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Capabilities, Products, and Services of the AFCCC

Air Force
Combat Climatology Center

DECEMBER 1995

Air Force Combat Climatology Center
859 Buchanan Street
Scott Air Force Base, Illinois 62225-5116

REVIEW AND APPROVAL STATEMENT

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FOR THE COMMANDER

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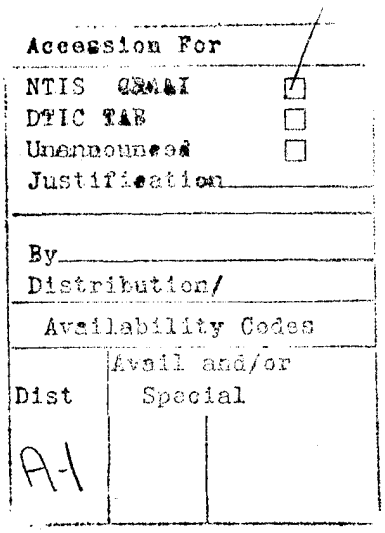

PREFACE

This technical note describes the capabilities, purpose, and organization of the Air Force Combat Climatology Center, formerly the United States Air Force Environmental Technical Applications Center (USAFETAC), the Air Weather Service unit charged with building, maintaining, and applying the United States Air Force's climatic database.

AFCCC is located at Scott Air Force Base, Illinois. Its Operating Location A (OL-A), collocated with the National Climatic Data Center at Asheville, North Carolina, maintains the Air Force's climatic computer database as part of the Federal Climate Complex.

AFCCC analysts apply the contents of the total database to satisfy specific customer needs upon request. The computer database maintained by OL-A, AFCCC at Asheville is in the same building as a civilian version maintained by the National Climatic Data Center. Both databases were built from weather observations collected, in some cases, over periods of more than 100 years. The databases are continuously updated through electronic input of environmental information from worldwide sources.

The purpose of this document is to familiarize potential AFCCC customers throughout the Department of Defense with AFCCC and its capabilities. It begins by describing some of AFCCC's products and services and telling potential customers how to obtain them. Most AFCCC services are requested in accordance with AFI 15-118, *Requesting Specialized Weather Support*; AR 115-12, *U.S. Army Requirements for Weather and Climatological Support*; and NAVOCEANCOMINST 3140.1. After describing the contents of the climatic database, AFCCC's computer assets and organization are discussed briefly. Appendices provide request formats, "Online" applications, and a history of AFCCC and military climatology.

Because weather affects virtually every military operation, all levels of planners and operational specialists should find something of interest here. Those familiar with past AFCCC services should take a careful look at the new capabilities listed. Recent technological advancements have resulted in a number of new climatological data applications.

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Chapter 1
HOW TO REQUEST AFCCC PRODUCTS AND SERVICES

Who Is Eligible?

• Department of Defense (DoD) agencies and their contractors.

• Other United States Government agencies.

• Other activities by special arrangement and in accordance with public law and DoD regulations.

Request Channels

Air Force and Army
Send requests directly to AFCCC/DOO. Requests can be submitted by telephone, facsimile (FAX), message, email, or letter. Address requests to:

AFCCC/DOO
859 Buchanan Street
Scott AFB IL 62225-5116

DSN: 576-4024/4413 FAX: 576-3772
Commercial: (618) 256-4024/4413
Secure FAX: DSN 576-2897
STU-III: DSN 576-3465
EMAIL: afcccdoo@thunder.safb.af.mil
Pager: DSN 576-6789 plus (2256-Voice) or (2257-Numeric) (Use for emergency requests that require immediate responses during non-duty hours only).

Navy and Marine Corps
Send routine requests to the nearest Naval Meteorology and Oceanography Center in accordance with NAVOCEANCOMINST 3140-1 Series. Send urgent requests to the Fleet Numerical Meteorology and Oceanographic Detachment (FMNOD), 151 Patton Ave, Asheville, NC, 28801-5002, for action, with an information copy to AFCCC/DOO. FNMOD telephones: (704) 271-4232; FAX: (704) 271-4672; STU-III: (704) 271-4852.

Other DoD and U.S. Government Agencies
Send requests direct to AFCCC/DOO.

DoD Contractors
Send requests to AFCCC/DOO through your contract monitor.

Foreign Governments
Submit requests through your embassy to SAF/IADD.

Request Formats

Placing your request in a standard format saves time and effort and minimizes confusion. See Appendix A for the standard environmental support request format. Extra information is required in requests for Standard Summary Packages (see Appendix B).

Telephone Consultation

For unique or complex requests, preliminary telephone consultation with AFCCC/DOO or the chief scientist (DSN 576-4024/4413) is recommended and encouraged. These consultations can save time, money, and effort by making sure both parties are aware of what is wanted, needed, and available.

Responsiveness

AFCCC's response time, which ranges from hours for emergencies to years for extraordinarily large projects, depends primarily on the size of the project and its priority. Other considerations include project executability, required data, and required operational dates. Table 1 shows the availability of select products for crisis/contingency support.

Support Categories

The three categories listed below are from AFI 15-118, *Requesting Specialized Weather Support.*

- ***Category A.*** Operational support for wartime and contingencies (including deployments), and other operational support.
- ***Category B.*** JCS exercise and major USAF or Army command exercise support, and support to readiness inspections.
- ***Category C.*** Other operations, including routine peacetime operations, training, and contractors. Includes support to VIP travel, support to civilian contractors, and support to other DoD agencies.

Table 1. AFCCC Crisis/Contingency Support Products.

Product	Availability (After tasking)	Remarks
Area Cloud Cover by Heights	H+48 hours	
Area Ceilings by Heights	H+48 hours	
MODCURVES	H+24 hours	
MODCV	H+24 hours	
CFLOS	H+24 hours	
E-O Climo	H+24 hours	New point
Diurnal Curves	H+24 hours	
Light Data	H+24 hours	
Surface and Upper Air Wind Roses	H+24 hours	
Operational Climatic Data Summaries	H+12 hours	
Percent Frequency of Occurance (user specified elements/limits)	H+12 hours	
Point Refractivity Profile	H+12 hours	
Point/Small Area Narrative (present season)	H+12 hours	Annual H+24 hours
All summarized numerical data are, where possible, presented in graphical form. Times shown are "NLT" times-every effort will be made to prepare and ship sooner. Copies of already prepared information are available within 6 hours. "H" refers to the time AFCCC receives the tasking.		

Project Life Cycle

Upon receipt of your request for environmental support, the AFCCC Operations Support Branch (DOO) reviews it and assigns a priority. DOO then passes the project to an office of primary responsibility (OPR) where, according to the assigned priority, work on the project begins. An AFCCC project board reviews projects requiring extraordinary resources, modifies them if necessary, and reenters them into the queue. If the board determines a project exceeds AFCCC's capabilities, it may be referred to Headquarters Air Weather Service. HQ AWS either provides more resources or suggests that the customer go elsewhere. Upon project completion, the OPR quality controls and corrects the final output, sends it to the customer along with a Product Improvement Survey, and closes the project. We ask that customers provide a frank appraisal of AFCCC services in the Product Improvement Survey, with emphasis on how we affected your operations. We need and use your feedback to improve the way we conduct operations.

Requesting Standard Summary Packages

AFCCC produces these packages on request. The standard package consists of a SOCS (Surface Observation Climatic Summary), Wind-Stratified Conditional Climatology (WSCC) tables, an Hourly Temperature/Dew-Point Change Summary, and a Climatic Brief. Use the format shown in Appendix A to request a summary package, but be sure to include all the information requested in Appendix B.

Requesting Library Support

The Air Weather Service Technical Library (AWSTL), an integral part of AFCCC as shown in Chapter 5, is an officially designated USAF library (FL4414). The AWSTL is the only library in the DoD that is dedicated to the atmospheric sciences, and one of two in the entire Federal Government. The AWSTL collections comprise some 500,000 documents, including monographs, technical reports, research papers, theses, journals, and summarized climatological data in multimedia. The AWSTL Publishing Services Team edits and publishes technical reports and other documents written by Air Force weather personnel. Since it is an official Air Force library, many of the AWSTL's services are available to all DoD agencies and DoD contractors. Direct contact is authorized. Simple initial library support requests may be made by phone (DSN 576-5023/2625/4044), but requests for more complicated services, such as bibliographies or extended literature searches, should be in writing (see the suggested format in Appendix C). FAX (DSN 576-3772) or mail requests to AWSTL (FL4414), 859 Buchanan St, Scott AFB, IL 62225-5118. The AWSTL Email address is: AWSTL@thunder.safb.af.mil.

