50.17      | 7.06       | GERMANY                        |
| ERDING                    | ETSE              | 48.32      | 11.95      | GERMANY                        |
| FRANKFURT HAHN            | EDFH              | 49.95      | 7.26       | GERMANY                        |
| FRANKFURT MAIN            | EDDF              | 50.03      | 8.54       | GERMANY                        |
| GARMISCH-PARTENKIRCHEN    | 10963             | 47.48      | 11.07      | GERMANY                        |
| GEILENKIRCHEN             | ETNG              | 50.96      | 6.04       | GERMANY                        |
| GIESSEN-WETTENBERG        | 10532             | 50.6       | 8.65       | GERMANY                        |

| <b>Site Name</b>          | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b> |
|---------------------------|-------------------|------------|------------|----------------|
| GRAFENWOHR AAF            | ETIC              | 49.7       | 11.94      | GERMANY        |
| HANAU AAF                 | ETID              | 50.17      | 8.96       | GERMANY        |
| HANNOVER                  | EDDV              | 52.46      | 9.69       | GERMANY        |
| HEIDELBERG AHP            | ETIE              | 49.39      | 8.65       | GERMANY        |
| IDAR-OBERSTEIN(MIL)       | ETGI              | 49.7       | 7.33       | GERMANY        |
| KARLSRUHE                 | 10727             | 49.03      | 8.37       | GERMANY        |
| KASSEL                    | 10438             | 51.3       | 9.45       | GERMANY        |
| KITZINGEN AAF             | ETIN              | 49.74      | 10.2       | GERMANY        |
| KITZINGEN(US ARMY)        | 10659             | 49.75      | 10.2       | GERMANY        |
| LAUTERTAL-OBERLAUTER      | 10671             | 50.3       | 10.97      | GERMANY        |
| LEUCHTTURM KIEL           | 10044             | 54.5       | 10.27      | GERMANY        |
| MANNHEIM CITY             | EDFM              | 49.47      | 8.51       | GERMANY        |
| MUNCHEN                   | EDDM              | 48.35      | 11.79      | GERMANY        |
| NURNBERG                  | EDDN              | 49.5       | 11.08      | GERMANY        |
| OLDENBURG                 | 10215             | 53.18      | 8.17       | GERMANY        |
| RAMSTEIN AB               | ETAR              | 49.44      | 7.6        | GERMANY        |
| SEMBACH (USAFB)           | ETAS              | 49.5       | 7.87       | GERMANY        |
| SPANGDAHLEM AB            | ETAD              | 49.97      | 6.69       | GERMANY        |
| STOETTEN                  | 10836             | 48.67      | 9.87       | GERMANY        |
| STUTTGART                 | EDDS              | 48.69      | 9.22       | GERMANY        |
| TEMPELHOF                 | EDDI              | 52.47      | 13.4       | GERMANY        |
| ULM                       | 10838             | 48.38      | 9.95       | GERMANY        |
| WENDELSTEIN               | 10980             | 47.7       | 12.02      | GERMANY        |
| WIESBADEN AAF             | ETOU              | 50.05      | 8.33       | GERMANY        |
| WUERZBURG                 | 10655             | 49.77      | 9.95       | GERMANY        |
| ZWEIBRUCKEN               | EDRZ              | 49.21      | 7.4        | GERMANY        |
| KOTOKA INTL               | DGAA              | 5.61       | -0.17      | GHANA          |
| AKTIO                     | LGPZ              | 38.93      | 20.77      | GREECE         |
| ANDRAVIDA                 | LGAD              | 37.92      | 21.29      | GREECE         |
| ATHINAI                   | LGAT              | 37.88      | 23.73      | GREECE         |
| DIAGORAS                  | LGRP              | 36.41      | 28.09      | GREECE         |
| ELEFSIS                   | LGEL              | 38.06      | 23.56      | GREECE         |
| IOANNIS KAPODISTRIAS INTL | LGKR              | 39.6       | 19.91      | GREECE         |
| LARISA                    | LGLR              | 39.65      | 22.47      | GREECE         |
| MAKEDONIA                 | LGTS              | 40.52      | 22.97      | GREECE         |
| NIKOS KAZANTZAKIS         | LGIR              | 35.34      | 25.18      | GREECE         |
| SOUDA                     | LGSA              | 35.53      | 24.15      | GREECE         |
| SOUDA BAY (NEMOD)         | EQYG              | 35.53      | 24.15      | GREECE         |
| NUUK (GODTHAAB)           | 4250              | 64.17      | -51.75     | GREENLAND      |
| SONDRE STROMFJORD         | BGSF              | 67.02      | -50.69     | GREENLAND      |

| Site Name                        | Station ID | Lat   | Lon    | Country   |
|----------------------------------|------------|-------|--------|-----------|
| TASIILAQ                         | BGAM       | 65.6  | -37.63 | GREENLAND |
| THULE AIR BASE                   | BGTL       | 76.53 | -68.7  | GREENLAND |
| ANDERSEN AFB                     | PGUA       | 13.58 | 144.93 | GUAM      |
| GUAM INTL                        | PGUM       | 13.48 | 144.8  | GUAM      |
| LA AURORA                        | MGGT       | 14.58 | -90.53 | GUATEMALA |
| TOUSSAINT LOUVERTURE INTL        | MTTP       | 18.58 | -72.29 | HAITI     |
| SOTO CANO AB                     | MHSC       | 14.38 | -87.62 | HONDURAS  |
| TONCONTIN INTL                   | MHTG       | 14.06 | -87.22 | HONDURAS  |
| HONG KONG INTL                   | VHHH       | 22.31 | 113.91 | HONG KONG |
| FERIHEGY                         | LHBP       | 47.44 | 19.26  | HUNGARY   |
| KEFLAVIK NAS                     | BIKF       | 63.99 | -22.61 | ICELAND   |
| REYKJAVIK                        | BIRK       | 64.13 | -21.94 | ICELAND   |
| BEGUMPET AIRPORT                 | VOHY       | 17.45 | 78.46  | INDIA     |
| CHENNAI INTL                     | VOMM       | 12.99 | 80.18  | INDIA     |
| CHHATRAPATI SHIVAJI INTL         | VABB       | 19.09 | 72.87  | INDIA     |
| NETAJI SUBHASH CHANDRA BOSE INTL | VECC       | 22.65 | 88.45  | INDIA     |
| SAFDARJUNG                       | VIDD       | 28.58 | 77.21  | INDIA     |
| DENPASAR NGURAH RAI              | WRRR       | -8.75 | 115.17 | INDONESIA |
| MEHRABAD INTL                    | OIII       | 35.69 | 51.31  | IRAN      |
| BAGHDAD                          | KQTZ       | 33.25 | 44.23  | IRAQ      |
| BASRAH INTL                      | ORMM       | 30.55 | 47.66  | IRAQ      |
| DIWANIYA                         | 40672      | 31.95 | 44.95  | IRAQ      |
| KIRKUK AB                        | ORKK       | 35.47 | 44.35  | IRAQ      |
| KUT-AL-HAI                       | 40665      | 32.13 | 46.03  | IRAQ      |
| MOSUL                            | ORBM       | 36.31 | 43.15  | IRAQ      |
| NASIRIYA                         | 40676      | 31.02 | 46.23  | IRAQ      |
| RUTBAH                           | 40642      | 33.03 | 40.28  | IRAQ      |
| DUBLIN                           | EIDW       | 53.42 | -6.27  | IRELAND   |
| SHANNON                          | EINN       | 52.7  | -8.92  | IRELAND   |
| OVDA                             | LLOV       | 29.94 | 34.94  | ISRAEL    |
| RAMAT DAVID                      | LLRD       | 32.67 | 35.18  | ISRAEL    |
| SDE DOV                          | LLSD       | 32.11 | 34.78  | ISRAEL    |
| AVIANO AB                        | LIPA       | 46.03 | 12.6   | ITALY     |
| CAPODICHINO                      | LIRN       | 40.89 | 14.29  | ITALY     |
| CASALE                           | LIBR       | 40.66 | 17.95  | ITALY     |
| CIAMPINO                         | LIRA       | 41.8  | 12.59  | ITALY     |
| CIMONE MOUNTAIN                  | LIVC       | 44.2  | 10.7   | ITALY     |
| DECIMOMANNU                      | LIED       | 39.35 | 8.97   | ITALY     |
| ELMAS                            | LIEE       | 39.25 | 9.05   | ITALY     |
| GHEDI                            | LIPL       | 45.43 | 10.27  | ITALY     |

| Site Name          | Station ID | Lat   | Lon     | Country        |
|--------------------|------------|-------|---------|----------------|
| GRAZZANISE         | LIRM       | 41.06 | 14.08   | ITALY          |
| LINATE             | LIML       | 45.45 | 9.28    | ITALY          |
| PISA               | LIRP       | 43.68 | 10.39   | ITALY          |
| RIMINI             | LIPR       | 44.02 | 12.61   | ITALY          |
| SIGONELLA          | LICZ       | 37.4  | 14.92   | ITALY          |
| SIGONELLA (NEMOD)  | EQYS       | 37.4  | 14.9    | ITALY          |
| VENEZIA TESSERA    | LIPZ       | 45.51 | 12.35   | ITALY          |
| VICENZA            | LIPT       | 45.57 | 11.53   | ITALY          |
| VILLAFRANCA        | LIPX       | 45.4  | 10.89   | ITALY          |
| NORMAN MANLEY INTL | MKJP       | 17.94 | -76.79  | JAMAICA        |
| ASHIYA             | RJFA       | 33.88 | 130.65  | JAPAN          |
| ATSUGI NAF         | RJTA       | 35.45 | 139.45  | JAPAN          |
| FUKUOKA            | 47807      | 33.58 | 130.38  | JAPAN          |
| FUKUOKA            | RJFF       | 33.59 | 130.45  | JAPAN          |
| FUTENMA MCAS       | ROTM       | 26.27 | 127.76  | JAPAN          |
| IRUMA              | RJTJ       | 35.84 | 139.41  | JAPAN          |
| IWAKUNI MCAS       | RJOI       | 34.14 | 132.24  | JAPAN          |
| KADENA AB          | RODN       | 26.36 | 127.77  | JAPAN          |
| MISAWA AB          | RJSM       | 40.7  | 141.37  | JAPAN          |
| MORIOKA            | 47584      | 39.7  | 141.17  | JAPAN          |
| NAGASAKI           | 47817      | 32.73 | 129.87  | JAPAN          |
| NAGASAKI           | RJFU       | 32.92 | 129.91  | JAPAN          |
| NAGOYA             | RJNA       | 35.26 | 136.92  | JAPAN          |
| NAHA               | ROAH       | 26.2  | 127.65  | JAPAN          |
| NARITA INTL        | RJAA       | 35.76 | 140.39  | JAPAN          |
| NEW CHITOSE        | RJCC       | 42.78 | 141.69  | JAPAN          |
| OSAKA INTL         | RJOO       | 34.79 | 135.44  | JAPAN          |
| SAPPORO            | 47412      | 43.07 | 141.33  | JAPAN          |
| SAPPORO            | RJCO       | 43.12 | 141.38  | JAPAN          |
| SASEBO             | 47812      | 33.17 | 129.73  | JAPAN          |
| TOKYO              | RJTD       | 35.68 | 139.77  | JAPAN          |
| TOKYO INTL         | RJTT       | 35.55 | 139.78  | JAPAN          |
| YOKOSUKA (NPMOF)   | RJTX       | 35.28 | 139.67  | JAPAN          |
| YOKOTA AB          | RJTY       | 35.75 | 139.35  | JAPAN          |
| JOHNSTON ATOLL     | PJON       | 16.73 | -169.53 | JOHNSTON ATOLL |
| H4                 | OJHR       | 32.54 | 38.19   | JORDAN         |
| JERUSALEM AIRPORT  | 40290      | 31.87 | 35.22   | JORDAN         |
| MARKA INTL         | OJAM       | 31.97 | 35.99   | JORDAN         |
| AKKUDUK            | 38232      | 42.97 | 54.12   | KAZAKHSTAN     |
| AKTAU              | UATE       | 43.86 | 51.09   | KAZAKHSTAN     |

