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OF THE AIR FORCE**

**AIR FORCE MANUAL 15-129,
Volume 1**



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Weather

**AIR AND SPACE WEATHER
OPERATIONS - CHARACTERIZATION**

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This manual implements Air Force Policy Directive (AFPD) 15-1, *Air Force Weather Operations*. This publication applies to all organizations in the US Air Force (USAF) with weather forces assigned, to include Air Force Reserve Command (AFRC), Air National Guard (ANG), and government-contracted weather operations if stated in the Statement of Work (SOW) or Performance Work Statement (PWS). This publication provides Air Force weather personnel and organizations guidance on how to accomplish operations for characterization as described in AFI 15-128, *Air And Space Weather Roles and Responsibilities*. Major commands (MAJCOMs), field-operating agencies (FOAs) and direct reporting units (DRUs), send one copy of supplements to AF/A3O-W, 1490 Air Force Pentagon, Washington, DC 20330-1490 for coordination. Refer recommended changes and questions about this publication to the office of primary responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Form 847s from the field through the appropriate functional chain of command. MAJCOMs, FOAs, and DRUs send one copy of implementing instructions to AF/A3O-WP, 1490 Air Force Pentagon, Washington, DC 20330-1490 for review and coordination.

Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with (IAW) AFMAN 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule (RDS) located at www.my.af.mil/afrims/afrims/afrims/rims.cfm

This publication provides Air Force weather personnel and organizations guidance on how to accomplish their roles and responsibilities as described in AFI 15-128, *Air Force Weather Operations - Roles and Responsibilities* and Army Regulation 115-10/AFI 15-157 (IP), *Weather Support for the US Army*. Effective use of the guidance and procedures in this manual will enhance the quality, timeliness, and relevance of air and space weather information, products, and services. In this manual, “will” and “shall” indicate mandatory requirements. “Should” is used to indicate a preferred but not mandatory practice or method of accomplishment. “May” indicates an acceptable or suggested method of accomplishment.

The acronym “AFW” is used as a convenience term throughout this document and refers to the AF’s weather functional community that supports national, Joint, AF, and Army operations. It is inclusive of all forces, units, and specialties that are involved in conducting weather operations and providing weather services. It does not imply any organizational or unit alignment, nor an Air Force specialty (AFS) alignment. Specific organizations, specialties, and units will be cited when critical to understanding concepts within this document.

SUMMARY OF CHANGES

This manual has been divided into two volumes and must be completely reviewed. Volume One contains information on overarching weather principles and weather characterization, Volume Two contains information concerning integration and exploitation of weather data. Training information has been removed from this manual and is included in AFI 15-127, *Mission Readiness Training*. Guidance specific to the unique operations of Special Operations Weather Teams (SOWT) will be maintained in AFI 15-135, *Special Operations Weather*.

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Chapter 1

OVERARCHING PRINCIPLES

1.1. Overarching Principles.

1.1.1. General. For the purposes of this document, characterization organizations include, but are not limited to, the Air Force Weather Agency (AFWA), Operational Weather Squadrons (OWSs), appropriate Weather Squadrons (e.g., 23 WS, 16WS), and other organizations whose primary responsibility is to produce and disseminate authoritative products that specify the past, current, and future state of the atmosphere for their respective geographic/functional AOR. OWSs will develop procedures and products as directed in this publication. Non-OWS AFWA units will develop standard operating procedures and products to fulfill Air Force Mission Directive 52, *Air Force Weather Agency* and roles and responsibilities outline within AFI 15-128, *Air Force Weather Roles and Responsibilities*. Exploitation Units (EU) include, but are not limited to, Weather Flights (WFs), Weather Specialty Teams (WSTs) and other organizations whose primary purpose is to use products created by characterization organizations for exploitation of the environment through direct integration with the warfighter. A weather organization's operability spans the full spectrum of strategic, operational and tactical operations. Given the dynamic nature of modern warfare, an organization can find itself supporting more than one function at a time. Therefore, the volumes of AFMAN 15-129 will focus on weather functions that are integral to supporting operations at each level.

1.1.1.1. Characterization. Characterization encompasses the "collect, analyze and predict" weather core competencies. Characterization depends on our ability to collect accurate data, correctly analyze that data, and use the results to produce a coherent picture of the present and future state of the air and space environment. Specific weather units are designated with the responsibility for environmental characterization. In accordance with (IAW) AFI 38-101 *Air Force Organization*, characterization units are organized, trained, and equipped at the squadron level, with the exception of the 612 Support Squadron/Operational WF (also known as the AFSOUTH WF). Units organized below squadron level are not characterization units.

1.1.2. Exploitation. Exploitation is the ability to minimize the impact of environmental threats to friendly forces while simultaneously capitalizing on environmental conditions that maximize the operational advantage over enemy forces. AFW enables decision makers to plan and execute weather-optimized courses of action through timely injection of mission-tailored environmental threat information at every decision point in the mission planning and execution process.