Requesting Access to AFCCC On-line Climatology Service (OCS)

AFCCC's OCS gives designated customers direct access to certain climatological products as well as TAFVER II statistics through special software and a modem. Appendix D contains a list of Dial-In applications currently available. AFCCC is developing a new access to the OCS. The new access allows users to AFCCC's computer workstations using their own standard communication software. To request access to the OCS, contact AFCCC/DOO stating your requirement. Upon approval, AFCCC will mail instructions for connecting to the OCS.

Accessing AFCCC on the Internet

AFCCC publicizes its capabilities, products, and services, and provides an organizational chart, telephone directory, and examples of interactive graphic products and capabilities over the Internet. Customers may access the AFCCC Homepage by opening their Universal Resource Locator (URL) to: http://thunder.safb.af.mil/html/afccc.html.

Chapter 2
AFCCC PRODUCTS AND SERVICES

The following partial alphabetical listing of AFCCC's products and services should give potential customers an idea of our nearly limitless capabilities. Most of the products and services listed here can be modified or tailored to meet unique or specialized requirements. To discuss your requirements, call AFCCC/DOO, DSN 576-4024/4413.

Aerial Spray Analysis

This PC version of the Forest Service (Cramer-Barry-Grim) Aerial Spray Computer Model is used to predict aircraft spray dispersion and deposition over a given area. Some applications include design optimization of spray concentrations, optimum flight and meteorological conditions for spraying, and assessment of potential environmental impacts.

Atmospheric Profiles

Our analysts can prepare a detailed atmospheric analysis for any predefined atmospheric segment of the world, for a specified time in the recorded past, from the surface to 400,000 feet. These analyses include vertical or slant-range profiles of wind, temperature, absolute humidity, density, pressure, and precipitable water. Profiles also provide gridded cloud depictions, site weather pseudo-surface observations, 24-hour weather history, and aerosol variables. These vertical profiles are produced by the AWS Atmospheric Slant-Path Analysis Model (ASPAM).

Atmospheric Stability Summaries

This empirical program uses surface observations to calculate the Pasquill classes (A-F) by hour and month, where A indicates strong convection, D represents purely mechanical turbulence, and F implies stable air in which mechanical turbulence is strongly damped by stratification.

Bibliographies

With access to more than 400 online computer databases, AFCCC can provide requesters with bibliographies that cite currently available references on any given subject in the atmospheric sciences and related disciplines. Database vendors include DIALOG, CIRC II, and the Defense Technical Information Center (DTIC). We also have a secure terminal on the Defense Research Development Test and Evaluation (RDT&E) Online System (DROLS), which contains more than 1 million citations on DoD scientific and technical documents. "Subject" bibliographies (SBs) are prepared ad hoc on one subject, for one requester. "Current awareness" bibliographies (CABs) are prepared periodically to provide one or more requesters with recent additions to the literature on a specific subject or discipline.

Climatic Summaries

AFCCC routinely produces a number of standard climatic summaries, including the following:

• ***Ceiling and Visibility (MODCV).*** We've modeled ceiling and visibility climatology for more than 600 stations worldwide. MODCV is available in DOS or Windows versions. MODCV displays conditional and unconditional climatological probabilities of selected ceiling and visibility thresholds out to 72 hours and is similar to wind-stratified conditional climatology tables. The latest MODCV version includes better graphics and data for limited duty stations.

• ***Modeled Diurnal Curves (MODCURVES).*** These products provide monthly summarized temperature, dew point, altimeter setting, relative humidity, and pressure altitude changes by hour for stations from which surface observations are available. The product provides data in monthly increments, and includes four wind sectors and two sky cover categories. Values are displayed in graphic and tabular form. The product is used primarily as a forecaster aid and in systems development when variation of any of the weather elements listed is important. These summaries resemble temperature/dewpoint summaries, but are menu driven in a Windows environment.

• ***Surface Observation Climatic Summaries (SOCS).*** The SOCS replaced the Revised Uniform Summary of Surface Weather Observations (RUSSWO) in July 1988. Each SOCS summarizes hourly observations (and "summary of day" data) for a given weather station. Five years of record are required to create a SOCS. AFCCC updates existing SOCS whenever 10 additional years are added to the database, or more frequently on request. SOCS summarize observed data in eight categories: atmospheric phenomena, precipitation, wind, ceiling/visibility/sky cover, pressure, crosswinds, degree days, temperature, and humidity. Each SOCS includes a Climatic Brief, described below. AFCCC publishes SOCS as AFCCC data summaries and provides the information in diskette or microfiche format.

• ***Climatic Brief.*** AFCCC publishes climatic briefs, two-page summaries of monthly and annual climatic data for any station with a SOCS, as part of a larger publication entitled *Station Climatic Summaries.* This product consists of a seven-part series that comprises North America; Latin America; Europe; Africa; Asia; Antarctica, Australia, and Oceania; and USSR, Mongolia, and China. The publications also include collections of the Operational Climatic Data Summaries (OCDS).

• ***Operational Climatic Data Summary (OCDS).*** This product is a summary of monthly and annual climatic data prepared manually when the creation of a standard computerized "climatic brief" is impractical due to lack of data, or to answer a short-notice request. The most recent 10-year period of record is used unless more data is available. Data is supplemented from other sources such as earlier periods of record, data from contemporary and/or earlier stations, and published data from other sources.

• ***Temperature/Dew-Point Summaries.*** These summaries provide monthly summarized temperature and dew point changes by hour, stratified by ceiling and wind, for stations from which surface weather observations are available. Data is provided in monthly increments. Up to six wind sectors, three wind-speed classifications, and up to five ceiling categories may be stipulated by the customer. Values are displayed in tabular and graphic form. The product is used primarily as a forecaster aid in systems development when temperature and/or humidity variation is important. These summaries are available in diskette or microfiche format.

• ***Wind-Stratified Conditional Climatology Tables.*** These monthly tables give percent occurrence frequencies of past hourly weather observations for specified weather categories of ceiling or visibility stratified by surface wind direction and valid for 1 to 48 hours from the initial weather condition. These summaries are available in diskette or microfiche format.

• ***Crosswind summaries.*** These summaries give percent occurrence frequencies for specified crosswind components based on hourly observations. Categorical ceiling/visibility constraints are included. The content and basis for each summary is clearly described in each product. Crosswind summaries have been a part of each SOCS since July 1988.

• ***Heating and Cooling Degree-Day Summaries.*** These monthly tables are computed by determining the difference between daily mean temperatures and 65° F (or another base temperature determined by the customer), then summing these differences for each individual month. For calculating degree-days, the daily mean temperature is normally defined as the sum of the daily maximum and minimum temperatures divided by two. The use of other mean temperature definitions is identified in individual summaries. A modified version of these summaries has been a part of each SOCS since July 1988.

• ***Temperature Duration Summaries.*** These can be for high or low temperatures. They have been used in applications such as the determination of battery life.

• ***Precipitation Summaries.*** These provide climatological precipitation amounts for every week of the year. They can be used in combination with temperature to determine the best times to use heavy equipment with the least damage to roads and grounds.

• ***Daily Temperature/Precipitation Summaries.*** These give maximum/minimum and mean maximum/minimum temperatures, degree-days, two maximum and mean precipitation, and maximum and mean snowfall for every day of the year during a specified period of record. Mean precipitation and snowfall are based only on days in which precipitation and snowfall actually occurred; the number of years of precipitation or snowfall for each date is given.

• ***Cloud Data Summaries.*** These include cloud amount distributions of total cloud, cloud cover (low, middle, or high) within various layer combinations, frequency of occurrence of clear skies, and frequency of less than a specified cloud amount above or below various heights. Distributions of total cloud cover versus maximum cloud tops and frequency of occurrence of consecutive grid points along a specified great circle route having specified cloud cover are also included. Monthly summaries for available analysis hours can be prepared for any point, anywhere in the world.

Cloud-Free and Visible Clear Line-of-Sight (CFLOS and VCLOS) Probabilities

Static CFLOS probabilities of various look-angles can be produced for specified locations by using cloud cover distributions from surface observations or Air Force Global Weather Central (AFGWC) cloud analyses using the Standard Research Institute (SRI) CFLOS Model. AFCCC also has a visible clear-line-of-sight (VCLOS) model that estimates environmental effects on sensors at visible light frequencies, such as those in the TV Maverick and TV GBU 15. Input data consists of surface weather observations, nephanalysis cloud fields, date, time, locations, attack geometry, and target/background albedos. Data can be processed for single case and climatological studies and used to evaluate the effectiveness of electrooptical systems (see also our CFLOS simulation capabilities described under environmental simulation).