| Site Name            | Station ID | Lat   | Lon    | Country                                      |
|----------------------|------------|-------|--------|--|
| AKTYUBINSK           | UATT       | 50.25 | 57.21  | KAZAKHSTAN                                   |
| BALHASH              | 35796      | 46.8  | 75.08  | KAZAKHSTAN                                   |
| CIRIK-RABAT          | 38049      | 44.07 | 62.9   | KAZAKHSTAN                                   |
| KOKSHETAY            | 28879      | 53.28 | 69.38  | KAZAKHSTAN                                   |
| KZYL-ORDA            | UAOO       | 44.77 | 65.53  | KAZAKHSTAN                                   |
| NOVYJ USHTOGAN       | 34691      | 47.9  | 48.8   | KAZAKHSTAN                                   |
| SAM                  | 35925      | 45.4  | 56.12  | KAZAKHSTAN                                   |
| SEMIPALATINSK        | 36177      | 50.42 | 80.3   | KAZAKHSTAN                                   |
| TAIPAK               | 35406      | 49.05 | 51.87  | KAZAKHSTAN                                   |
| TASTY                | 380810     | 44.8  | 69.12  | KAZAKHSTAN                                   |
| URALSK               | UARR       | 51.15 | 51.54  | KAZAKHSTAN                                   |
| GARISSA              | HKGA       | -0.46 | 39.65  | KENYA  |
| MANDERA              | HKMA       | 3.93  | 41.87  | KENYA  |
| MOMBASA MOI INTL     | HKMO       | -4.03 | 39.59  | KENYA  |
| NAIROBI JKIA         | HKJK       | -1.32 | 36.93  | KENYA  |
| CHONGJIN             | 47008      | 41.78 | 129.82 | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| KANGGYE              | 47020      | 40.97 | 126.6  | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| PYONGYANG INTL       | ZKPY       | 39.22 | 125.67 | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| SENBONG              | 47003      | 42.32 | 130.4  | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| SINUJU               | 47035      | 40.1  | 124.38 | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| WONSAN               | 47055      | 39.18 | 127.43 | KOREA, DEMOCRATIC<br>PEOPLE'S REPUBLIC<br>OF |
| A 511/PYEONGTAEK     | RKSG       | 36.97 | 127.03 | KOREA, REPUBLIC OF                           |
| ANMYEONDO            | 47132      | 36.52 | 126.32 | KOREA, REPUBLIC OF                           |
| BAENGNYEONGDO        | 47102      | 37.97 | 124.63 | KOREA, REPUBLIC OF                           |
| BUSAN                | 47159      | 35.1  | 129.03 | KOREA, REPUBLIC OF                           |
| CAMP REDCLOUD/UIJD   | RKSB       | 37.75 | 127.03 | KOREA, REPUBLIC OF                           |
| CAMP STANLEY TMQ-53P | KQFA       | 37.72 | 127.1  | KOREA, REPUBLIC OF                           |
| CHEONGJU INTL        | RKTU       | 36.72 | 127.5  | KOREA, REPUBLIC OF                           |
| CHUNCHEON            | 47101      | 37.9  | 127.73 | KOREA, REPUBLIC OF                           |
| CHUPUNGNYEONG        | 47135      | 36.22 | 127.98 | KOREA, REPUBLIC OF                           |
| DAEGU AB             | RKTN       | 35.89 | 128.66 | KOREA, REPUBLIC OF                           |
| GANGNEUNG            | RKNN       | 37.75 | 128.94 | KOREA, REPUBLIC OF                           |

| Site Name                     | Station ID | Lat   | Lon     | Country            |
|-------------------------------|------------|-------|---------|--------------------|
| GIMHAE INTL                   | RKPK       | 35.18 | 128.94  | KOREA, REPUBLIC OF |
| GIMPO                         | RKSS       | 37.56 | 126.79  | KOREA, REPUBLIC OF |
| GWANGJU                       | RKJJ       | 35.13 | 126.81  | KOREA, REPUBLIC OF |
| INCHEON                       | 47112      | 37.47 | 126.63  | KOREA, REPUBLIC OF |
| KAESONG                       | 47070      | 37.97 | 126.57  | KOREA, REPUBLIC OF |
| KOREAN AF HQ                  | RKSF       | 37.5  | 126.92  | KOREA, REPUBLIC OF |
| KUNSAN AB                     | RKJK       | 35.9  | 126.62  | KOREA, REPUBLIC OF |
| MANGILSAN                     | 47126      | 36.93 | 126.45  | KOREA, REPUBLIC OF |
| MOSULPO (KOR-AFB)             | RKPM       | 33.2  | 126.27  | KOREA, REPUBLIC OF |
| OSAN AB                       | RKSO       | 37.09 | 127.03  | KOREA, REPUBLIC OF |
| POHANG                        | RKTH       | 35.99 | 129.42  | KOREA, REPUBLIC OF |
| SACHEON AB                    | RKPS       | 35.09 | 128.07  | KOREA, REPUBLIC OF |
| SEOUL AB                      | RKSM       | 37.45 | 127.11  | KOREA, REPUBLIC OF |
| SUWON                         | RKSW       | 37.24 | 127.01  | KOREA, REPUBLIC OF |
| YECHEON                       | RKTY       | 36.63 | 128.35  | KOREA, REPUBLIC OF |
| ALI AL SALEM                  | KQGV       | 29.33 | 47.52   | KUWAIT             |
| KUWAIT INTL                   | OKBK       | 29.23 | 47.97   | KUWAIT             |
| BISHKEK                       | 38353      | 42.85 | 74.53   | KYRGYZSTAN         |
| GULBENE                       | 26348      | 57.13 | 26.72   | LATVIA             |
| LIEPAJA INTL                  | EVLA       | 56.52 | 21.1    | LATVIA             |
| RAFIC HARIRI INTL             | OLBA       | 33.82 | 35.49   | LEBANON            |
| BENINA AIRPORT                | HLLB       | 32.1  | 20.27   | LIBYA              |
| TRIPOLI INTL                  | HLLT       | 32.66 | 13.16   | LIBYA              |
| VILNIUS INTL                  | EYVI       | 54.63 | 25.29   | LITHUANIA          |
| KOTA KINABALU INTL            | WBKK       | 5.94  | 116.05  | MALAYSIA           |
| KUCHING INTL                  | WBGG       | 1.48  | 110.35  | MALAYSIA           |
| PENANG INTL                   | WMKP       | 5.3   | 100.28  | MALAYSIA           |
| SULTAN ABDUL AZIZ SHAH INTL   | WMSA       | 3.13  | 101.55  | MALAYSIA           |
| BUCHOLZ AAF                   | PKWA       | 8.72  | 167.73  | MARSHALL ISLAND    |
| MARSHALL ISLANDS INTL         | PKMJ       | 7.06  | 171.27  | MARSHALL ISLAND    |
| LE LAMENTIN                   | TFFF       | 14.59 | -61     | MARTINIQUE         |
| NOUAKCHOTT                    | GQNN       | 18.1  | -15.95  | MAURITANIA         |
| DZAOUDZI PAMANDZI             | FMCZ       | -12.8 | 45.28   | MAYOTTE            |
| LICENCIADO BENITO JUAREZ INTL | MMMX       | 19.44 | -99.07  | MEXICO             |
| MIDWAY ATOLL                  | PMDY       | 28.2  | -177.38 | MIDWAY ISLANDS     |
| CHISINAU                      | 33815      | 47.02 | 28.98   | MOLDOVA            |
| DALANZADGAD                   | 44373      | 43.58 | 104.42  | MONGOLIA           |
| MANDALGOBI                    | 44341      | 45.77 | 106.28  | MONGOLIA           |
| TSETSERLEG                    | 44282      | 47.45 | 101.47  | MONGOLIA           |
| UNDERKHAAN                    | 44304      | 47.32 | 110.63  | MONGOLIA           |



| Site Name                          | Station ID | Lat    | Lon    | Country                     |
|------------------------------------|------------|--------|--------|-----------------------------|
| PODGORICA / GOLUBOVCI              | LYTI       | 42.37  | 19.25  | MONTENEGRO                  |
| TIVAT                              | LYTV       | 42.4   | 18.72  | MONTENEGRO                  |
| IBN BATOUTA                        | GMTT       | 35.73  | -5.92  | MOROCCO                     |
| MOHAMMED V                         | GMMN       | 33.37  | -7.59  | MOROCCO                     |
| SALE                               | GMME       | 34.05  | -6.75  | MOROCCO                     |
| MAPUTO                             | FQMA       | -25.92 | 32.57  | MOZAMBIQUE                  |
| HOEK VAN HOLLAND                   | 6330       | 51.98  | 4.1    | NETHERLANDS                 |
| LEEWARDEN                          | EHLW       | 53.23  | 5.76   | NETHERLANDS                 |
| SCHIPHOL                           | EHAM       | 52.31  | 4.76   | NETHERLANDS                 |
| SOESTERBERG                        | EHSB       | 52.13  | 5.28   | NETHERLANDS                 |
| VOLKEL                             | EHVK       | 51.66  | 5.71   | NETHERLANDS                 |
| HATO                               | TNCC       | 12.19  | -68.96 | NETHERLANDS<br>ANTILLES     |
| CHRISTCHURCH INTL                  | NZCH       | -43.49 | 172.53 | NEW ZEALAND                 |
| WELLINGTON INTL                    | NZWN       | -41.33 | 174.81 | NEW ZEALAND                 |
| MANAGUA INTL                       | MNMG       | 12.14  | -86.17 | NICARAGUA                   |
| DIORI HAMANI                       | DRRN       | 13.48  | 2.18   | NIGER                       |
| FRANCISCO C ADA SAIPAN INTL        | PGSN       | 15.12  | 145.73 | NORTHERN MARIANA<br>ISLANDS |
| ANDOYA                             | ENAN       | 69.29  | 16.14  | NORWAY                      |
| BANAK                              | ENNA       | 70.07  | 24.97  | NORWAY                      |
| BODO                               | ENBO       | 67.27  | 14.37  | NORWAY                      |
| FLESLAND                           | ENBR       | 60.29  | 5.22   | NORWAY                      |
| HOYBUKTMOEN                        | ENKR       | 69.73  | 29.89  | NORWAY                      |
| JAN MAYEN(NOR-NAVY)                | ENJA       | 70.93  | -8.67  | NORWAY                      |
| ORLAND                             | ENOL       | 63.7   | 9.6    | NORWAY                      |
| OSLO/FORNEBU                       | 14882      | 59.9   | 10.62  | NORWAY                      |
| SOLA                               | ENZV       | 58.88  | 5.64   | NORWAY                      |
| MASIRAH                            | OOMA       | 20.68  | 58.89  | OMAN                        |
| SEEB INTL                          | OOMS       | 23.59  | 58.28  | OMAN                        |
| THUMRAIT                           | OOTH       | 17.67  | 54.02  | OMAN                        |
| CHAKLALA                           | OPRN       | 33.62  | 73.1   | PAKISTAN                    |
| JINNAH INTL                        | OPKC       | 24.91  | 67.16  | PAKISTAN                    |
| PESHAWAR INTL                      | OPPS       | 33.99  | 71.51  | PAKISTAN                    |
| PANAMA PACIFICO                    | MPPA       | 8.92   | -79.6  | PANAMA                      |
| TOCUMEN INTL                       | MPTO       | 9.07   | -79.38 | PANAMA                      |
| SILVIO PETTIROSSI INTL             | SGAS       | -25.24 | -57.52 | PARAGUAY                    |
| CAP FAP DAVID ABENZUR RENGIFO INTL | SPCL       | -8.38  | -74.57 | PERU                        |
| CAPITAN MONTES                     | SPYL       | -4.58  | -81.25 | PERU                        |
| CAPT JOSE A QUINONES GONZALES INTL | SPHI       | -6.79  | -79.83 | PERU                        |



| Site Name                              | Station ID | Lat    | Lon    | Country     |
|--|------------|--------|--------|-------------|
| CORONEL FRANCISCO SECADA VIGNETTA INTL | SPQT       | -3.78  | -73.31 | PERU        |
| JORGE CHAVEZ INTL                      | SPJC       | -12.02 | -77.11 | PERU        |
| BAGUIO                                 | RPUB       | 16.38  | 120.62 | PHILIPPINES |
| CLARK INTL                             | RPLC       | 15.19  | 120.56 | PHILIPPINES |
| MACTAN CEBU INTL                       | RPVM       | 10.31  | 123.98 | PHILIPPINES |
| NINYO AQUINO INTL                      | RPLL       | 14.51  | 121.02 | PHILIPPINES |
| SUBIC BAY INTL                         | RPLB       | 14.79  | 120.27 | PHILIPPINES |
| LASK                                   | EPLK       | 51.55  | 19.18  | POLAND      |
| OKECIE                                 | EPWA       | 52.17  | 20.97  | POLAND      |
| LAJES                                  | LPLA       | 38.76  | -27.09 | PORTUGAL    |
| LISBOA                                 | LPPT       | 38.78  | -9.14  | PORTUGAL    |
| LUIS MUNOZ MARIN INTL                  | TJSJ       | 18.44  | -66    | PUERTO RICO |
| RAFAEL HERNANDEZ                       | TJBQ       | 18.49  | -67.13 | PUERTO RICO |
| ROOSEVELT ROADS NS                     | TJNR       | 18.25  | -65.64 | PUERTO RICO |
| AL UDEID                               | KQIR       | 25.12  | 51.32  | QATAR       |
| DOHA INTL                              | OTBD       | 25.26  | 51.57  | QATAR       |
| ST DENIS GILLOT                        | FMEE       | -20.89 | 55.51  | REUNION     |
| AUREL VLAICU                           | LRBS       | 44.5   | 26.1   | ROMANIA     |
| CARANSEBES                             | LRCS       | 45.42  | 22.25  | ROMANIA     |
| CRAIOVA                                | LRCV       | 44.32  | 23.89  | ROMANIA     |
| DROBETA TURNU SEVERIN                  | 15410      | 44.63  | 22.63  | ROMANIA     |
| FAGARAS                                | 15235      | 45.83  | 24.93  | ROMANIA     |
| MIHAIL KOGALNICEANU                    | LRCK       | 44.36  | 28.49  | ROMANIA     |
| SATU MARE                              | LRSM       | 47.7   | 22.89  | ROMANIA     |
| APUKA                                  | 25956      | 60.43  | 169.67 | RUSSIA      |
| ARHARA                                 | 31594      | 49.42  | 130.08 | RUSSIA      |
| BOLSHOYE SAVINO                        | USPP       | 57.91  | 56.02  | RUSSIA      |
| BORZYA                                 | 30965      | 50.4   | 116.52 | RUSSIA      |
| CAPE VASILEVA                          | 32217      | 50     | 155.38 | RUSSIA      |
| CHERNISHEVSKIY                         | 24724      | 63.03  | 112.48 | RUSSIA      |
| CHERTOVITSKOYE                         | UUOO       | 51.81  | 39.23  | RUSSIA      |
| CHOKURDAH                              | 21946      | 70.62  | 147.88 | RUSSIA      |
| DARPIR                                 | 24598      | 64.17  | 148.03 | RUSSIA      |
| ERBOGACEN                              | 24817      | 61.27  | 108.02 | RUSSIA      |
| GMO IM.E.K. FEDOROVA                   | 20292      | 77.72  | 104.3  | RUSSIA      |
| HATANGA                                | 20891      | 71.98  | 102.47 | RUSSIA      |
| ICA                                    | 32411      | 55.58  | 155.58 | RUSSIA      |
| ILYINSKIY                              | 32121      | 47.98  | 142.2  | RUSSIA      |
| IRKUTSK                                | UIII       | 52.27  | 104.39 | RUSSIA      |