1.1.2.1. Tailoring. Tailoring is the extraction of data that is pertinent to a specific mission profile from the overall characterization of the air and space environment. This information can be spatial, temporal or both, but will always focus on the mission profile and the associated mission-limiting weather thresholds. Tailoring does not mean changing the characterization of the air and space environment. To the greatest extent possible, weather organizations charged with tailoring and exploitation will use the characterized data provided to them.

1.1.2.2. Integration. Integration is the process by which AFW organizations seek to inject the right information at the right time every time. The foundation of exploitation and integration is built upon two tenets: knowledge and relationships.

1.1.2.2.1. Knowledge. Missions are affected by a wide variety of environmental threats, requiring operational commanders and mission planners to understand the threats most likely to impair their mission's effectiveness. AFW leaders will identify and understand specific impacts of the environment on those missions, translate those impacts into the mission-language of their supported warfighters for action, and impart this expertise to their subordinate weather personnel through enduring training, processes, and procedures. It is crucial to understand not only the capabilities and sensitivities of mission platforms, equipment, and systems but also mission processes (e.g., mission analysis, planning, course of action (COA) development/comparison/selection, and execution) and the points where weather processes must intersect or work in parallel with these mission processes. For example, when supporting the Army, one needs to be intimately involved in the Military Decision Making Process (MDMP), and know key decision points that will influence the process and optimize the outcome. It is the responsibility of AFW leaders and their subordinates to actively seek this knowledge using every available resource, starting with their supported warfighters.

1.1.2.2.2. Relationships. AFW leaders must be proactively involved with their supported organizations, building trust through the skillful application of weather and mission-based expertise to maintain commanders' environmental awareness, optimize mission planning, and achieve mission success. To be effective, these relationships will be established and actively maintained with the supported organizations' key operational decision makers, operators, intelligence specialists, tactical-level mission planners, schedulers, and weapons and tactics experts. Once established, AFW personnel will be able to quickly adapt to process and/or mission changes.

1.2. Risk Management. Risk management (RM) is a decision-making process to systematically evaluate possible courses of action, identify risks and benefits, and determine the best course of action for any given situation. Leadership will apply RM principles and processes to day-to-day weather operations to focus activities and allocate resources of the weather unit to exploit environmental conditions, mitigate mission delays, and enhance the overall effectiveness of operations.

1.2.1. AFPD 90-9, *Operational Risk Management*, establishes the Air Force Operational Risk Management Program. AF weather units will implement AFD 90-9 with Air Force Instruction (AFI) 90-901, *Operational Risk Management*, and use the Air Force Pamphlet (AFPAM) 90-902, *Operational Risk Management (ORM) Guidelines and Tools*, as a process guide. This pamphlet provides the definitions, guidelines, procedures, and tools for the integration and execution of ORM for all US Air Force organizations and personnel. **Figure 1.1** identifies and describes the six-step ORM process.

Figure 1.1. Six-Step Process of Operational Risk Management

Step 1	Identify the Hazard. A hazard can be defined as any real or potential condition that can cause mission degradation, injury, illness, death to personnel or damage to or loss of equipment or property. Experience, common sense, and specific risk management tools help identify real or potential hazards.
Step 2	Assess the Risk. Risk is the probability and severity of loss from exposure to the hazard. The assessment step is the application of quantitative or qualitative measures to determine the level of risk associated with a specific hazard. This process defines the probability and severity of a mishap that could result from the hazard based upon the exposure of personnel or assets to that hazard.
Step 3	Analyze Risk Control Measures. Investigate specific strategies and tools that reduce, mitigate, or eliminate the risk. Effective control measures reduce or eliminate one of the three components (probability, severity, or exposure) of risk.
Step 4	Make Control Decisions. Decision-makers at the appropriate level choose the best control or combination of controls based on the analysis of overall costs and benefits.
Step 5	Implement Risk Controls. Once control strategies have been selected, an implementation strategy needs to be developed and then applied by management and the work force. Implementation requires commitment of time and resources.
Step 6	Supervise and Review. Risk management is a process that continues throughout the life cycle of the system, mission, or activity. Leaders at every level must fulfill their respective roles in assuring controls are sustained over time. Once controls are in place, the process must be periodically reevaluated to ensure their effectiveness.
See AFPAM 90-902 for Application and Techniques	