Descriptive Climatology

These narrative studies (prepared on request for regions, areas, or points) are written to the customer's order. Studies include descriptions and effects of synoptic climatology on the point or region studied. The emphasis is on typical daily weather scenarios and their causes. Studies can be prepared to cover events that, while rare, may still affect mission success drastically. A typical study, for example, might discuss the occurrence of dust storms that restrict visibility to less than

1/2 mile in a region or at a point during a specific time period. Narrative studies are typically produced in one of three packages according to the needs of the customer:

- ***Point/Small Area Climatologies*** are site-specific, for areas smaller than Connecticut and for operations below 5,000 feet above ground level (AGL). They can be prepared for specific time periods. They usually take from a week to three months to complete, but high-priority projects covering time periods of a month or less can be turned out in less than 72 hours.

- ***Large/Intermediate Area Climatologies*** describe areas larger than the point/small area products—the Persian Gulf is an example. They place more emphasis on mean low-, middle-, and upper-level features. They may be seasonal or annual. These studies generally take from 3 to 12 months.

- ***Regional Climatologies*** cover portions of one or more continents, typically for periods of an entire year. These studies provide detailed discussions of major meteorological and climatological regimes, with emphasis on the interaction of semipermanent climatic controls responsible for seasonal weather patterns. Regional studies may take from 12 months to 2 years.

Electrooptical (EO) Climatology

We have adapted the LOWTRAN7 model to use conventional data bases in generating electrooptical transmittance climatologies in selected wavelength intervals, such as the 8-12 micron band for infrared systems. A "driver" program was developed to read conventional surface data for input into LOWTRAN7 and selection of the aerosol model to be used. We've also developed a program that reads conventional upper-air data and creates input for FASCOD2, the model used to compute transmittance for laser-guided munitions. Our EOCLIMO microcomputer program provides three station-specific transmittance climatology in an interactive format. The current version provides monthly transmittance climatology for individual stations at 3-hour intervals. For some regions of the world, a brief descriptive narrative accompanies the statistical data for each station. The program also generates a map of available stations, along with joint probabilities of user-defined transmittance and ceiling thresholds. The EOCLIMO CD-ROM is now available providing a climatology for selected stations worldwide. The EO Tactical Decision Aid (EOTDA) allows us to simulate performance of air-to-ground weapons systems based on environmental information.

Engineering Design and Construction Studies

Standard engineering design data packages include temperature, precipitation, icing, and extreme wind analyses. Crosswind studies for runway orientation, along with meteorological data and climatological narratives for inclusion in base master or comprehensive plans are also available. We also provide design freezing index and other data, to include pavement temperature information for pavement evaluation studies. We provide engineering design and meteorological data for the USAF Base Master Plan, Tabs A and D, as well as the data for Engineering Weather Data, the Tri-Service manual.

Environmental Simulation

When weather data is inadequate or not available for use in operational simulations, war-gaming, or weapons systems effectiveness studies, simulated weather observations may be the answer. AFCCC has developed a number of sophisticated techniques that provide simulations for single stations or for large arrays of statistically correlated points. These techniques include:

• ***Ceiling and Visibility Observations and Forecasts (CVOF).*** The CVOF model is a state-of-the-art simulation model that generates ceiling and visibility observations and forecasts. The observations have the proper spatial and temporal correlation. The forecasts are designed to show the same skill as the Air Force average for ceiling and visibility forecasts.

• ***Cloud-Free Line-of-Sight (CFLOS).*** We've developed several CFLOS simulation models. One tabulates a climatology of CFLOS statistics based on a ground-based view of orbiting or geostationary satellites. It is capable of handling several sites simultaneously to produce joint-site CFLOS probabilities. Another simulator (CLDGEN) creates cloud scenes as if they were observed by someone on the ground. It can be used to estimate the probability of a cloud-free arc for a specified duration. Another model (C_Cloud_S) provides cloud-cover distribution statistics and CFLOS probabilities for any point on Earth. Output applies to space- or earth-based viewing.

Exercise Support

We provide tailored climatological support with products that range from weather impact indicators to en route winds for all DoD exercises, major or minor.

Heating and Cooling Data

AFCCC offers a wide range of heating and cooling data, which includes:

• ***Heating and air conditioning design and criteria data*** (AFM 88-29, *Engineering Weather Data*).

• ***Heating and cooling degree-day statistics.***

• ***Computerized Energy Analysis Reference Year (CEARY) data*** for use in building-load analysis. CEARY data is from 12 months of specially selected surface observations for each location. Direct, diffuse, reflected, and total solar irradiance are calculated from weather elements and added to each observation.

Illumination Data

The NITELITE Windows-based microcomputer program has been upgraded to include all the information contained in the various LIGHT programs. Units should switch to NITELITE since this is now the standard and it is the only one we plan to improve in the future.

Information Scouting and Acquisition

AFCCC continually improves and enlarges its library collections by actively identifying and acquiring new scientific and technical documents (particularly those from sources outside the United States).

Journal Accessions Lists (JALs)

JALs are lists of articles in recent journals (magazines) received by the AWS Technical Library. They are published and distributed monthly to make recipients aware of recent scientific and technical articles and make it possible to order copies. JALs are produced on topics that include atmospheric physics, space, atmospheric sciences, meteorology, statistics and mathematics, climatology and forecasting, and general topics.

Lightning Climatology

We provide cloud-to-ground lightning-strike climatology on diskette for anywhere in the CONUS. Data format options include graphs and tables of monthly and diurnal variations of average lightning strikes and isopleth analyses of average strikes for each of eight regions, or for the entire CONUS. Tailored regional lightning climatologies stratified by upper-level wind direction are also available. A microcomputer graphics program lets users display lightning-strike climatology for any of the eight regions or for the entire CONUS.

Low-Level Route Climatology

Our interactive microcomputer programs provide worst-case route climatology for low-level refueling or training routes. Users enter entry, turn, and exit points.

Mission Success Indicators (MSIs)

Our program computes percent occurrence frequencies with respect to time, the number of days a specific weather event occurred, or the start-stop date-time groups with duration in hours of any weather or combination of weather elements in the DATSAV surface weather observation database.

Pavement Temperature Summaries

Using a model provided by the Air Force Civil Engineering Support Agency, we provide runway pavement temperature data for varying depths and types of runway surface.

Post-Event Analysis

We provide observational data, AFGWC analyses, and other published information for specific locations (from days to years in duration) to answer questions related to specific events.

Pressure Reduction Ratios

We provide pressure reduction ratios ("r" factors) on request for DoD weather observing facilities.

Rainrate Studies

These studies provide statistics on the effects of rain/atmospheric moisture on attenuation of radio wave propagation. This product contains estimates of rain-event duration and rainrate frequency of occurrence for instantaneous rainrate thresholds using a dataset that includes both instantaneous and clockhour rainrates. This product uses rainfall statistics, cloud moisture, and freezing level data along with state-of-the-art attenuation models to estimate the related attenuation of electromagnetic radiation.

Range Reference Atmosphere (RRA)

A "reference atmosphere" is a statistical model of the atmosphere derived from upper-air observations over a specific location. The five atmospheric models developed for the Range Commander's Council/Meteorology Group (RCC/MG) are called "range reference atmospheres," or RRAs. The RRA is the authoritative source for upper-atmosphere climatology over the launch/recovery site for which it has been prepared. RRAs are used to plan, evaluate, and establish environmental launch constraints for aerospace vehicles launched from a particular location. RRAs contain tabulations of monthly and annual means, standard deviations, and skewness coefficients for wind speed, pressure, temperature, density, water vapor pressure, virtual temperature, and dew point temperature. They also provide means and standard deviations for zonal and meridional wind components and the linear (product moment) correlation coefficient between wind components. Statistical values are tabulated at 1-km intervals from mean sea level (MSL) to 30 km and at 2-km intervals from 30 to 70 km. Wind statistics begin at about 10 meters above station elevation and continue upward with respect to MSL thereafter. For ranges without rocketsonde measurements, RRAs terminate at 30 km, but they may be extended upward when rocketsonde data from a nearby location is available.

Raytrace Diagnostic Models

The RAYTRAC (formerly CLIMORAY) model uses AFCCC's upper-air database to produce a series of historical raytraces that can be used to generate height-error climatologies and other refractive statistics. For example, an easy to use program derived from RAYTRAC is now available to compute optimum transmitter heights for balloon-borne radars.