| Site Name                   | Station ID | Lat   | Lon    | Country |
|-----------------------------|------------|-------|--------|---------|
| ISIT'                       | 24951      | 60.82 | 125.32 | RUSSIA  |
| JAKUTSK                     | 24959      | 62.02 | 129.72 | RUSSIA  |
| JUR'EVEC                    | 27355      | 57.33 | 43.12  | RUSSIA  |
| JUZHNO-KURIL'SK             | 32165      | 44.02 | 145.87 | RUSSIA  |
| KALAC                       | 34247      | 50.42 | 41.05  | RUSSIA  |
| KAMYSIN                     | 34363      | 50.07 | 45.37  | RUSSIA  |
| KANIN NOS                   | 22165      | 68.65 | 43.3   | RUSSIA  |
| KARASUK                     | 29814      | 53.73 | 78.02  | RUSSIA  |
| KAZAN                       | UWKD       | 55.61 | 49.28  | RUSSIA  |
| KHANTY MANSIYSK             | USHH       | 61.03 | 69.09  | RUSSIA  |
| KHOMUTOVO                   | UHSS       | 46.89 | 142.72 | RUSSIA  |
| KINGISEPP                   | 26059      | 59.37 | 28.6   | RUSSIA  |
| KIRENSK                     | UIKK       | 57.77 | 108.07 | RUSSIA  |
| KLJUCHI                     | 32389      | 56.32 | 160.83 | RUSSIA  |
| KOJNAS                      | 22583      | 64.75 | 47.65  | RUSSIA  |
| KOLTSOVO                    | USSS       | 56.74 | 60.8   | RUSSIA  |
| KOTLAS                      | ULKK       | 61.23 | 46.72  | RUSSIA  |
| KRASNOSCEL'E                | 22235      | 67.35 | 37.05  | RUSSIA  |
| KYRA                        | 30949      | 49.57 | 111.97 | RUSSIA  |
| LENSK                       | 24923      | 60.72 | 114.88 | RUSSIA  |
| MAHACHKALA                  | 37472      | 43    | 47.5   | RUSSIA  |
| MALYE KARMAKULY             | 20744      | 72.37 | 52.7   | RUSSIA  |
| MARIINSK                    | 29551      | 56.18 | 87.68  | RUSSIA  |
| MEDVEZEGORSK                | 22721      | 62.92 | 34.43  | RUSSIA  |
| MUKHINO                     | UIUU       | 51.81 | 107.44 | RUSSIA  |
| MURMANSK                    | ULMM       | 68.78 | 32.75  | RUSSIA  |
| NIKOLAEVSK-ON-AMUR          | UHNN       | 53.15 | 140.7  | RUSSIA  |
| NIZNE-UDINSK                | UINN       | 54.88 | 99.03  | RUSSIA  |
| NJANDOMA                    | 22854      | 61.67 | 40.18  | RUSSIA  |
| NJURBA                      | 24639      | 63.28 | 118.33 | RUSSIA  |
| NOVY                        | UH HH      | 48.53 | 135.19 | RUSSIA  |
| OHOTSK                      | 31088      | 59.37 | 143.2  | RUSSIA  |
| OLEKMINSK                   | 24944      | 60.37 | 120.42 | RUSSIA  |
| OMSK                        | UNOO       | 54.97 | 73.31  | RUSSIA  |
| OSTROV DIKSON               | 20674      | 73.5  | 80.4   | RUSSIA  |
| PASHKOVSKIY                 | URKK       | 45.03 | 39.17  | RUSSIA  |
| PECHORA                     | 23418      | 65.13 | 57.13  | RUSSIA  |
| POLARGMO IM. E.T. KRENKELJA | 20046      | 80.62 | 58.05  | RUSSIA  |
| PORONAJSK                   | 32098      | 49.22 | 143.1  | RUSSIA  |
| REMONTNOE                   | 34759      | 46.57 | 43.67  | RUSSIA  |

| Site Name                  | Station ID | Lat   | Lon    | Country      |
|----------------------------|------------|-------|--------|--------------|
| RJAZAN'                    | 27731      | 54.62 | 39.72  | RUSSIA       |
| SHEREMETYEVO               | UUEE       | 55.97 | 37.41  | RUSSIA       |
| SKOVORODINO                | 30692      | 54    | 123.97 | RUSSIA       |
| SOCHI                      | URSS       | 43.45 | 39.96  | RUSSIA       |
| SOKOL                      | UHMM       | 59.91 | 150.72 | RUSSIA       |
| TAMBOV                     | 27947      | 52.8  | 41.33  | RUSSIA       |
| TIHVIN                     | 26094      | 59.65 | 33.55  | RUSSIA       |
| TOLMACHEVO                 | UNNT       | 55.01 | 82.65  | RUSSIA       |
| TROICKO-PECHERSKOE         | 23711      | 62.7  | 56.2   | RUSSIA       |
| TURUHANSK                  | 23472      | 65.78 | 87.93  | RUSSIA       |
| UGOLNY                     | UHMA       | 64.73 | 177.74 | RUSSIA       |
| UST'-KAMCHATSK             | 32408      | 56.22 | 162.72 | RUSSIA       |
| VANZIL'-KYNAL              | 23966      | 60.35 | 84.08  | RUSSIA       |
| VERHNEE PENZINO            | 25538      | 64.22 | 164.23 | RUSSIA       |
| VERHOJANSK                 | 24266      | 67.57 | 133.4  | RUSSIA       |
| VILJUJSK                   | 24641      | 63.77 | 121.62 | RUSSIA       |
| VITIM                      | 30054      | 59.45 | 112.58 | RUSSIA       |
| VLADIKAVKAZ                | 37228      | 43.03 | 44.68  | RUSSIA       |
| VLADIVOSTOK                | 31960      | 43.12 | 131.93 | RUSSIA       |
| ZEJA                       | 31300      | 53.7  | 127.3  | RUSSIA       |
| ZHIGANSK                   | 24343      | 66.77 | 123.4  | RUSSIA       |
| AL JOUF                    | OESK       | 29.79 | 40.1   | SAUDI ARABIA |
| ARAR                       | OERR       | 30.91 | 41.14  | SAUDI ARABIA |
| GASSIM                     | OEGS       | 26.3  | 43.77  | SAUDI ARABIA |
| HAIL                       | OEHL       | 27.44 | 41.69  | SAUDI ARABIA |
| KING ABDULAZIZ AB          | OEDR       | 26.27 | 50.15  | SAUDI ARABIA |
| KING ABDULAZIZ INTL        | OEJN       | 21.68 | 39.16  | SAUDI ARABIA |
| KING KHALED AB             | OEKM       | 18.3  | 42.8   | SAUDI ARABIA |
| KING KHALED INTL           | OERK       | 24.96 | 46.7   | SAUDI ARABIA |
| QAISUMAH                   | OEPA       | 28.34 | 46.13  | SAUDI ARABIA |
| RAFHA                      | OERF       | 29.63 | 43.49  | SAUDI ARABIA |
| RIYADH AB                  | OERY       | 24.71 | 46.73  | SAUDI ARABIA |
| TABUK                      | OETB       | 28.37 | 36.62  | SAUDI ARABIA |
| TURAIF                     | OETR       | 31.69 | 38.73  | SAUDI ARABIA |
| WEJH                       | OEWJ       | 26.2  | 36.48  | SAUDI ARABIA |
| YENBO                      | OEYN       | 24.14 | 38.06  | SAUDI ARABIA |
| LEOPOLD SEDAR SENGHOR INTL | GOOY       | 14.74 | -17.49 | SENEGAL      |
| BEOGRAD                    | LYBE       | 44.82 | 20.31  | SERBIA       |
| SEYCHELLES INTL            | FSIA       | -4.67 | 55.52  | SEYCHELLES   |
| PAYA LEBAR                 | WSAP       | 1.36  | 103.91 | SINGAPORE    |

| Site Name                     | Station ID | Lat    | Lon    | Country      |
|-------------------------------|------------|--------|--------|--------------|
| BLOEMFONTEIN INTL             | FABL       | -29.09 | 26.3   | SOUTH AFRICA |
| DURBAN INTL                   | FADN       | -29.97 | 30.95  | SOUTH AFRICA |
| JOHANNESBURG INTL             | FAJS       | -26.14 | 28.25  | SOUTH AFRICA |
| UPINGTON                      | FAUP       | -28.4  | 21.26  | SOUTH AFRICA |
| ALICANTE                      | LEAL       | 38.28  | -0.56  | SPAIN        |
| BARAJAS                       | LEMD       | 40.49  | -3.57  | SPAIN        |
| BARCELONA                     | LEBL       | 41.3   | 2.08   | SPAIN        |
| CORDOBA                       | LEBA       | 37.84  | -4.85  | SPAIN        |
| MALAGA                        | LEMG       | 36.67  | -4.5   | SPAIN        |
| MENORCA                       | LEMH       | 39.86  | 4.22   | SPAIN        |
| MORON AB                      | LEMO       | 37.17  | -5.62  | SPAIN        |
| ROTA NS                       | LERT       | 36.65  | -6.35  | SPAIN        |
| SEVILLA                       | LEZL       | 37.42  | -5.89  | SPAIN        |
| TORREJON                      | LETO       | 40.5   | -3.45  | SPAIN        |
| VALENCIA                      | LEVC       | 39.49  | -0.48  | SPAIN        |
| ZARAGOZA AB                   | LEZG       | 41.67  | -1.04  | SPAIN        |
| ASCENSION AUX AF              | FHAW       | -7.97  | -14.39 | ST. HELENA   |
| JOHAN A PENGEL INTL           | SMJP       | 5.45   | -55.19 | SURINAME     |
| ARLANDA                       | ESSA       | 59.65  | 17.92  | SWEDEN       |
| BROMMA                        | ESSB       | 59.35  | 17.94  | SWEDEN       |
| UMEA                          | ESNU       | 63.79  | 20.28  | SWEDEN       |
| GENEVA COINTRIN               | LSGG       | 46.24  | 6.11   | SWITZERLAND  |
| ZURICH                        | LSZH       | 47.46  | 8.55   | SWITZERLAND  |
| ABUKMAL                       | 40072      | 34.42  | 40.92  | SYRIA        |
| ALEPPO INTL                   | OSAP       | 36.18  | 37.22  | SYRIA        |
| DAMASCUS INTL                 | OSDI       | 33.41  | 36.52  | SYRIA        |
| CHIAYI                        | RCKU       | 23.46  | 120.39 | TAIWAN       |
| CHING CHUAN KANG AB           | RCMQ       | 24.26  | 120.62 | TAIWAN       |
| SUNGSHAN                      | RCSS       | 25.07  | 121.55 | TAIWAN       |
| TAICHUNG                      | RCLG       | 24.19  | 120.65 | TAIWAN       |
| TAINAN                        | RCNN       | 22.95  | 120.21 | TAIWAN       |
| DUSHANBE                      | UTDD       | 38.54  | 68.83  | TAJIKISTAN   |
| KHUDJANT                      | 38599      | 40.22  | 69.73  | TAJIKISTAN   |
| MWALIMU JULIUS K NYERERE INTL | HTDA       | -6.88  | 39.2   | TANZANIA     |
| BANGKOK INTL                  | VTBD       | 13.91  | 100.61 | THAILAND     |
| CHIANG MAI INTL               | VTCC       | 18.77  | 98.96  | THAILAND     |
| KHORAT                        | VTUN       | 14.93  | 102.08 | THAILAND     |
| NAKHON PHANOM                 | 48357      | 17.42  | 104.78 | THAILAND     |
| UBON RATCHATHANI              | VTUU       | 15.25  | 104.87 | THAILAND     |
| UDON THANI                    | VTUD       | 17.39  | 102.79 | THAILAND     |

| Site Name                  | Station ID | Lat   | Lon    | Country  |
|----------------------------|------------|-------|--------|--|
| SKOPJE                     | LWSK       | 41.96 | 21.62  | The Former Yugoslav Republic of Macedonia      |
| PIARCO                     | TTPP       | 10.6  | -61.34 | TRINIDAD AND TOBAGO                            |
| BABELTHUAP / KOROR AIRPORT | PTRO       | 7.37  | 134.54 | TRUST TERRITORY OF THE PACIFIC ISLANDS (PALAU) |
| CARTHAGE                   | DTTA       | 36.85 | 10.23  | TUNISIA  |
| ANTALYA                    | LTAI       | 36.9  | 30.8   | TURKEY   |
| ATATURK                    | LTBA       | 40.98 | 28.82  | TURKEY   |
| BALIKESIR                  | LTBF       | 39.62 | 27.93  | TURKEY   |
| CIGLI                      | LTBL       | 38.51 | 27.01  | TURKEY   |
| DIYARBAKIR                 | LTCC       | 37.89 | 40.2   | TURKEY   |
| ERHAC                      | LTAT       | 38.44 | 38.09  | TURKEY   |
| ESENBAGA                   | LTAC       | 40.13 | 33     | TURKEY   |
| ESKISEHIR                  | LTBI       | 39.78 | 30.58  | TURKEY   |
| GOLCUK/DUMLUPINAR          | 17067      | 40.67 | 29.83  | TURKEY   |
| INCIRLIK AB                | LTAG       | 37    | 35.43  | TURKEY   |
| KONYA                      | LTAN       | 37.98 | 32.56  | TURKEY   |
| SAMSUN                     | 17030      | 41.28 | 36.3   | TURKEY   |
| SINOP                      | 17026      | 42.03 | 35.17  | TURKEY   |
| TRABZON                    | LTCG       | 41    | 39.79  | TURKEY   |
| VAN                        | LTCI       | 38.47 | 43.33  | TURKEY   |
| ASHGABAT                   | UTAA       | 37.99 | 58.36  | TURKMENISTAN                                   |
| BAJRAMALY                  | 38895      | 37.6  | 62.18  | TURKMENISTAN                                   |
| CHARDZHEV                  | 38687      | 39.08 | 63.6   | TURKMENISTAN                                   |
| DARGANATA                  | 38545      | 40.47 | 62.28  | TURKMENISTAN                                   |
| DASHKHOVUZ                 | 38392      | 41.83 | 59.98  | TURKMENISTAN                                   |
| EKEZHE                     | 38388      | 41.03 | 57.77  | TURKMENISTAN                                   |
| ESENGULY                   | 38750      | 37.47 | 53.97  | TURKMENISTAN                                   |
| GYSHGY                     | 38987      | 35.28 | 62.35  | TURKMENISTAN                                   |
| KERKI                      | 38911      | 37.83 | 65.2   | TURKMENISTAN                                   |
| TURKMENBASHI               | 38507      | 40.03 | 52.98  | TURKMENISTAN                                   |
| IZIUM                      | 34415      | 49.18 | 37.3   | UKRAINE  |
| KONOTOP                    | 33261      | 51.23 | 33.2   | UKRAINE  |
| KRYVYI RIH                 | 33791      | 48.03 | 33.22  | UKRAINE  |
| ODESA INTL                 | UKOO       | 46.43 | 30.68  | UKRAINE  |
| YALTA                      | 33990      | 44.48 | 34.17  | UKRAINE  |
| ZHULIANY INTL              | UKKK       | 50.4  | 30.45  | UKRAINE  |
| ABU DHABI INTL             | OMAA       | 24.43 | 54.65  | UNITED ARAB EMIRATES                           |