Refractive Index Studies

These studies provide refractive index values and refractive gradients through the atmosphere. We can provide refractive climatologies for individual radiosonde stations as well as post-analysis of meteorological data to investigate anomalous radiowave propagation. We offer a PC program that displays different types of refractivity climatology for any upper-air station with a statistically significant number of observations. Several raytrace models are available for use in post-analysis studies. They have various capabilities that include graphic output, altitude error, laterally heterogeneous atmosphere (multiple soundings) and elevation angle errors. The Variable Terrain Radio Parabolic Equation (VTRPE) model handles microwave propagation over land and water, and includes terrain effects and multiple soundings. A climatological raytrace program produces a climatology of height error (see Raytrace Diagnostic Models).

Simulation Support

Surface observations, cloud analyses, and various analyzed weather charts for selected scenarios are available for use in simulation studies.

Space Environmental Support System (SESS) Climatology

AFCCC has developed techniques for providing statistical studies of the space environment. These studies include those that provide climatological distributions of data. Results are displayed in graphic or tabular format. Using SESS models with historical inputs, we can analyze past events. The Ionospheric Conductivity and Electron Density (ICED) model provides state-of-the-art specifications of the mid-latitude ionosphere. The International Reference Ionosphere (IRl 90) model provides climatology of the ionosphere for nonauroral latitudes. Together, these models provide a means for performing ionospheric point analysis. The Wide-Band Scintillation Model (WBMOD) is available for analyzing trans-ionospheric communication anomalies. The Magnetospheric Specification Model (MSM) specifies fluxes of particles up to 100 KeV from 2 to 10 earth radii. The Vector Spheric Harmonic (VSH) and Mass Spectrometer and Incoherent Scatter (MSIS) models provide atmospheric conditions up to 1500 KM.

Technical Publications

AFCCC writes, edits, publishes, distributes, and maintains AWS, AFCCC, and AFGWC technical reports, technical notes, forecaster memos, catalogs, project reports, users handbooks, and data summaries in a variety of media, including conventional paper, microfiche, diskette, and CD-ROM. We also maintain copies of former AWS wing technical publications.

Uniform Gridded Data Fields (UGDF) Historical Data Grids

We can provide (from our archives, in UGDF format) weather-event scenarios for a given date or for a series of dates. The data consists of surface variables; low, middle, and high cloud type, amount, bases, and tops; and wind, temperature, dew point temperature, and D-value for mandatory upper-air levels.

Upper-Air Climatologies

Statistical summaries of means, extremes, etc., for user-selected atmospheric variables are available, along with estimates of "worst case" scenarios. The current menu now contains about 40 measured or derived meteorological elements from upper-air observations. These include various thermodynamic variables of pressure, temperature, moisture, and stability, along with wind speed, direction, wind shear values, and refractive coefficients. Users can specify starting and stopping elevations, as well as the increment, to study any layer of the atmosphere for which data is available. Graphics depicting the vertical

profiles of statistical values can be generated for any of the available meteorological elements versus height. Wind roses (graphic or tabular) can also be produced from user-specified upper-atmospheric levels.

Upper-Air Studies

We can provide specialized studies of such weather variables as upper-level winds, temperature, moisture, density, standard height levels, D-values, and wind shear (to include extreme values), on request. We can also provide probability ellipses for debris fallout and inter- or intra-level correlations of winds.

Vector Wind Models

Although these models were originally designed to derive additional information for RRAs, they can be used independently. The software, based on the work of O. E. Smith of NASA, calculates a number of wind statistics based on an assumed bivariate normal distribution of the wind. Input consists of five variables: two means, two standard deviations, and correlation between the u- and v-wind components. The interactive program can answer a number of questions, such as "What's the probability of a wind speed greater than 50 knots?" or "What's the probability wind rose for a selected location at 10-km altitude?" A limited amount of graphics can be produced.

Visualizations

AFCCC has numerous graphics and data visualization capabilities through the use of McIDAS, PV-Wave, and ARC/INFO. We provide high quality maps and charts depicting customer-specified atmospheric variables, terrain, and geographic boundaries. Graphical products can be provided on color or black/white hard copy, or in standard graphic file formats such as GIF and TIFF. Using ARC/INFO, we can perform Geographic Information System (GIS) functions and create GIS datasets.

Wet-Bulb Globe Temperature (WBGT) Climatologies

WGBT studies, most frequently used to determine the effects of heat stress on troops, are available on request.

Wind Duration Studies

Studies of wind duration and other wind variables, often useful for evaluating the feasibility and sizing of wind-powered generators, are available.

Chapter 3
AFCCC CLIMATIC DATABASE

The Database

The AFCCC climatic database, created and maintained by OL-A, AFCCC at Asheville, is subject to continuous monitoring and quality control. The data it contains is as comprehensive and accurate request. As we can make it. Because the application and use of this data (mostly "raw" or unprocessed) requires considerable meteorological skill and experience; we generally discourage its unconditional release to agencies outside AFCCC. Even AFCCC analysts who use the data routinely (almost all of whom are meteorologists) occasionally confer with the dataset specialists at OL-A, AFCCC before attempting to use it in a specific application. AFCCC also has access to the National Climatic Data Center (NCDC) climatic database, the civil counterpart to the collocated Air Force version.

Database Contents

The AFCCC climatic database contains more than 40 subsets of related data. Some of the best known of these are listed below. Most are described in detail in USAFETAC/TN—86/003, *Directory of Climatic Databases* . In addition to the commonly used databases (or datasets) listed here, AFCCC has produced hundreds of others to fulfill special customer needs; although these remain available, they are not advertised for general use. Customers with unique requirements need only describe those requirements in their initial request for AFCCC services. In consultation with the customer, we will determine the best way to satisfy these requirements by developing a new customized dataset or by modifying an existing one. The following are examples of frequently used databases/datasets; periods of record vary and are subject to change.

- ***AWS Master Station Catalog***

This is a dataset which lists weather stations worldwide (with location, elevation, and current reporting status) that now transmit (or have transmitted since January 1977) surface and upper-air observations, radar observations, and/or forecasts.

- ***Summary of Day***

Daily weather element summaries for about 1,800 stations, mostly U.S. periods of record vary, but some go back to 1890. Elements included are maximum, minimum, and mean temperature; precipitation, snowfall, snow depth, peak wind, and the number of days on which specified atmospheric phenomena, such as fog, dust, and haze occurred.

- ***Station File***

Weather station datasets consisting of surface observations from the mid-1930s to the present. They include elements such as wind, pressure, temperature, cloud, visibility, and weather. These files have undergone the most rigorous quality control available.

- ***Real-Time Nephanalysis (RTNEPH)***

Global analyses (on an eighth-mesh polar stereographic grid) of cloud and weather data from conventional surface and satellite observations since January 1984. Data includes present weather, visibility, and total cloud coverage, along with cloud type, base, top, and coverage for each of four floating layers. RTNEPH replaced 3DNEPH in 1983.

DATSAV

In five parts, these datasets contain worldwide weather observations collected through the Automated Weather Network (AWN). Daily observations are decoded at AFGWC and transmitted to OL-A, AFCCC for electronic storage. OL-A, AFCCC creates monthly and yearly datasets from the following:

DATSAV2 Surface. Surface observational data (synoptic, airways, METAR, synoptic ship) from January 1973 to the present include such elements as wind, pressure, temperature, cloud cover, visibility, weather, and precipitation.

DATSAV2 Upper-Air. Radiosonde, rawinsonde, pibal, and dropsonde observations from January 1973 to the present. Data includes wind, pressure, temperature, height, cloud, stability, thickness, and precipitable water.

DATSAV Aircraft. Aircraft observations from October 1975 to the present include wind, temperature, altitude, turbulence, cloud, icing, visibility, and radar data.

DATSAV Rocketsonde. Rocketsonde observations from October 1975 to the present include height, temperature, pressure, wind, and density data.

DATSAV Satellite. Satellite observations from October 1975 to the present include height, temperature, and wind data from geostationary and polar-orbiting satellites.

- ***High-Resolution Analysis System (HIRAS)***

HIRAS replaced the Coarse-Mesh Upper-Air Analysis (below) in 1985. HIRAS is a global analysis of surface and upper-air data (on a 2.5-by 2.5-degree grid) compiled from conventional surface observations, upper-air soundings, and satellite data from January 1985 to the present. HIRAS includes wind, pressure, height, temperature, D-value, precipitable water, vorticity, and vertical velocity data for 16 levels from the surface to 10 millibars.

- ***Snow Depth Climatology***

This contains global mean monthly snow depth values on a polar stenographic eighth-mesh grid (approximately 25 nm spacing).

- ***Surface Temperature Analysis***

A global analysis (on an eighth-mesh grid) of surface temperatures compiled since April 1979. To produce this analysis, AFGWC uses surface observations of ambient temperatures over land and sea-surface temperatures over water.

- ***Terrain-Geography File***

A global analysis (on an eighth-mesh grid) of geographical and terrain height data. It includes a geography indicator (water, ice, land, or coast), time zone indicator, and elevation. AFCCC now has a version of the Terrain-Geography file that gives probable aerosol type (rural, industrial, or maritime).

- ***Post-1985 Vandenberg Tower Database***

Weather Information Network Display System data from Vandenberg AFB's micrometeorological network of more than 20 tower-mounted sensors. Data includes 5-minute averages of wind direction, speed, temperature, pressure, and vertical temperature differential at elevations of 6, 12, 50, 100, 200, and 300 feet.

- ***Lightning Database***

Consists of cloud-to-ground lightning-flash data across the CONUS from 1986 to 1994. Data includes flash location, time, polarity, and peak current of the first return stroke. Although the

lightning dataset is proprietary and not therefore releasable outside AFCCC, we can provide summaries that give temporal or spatial variations of lightning flashes as they affect aircraft operations, space vehicle launches, and resource protection.

- ***Upper-Air Climatology***

This consists of monthly statistical information for gridded upper air parameters based upon the European Center for Mid-Range Weather Forecasts (ECMWF) analysis product. These analyses were summarized over the years 1980-1991 for each grid point, pressure level, and month of the year.

- ***Agricultural Meteorological Database***

This is a gridded dataset (approximately 25nm spacing) covering the worlds major crop raising regions composed of meteorological parameters such as temperature, precipitation, radiation, and evapotranspiration. The analysis is produced once per day and is available since 1993. Only DoD customers have access to this data.

- ***Patrick Tower Database***

Weather Information Network Display System data from Patrick AFB's micrometeorological network of more than 60 tower-mounted sensors. Data includes 5-minute averages of wind direction, speed, temperature, pressure, and vertical temperature differential at various elevations from 6 to 492 feet.

Chapter 4
COMPUTER ASSETS

Mainframe Computers

AFCCC operates two mainframe computers at Scott AFB: an IBM 3090 for unclassified and collateral secret work, and an IBM ES9000 for classified and SCI work. Both are in the Scott Consolidated Computer Facility, Bldg. 1575. OL-A, AFCCC operates a UNISYS mainframe computer for unclassified work only.

• ***IBM 3090 Mainframe (Scott AFB)***

The IBM 3090 mainframe is capable of high-speed processing of data and is supported by 228 gigabytes of on-line storage. It contains two Central Processing Units (CPU). Data is fed into the computer by 9-track reel tape units, 36-track cartridge tape units, and two communication channels from remote locations. The main feature of the mainframe is its relational database management system (IBM's DB2) that can search millions of pieces of data in seconds. Current print capabilities include a graphics plotter, four remote printers, two high-speed printers, and a photographic quality Postscript color printer. The mainframe is accessible using IBM dumb terminals, or by IBM terminal emulation packages on the local area network (LAN) file server, and on the UNIX workstations. This LAN is connected to the Scott AFB backbone, allowing connection to the AFIN and the global internet using TCP/IP protocol. This allows connection between the 3090 mainframe and the UNIX workstations.

• ***IBM ES9000 Mainframe (Scott AFB)***

The IBM ES9000 mainframe is a powerful system supported by 240 gigabytes of on-line storage capability. Installed in February 1993, it was the first system in DoD to incorporate relational DBMS with IBM's read/write optical disk, Symmetrix EMC Disk Array, and traditional Direct Access Storage Device (DASD) storage. The ES9000 also uses 9-track and 36-track tape storage.

• ***UNISYS 2200 Mainframe (OL-A)***

The AFCCC climatic database is stored and manipulated on a UNISYS 2200 mainframe with 233 gigabytes of on-line storage. OL-A, AFCCC is collocated with the National Climatic Data Center (NCDC) at Asheville, NC.

Workstations

AFCCC is modernizing its hardware architecture. RISC workstations have been purchased and are being used for prototyping. The new architecture will be on a Unix operating system and will provide enhanced graphical support capabilities.

Small Computers

Access to the mainframe and the UNIX workstations is provided by a Novell-based LAN of small computers, along with a comprehensive collection of software that can meet virtually any customer requirement

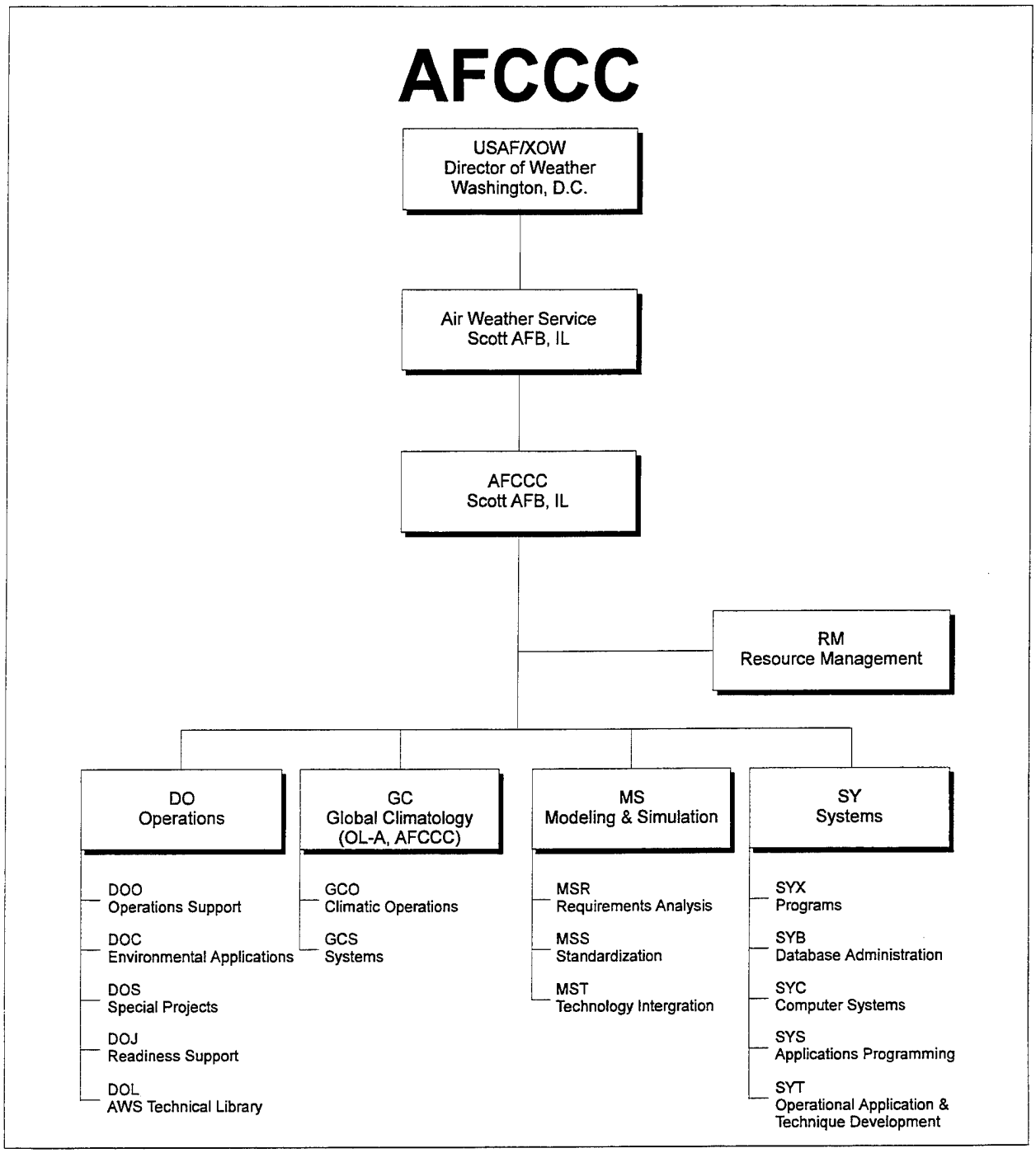

Figure 1. AFCCC Organization as of December 1995.