| Site Name                                  | Station ID | Lat   | Lon     | Country              |
|--|------------|-------|---------|----------------------|
| DUBAI INTL                                 | OMDB       | 25.25 | 55.36   | UNITED ARAB EMIRATES |
| BENSON                                     | EGUB       | 51.62 | -1.1    | UNITED KINGDOM       |
| BENTWATERS RAF                             | EGVJ       | 52.13 | 1.43    | UNITED KINGDOM       |
| BRIZE NORTON                               | EGVN       | 51.75 | -1.58   | UNITED KINGDOM       |
| CHURCH LAWFORD                             | 3544       | 52.37 | -1.33   | UNITED KINGDOM       |
| DYCE                                       | EGPD       | 57.2  | -2.2    | UNITED KINGDOM       |
| EDINBURGH                                  | EGPH       | 55.95 | -3.37   | UNITED KINGDOM       |
| FAIRFORD                                   | EGVA       | 51.68 | -1.79   | UNITED KINGDOM       |
| FYLINGDALES                                | 3281       | 54.37 | -0.67   | UNITED KINGDOM       |
| GATWICK                                    | EGKK       | 51.15 | -0.19   | UNITED KINGDOM       |
| HEATHROW                                   | EGLL       | 51.48 | -0.46   | UNITED KINGDOM       |
| LAKENHEATH                                 | EGUL       | 52.41 | 0.56    | UNITED KINGDOM       |
| LEUCHARS                                   | EGQL       | 56.37 | -2.87   | UNITED KINGDOM       |
| MILDENHALL                                 | EGUN       | 52.36 | 0.49    | UNITED KINGDOM       |
| NORTHOLT                                   | EGWU       | 51.55 | -0.42   | UNITED KINGDOM       |
| PRESTWICK                                  | EGPK       | 55.51 | -4.59   | UNITED KINGDOM       |
| WOODBIDGE RAF                              | EGVG       | 52.08 | 1.4     | UNITED KINGDOM       |
| ALAMEDA/NAS CA.                            | 74506      | 37.78 | -122.32 | UNITED STATES        |
| BRAINERD BRAINERD-CROW WING COU            | KBRD       | 46.4  | -94.13  | UNITED STATES        |
| CAPE HATTERAS NC.                          | 72304      | 35.27 | -75.55  | UNITED STATES        |
| FT. RICHARDSON/BRYANT AHP AK               | 70270      | 61.27 | -149.65 | UNITED STATES        |
| GOODLAND/RENNER<br>FIELD/GOODLAND/MUN. KS. | 72465      | 39.37 | -101.68 | UNITED STATES        |
| RUMFORD ME.                                | 72618      | 44.53 | -70.53  | UNITED STATES        |
| SAN CLEMENTE NAVAL AUXILIARY LA            | KNUC       | 33.02 | -118.58 | UNITED STATES        |
| ADAK                                       | PADK       | 51.88 | -176.65 | UNITED STATES - AK   |
| ALLEN AAF                                  | PABI       | 63.99 | -145.72 | UNITED STATES - AK   |
| ANIAK                                      | PANI       | 61.58 | -159.54 | UNITED STATES - AK   |
| ANNETTE ISLAND                             | PANT       | 55.04 | -131.57 | UNITED STATES - AK   |
| BARTER ISLAND LRRS                         | PABA       | 70.13 | -143.58 | UNITED STATES - AK   |
| BETHEL                                     | PABE       | 60.78 | -161.84 | UNITED STATES - AK   |
| BETTLES                                    | PABT       | 66.91 | -151.53 | UNITED STATES - AK   |
| CAPE LISBURNE LRRS                         | PALU       | 68.88 | -166.11 | UNITED STATES - AK   |
| CAPE NEWENHAM LRRS                         | PAEH       | 58.65 | -162.06 | UNITED STATES - AK   |
| CAPE ROMANZOF LRRS                         | PACZ       | 61.78 | -166.04 | UNITED STATES - AK   |
| COLD BAY                                   | PACD       | 55.21 | -162.72 | UNITED STATES - AK   |
| DEADHORSE                                  | PASC       | 70.19 | -148.47 | UNITED STATES - AK   |
| EARECKSON AS                               | PASY       | 52.71 | 174.11  | UNITED STATES - AK   |
| EDWARD G PITKA SR                          | PAGA       | 64.74 | -156.94 | UNITED STATES - AK   |
| EIELSON AFB                                | PAEI       | 64.67 | -147.1  | UNITED STATES - AK   |

| Site Name                        | Station ID | Lat   | Lon     | Country            |
|----------------------------------|------------|-------|---------|--------------------|
| ELMENDORF AFB                    | PAED       | 61.25 | -149.81 | UNITED STATES - AK |
| FAIRBANKS INTL                   | PAFA       | 64.82 | -147.86 | UNITED STATES - AK |
| FORT YUKON                       | PFYU       | 66.57 | -145.25 | UNITED STATES - AK |
| GULKANA                          | PAGK       | 62.15 | -145.46 | UNITED STATES - AK |
| HOMER                            | PAHO       | 59.65 | -151.48 | UNITED STATES - AK |
| ILIAMNA                          | PAIL       | 59.75 | -154.91 | UNITED STATES - AK |
| INDIAN MOUNTAIN LRRS             | PAIM       | 65.99 | -153.7  | UNITED STATES - AK |
| JUNEAU INTL                      | PAJN       | 58.35 | -134.58 | UNITED STATES - AK |
| KENAI MUNI                       | PAEN       | 60.57 | -151.24 | UNITED STATES - AK |
| KING SALMON                      | PAKN       | 58.68 | -156.65 | UNITED STATES - AK |
| KODIAK                           | PADQ       | 57.75 | -152.49 | UNITED STATES - AK |
| MCGRATH                          | PAMC       | 62.97 | -155.62 | UNITED STATES - AK |
| MERLE K MUDHOLE SMITH            | PACV       | 60.49 | -145.48 | UNITED STATES - AK |
| MERRILL FLD                      | PAMR       | 61.21 | -149.84 | UNITED STATES - AK |
| MIDDLETON ISLAND                 | PAMD       | 59.45 | -146.31 | UNITED STATES - AK |
| NENANA MUNI                      | PANN       | 64.55 | -149.07 | UNITED STATES - AK |
| NOME                             | PAOM       | 64.51 | -165.45 | UNITED STATES - AK |
| NORTHWAY                         | PAOR       | 62.96 | -141.93 | UNITED STATES - AK |
| PORT HEIDEN                      | PAPH       | 56.96 | -158.63 | UNITED STATES - AK |
| RALPH WIEN MEM                   | PAOT       | 66.88 | -162.6  | UNITED STATES - AK |
| SITKA ROCKY GUTIERREZ            | PASI       | 57.05 | -135.36 | UNITED STATES - AK |
| SPARREVOHN LRRS                  | PASV       | 61.1  | -155.57 | UNITED STATES - AK |
| ST PAUL ISLAND                   | PASN       | 57.17 | -170.22 | UNITED STATES - AK |
| TATALINA LRRS                    | PATL       | 62.89 | -155.98 | UNITED STATES - AK |
| TED STEVENS ANCHORAGE INTL       | PANC       | 61.17 | -150    | UNITED STATES - AK |
| TIN CITY LRRS                    | PATC       | 65.56 | -167.92 | UNITED STATES - AK |
| UNALAKLEET                       | PAUN       | 63.89 | -160.8  | UNITED STATES - AK |
| UNALASKA                         | PADU       | 53.9  | -166.54 | UNITED STATES - AK |
| WAINWRIGHT AAF                   | PAFB       | 64.83 | -147.62 | UNITED STATES - AK |
| WHITTIER                         | PAWR       | 60.77 | -148.68 | UNITED STATES - AK |
| WILEY POST WILL ROGERS MEM       | PABR       | 71.29 | -156.77 | UNITED STATES - AK |
| YAKUTAT                          | PAYA       | 59.5  | -139.65 | UNITED STATES - AK |
| ANNISTON METRO                   | KANB       | 33.59 | -85.86  | UNITED STATES - AL |
| BIRMINGHAM INTL                  | KBHM       | 33.56 | -86.75  | UNITED STATES - AL |
| CAIRNS AAF                       | KOZR       | 31.28 | -85.71  | UNITED STATES - AL |
| DOTHAN RGNL                      | KDHN       | 31.32 | -85.45  | UNITED STATES - AL |
| HUNTSVILLE INTL CARL T JONES FLD | KHSV       | 34.64 | -86.78  | UNITED STATES - AL |
| MAXWELL AFB                      | KMXF       | 32.38 | -86.37  | UNITED STATES - AL |
| MOBILE DOWNTOWN                  | KBFM       | 30.63 | -88.07  | UNITED STATES - AL |
| MOBILE RGNL                      | KMOB       | 30.69 | -88.24  | UNITED STATES - AL |



| <b>Site Name</b>                          | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b>     |
|---|-------------------|------------|------------|--------------------|
| MONTGOMERY RGNL                           | KMGM              | 32.3       | -86.39     | UNITED STATES - AL |
| NORTHWEST ALABAMA RGNL                    | KMSL              | 34.75      | -87.61     | UNITED STATES - AL |
| TUSCALOOSA RGNL                           | KTCL              | 33.22      | -87.61     | UNITED STATES - AL |
| ARKANSAS INTL                             | KBYH              | 35.96      | -89.94     | UNITED STATES - AR |
| BOONE CO                                  | KHRO              | 36.26      | -93.15     | UNITED STATES - AR |
| DRAKE FLD                                 | KFYV              | 36.01      | -94.17     | UNITED STATES - AR |
| FORT SMITH RGNL                           | KFSM              | 35.34      | -94.37     | UNITED STATES - AR |
| GRIDER FLD                                | KPBF              | 34.17      | -91.94     | UNITED STATES - AR |
| LITTLE ROCK AFB                           | KLRF              | 34.92      | -92.15     | UNITED STATES - AR |
| MEMORIAL FLD                              | KHOT              | 34.48      | -93.1      | UNITED STATES - AR |
| SOUTH ARKANSAS RGNL AT GOODWIN FLD        | KELD              | 33.22      | -92.81     | UNITED STATES - AR |
| TEXARKANA RGNL WEBB FLD                   | KTXK              | 33.45      | -93.99     | UNITED STATES - AR |
| DAVIS MONTHAN AFB                         | KDMA              | 32.17      | -110.88    | UNITED STATES - AZ |
| FLAGSTAFF PULLIAM                         | KFLG              | 35.14      | -111.67    | UNITED STATES - AZ |
| LUKE AFB                                  | KLUF              | 33.53      | -112.38    | UNITED STATES - AZ |
| PHOENIX SKY HARBOR INTL                   | KPHX              | 33.43      | -112.01    | UNITED STATES - AZ |
| SIERRA VISTA MUNI LIBBY AAF / FT HUACHUCA | KFHU              | 31.58      | -110.35    | UNITED STATES - AZ |
| TUCSON INTL                               | KTUS              | 32.12      | -110.94    | UNITED STATES - AZ |
| WINSLOW LINDBERGH RGNL                    | KINW              | 35.02      | -110.72    | UNITED STATES - AZ |
| YUMA MCAS YUMA INTL                       | KYUM              | 32.66      | -114.61    | UNITED STATES - AZ |
| ARCATA                                    | KACV              | 40.98      | -124.11    | UNITED STATES - CA |
| BARSTOW DAGGETT                           | KDAG              | 34.85      | -116.79    | UNITED STATES - CA |
| BEALE AFB                                 | KBAB              | 39.14      | -121.44    | UNITED STATES - CA |
| BLUE CANYON NYACK                         | KBLU              | 39.27      | -120.71    | UNITED STATES - CA |
| CAMP PENDLETON MCAS                       | KNFG              | 33.3       | -117.36    | UNITED STATES - CA |
| CASTLE                                    | KMER              | 37.38      | -120.57    | UNITED STATES - CA |
| CHINA LAKE NAWS                           | KNID              | 35.69      | -117.69    | UNITED STATES - CA |
| EDWARDS AFB                               | KEDW              | 34.92      | -117.87    | UNITED STATES - CA |
| EL TORO MCAS                              | KNZJ              | 33.67      | -117.73    | UNITED STATES - CA |
| FRESNO YOSEMITE INTL                      | KFAT              | 36.78      | -119.72    | UNITED STATES - CA |
| HAYWARD HAYWARD AIR TERMINAL              | KHWD              | 37.66      | -122.12    | UNITED STATES - CA |
| IMPERIAL CO                               | KIPL              | 32.83      | -115.58    | UNITED STATES - CA |
| JACK MC NAMARA FLD                        | KCEC              | 41.78      | -124.24    | UNITED STATES - CA |
| JOHN WAYNE ARPT ORANGE CO                 | KSNA              | 33.68      | -117.87    | UNITED STATES - CA |
| LAKE TAHOE                                | KTVL              | 38.9       | -120       | UNITED STATES - CA |
| LEMOORE NAS                               | KNLC              | 36.33      | -119.95    | UNITED STATES - CA |
| LONG BEACH                                | KLGB              | 33.82      | -118.15    | UNITED STATES - CA |
| LOS ANGELES INTL                          | KLAX              | 33.94      | -118.41    | UNITED STATES - CA |



| Site Name                        | Station ID | Lat   | Lon     | Country            |
|----------------------------------|------------|-------|---------|--------------------|
| MARCH ARB                        | KRIV       | 33.88 | -117.26 | UNITED STATES - CA |
| MARINA MUNI                      | KOAR       | 36.68 | -121.76 | UNITED STATES - CA |
| MCCLELLAN AFLD                   | KMCC       | 38.67 | -121.4  | UNITED STATES - CA |
| MEADOWS FLD                      | KBFL       | 35.43 | -119.06 | UNITED STATES - CA |
| METROPOLITAN OAKLAND INTL        | KOAK       | 37.72 | -122.22 | UNITED STATES - CA |
| MOFFETT FEDERAL AFLD             | KNUQ       | 37.42 | -122.05 | UNITED STATES - CA |
| MONTEREY PENINSULA               | KMRY       | 36.59 | -121.84 | UNITED STATES - CA |
| NORMAN Y MINETA SAN JOSE INTL    | KSJC       | 37.36 | -121.93 | UNITED STATES - CA |
| NORTH ISLAND NAS                 | KNZY       | 32.7  | -117.22 | UNITED STATES - CA |
| ONTARIO INTL                     | KONT       | 34.06 | -117.6  | UNITED STATES - CA |
| OXNARD AIRPORT                   | KOXR       | 34.2  | -119.21 | UNITED STATES - CA |
| PASO ROBLES MUNI                 | KPRB       | 35.67 | -120.63 | UNITED STATES - CA |
| POINT MUGU NAS                   | KNTD       | 34.12 | -119.12 | UNITED STATES - CA |
| POINT PIEDRAS BLANCA             | K87Q       | 35.67 | -121.28 | UNITED STATES - CA |
| RED BLUFF MUNI                   | KRBL       | 40.15 | -122.25 | UNITED STATES - CA |
| SACRAMENTO EXECUTIVE             | KSAC       | 38.51 | -121.49 | UNITED STATES - CA |
| SACRAMENTO MATHER AIRPORT        | KMHR       | 38.56 | -121.3  | UNITED STATES - CA |
| SAN BERNARDINO INTL              | KSBD       | 34.1  | -117.23 | UNITED STATES - CA |
| SAN DIEGO INTL                   | KSAN       | 32.73 | -117.19 | UNITED STATES - CA |
| SAN DIEGO/MIRAMAR NAS CA.        | 72293      | 32.83 | -117.12 | UNITED STATES - CA |
| SAN FRANCISCO INTL               | KSFO       | 37.62 | -122.37 | UNITED STATES - CA |
| SANDBERG                         | KSDB       | 34.74 | -118.72 | UNITED STATES - CA |
| SANTA BARBARA MUNI               | KSBA       | 34.43 | -119.84 | UNITED STATES - CA |
| SISKIYOU CO                      | KSIY       | 41.78 | -122.47 | UNITED STATES - CA |
| SOUTHERN CALIFORNIA LOGISTICS    | KVCV       | 34.6  | -117.38 | UNITED STATES - CA |
| STOCKTON METROPOLITAN            | KSCK       | 37.89 | -121.24 | UNITED STATES - CA |
| TRAVIS AFB                       | KSUU       | 38.26 | -121.93 | UNITED STATES - CA |
| TUSTIN MCAS                      | KNTK       | 33.7  | -117.83 | UNITED STATES - CA |
| TWENTYNINE PALMS EAF             | KNXP       | 34.3  | -116.16 | UNITED STATES - CA |
| USMC MTN WARFARE TRAINING CENTER | KBAN       | 38.35 | -119.52 | UNITED STATES - CA |
| VANDENBERG AFB                   | KVBG       | 34.74 | -120.58 | UNITED STATES - CA |
| BUCKLEY AFB                      | KBKF       | 39.7  | -104.75 | UNITED STATES - CO |
| BUTTS AAF                        | KFCS       | 38.68 | -104.76 | UNITED STATES - CO |
| CITY OF COLORADO SPRINGS MUNI    | KCOS       | 38.81 | -104.7  | UNITED STATES - CO |
| DENVER/STAPLETON INT             | 72469      | 39.75 | -104.87 | UNITED STATES - CO |
| LA JUNTA MUNI                    | KLHX       | 38.05 | -103.51 | UNITED STATES - CO |
| PERRY STOKES                     | KTAD       | 37.26 | -104.34 | UNITED STATES - CO |
| PUEBLO MEM                       | KPUB       | 38.29 | -104.5  | UNITED STATES - CO |
| WALKER FLD                       | KGJT       | 39.12 | -108.53 | UNITED STATES - CO |
| BRADLEY INTL                     | KBDL       | 41.94 | -72.68  | UNITED STATES - CT |

| <b>Site Name</b>                 | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b>     |
|----------------------------------|-------------------|------------|------------|--------------------|
| GROTON NEW LONDON                | KGON              | 41.33      | -72.05     | UNITED STATES - CT |
| HARTFORD BRAINARD                | KHFD              | 41.74      | -72.65     | UNITED STATES - CT |
| IGOR I SIKORSKY MEM              | KBDR              | 41.16      | -73.13     | UNITED STATES - CT |
| RONALD REAGAN WASHINGTON NATL    | KDCA              | 38.85      | -77.04     | UNITED STATES - DC |
| WASHINGTON DULLES INTL           | KIAD              | 38.94      | -77.46     | UNITED STATES - DC |
| DOVER AFB                        | KDOV              | 39.13      | -75.47     | UNITED STATES - DE |
| NEW CASTLE                       | KILG              | 39.68      | -75.61     | UNITED STATES - DE |
| APALACHICOLA MUNI                | KAAF              | 29.73      | -85.03     | UNITED STATES - FL |
| CAPE CANAVERAL AFS SKID STRIP    | KXMR              | 28.47      | -80.57     | UNITED STATES - FL |
| CRAIG MUNI                       | KCRG              | 30.34      | -81.51     | UNITED STATES - FL |
| DAYTONA BEACH INTL               | KDAB              | 29.18      | -81.06     | UNITED STATES - FL |
| EGLIN AFB                        | KVPS              | 30.48      | -86.53     | UNITED STATES - FL |
| FORT LAUDERDALE HOLLYWOOD INTL   | KFLL              | 26.07      | -80.15     | UNITED STATES - FL |
| GAINESVILLE RGNL                 | KGNV              | 29.69      | -82.27     | UNITED STATES - FL |
| HOMESTEAD ARB                    | KHST              | 25.49      | -80.38     | UNITED STATES - FL |
| HURLBURT FLD                     | KHRT              | 30.43      | -86.69     | UNITED STATES - FL |
| JACKSONVILLE CECIL FIELD AIRPORT | KVQQ              | 30.22      | -81.88     | UNITED STATES - FL |
| JACKSONVILLE INTL                | KJAX              | 30.49      | -81.69     | UNITED STATES - FL |
| JACKSONVILLE NAS                 | KNIP              | 30.24      | -81.68     | UNITED STATES - FL |
| KENDALL TAMiami EXECUTIVE        | KTMB              | 25.65      | -80.43     | UNITED STATES - FL |
| KEY WEST INTL                    | KEYW              | 24.56      | -81.76     | UNITED STATES - FL |
| KEY WEST NAS                     | KNQX              | 24.58      | -81.69     | UNITED STATES - FL |
| MACDILL AFB                      | KMCF              | 27.85      | -82.52     | UNITED STATES - FL |
| MAYPORT NS                       | KNRB              | 30.39      | -81.42     | UNITED STATES - FL |
| MELBOURNE INTL                   | KMLB              | 28.1       | -80.65     | UNITED STATES - FL |
| MIAMI INTL                       | KMIA              | 25.79      | -80.29     | UNITED STATES - FL |
| NASA SHUTTLE LANDING FACILITY    | KTTS              | 28.61      | -80.69     | UNITED STATES - FL |
| ORLANDO INTL                     | KMCO              | 28.43      | -81.31     | UNITED STATES - FL |
| PAGE FLD                         | KFMY              | 26.59      | -81.86     | UNITED STATES - FL |
| PALM BEACH INTL                  | KPBI              | 26.68      | -80.1      | UNITED STATES - FL |
| PATRICK AFB                      | KCOF              | 28.25      | -80.62     | UNITED STATES - FL |
| PENSACOLA NAS                    | KNPA              | 30.35      | -87.32     | UNITED STATES - FL |
| PENSACOLA RGNL                   | KPNS              | 30.47      | -87.19     | UNITED STATES - FL |
| ST PETERSBURG CLEARWATER INTL    | KPIE              | 27.91      | -82.69     | UNITED STATES - FL |
| TALLAHASSEE RGNL                 | KTLH              | 30.4       | -84.35     | UNITED STATES - FL |
| TAMPA INTL                       | KTPA              | 27.98      | -82.53     | UNITED STATES - FL |
| TYNDALL AFB                      | KPAM              | 30.07      | -85.58     | UNITED STATES - FL |
| VERO BEACH MUNI                  | KVRB              | 27.66      | -80.42     | UNITED STATES - FL |
| WHITING FLD NAS NORTH            | KNSE              | 30.72      | -87.02     | UNITED STATES - FL |
| AUGUSTA RGNL AT BUSH FLD         | KAGS              | 33.37      | -81.96     | UNITED STATES - GA |

| Site Name                       | Station ID | Lat   | Lon     | Country            |
|---------------------------------|------------|-------|---------|--------------------|
| COLUMBUS METROPOLITAN           | KCSG       | 32.52 | -84.94  | UNITED STATES - GA |
| DOBBINS ARB                     | KMGE       | 33.92 | -84.52  | UNITED STATES - GA |
| HARTSFIELD JACKSON ATLANTA INTL | KATL       | 33.64 | -84.43  | UNITED STATES - GA |
| HUNTER AAF                      | KSVN       | 32.01 | -81.15  | UNITED STATES - GA |
| LAWSON AAF                      | KLSF       | 32.34 | -84.99  | UNITED STATES - GA |
| MALCOLM MCKINNON                | KSSI       | 31.15 | -81.39  | UNITED STATES - GA |
| MIDDLE GEORGIA RGNL             | KMCN       | 32.69 | -83.65  | UNITED STATES - GA |
| MOODY AFB                       | KVAD       | 30.97 | -83.19  | UNITED STATES - GA |
| RICHARD B RUSSELL               | KRMG       | 34.35 | -85.16  | UNITED STATES - GA |
| ROBINS AFB                      | KWRB       | 32.64 | -83.59  | UNITED STATES - GA |
| SAVANNAH HILTON HEAD INTL       | KSAV       | 32.13 | -81.2   | UNITED STATES - GA |
| SOUTHWEST GEORGIA RGNL          | KABY       | 31.54 | -84.19  | UNITED STATES - GA |
| WRIGHT AAF                      | KLHW       | 31.89 | -81.56  | UNITED STATES - GA |
| HILO INTL                       | PHTO       | 19.72 | -155.05 | UNITED STATES - HI |
| HONOLULU INTL                   | PHNL       | 21.32 | -157.92 | UNITED STATES - HI |
| KAHULUI                         | PHOG       | 20.9  | -156.43 | UNITED STATES - HI |
| KALAELOA                        | PHJR       | 21.31 | -158.07 | UNITED STATES - HI |
| KANEOHE BAY MCAF                | PHNG       | 21.45 | -157.77 | UNITED STATES - HI |
| LIHUE                           | PHLI       | 21.98 | -159.34 | UNITED STATES - HI |
| WHEELER AAF                     | PHHI       | 21.48 | -158.04 | UNITED STATES - HI |
| DES MOINES INTL                 | KDSM       | 41.53 | -93.66  | UNITED STATES - IA |
| FORT DODGE RGNL                 | KFOD       | 42.55 | -94.19  | UNITED STATES - IA |
| MASON CITY MUNI                 | KMCW       | 43.16 | -93.33  | UNITED STATES - IA |
| SIOUX GATEWAY COL BUD DAY FLD   | KSUX       | 42.4  | -96.38  | UNITED STATES - IA |
| SOUTHEAST IOWA RGNL             | KBRL       | 40.78 | -91.13  | UNITED STATES - IA |
| THE EASTERN IOWA                | KCID       | 41.88 | -91.71  | UNITED STATES - IA |
| WATERLOO RGNL                   | KALO       | 42.56 | -92.4   | UNITED STATES - IA |
| BOISE AIR TERMINAL              | KBOI       | 43.56 | -116.22 | UNITED STATES - ID |
| COEUR D ALENE AIR TERMINAL      | KCOE       | 47.77 | -116.82 | UNITED STATES - ID |
| IDAHO FALLS RGNL                | KIDA       | 43.51 | -112.07 | UNITED STATES - ID |
| LEWISTON NEX PERCE CO           | KLWS       | 46.37 | -117.02 | UNITED STATES - ID |
| MOUNTAIN HOME AFB               | KMUO       | 43.04 | -115.87 | UNITED STATES - ID |
| POCATELLO RGNL                  | KPIH       | 42.91 | -112.6  | UNITED STATES - ID |
| ABRAHAM LINCOLN CAPITAL         | KSPI       | 39.84 | -89.68  | UNITED STATES - IL |
| CHICAGO MIDWAY INTL             | KMDW       | 41.79 | -87.75  | UNITED STATES - IL |
| CHICAGO OHARE INTL              | KORD       | 41.98 | -87.9   | UNITED STATES - IL |
| DECATUR                         | KDEC       | 39.83 | -88.87  | UNITED STATES - IL |
| DUPAGE                          | KDPA       | 41.91 | -88.25  | UNITED STATES - IL |
| GLENVIEW NAS                    | KNBU       | 42.08 | -87.82  | UNITED STATES - IL |
| GREATER PEORIA RGNL             | KPIA       | 40.66 | -89.69  | UNITED STATES - IL |