Chapter 5
MISSION, PEOPLE, AND ORGANIZATION

Mission

AFCCC is an Air-Force controlled, named organization assigned to the Air Weather Service, a field operating agency. After collecting and storing worldwide environmental observations in its climatic database, AFCCC develops and produces special weather impact information used in planning and executing worldwide military operations of the Air Force, Army, Navy, Marine Corps, unified commands, and allied nations. AFCCC also provides information to support engineering design and employment of weapons systems, and to support weather sensitive, multi-millon dollar National Programs controlled by the Secretary of the Air Force. AFCCC is the DoD lead for air and space weather modeling and simulation. Figure 1, opposite page, shows AFCCC organization as of November 1995.

• ***At Asheville (OL-A, AFCCC)*** civilian technicians create and maintain the Air Force's computerized climatic database from environmental information received from observing stations around the world primarily through AFGWC at Offutt AFB. After quality-controlling these observations, OL-A, AFCCC summarizes and preserves the data as a permanent climatological record that it uses to produce standard summaries and other data to requesters.

• ***At Scott AFB,*** a mixed force of military and civilian scientists and computer specialists use the climatic database (the second largest relational database in the Air Force), along with the vast information resources of the Air Weather Service Technical Library (AWSTL), to prepare weather and space environmental studies and analyses for DoD and other clients upon request. Tailored application of information in the database ranges from answers to simple requests for climatological probabilities to the very latest in weather and space environmental simulation studies.

People

AFCCC's manning authorizations include about 150 positions at Scott AFB and 64 at OL-A. About 110 civilian positions are distributed for the most part among weather technicians or meteorologists (at least 20 with advanced degrees) and computer specialists. Officer authorizations include about 30 for meteorologists with advanced degrees. The 70 enlisted positions are distributed primarily among the weather and computer specialties.

Organization

AFCCC comprises five divisions. The first, Resource Management (RM), provides the commander and staff with support services in the areas of personnel, manpower, organization, supply, budget, training, mobility, facilities, intelligence/security, and information management. The other three (Operations, Systems, and Operating Location A) interact with AFCCC customers. Each division is further organized into branches and teams of specialists that work together to satisfy customer requests.

Operations Division (DO)

The central point of contact for all AFCCC support services. Supervises production of studies and analyses performed in response to customer requests. The following branches are under DO.

• *DOO—Operations Support Branch*

Receives, processes, prioritizes, and assigns taskings to satisfy customer support requests. Manages AFCCC production. Maintains AFCCC capabilities and requirements baselines; develops

strategies to ensure that AFCCC meets present and future weather operations requirements.

• *DOC—Environmental Applications Branch*
Uses AFCCC's climatic database and data from other sources to analyze, simulate, and determine probabilities of environmental conditions and their effects on customer activities such as military operations, weapons system research and development, a variety of simulation activities, military construction projects, and planning for any environmentally dependent event.

• *DOS—Special Projects Branch*
Uses the AFCCC climatic database and data from other sources to analyze, simulate, and determine probabilities of environmental conditions and their effects on classified programs and projects.

• *DOJ—Readiness Support Branch*
Researches existing literature and data to prepare regional, area, and point descriptive climatologies to meet specific customer-defined operational requirements. Manages the contingency response capability.

• *DOL—AWS Technical Library*
Provides specialized environmental library support products and services to DoD agencies that include AFCCC, AWS, and AF weather units worldwide.

***Systems Division* (SY)**
Plans and develops AFCCC's scientific and technical capabilities; manages AFCCC's computer systems and operations.

• *SYB—Database Administration Branch*
Administers and maintains specialized computer databases; coordinates data interface requirements with outside agencies.

• *SYC—Mainframe Computer Branch*
Operates AFCCC's mainframe computers and maintains the local area network.

• *SYS—Applications Programming Branch*
Designs, develops, evaluates, produces, and maintains mainframe and small computer software.

• *SYT—Operational Application and Technique Development Branch*
Monitors the results of research in the environmental sciences; adapts promising scientific and technical modeling developments to meet identified DoD climatic support requirements.

• *SYX—Programs Branch*
Manages AFCCC computer systems. Maintains computer configuration baseline; develops strategies to meet present and future computer requirements. Initiates and processes baseline changes. Monitors contracts.

***Global Climatology Division* (OL-A, AFCCC)**
Manages the Air Force's climatological database. As a participating member of the Federal Climate Complex at Asheville NC, maintains reciprocal agreements that make climatic databases available to other agencies. Organizes and maintains environmental datasets. Summarizes climatological data.

• *GCO—Climatic Operations Branch*
Creates and manages the climatological database; processes data into discrete datasets for specialized applications. Prepares standard and specialized climatic summaries. Arranges for Air Force access to the National Climatic Data Center (NCDC) climatic database.

• *GCS—Systems Branch*
Manages and operates OL-A computers. Designs and produces software used for processing climatology. Develops strategies to meet present and future computer requirements.

***Modeling and Simulation Division* (M&S)**
AFCCC recently formed a new division, manned by representatives of all services, to support the commander of AFCCC in his role as the DoD Executive Agent for Air and Space Natural Environment Modeling and Simulation. Over a dozen meteorologists, oceanographers, and computer scientists will coordinate technical support to all DoD M&S activities that use weather or weather effects data, and ensure the seamless inclusion of natural environment representations into these M&S activities.

- *Requirements Analysis Branch*

Identifies and documents DoD M&S weather capabilities and requirements, and documents shortfalls.

- *Standardization Branch*

Develops and coordinates standards for weather products and services ensuring interoperability with DoD systems and activities. Guides and oversees DoD verification and validation of weather models, modules, subroutines, algorithms, etc., and data used for joint M&S applications.

- *Technology Integration Branch*

Identifies technologies for solving shortfalls and guide (and influence through indorsement and funding recommendations) DoD short-term and long-term efforts for technology development and implementation. Coordinates M&S weather technical support to DoD M&S activities.

APPENDIX A
Support Assistance Request (SAR) Format

Request AFCCC services by letter, message, or fax using the format in AFI 15-118 or the format below.

1. **Support name:** Give exercise, operation nickname, or project title.

2. **Unit supported.** The unit that the requester supports; for example, "175 Composite Wing, Elmendorf AFB."

3. **Mission category/impact:** Category A, B, or C, and provide an impact if support is unavailable.

4. **Point of contact.** Give name, complete address, and phone number of your point of contact for this project. Specify an alternate, please.

5. **Medium/number of copies.** Specify paper, microfiche, floppy disk, facsimile, email, etc. How many copies?

6. **Delivery/address for response:** To whom do you want the data sent? Give complete address. Specify ordinary mail, express mail, message, fax, email, etc.

7. **Security classification.** Specify classification/precedence for response.

8. **Type of support.** Tell us exactly what you need; for example, "Elmendorf AFB percent occurrence frequency of: (1) ceilings less than 300 feet, (2) visibilities less than 1 statute mile, and (3) crosswinds greater than 30 knots for each month (all hours) and for all months." Include any other information (including environmental factors) we may need to fill the request. Note the special information requirements for requesting standard summary packages—see Appendix B.

9. **Suspense date.** Tell us when you need it. Describe the effect(s) on your mission (and on your customer's mission, if applicable) if we can't meet your suspense.

10. **Justification.** Tell us why you need it. Describe the effect(s) on your mission (and on your customer's mission, if applicable) if AFCCC were unable to provide the requested services. If support is for a contractor, tell us (a) whether or not DoD has a contract obligation to provide the support and (b) what the penalties are if the support cannot be provided or if the suspense cannot be met.

11. **Telephone consultations.** If you have discussed this request with us previously, please describe those contacts here. Include dates, subject, and participants.

APPENDIX B
Standard Summary Package Request Information

Surface Observation Climatic Summary (SOCS). When requesting a SOCS, include the following:

• ***Part A, Specified Atmospheric Phenomena Vs Wind Direction:*** Specify up to five wind direction sectors ("calm" and "variable" are included automatically). Sectors must not overlap; for example, use 260-349 and 350-019—not 260-355 and 350-030.

• ***Part B, Precipitation/Snowfall Tables:*** Specify inches or centimeters.

• ***Part C, Peak Wind Tables:*** Specify knots or meters per second.

• ***Part D, Ceiling vs Visibility Summary:*** Specify visibility units as either statute miles or meters.

• ***Part E, Summary of Day Temperature Tables:*** Specify Fahrenheit or Celsius.

• ***Part G, Crosswind Summary:*** Specify magnetic heading for the primary runway. Specify three wind-speed thresholds. Since this summary includes gusts, standard thresholds are greater than or equal to 10, 15, and 25 knots.

Wind Stratified Conditional Climatology (WSCC) Tables. When requesting WSCC tables, include the following:

• ***Visibility:*** Specify visibility units as statute miles, nautical miles, or meters. Wind sectors: customers may specify up to six wind direction sectors, OL-A recommends using five or less, plus the "calm" and "all" categories. Too many sectors cause WSCC tables to be "overstratified" and lacking in statistical significance. For stations with data shortfalls and/or periods of record shorter than 15 years, OL-A recommends using the smallest number of sectors that will meet operational requirements. Sectors must not overlap.

• ***Ceiling/Visibility:*** Because of program limitations, and to avoid overstratification, specify a maximum of six each ceiling and visibility categories. Stations that report in METAR code should specify visibilities in meters. If your station consistently reports "CAVOK," limit your highest ceiling category choices to 5,000 feet or less. The following are the standard categories; stations with different ceiling/visibility minimums may request additional categories to meet their requirements.

Table 2. Standard Ceiling and Visibility Categories

Ceiling Category	Visibility Category
A < 200 feet	J < 1/2 mile
B ≥ 200 feet but < 1,000 feet	K ≥ 1/2 mile but < 2 miles
C ≥ 1,000 feet but < 3,000 feet	L ≥ 2 miles but < 3 miles
D ≥ 3,000 feet	M ≥ 3 miles

Hourly Temperature/Dew-Point Change Summaries. In requests for Hourly Temperature/Dew-Point Change Summaries:

- ***Specify up to five ceiling categories***: standard categories are:

  < 1,000 feet
  ≥ 1,000 feet but < 3,000 feet
  ≥ 3,000 feet but <12,000 feet
  ≥ 12,000 feet but <20,000 feet
  ≥ 20,000 feet

- ***Specify up to six wind direction sectors***; note, however, that more than four sectors can decrease a summary's usefulness due to overstratification. The four standard sectors are:

  330-059 North 060-149 East
  150-239 South 240-329 West

- ***Specify up to three wind-speed categories***; the lowest includes "calm." Standard categories are:

  Calm to < 5 knots
  ≥5 knots but < 12 knots
  ≥12 knots

NOTES:

1. Although each of the components of a standard summary package is normally prepared at the same time, data shortfalls may occasionally make it necessary for OL-A to truncate or even eliminate one or more of those components. For example, there are some full-time stations for which "extremes" are not available and are not provided.

2. Whenever OL-A begins a routine update of a standard summary package, they send a criteria worksheet to the affected station. For those stations with serious data shortfalls and/or short periods of record, OL-A will suggest that category choices be limited to avoid overstratification and loss of statistical significance.

3. Ceiling categories for the WSCC and the Hourly Temperature/Dew-Point Change Summary should not normally be the same. When they are, the latter is seriously overstratified in the lower ceiling categories where, in most cases, fewer observations fall. This can also cause overstratification in the higher categories. For example, 3,000-foot ceilings should not be grouped with clear skies; the result would be underestimation of the maximum temperature. For the best definition of temperature change from insolation, clear skies and high ceilings should not be included with middle or lower ceilings.

To request AWSTL services, send a letter, message, or Email to the AWSTL with the following information (you may use the Support Assistance Request format in AFI 15-118):

APPENDIX C
AWS Technical Library Support Request Formats

1. Requester. Give full name, office symbol, address, and telephone number.

2. Date Required. Please be realistic. Do not use "ASAP."

3. Reference Services Requests. When requesting answers to reference questions, state the question(s) clearly and tell us how you plan to use the information. When requesting a bibliographic search:

- Specify "subject" or "current awareness" bibliography.
- Provide as narrow a topic for the database search as possible.
- Provide a general description of the purpose to which the bibliography is to be put.
- Provide as many keywords and terms (for use in the literature search) as possible.
- Give us a search time period; that is, how far back do you want us to search?
- Describe the geographical specifications; that is, countries, regions, and/or stations.
- If you already know of any expert sources, list them.

4. Requests for Library Services (Books and Periodicals). Turnaround time for purchase varies with the type of purchase and current funding, but it is normally 6 to 12 weeks.

- *Book Requests.* Give full title, author(s), publisher, date of publication, and ISBN (International Standard Book Number). If we don't have the book for loan, we'll borrow it for you from another library (for AWS direct reporting units only, other units must go through their local servicing library or MAJCOM librarian). For purchase requests (AWS units only), we need full justification, including purpose, impact(s) on your mission if you don't get the requested item, and authorized signature.

- *Periodical Article Requests.* Give full titles of the article and the periodical, author, periodical volume and date, ISSN number if available, and inclusive page numbers.

- *Periodical Subscription Requests* (again, AWS units only). Provide full title and ads or brochures, if available. We need the same full justification as for a book request.

5. Requests for Publishing Services. Prior to writing your technical document, refer to USAFETAC/TN—86/001 (Revised), *Author-Editor Guide to Technical Publications*, then contact the Publishing Services Team, for current guidance on federal and DoD standards for manuscript preparation. Once you submit your draft manuscript and accompanying material, our technical editor will work with you to finalize text and graphics and arrange for printing and distribution.

APPENDIX D
AFCCC Online Climatology Service

Mainframe Connection

Hardware/Software Requirements

- IBM-compatible 286-based personal computer with 640 KB main memory.
- 1.5 MB of available hard-disk space, increasing as the number of applications grows.
- MS-DOS version 3.2 or later.
- EGA display (256 KB) memory.
- 100 percent Hayes-compatible 2400-baud modem.
- A Microsoft-compatible mouse is highly recommended.

Surface Applications Currently Available

- "A Summary" (Weather Conditions). The equivalent of the "A Summary" in a Surface Observation Climatic Summary (SOCS), gives frequency count and percentage frequency for the following weather elements: thunderstorm, rain or drizzle, freezing rain or drizzle, snow and/or sleet, hail, fog, smoke and/or haze, blowing snow, and dust and/or sand.
- Conditional Weather Summary. Gives mean number of days a selected weather element (e.g., fog, rain, other precipitation) or a combination of any two elements occurred for each month of a specified period of record.
- Distribution Summary. Gives cumulative frequency distribution (hourly, monthly, or annual) for density altitude, pressure altitude, and dry-bulb temperature.
- Low-ceiling Duration. Gives duration in hours that a ceiling is below a specified value.
- Mean Coincident Wet Bulb. Gives mean frequency of occurrence of a primary temperature type with a coincident secondary temperature type for each primary temperature range. Possible primary and secondary temperature types are dew point, dry-bulb, and wet-bulb.
- Percent Cloud-Free Line-of-Sight. Gives matrices of percent probability of cloud-free line-of-sight above a selected latitude and longitude. Data is on tape.
- Percent Cloud-Free Line-of-Sight (RTNEPH). Same as above, but uses RTNEPH "I, J" grid system.
- Phenomena Summary. Gives weather phenomena occurrence frequency. Mimics SOCS Section A.

• Precipitation Summary. Gives precipitation, temperature, and sky-cover information for a selected station and POR. Derived from DATSAV database.

• Surface Package. Gives percent occurrence frequency of specified elements. More than 50 elements can be compared for a given station.

• Temperature, Relative Humidity, and Wind Climatology. Provides tabular statistics of monthly and annual temperature and relative humidity, percent occurrence frequency of wind direction and speed, monthly and annual winds, maximum wind occurrence.

• Wind Chill. Gives percent occurrence frequency tables for equivalent (wind chill) temperature.

• Wind Speed Analysis. Retrieves five highest wind speeds for every month of a specified POR for a given station.

Upper-Air Applications Currently Available

• Icing Frequency. Computes icing information for selected rawinsonde stations. Determines probability of icing at mandatory pressure levels (1,000, 850, 700, 500, and 400 mb).

• Upper-Air Data Reader. Extracts RAOB data for a given station. Pressure, temperature, moisture, and wind data are interpolated to either pressure or height.

Utility Applications Currently Available

• Station Locator. Helps find the best surface or upper-air reporting stations in a defined area. Selects and plots stations in specified areas that offer best reporting frequencies. This fast-running program can save hours of research.

• Nearest 50 Stations. Returns the closest 50 active reporting stations to an input latitude and longitude.

• TAFVER II. Verifies terminal aerodrome forecasts issued by Air Force weather forecasters, providing corresponding observations are available (see USAFETAC/TN—93/003, *TAFVER II Users Manual*).

Workstation Connection

Hardware/Software Requirements

- Allows users to connect with their own communication software, or via the Internet--user no longer tied to special communication software.

- Complete Process handled at AFCCC--no need for mailings of upgrades.

- Binary download--compresses data into small packets for quicker downloads--allows future graphics output and microcomputer software downloads.

- Six telephone lines available with 9600 baud modems attached.