| Site Name                          | Station ID | Lat   | Lon    | Country            |
|------------------------------------|------------|-------|--------|--------------------|
| QUAD CITY INTL                     | KMLI       | 41.45 | -90.51 | UNITED STATES - IL |
| SCOTT AFB MIDAMERICA               | KBLV       | 38.55 | -89.84 | UNITED STATES - IL |
| UNIV OF ILLINOIS WILLARD           | KCMI       | 40.04 | -88.28 | UNITED STATES - IL |
| EVANSVILLE RGNL                    | KEVV       | 38.04 | -87.53 | UNITED STATES - IN |
| FORT WAYNE INTL                    | KFWA       | 40.98 | -85.2  | UNITED STATES - IN |
| GRISSOM ARB                        | KGUS       | 40.65 | -86.15 | UNITED STATES - IN |
| INDIANAPOLIS INTL                  | KIND       | 39.72 | -86.29 | UNITED STATES - IN |
| SOUTH BEND RGNL                    | KSBN       | 41.71 | -86.32 | UNITED STATES - IN |
| TERRE HAUTE INTL HULMAN FLD        | KHUF       | 39.45 | -87.31 | UNITED STATES - IN |
| CHANUTE MARTIN JOHNSON             | KCNU       | 37.67 | -95.49 | UNITED STATES - KS |
| DODGE CITY RGNL                    | KDDC       | 37.76 | -99.97 | UNITED STATES - KS |
| FORBES FLD                         | KFOE       | 38.95 | -95.66 | UNITED STATES - KS |
| HUTCHINSON MUNI                    | KHUT       | 38.07 | -97.86 | UNITED STATES - KS |
| MARSHALL AAF                       | KFRI       | 39.06 | -96.76 | UNITED STATES - KS |
| MCCONNELL AFB                      | KIAB       | 37.62 | -97.27 | UNITED STATES - KS |
| PHILIP BILLARD MUNI                | KTOP       | 39.07 | -95.62 | UNITED STATES - KS |
| SALINA MUNI                        | KSLN       | 38.79 | -97.65 | UNITED STATES - KS |
| WICHITA MID CONTINENT              | KICT       | 37.65 | -97.43 | UNITED STATES - KS |
| BLUE GRASS                         | KLEX       | 38.04 | -84.61 | UNITED STATES - KY |
| CAMPBELL AAF                       | KHOP       | 36.67 | -87.5  | UNITED STATES - KY |
| CINCINNATI NORTHERN KENTUCKY INTL  | KCVG       | 39.05 | -84.67 | UNITED STATES - KY |
| GODMAN AAF                         | KFTK       | 37.91 | -85.97 | UNITED STATES - KY |
| LOUISVILLE INTL STANDIFORD FLD     | KSDF       | 38.17 | -85.74 | UNITED STATES - KY |
| ALEXANDRIA INTL                    | KAEX       | 31.33 | -92.55 | UNITED STATES - LA |
| BARKSDALE AFB                      | KBAD       | 32.5  | -93.66 | UNITED STATES - LA |
| BATON ROUGE METRO RYAN FLD         | KBTR       | 30.53 | -91.15 | UNITED STATES - LA |
| ESLER RGNL                         | KESF       | 31.39 | -92.3  | UNITED STATES - LA |
| LAFAYETTE RGNL                     | KLFT       | 30.21 | -91.99 | UNITED STATES - LA |
| LAKE CHARLES RGNL                  | KLCH       | 30.13 | -93.22 | UNITED STATES - LA |
| LAKEFRONT                          | KNEW       | 30.04 | -90.03 | UNITED STATES - LA |
| LOUIS ARMSTRONG NEW ORLEANS INTL   | KMSY       | 29.99 | -90.26 | UNITED STATES - LA |
| MONROE RGNL                        | KMLU       | 32.51 | -92.04 | UNITED STATES - LA |
| NEW ORLEANS NAS JRB                | KNBG       | 29.83 | -90.03 | UNITED STATES - LA |
| POLK AAF                           | KPOE       | 31.04 | -93.19 | UNITED STATES - LA |
| SHREVEPORT RGNL                    | KSHV       | 32.45 | -93.83 | UNITED STATES - LA |
| BARNES MUNI                        | KBAF       | 42.16 | -72.72 | UNITED STATES - MA |
| GENERAL EDWARD LAWRENCE LOGAN INTL | KBOS       | 42.36 | -71.01 | UNITED STATES - MA |
| LAURENCE G HANSCOM FLD             | KBED       | 42.47 | -71.29 | UNITED STATES - MA |
| NANTUCKET MEM                      | KACK       | 41.25 | -70.06 | UNITED STATES - MA |

| Site Name                            | Station ID | Lat   | Lon    | Country            |
|--------------------------------------|------------|-------|--------|--------------------|
| OTIS AIR NATIONAL GUARD BASE         | KFMH       | 41.65 | -70.52 | UNITED STATES - MA |
| SOUTH WEYMOUTH NAS                   | KNZW       | 42.15 | -70.93 | UNITED STATES - MA |
| WESTOVER ARB METROPOLITAN            | KCEF       | 42.19 | -72.53 | UNITED STATES - MA |
| WORCESTER RGNL                       | KORH       | 42.27 | -71.88 | UNITED STATES - MA |
| ANDREWS AFB                          | KADW       | 38.81 | -76.87 | UNITED STATES - MD |
| BALTIMORE WASHINGTON INTL            | KBWI       | 39.18 | -76.67 | UNITED STATES - MD |
| HAGERSTOWN RGNL RICHARD A HENSON FLD | KHGR       | 39.71 | -77.73 | UNITED STATES - MD |
| PATUXENT RIVER NAS                   | KNHK       | 38.29 | -76.41 | UNITED STATES - MD |
| AUGUSTA STATE                        | KAUG       | 44.32 | -69.8  | UNITED STATES - ME |
| BANGOR INTL                          | KBGR       | 44.81 | -68.83 | UNITED STATES - ME |
| BRUNSWICK NAS                        | KNHZ       | 43.89 | -69.94 | UNITED STATES - ME |
| LORING INTL                          | ME16       | 46.95 | -67.89 | UNITED STATES - ME |
| PORTLAND INTL JETPORT                | KPWM       | 43.65 | -70.31 | UNITED STATES - ME |
| ALPENA CO RGNL                       | KAPN       | 45.08 | -83.56 | UNITED STATES - MI |
| BISHOP INTL                          | KFNT       | 42.97 | -83.74 | UNITED STATES - MI |
| CAPITAL CITY                         | KLAN       | 42.78 | -84.59 | UNITED STATES - MI |
| CHERRY CAPITAL                       | KTVC       | 44.74 | -85.58 | UNITED STATES - MI |
| COLEMAN A YOUNG MUNI                 | KDET       | 42.41 | -83.01 | UNITED STATES - MI |
| GERALD R FORD INTL                   | KGRR       | 42.88 | -85.52 | UNITED STATES - MI |
| HOUGHTON CO MEM                      | KCMX       | 47.17 | -88.49 | UNITED STATES - MI |
| JACKSON CO REYNOLDS FLD              | KJXN       | 42.26 | -84.46 | UNITED STATES - MI |
| MARQUETTE CO. ARPT                   | KMQT       | 46.53 | -87.55 | UNITED STATES - MI |
| MUSKEGON CO                          | KMKG       | 43.17 | -86.24 | UNITED STATES - MI |
| OSCODA WURTSMITH                     | KOSC       | 44.45 | -83.39 | UNITED STATES - MI |
| PELLSTON RGNL ARPT OF EMMET CO       | KPLN       | 45.57 | -84.8  | UNITED STATES - MI |
| ROSCOMMON CO                         | KHTL       | 44.36 | -84.67 | UNITED STATES - MI |
| SAULT STE MARIE MUNI SANDERSON FLD   | KANJ       | 46.48 | -84.37 | UNITED STATES - MI |
| SAWYER INTL                          | KSAW       | 46.35 | -87.4  | UNITED STATES - MI |
| SELFRIEDGE ANGB                      | KMTC       | 42.61 | -82.83 | UNITED STATES - MI |
| W K KELLOGG                          | KBTL       | 42.31 | -85.25 | UNITED STATES - MI |
| BEMIDJI RGNL                         | KBJI       | 47.51 | -94.93 | UNITED STATES - MN |
| DULUTH INTL                          | KDLH       | 46.84 | -92.19 | UNITED STATES - MN |
| FALLS INTL                           | KINL       | 48.57 | -93.4  | UNITED STATES - MN |
| MINNEAPOLIS ST PAUL INTL             | KMSP       | 44.88 | -93.22 | UNITED STATES - MN |
| ROCHESTER INTL                       | KRST       | 43.91 | -92.5  | UNITED STATES - MN |
| COLUMBIA RGNL                        | KCOU       | 38.82 | -92.22 | UNITED STATES - MO |
| JEFFERSON CITY MEM                   | KJEF       | 38.59 | -92.16 | UNITED STATES - MO |
| JOPLIN RGNL                          | KJLN       | 37.15 | -94.5  | UNITED STATES - MO |
| KANSAS CITY INTL                     | KMCI       | 39.3  | -94.71 | UNITED STATES - MO |

| Site Name                           | Station ID | Lat   | Lon     | Country            |
|-------------------------------------|------------|-------|---------|--------------------|
| LAMBERT ST LOUIS INTL               | KSTL       | 38.75 | -90.36  | UNITED STATES - MO |
| RICHARDS-GEBAUR AP                  | KGWV       | 38.85 | -94.55  | UNITED STATES - MO |
| ROSECRANS MEM                       | KSTJ       | 39.77 | -94.91  | UNITED STATES - MO |
| SPIRIT OF ST LOUIS                  | KSUS       | 38.66 | -90.65  | UNITED STATES - MO |
| SPRINGFIELD BRANSON RGNL            | KSGF       | 37.25 | -93.39  | UNITED STATES - MO |
| WAYNESVILLE RGNL ARPT AT FORNEY FLD | KTBN       | 37.74 | -92.14  | UNITED STATES - MO |
| WHITEMAN AFB                        | KSZL       | 38.73 | -93.55  | UNITED STATES - MO |
| COLUMBUS AFB                        | KCBM       | 33.65 | -88.45  | UNITED STATES - MS |
| GULFPORT BILOXI INTL                | KGPT       | 30.41 | -89.07  | UNITED STATES - MS |
| HATTIESBURG LAUREL RGNL             | KPIB       | 31.47 | -89.34  | UNITED STATES - MS |
| JACKSON EVERS INTL                  | KJAN       | 32.31 | -90.08  | UNITED STATES - MS |
| KEESLER AFB                         | KBIX       | 30.41 | -88.92  | UNITED STATES - MS |
| KEY FLD                             | KMEI       | 32.33 | -88.75  | UNITED STATES - MS |
| MCCOMB PIKE CO JOHN E LEWIS FLD     | KMCB       | 31.18 | -90.47  | UNITED STATES - MS |
| MERIDIAN NAS                        | KNMM       | 32.55 | -88.56  | UNITED STATES - MS |
| TUPELO RGNL                         | KTUP       | 34.27 | -88.77  | UNITED STATES - MS |
| BERT MOONEY                         | KBTM       | 45.95 | -112.5  | UNITED STATES - MT |
| BILLINGS LOGAN INTL                 | KBIL       | 45.81 | -108.54 | UNITED STATES - MT |
| CUT BANK MUNI                       | KCTB       | 48.61 | -112.38 | UNITED STATES - MT |
| FRANK WILEY FLD                     | KMLS       | 46.43 | -105.89 | UNITED STATES - MT |
| GLACIER PARK INTL                   | KGPI       | 48.31 | -114.26 | UNITED STATES - MT |
| GREAT FALLS INTL                    | KGTF       | 47.48 | -111.37 | UNITED STATES - MT |
| HAVRE CITY CO                       | KHVR       | 48.54 | -109.76 | UNITED STATES - MT |
| HELENA RGNL                         | KHLN       | 46.61 | -111.98 | UNITED STATES - MT |
| LEWISTOWN MUNI                      | KLWT       | 47.05 | -109.47 | UNITED STATES - MT |
| MALMSTROM AFHP                      | KGFA       | 47.5  | -111.19 | UNITED STATES - MT |
| MISSOULA INTL                       | KMSO       | 46.92 | -114.09 | UNITED STATES - MT |
| WOKAL FLD GLASGOW INTL              | KGGW       | 48.21 | -106.61 | UNITED STATES - MT |
| ALBERT J ELLIS                      | KOAJ       | 34.83 | -77.61  | UNITED STATES - NC |
| ASHEVILLE RGNL                      | KAVL       | 35.44 | -82.54  | UNITED STATES - NC |
| CHARLOTTE DOUGLAS INTL              | KCLT       | 35.21 | -80.94  | UNITED STATES - NC |
| CHERRY POINT MCAS                   | KNKT       | 34.9  | -76.88  | UNITED STATES - NC |
| MACKALL AAF                         | KHFF       | 35.04 | -79.5   | UNITED STATES - NC |
| NEW RIVER MCAS                      | KNCA       | 34.71 | -77.44  | UNITED STATES - NC |
| PIEDMONT TRIAD INTL                 | KGSO       | 36.1  | -79.94  | UNITED STATES - NC |
| POPE FIELD                          | KPOB       | 35.17 | -79.01  | UNITED STATES - NC |
| RALEIGH DURHAM INTL                 | KRDU       | 35.88 | -78.79  | UNITED STATES - NC |
| SEYMOUR JOHNSON AFB                 | KGSB       | 35.34 | -77.96  | UNITED STATES - NC |
| SIMMONS AAF                         | KFBG       | 35.13 | -78.94  | UNITED STATES - NC |
| BISMARCK MUNI                       | KBIS       | 46.77 | -100.75 | UNITED STATES - ND |