Utility Applications Currently Available

- Nearest 50 Stations

- TAFVER II

APPENDIX E
An Evolution of AFCCC and Military Climatology

Military Climatology Origins

The paper punched card, developed by Herman Hollerith for use in the 1890 U.S. Census, made the use of historical weather records a practical means for determining the probability of future weather events and patterns. The British used punched cards successfully in about 1920 to extract wind data from ships' logs and produce wind roses for ocean areas. The Dutch Meteorological Institute borrowed some of the British cards in 1922 and began their own weather analyses. Norway, France, and Germany followed. In 1927, the Czech meteorologist L.W. Pollak placed small and cheap punch machines of his own design in every Czech weather station; as each observation was taken, it was punched on a card that was sent to a central tabulating unit for summary and analysis. Although the equipment for gathering and tabulating weather data has changed since then, the basic process has not.

The United States, where the punched card originated, was late to join the Europeans in collecting and tabulating weather observations. Fortunately, one of the "make-work" projects of the mid-thirties resulted in a sizeable punched card climatic database. A 1934 Works Progress Administration (WPA) project resulted in an atlas of ocean climates, prepared by punching 2 million observations (taken from 1880 to 1933) onto cards and summarizing the results. Another 3 1/2 million observations were processed manually, a task that took 90 percent of the labor devoted to the entire project.

In 1936, the WPA also funded a project that resulted in the compilation and analysis of millions of surface and upper-air-observations taken from 1928 to 1941. From this project came a number of climatological publications vital to the Nation's preparation for World War II.

WWII

The Army Air Forces Weather Research Center's Climatological Section was born at Bolling Field September 10, 1941. This was just a week after the U.S. Destroyer Greer was attacked by a German submarine off the coast of Iceland. The attack provoked President Franklin Roosevelt to announce that "From now on, if German or Italian vessels of war enter these waters, they do so at their own risk." An unofficial state of war with Germany and Italy existed from that day forward. Although there was strong pressure for neutrality, military visionaries had seen the need to prepare for war as early as 1937, when the Air Weather Service itself was founded.

By 1941, the U.S. Weather Bureau had already turned over most of its climatological records and facilities to the military. Most of the Weather Bureau's climatology had been produced by the depression-induced WPA projects mentioned earlier. Even so, military climatology had a long way to go, especially since the meteorological offices of every major country in Europe had been analyzing the world's weather on punched cards long before World War II began in 1939.

The December 7, 1941 attack on Pearl Harbor moved the collection and application of weather statistics to a top-drawer priority overnight. With current weather and forecasts blacked-out in hostile areas, planners turned to the climatologists with their questions. Where should air bases be located? How should the runways be oriented? What areas should heavy armor avoid? What should specifications for fuels and lubricants be? How about specifications for landing mats, wires, buildings? What times, dates, and locations are best for amphibious landings? How about bombing weather? Prevailing winds aloft? With the limited information at their disposal, military

climatologists produced climatological summaries to help provide answers to planners' questions. The Army Air Forces climatological effort continued to expand. In 1943, the USAAF Statistical Services Division (now AFCCC's Operating Location A) was created at Winston-Salem, NC, to begin the routine storage and processing of military weather observations. There was probably no WWII operation, major or minor, that did not include a climatological input. The planning for every landing, mission, and offensive, including the D-Day invasion in 1944 and the atomic bombing of Japan, required extensive climatological preparation.

Postwar

Although demobilization cut deeply into the Air Weather Service's wartime strength of nearly 19,000, the importance of climatology and its applications continued to be recognized. In early 1946, the military established a Climatology Unit (the AFCCC of its time) at Gravelly Point, VA. The USAAF Statistical Services Division gained responsibility for processing and storage of military weather data in 1943, and moved to New Orleans in 1946. There, about 300 people punched weather observations onto cards and summarized them. A major postwar project was processing the "Kopenhagener Schlussel" deck of 7 million captured German punched cards containing weather observations taken during WWII in Europe and the Middle East. In 1948, the Military Climatology Unit (now a division) moved to Andrews AFB, with the well-known climatologist Dr Woodrow C. Jacobs as its Chief.

During the '50s

A Climatic Center at Andrews AFB continued to provide climatological data applications under various designations throughout the decade, with particular emphasis on the war in Korea and the strategic buildup necessitated by the Cold War. In 1952, the Statistical Services Division moved from New Orleans to Asheville, N.C., where it is today. In 1956, the first electronic computer (an IBM 705) became operational at Asheville, signalling the end for the high-speed electronic accounting machines (mostly IBM) used since WWII to process climatology. In 1959, IBM electronic accounting equipment installed at the Climatic Center allowed data processing directly from punched card to tape.

During the '60s

In July 1960, the Data Processing Division at Asheville began reporting to the Climatic Center. In 1964, a IBM 7040 computer was installed at the Climatic Center, now in Washington, DC, at the Navy Yard Annex. In December 1964, the Climatic Center was officially designated the "Environmental Technical Applications Center, USAF." Computer upgrades continued. OL-A bought a new IBM 705-III from the Department of Agriculture in 1965 and an IBM 7044 replaced the 7040 in 1966. In 1968, twin RCA Spectra 70/45 computer systems were commissioned at Asheville for joint use by OL-A (then the Data Processing Division) and the National Climatic Data Center (then the National Weather Records Center).

During the '70s

By 1972, OL-A's card-punching function had been all but eliminated, resulting in a manpower drop from about 200 to 122. A further RIF (reduction-in-force) brought OL-A's authorized civilian strength to 83. In 1975, USAFETAC's move to Scott AFB, Illinois was finally completed after the Air Force won a long legal battle against opponents who wanted to keep the unit in Washington. The move, which took 13 months and put USAFETAC's project commitments about 2 years behind schedule, was declared complete on October 31 when the new PDP 1 1/45 and IBM 360/45 computers became operational in Building 859. In 1976, the AWS

Library (a branch of AFCCC that now maintains the largest atmospheric physics collection in the DoD, if not the world) was officially designated Air Force Library #4414, and named the "AWS Technical Library." In 1979, the twin RCA computers at OL-A/NCDC were replaced by UNIVAC 1100/10s. By the end of 1979, USAFETAC strength stood at 232, with 149 at Scott and 83 at Asheville. Demand for climatological service still exceeded capabilities; the decade-end project backlog stood at 49,799 man-hours.

During the '80s and '90s

USAFETAC continued to exploit computer and electronic technology as its computer power expanded exponentially through the eighties and nineties. To better reflect the changing mission of the unit, USAFETAC was officially renamed the Air Force Combat Climatology Center (AFCCC) effective October 1, 1995. Today's climatologists and analysts continue to fulfill the same kinds of customer requirements that their predecessors handled 50 years ago, but with much-improved techniques and equipment. From a few microcomputers shared by eager analysts in 1980, AFCCC now offers choices from among workstations linked to a mainframe computer and from a variety of stand-alone and networked microcomputers, all equipped with the latest software. After several variations, AFCCC's unclassified mainframe computer is now an IBM 3090 with 195 gigabytes (195 billion bytes) of storage—the first AFCCC computer, an IBM 705, had only 300 megabytes (300 million bytes) of storage. At Asheville, the OL-A computer was upgraded to a UNISYS 2200 with 23.3 gigabytes of storage. Increased storage capacity and compute strength had been complemented by improved communications, most by direct satellite link. For the future, AFCCC is moving toward a networked workstation environment. This will allow exploitation of data visualization techniques and other new technologies.

GLOSSARY

Climatic. In general use, of or referring to climatology.

Climatological. Synonymous with climatic.

Climatological Forecast. A weather forecast based on the climate of a region rather than the dynamic implications of current weather; in essence, a statistical forecast.

Climatology. The scientific study of climate. Includes the presentation of climatic data (climatography), the analysis of the causes of differences in climate (physical climatology), and the application of climatic data to the solution of specific design or operational problems (applied climatology).

Climate. The long-term manifestations of weather, however they may be expressed.

Database. A collection of data fundamental to an enterprise. Data organized for rapid search and retrieval. An example is the all-inclusive climatological database maintained by ACCC's OL-A. Many of the larger subsets of the AFCCC database are also referred to as "databases."

Dataset. A collection of similar and related data records recorded for use by a computer. Unique combinations or aggregations of data elements; subsets of a database. Many subsets of the AFCCC climatological database maintained by OL-A, especially those created for a specific requirement, are referred to as "datasets."

Gigabyte. An amount of computer storage equal to one billion bytes or 1,000 megabytes.

Megabyte. An amount of computer storage equal to one million bytes.