| Site Name                             | Station ID | Lat   | Lon     | Country            |
|---------------------------------------|------------|-------|---------|--------------------|
| DICKINSON THEODORE ROOSEVELT RGNL     | KDIK       | 46.8  | -102.8  | UNITED STATES - ND |
| GRAND FORKS AFB                       | KRDR       | 47.96 | -97.4   | UNITED STATES - ND |
| HECTOR INTL                           | KFAR       | 46.92 | -96.82  | UNITED STATES - ND |
| MINOT AFB                             | KMIB       | 48.42 | -101.36 | UNITED STATES - ND |
| CENTRAL NEBRASKA RGNL                 | KGRI       | 40.97 | -98.31  | UNITED STATES - NE |
| EPPLEY AFLD                           | KOMA       | 41.3  | -95.89  | UNITED STATES - NE |
| LINCOLN                               | KLNK       | 40.85 | -96.76  | UNITED STATES - NE |
| NORTH PLATTE RGNL ARPT LEE BIRD FLD   | KLBF       | 41.13 | -100.68 | UNITED STATES - NE |
| OFFUTT AFB                            | KOFF       | 41.12 | -95.91  | UNITED STATES - NE |
| WESTERN NEB RGNL WILLIAM B HEILIG FLD | KBFF       | 41.87 | -103.6  | UNITED STATES - NE |
| CONCORD MUNI                          | KCON       | 43.2  | -71.5   | UNITED STATES - NH |
| LEBANON MUNI                          | KLEB       | 43.63 | -72.3   | UNITED STATES - NH |
| MANCHESTER                            | KMHT       | 42.93 | -71.44  | UNITED STATES - NH |
| MOUNT WASHINGTON                      | KMWN       | 44.27 | -71.3   | UNITED STATES - NH |
| PEASE INTL TRADEPORT                  | KPSM       | 43.08 | -70.82  | UNITED STATES - NH |
| ATLANTIC CITY INTL                    | KACY       | 39.46 | -74.58  | UNITED STATES - NJ |
| LAKEHURST NAES                        | KNEL       | 40.03 | -74.35  | UNITED STATES - NJ |
| MCGUIRE AFB                           | KWRI       | 40.02 | -74.59  | UNITED STATES - NJ |
| NEWARK LIBERTY INTL                   | KEWR       | 40.69 | -74.17  | UNITED STATES - NJ |
| TETERBORO                             | KTEB       | 40.85 | -74.06  | UNITED STATES - NJ |
| TRENTON MERCER                        | KTTN       | 40.28 | -74.81  | UNITED STATES - NJ |
| ALBUQUERQUE INTL                      | KABQ       | 35.04 | -106.61 | UNITED STATES - NM |
| CANNON AFB                            | KCVS       | 34.39 | -103.31 | UNITED STATES - NM |
| CAVERN CITY AIR TERMINAL              | KCNM       | 32.34 | -104.26 | UNITED STATES - NM |
| FOUR CORNERS RGNL                     | KFMN       | 36.74 | -108.23 | UNITED STATES - NM |
| GALLUP MUNI                           | KGUP       | 35.51 | -108.79 | UNITED STATES - NM |
| HOLLOMAN AFB                          | KHMN       | 32.85 | -106.11 | UNITED STATES - NM |
| ROSWELL INTL AIR CENTER               | KROW       | 33.3  | -104.53 | UNITED STATES - NM |
| TUCUMCARI MUNI                        | KTCC       | 35.18 | -103.6  | UNITED STATES - NM |
| WHITE SANDS NM.                       | 72269      | 32.38 | -106.48 | UNITED STATES - NM |
| DESERT ROCK                           | KDRA       | 36.62 | -116.03 | UNITED STATES - NV |
| ELKO RGNL                             | KEKO       | 40.82 | -115.79 | UNITED STATES - NV |
| ELY ARPT YELLAND FLD                  | KELY       | 39.3  | -114.84 | UNITED STATES - NV |
| MCCARRAN INTL                         | KLAS       | 36.08 | -115.15 | UNITED STATES - NV |
| NELLIS AFB                            | KLSV       | 36.24 | -115.03 | UNITED STATES - NV |
| RENO TAHOE INTL                       | KRNO       | 39.5  | -119.77 | UNITED STATES - NV |
| TONOPAH                               | KTPH       | 38.06 | -117.09 | UNITED STATES - NV |
| WINNEMUCCA MUNI                       | KWMC       | 40.9  | -117.81 | UNITED STATES - NV |
| ALBANY INTL                           | KALB       | 42.75 | -73.8   | UNITED STATES - NY |

| <b>Site Name</b>                    | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b>     |
|-------------------------------------|-------------------|------------|------------|--------------------|
| BUFFALO NIAGARA INTL                | KBUF              | 42.94      | -78.73     | UNITED STATES - NY |
| CHAUTAUQUA CO JAMESTOWN             | KJHW              | 42.15      | -79.26     | UNITED STATES - NY |
| DUTCHESS CO                         | KPOU              | 41.63      | -73.88     | UNITED STATES - NY |
| FLOYD BENNETT MEM                   | KGFL              | 43.34      | -73.61     | UNITED STATES - NY |
| GREATER BINGHAMTON EDWIN A LINK FLD | KBGM              | 42.21      | -75.98     | UNITED STATES - NY |
| GREATER ROCHESTER INTL              | KROC              | 43.12      | -77.67     | UNITED STATES - NY |
| GRIFFISS AFB/ROME                   | KRME              | 43.23      | -75.41     | UNITED STATES - NY |
| JOHN F KENNEDY INTL                 | KJFK              | 40.64      | -73.78     | UNITED STATES - NY |
| LA GUARDIA                          | KLGA              | 40.78      | -73.87     | UNITED STATES - NY |
| LONG ISLAND MAC ARTHUR              | KISP              | 40.8       | -73.1      | UNITED STATES - NY |
| NIAGARA FALLS INTL                  | KIAG              | 43.11      | -78.95     | UNITED STATES - NY |
| ONEIDA CO                           | KUCA              | 43.15      | -75.38     | UNITED STATES - NY |
| PLATTSBURGH AFB                     | KPBG              | 44.65      | -73.47     | UNITED STATES - NY |
| STEWART INTL                        | KSWF              | 41.5       | -74.1      | UNITED STATES - NY |
| SYRACUSE HANCOCK INTL               | KSYR              | 43.11      | -76.11     | UNITED STATES - NY |
| WATERTOWN INTL                      | KART              | 43.98      | -76.02     | UNITED STATES - NY |
| WESTCHESTER CO                      | KHPN              | 41.07      | -73.71     | UNITED STATES - NY |
| WHEELER SACK AAF                    | KGTB              | 44.06      | -75.72     | UNITED STATES - NY |
| AKRON CANTON RGNL                   | KCAK              | 40.92      | -81.44     | UNITED STATES - OH |
| CINCINNATI MUNI LUNKEN FLD          | KLUK              | 39.1       | -84.42     | UNITED STATES - OH |
| CLEVELAND HOPKINS INTL              | KCLE              | 41.41      | -81.85     | UNITED STATES - OH |
| JAMES M COX DAYTON INTL             | KDAY              | 39.9       | -84.22     | UNITED STATES - OH |
| MANSFIELD LAHM RGNL                 | KMFD              | 40.82      | -82.52     | UNITED STATES - OH |
| PORT COLUMBUS INTL                  | KCMH              | 40         | -82.89     | UNITED STATES - OH |
| RICKENBACKER INTL                   | KLCK              | 39.81      | -82.93     | UNITED STATES - OH |
| TOLEDO EXPRESS                      | KTOL              | 41.59      | -83.81     | UNITED STATES - OH |
| WRIGHT PATTERSON AFB                | KFFO              | 39.83      | -84.05     | UNITED STATES - OH |
| YOUNGSTOWN WARREN RGNL              | KYNG              | 41.26      | -80.68     | UNITED STATES - OH |
| ZANESVILLE MUNI                     | KZZV              | 39.94      | -81.89     | UNITED STATES - OH |
| ALTUS AFB                           | KLTS              | 34.67      | -99.27     | UNITED STATES - OK |
| HENRY POST AAF                      | KFSI              | 34.65      | -98.4      | UNITED STATES - OK |
| MCALESTER RGNL                      | KMLC              | 34.88      | -95.78     | UNITED STATES - OK |
| TINKER AFB                          | KTIK              | 35.41      | -97.39     | UNITED STATES - OK |
| TULSA INTL                          | KTUL              | 36.2       | -95.89     | UNITED STATES - OK |
| VANCE AFB                           | KEND              | 36.34      | -97.92     | UNITED STATES - OK |
| WILL ROGERS WORLD                   | KOKC              | 35.39      | -97.6      | UNITED STATES - OK |
| ASTORIA RGNL                        | KAST              | 46.16      | -123.88    | UNITED STATES - OR |
| BURNS MUNI                          | KBNO              | 43.59      | -118.96    | UNITED STATES - OR |
| EASTERN OREGON RGNL AT PENDLETON    | KPDT              | 45.7       | -118.84    | UNITED STATES - OR |



| Site Name                        | Station ID | Lat   | Lon     | Country            |
|----------------------------------|------------|-------|---------|--------------------|
| KLAMATH FALLS                    | KLMT       | 42.16 | -121.73 | UNITED STATES - OR |
| MAHLON SWEET FLD                 | KEUG       | 44.12 | -123.21 | UNITED STATES - OR |
| MCNARY FLD                       | KSLE       | 44.91 | -123    | UNITED STATES - OR |
| NORTH BEND MUNI                  | KOTH       | 43.42 | -124.25 | UNITED STATES - OR |
| PORTLAND INTL                    | KPDX       | 45.59 | -122.6  | UNITED STATES - OR |
| ROBERTS FLD AIRPORT              | KRDM       | 44.25 | -121.15 | UNITED STATES - OR |
| ROGUE VALLEY INTL MEDFORD        | KMFR       | 42.37 | -122.87 | UNITED STATES - OR |
| SEXTON SUMMIT                    | KSXT       | 42.6  | -123.36 | UNITED STATES - OR |
| ALTOONA BLAIR CO                 | KAOO       | 40.3  | -78.32  | UNITED STATES - PA |
| DU BOIS JEFFERSON CO             | KDUJ       | 41.18 | -78.9   | UNITED STATES - PA |
| HARRISBURG INTL                  | KMDT       | 40.19 | -76.76  | UNITED STATES - PA |
| JOHN MURTHA JOHNSTOWN CAMBRIA CO | KJST       | 40.32 | -78.83  | UNITED STATES - PA |
| LEHIGH VALLEY INTL               | KABE       | 40.65 | -75.44  | UNITED STATES - PA |
| NORTHEAST PHILADELPHIA           | KPNE       | 40.08 | -75.01  | UNITED STATES - PA |
| PHILADELPHIA INTL                | KPHL       | 39.87 | -75.24  | UNITED STATES - PA |
| PITTSBURGH INTL                  | KPIT       | 40.49 | -80.23  | UNITED STATES - PA |
| WILKES BARRE SCRANTON INTL       | KAVP       | 41.34 | -75.72  | UNITED STATES - PA |
| WILLIAMSPORT RGNL                | KIPT       | 41.24 | -76.92  | UNITED STATES - PA |
| WILLOW GROVE NAS JRB             | KNXX       | 40.2  | -75.15  | UNITED STATES - PA |
| QUONSET STATE                    | KOQU       | 41.6  | -71.41  | UNITED STATES - RI |
| THEODORE FRANCIS GREEN STATE     | KPVD       | 41.73 | -71.42  | UNITED STATES - RI |
| BEAUFORT MCAS                    | KNBC       | 32.48 | -80.72  | UNITED STATES - SC |
| CHARLESTON AFB INTL              | KCHS       | 32.9  | -80.04  | UNITED STATES - SC |
| COLUMBIA METROPOLITAN            | KCAE       | 33.94 | -81.12  | UNITED STATES - SC |
| FLORENCE RGNL                    | KFLO       | 34.19 | -79.72  | UNITED STATES - SC |
| GREENVILLE SPARTANBURG INTL      | KGSP       | 34.9  | -82.22  | UNITED STATES - SC |
| MCENTIRE JNGB                    | KMMT       | 33.92 | -80.8   | UNITED STATES - SC |
| MYRTLE BEACH INTL                | KMYR       | 33.68 | -78.93  | UNITED STATES - SC |
| ORANGEBURG MUNI                  | KOGB       | 33.46 | -80.86  | UNITED STATES - SC |
| SHAW AFB                         | KSSC       | 33.97 | -80.47  | UNITED STATES - SC |
| ABERDEEN RGNL                    | KABR       | 45.45 | -98.42  | UNITED STATES - SD |
| ELLSWORTH AFB                    | KRCA       | 44.15 | -103.1  | UNITED STATES - SD |
| HURON RGNL                       | KHON       | 44.39 | -98.23  | UNITED STATES - SD |
| JOE FOSS FLD                     | KFSD       | 43.58 | -96.74  | UNITED STATES - SD |
| PIERRE RGNL                      | KPIR       | 44.38 | -100.29 | UNITED STATES - SD |
| RAPID CITY RGNL                  | KRAP       | 44.05 | -103.06 | UNITED STATES - SD |
| LOVELL FLD                       | KCHA       | 35.04 | -85.2   | UNITED STATES - TN |
| MCGHEE TYSON                     | KTYS       | 35.81 | -83.99  | UNITED STATES - TN |
| MCKELLAR SIPES RGNL              | KMKL       | 35.6  | -88.92  | UNITED STATES - TN |

| <b>Site Name</b>                    | <b>Station ID</b> | <b>Lat</b> | <b>Lon</b> | <b>Country</b>     |
|-------------------------------------|-------------------|------------|------------|--------------------|
| MEMPHIS INTL                        | KMEM              | 35.04      | -89.98     | UNITED STATES - TN |
| MEMPHIS NAS                         | 723345            | 35.35      | -89.87     | UNITED STATES - TN |
| NASHVILLE INTL                      | KBNA              | 36.12      | -86.68     | UNITED STATES - TN |
| TRI CITIES RGNL TN VA               | KTRI              | 36.48      | -82.41     | UNITED STATES - TN |
| ABILENE RGNL                        | KABI              | 32.41      | -99.68     | UNITED STATES - TX |
| ANGELINA CO                         | KLFK              | 31.23      | -94.75     | UNITED STATES - TX |
| AUSTIN BERGSTROM INTL               | KAUS              | 30.19      | -97.67     | UNITED STATES - TX |
| BERGSTROM AFB/AUSTI                 | KBSM              | 30.2       | -97.68     | UNITED STATES - TX |
| BROWNSVILLE SOUTH PADRE ISLAND INTL | KBRO              | 25.91      | -97.43     | UNITED STATES - TX |
| CHASE NAS/BEEVILLE                  | KNIR              | 28.37      | -97.67     | UNITED STATES - TX |
| CORPUS CHRISTI INTL                 | KCRP              | 27.77      | -97.5      | UNITED STATES - TX |
| CORPUS CHRISTI NAS                  | KNGP              | 27.69      | -97.29     | UNITED STATES - TX |
| DALLAS (NAS)                        | KNBE              | 32.73      | -96.97     | UNITED STATES - TX |
| DALLAS FORT WORTH INTL              | KDFW              | 32.9       | -97.04     | UNITED STATES - TX |
| DALLAS LOVE FLD                     | KDAL              | 32.85      | -96.85     | UNITED STATES - TX |
| DEL RIO INTL                        | KDRT              | 29.37      | -100.93    | UNITED STATES - TX |
| DYESS AFB                           | KDYS              | 32.42      | -99.85     | UNITED STATES - TX |
| EL PASO INTL                        | KELP              | 31.81      | -106.38    | UNITED STATES - TX |
| ELLINGTON FLD                       | KEFD              | 29.61      | -95.16     | UNITED STATES - TX |
| FORT WORTH NAS JRB                  | KNFW              | 32.77      | -97.44     | UNITED STATES - TX |
| GEORGE BUSH INTCNTL HOUSTON         | KIAH              | 29.98      | -95.34     | UNITED STATES - TX |
| HOOD AAF                            | KHLR              | 31.15      | -97.72     | UNITED STATES - TX |
| KINGSVILLE NAS                      | KNQI              | 27.51      | -97.81     | UNITED STATES - TX |
| LACKLAND AFB KELLY FLD ANNEX        | KSKF              | 29.38      | -98.58     | UNITED STATES - TX |
| LAUGHLIN AFB                        | KDLF              | 29.36      | -100.78    | UNITED STATES - TX |
| LUBBOCK PRESTON SMITH INTL          | KLBB              | 33.66      | -101.82    | UNITED STATES - TX |
| MIDLAND INTL                        | KMAF              | 31.94      | -102.2     | UNITED STATES - TX |
| RANDOLPH AFB                        | KRND              | 29.53      | -98.28     | UNITED STATES - TX |
| REESE AFB/LUBBOCK                   | KREE              | 33.6       | -102.05    | UNITED STATES - TX |
| RICK HUSBAND AMARILLO INTL          | KAMA              | 35.22      | -101.71    | UNITED STATES - TX |
| ROBERT GRAY AAF                     | KGRK              | 31.07      | -97.83     | UNITED STATES - TX |
| SAN ANGELO RGNL MATHIS FLD          | KSJT              | 31.36      | -100.5     | UNITED STATES - TX |
| SAN ANTONIO INTL                    | KSAT              | 29.53      | -98.47     | UNITED STATES - TX |
| SCHOLES INTL AT GALVESTON           | KGLS              | 29.27      | -94.86     | UNITED STATES - TX |
| SHEPPARD AFB WICHITA FALLS MUNI     | KSPS              | 33.99      | -98.49     | UNITED STATES - TX |
| SOUTHEAST TEXAS RGNL                | KBPT              | 29.95      | -94.02     | UNITED STATES - TX |
| TYLER POUNDS RGNL                   | KTYR              | 32.35      | -95.4      | UNITED STATES - TX |
| WACO RGNL                           | KACT              | 31.61      | -97.23     | UNITED STATES - TX |
| CEDAR CITY RGNL                     | KCDC              | 37.7       | -113.1     | UNITED STATES - UT |
| HILL AFB                            | KHIF              | 41.12      | -111.97    | UNITED STATES - UT |

| Site Name                           | Station ID | Lat   | Lon     | Country            |
|-------------------------------------|------------|-------|---------|--------------------|
| PROVO MUNI                          | KPVU       | 40.22 | -111.72 | UNITED STATES - UT |
| SALT LAKE CITY INTL                 | KSLC       | 40.79 | -111.98 | UNITED STATES - UT |
| WENDOVER                            | KENV       | 40.72 | -114.03 | UNITED STATES - UT |
| CHARLOTTESVILLE ALBEMARLE           | KCHO       | 38.14 | -78.45  | UNITED STATES - VA |
| DANVILLE RGNL                       | KDAN       | 36.57 | -79.34  | UNITED STATES - VA |
| DAVISON AAF                         | KDAA       | 38.72 | -77.18  | UNITED STATES - VA |
| FELKER AAF                          | KFAF       | 37.13 | -76.61  | UNITED STATES - VA |
| LANGLEY AFB                         | KLFI       | 37.08 | -76.36  | UNITED STATES - VA |
| NEWPORT NEWS WILLIAMSBURG INTL      | KPHF       | 37.13 | -76.49  | UNITED STATES - VA |
| NORFOLK INTL                        | KORF       | 36.89 | -76.2   | UNITED STATES - VA |
| NORFOLK NS                          | KNGU       | 36.94 | -76.29  | UNITED STATES - VA |
| OCEANA NAS                          | KNTU       | 36.82 | -76.03  | UNITED STATES - VA |
| QUANTICO MCAF                       | KNYG       | 38.5  | -77.31  | UNITED STATES - VA |
| RICHMOND INTL                       | KRIC       | 37.51 | -77.32  | UNITED STATES - VA |
| ROANOKE RGNL WOODRUM FLD            | KROA       | 37.33 | -79.98  | UNITED STATES - VA |
| WALLOPS FLIGHT FACILITY             | KWAL       | 37.94 | -75.47  | UNITED STATES - VA |
| BURLINGTON INTL                     | KBTW       | 44.47 | -73.15  | UNITED STATES - VT |
| BELLINGHAM INTL                     | KBLI       | 48.79 | -122.54 | UNITED STATES - WA |
| BOEING FLD KING CO INTL             | KBFI       | 47.53 | -122.3  | UNITED STATES - WA |
| BREMERTON NATIONAL                  | KPWT       | 47.49 | -122.76 | UNITED STATES - WA |
| FAIRCHILD AFB                       | KSKA       | 47.62 | -117.66 | UNITED STATES - WA |
| FELTS FLD                           | KSFF       | 47.68 | -117.32 | UNITED STATES - WA |
| GRAY AAF                            | KGRF       | 47.08 | -122.58 | UNITED STATES - WA |
| HANFORD                             | KHMS       | 46.57 | -119.6  | UNITED STATES - WA |
| KELSO LONGVIEW                      | KKLS       | 46.12 | -122.9  | UNITED STATES - WA |
| MCCHORD FIELD                       | KTCM       | 47.13 | -122.48 | UNITED STATES - WA |
| OLYMPIA                             | KOLM       | 46.97 | -122.9  | UNITED STATES - WA |
| PANGBORN MEM                        | KEAT       | 47.4  | -120.21 | UNITED STATES - WA |
| QUILLAYUTE                          | KUIL       | 47.94 | -124.56 | UNITED STATES - WA |
| SEATTLE TACOMA INTL                 | KSEA       | 47.45 | -122.31 | UNITED STATES - WA |
| SNOHOMISH CO                        | KPAE       | 47.91 | -122.28 | UNITED STATES - WA |
| SPOKANE INTL                        | KGEG       | 47.62 | -117.53 | UNITED STATES - WA |
| WALLA WALLA RGNL                    | KALW       | 46.09 | -118.29 | UNITED STATES - WA |
| WHIDBEY ISLAND NAS                  | KNUW       | 48.35 | -122.66 | UNITED STATES - WA |
| WILLIAM R FAIRCHILD INTL            | KCLM       | 48.12 | -123.5  | UNITED STATES - WA |
| YAKIMA AIR TERMINAL MC ALLISTER FLD | KYKM       | 46.57 | -120.54 | UNITED STATES - WA |
| AUSTIN STRAUBEL INTL                | KGRB       | 44.49 | -88.13  | UNITED STATES - WI |
| CHIPPEWA VALLEY RGNL                | KEAU       | 44.87 | -91.48  | UNITED STATES - WI |
| DANE CO RGNL TRUAX FLD              | KMSN       | 43.14 | -89.34  | UNITED STATES - WI |
| GENERAL MITCHELL INTL               | KMKE       | 42.95 | -87.9   | UNITED STATES - WI |

| Site Name                              | Station ID | Lat    | Lon     | Country            |
|--|------------|--------|---------|--------------------|
| LA CROSSE MUNI                         | KLSE       | 43.88  | -91.26  | UNITED STATES - WI |
| EASTERN WV RGNL SHEPHERD FLD           | KMRB       | 39.4   | -77.98  | UNITED STATES - WV |
| HARRISON MARION RGNL                   | KCKB       | 39.3   | -80.23  | UNITED STATES - WV |
| MERCER CO                              | KBLF       | 37.3   | -81.21  | UNITED STATES - WV |
| MID OHIO VALLEY RGNL                   | KPKB       | 39.35  | -81.44  | UNITED STATES - WV |
| MORGANTOWN MUNI WALTER L BILL HART FLD | KMGW       | 39.64  | -79.92  | UNITED STATES - WV |
| RALEIGH CO MEM                         | KBKW       | 37.79  | -81.12  | UNITED STATES - WV |
| TRI STATE MILTON J FERGUSON FLD        | KHTS       | 38.37  | -82.56  | UNITED STATES - WV |
| WHEELING OHIO CO                       | KHLG       | 40.17  | -80.65  | UNITED STATES - WV |
| YEAGER                                 | KCRW       | 38.37  | -81.59  | UNITED STATES - WV |
| CHEYENNE RGNL JERRY OLSON FLD          | KCYS       | 41.16  | -104.81 | UNITED STATES - WY |
| EVANSTON UINTA CO BURNS FLD            | KEVW       | 41.27  | -111.03 | UNITED STATES - WY |
| HUNT FLD                               | KLND       | 42.82  | -108.73 | UNITED STATES - WY |
| NATRONA CO INTL                        | KCPR       | 42.91  | -106.46 | UNITED STATES - WY |
| ROCK SPRINGS SWEETWATER CO             | KRKS       | 41.59  | -109.07 | UNITED STATES - WY |
| SHERIDAN CO                            | KSHR       | 44.77  | -106.98 | UNITED STATES - WY |
| CARRASCO INTL                          | SUMU       | -34.84 | -56.03  | URUGUAY            |
| KARSHI                                 | 38812      | 38.8   | 65.72   | UZBEKISTAN         |
| SAMARKAND                              | UTSS       | 39.7   | 66.98   | UZBEKISTAN         |
| TERMEZ                                 | UTST       | 37.29  | 67.31   | UZBEKISTAN         |
| YUZHNY                                 | UTTT       | 41.26  | 69.28   | UZBEKISTAN         |
| ALBERTO CARNEVALLI                     | SVMD       | 8.58   | -71.16  | VENEZUELA          |
| BARQUISIMETO INTL                      | SVBM       | 10.04  | -69.36  | VENEZUELA          |
| GENERAL JOSE ANTONIO ANZOATEGUI INTL   | SVBC       | 10.11  | -64.69  | VENEZUELA          |
| SAN ANTONIO DEL TACHIRA                | SVSA       | 7.84   | -72.44  | VENEZUELA          |
| SIMON BOLIVAR INTL                     | SVMI       | 10.6   | -66.99  | VENEZUELA          |
| DANANG INTL                            | VVDN       | 16.04  | 108.2   | VIETNAM            |
| NOIBAI INTL                            | VVNB       | 21.22  | 105.81  | VIETNAM            |
| TANSONNHAT INTL                        | VVTS       | 10.82  | 106.65  | VIETNAM            |
| WAKE ISLAND AFLD                       | PWAK       | 19.28  | 166.64  | WAKE ISLAND        |
| HARARE INTL                            | FMHA       | -17.93 | 31.09   | ZIMBABWE           |