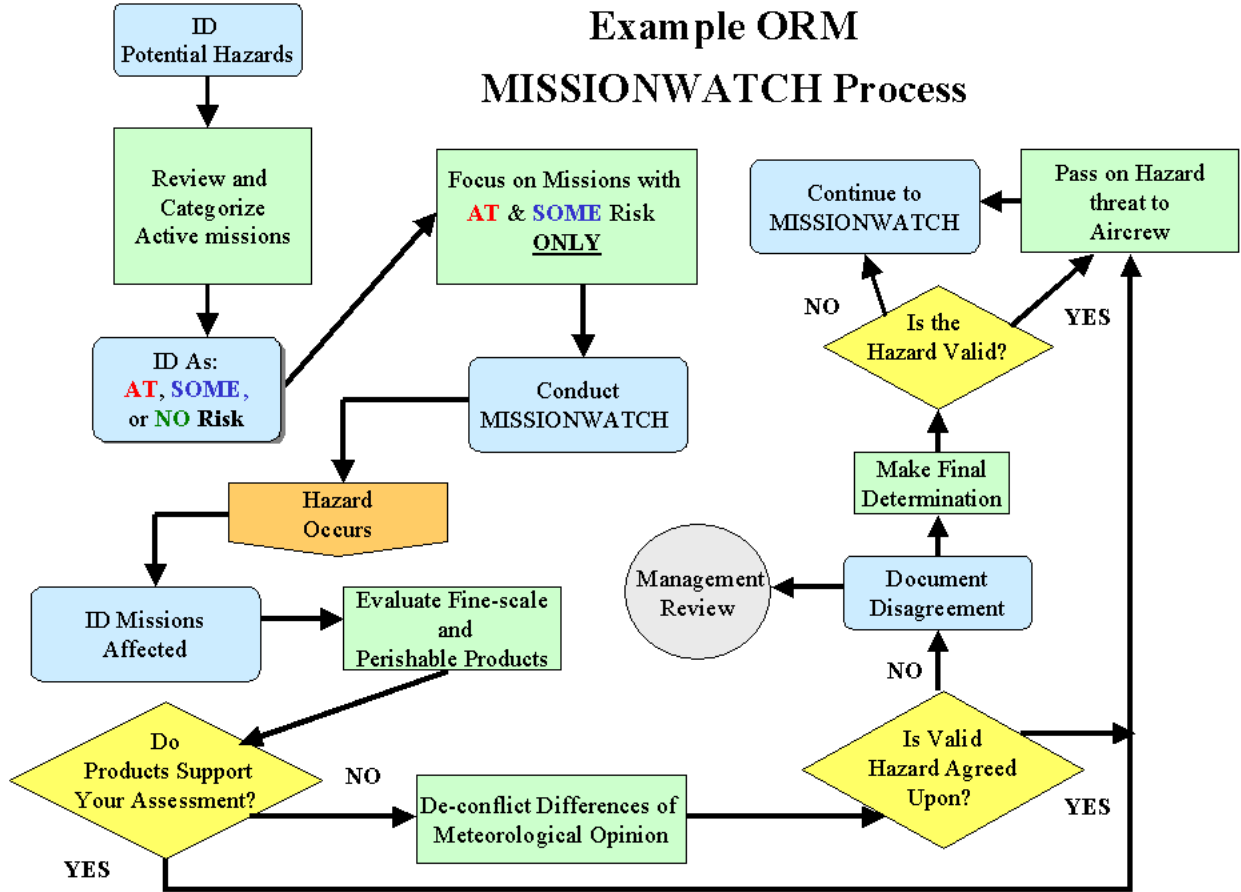
1.2.2. Unit leadership will tailor the six-step ORM process, and its application and techniques to be consistent with the ORM processes of operational customers, and to the unique mission needs of their organization. **Figure 1.2** is an example ORM Mission Meteorological Watch (MISSIONWATCH) process. The MISSIONWATCH is a continuous process determined by meteorological threats impacting operations. As a minimum, units will apply ORM practices to prioritize and manage activities in the following areas:

- 1.2.2.1. Meteorological Watch (METWATCH) and/or MISSIONWATCH processes and procedures.
- 1.2.2.2. Resource Protection processes and procedures to include Severe Weather Action Plan (SWAP).
- 1.2.2.3. Mission planning.
- 1.2.2.4. Mission Execution Forecast Processes (MEFP).

1.2.2.5. Backup plans and procedures.

1.2.2.6. Duty priorities.

Figure 1.2. Example ORM Mission Meteorological Watch (MISSIONWATCH) Process



Chapter 2

CHARACTERIZATION

2.1. Characterization. Characterization units will develop logical and repeatable analysis and forecast processes. These processes will focus on uniform analysis of observed data, forecasting of space and terrestrial weather conditions, producing and disseminating graphical and alphanumeric weather products, and Quality Assurance of all final products. Additionally, characterization units will develop metrics to assess product quality. Timely delivery of weather products to weather personnel, command and control agencies and systems, and decision aids is critical for effective exploitation.

2.1.1. **Principles.** The OWS is the primary or first source in analysis and prediction. As such, characterization is not a normal function of the EU. Certain weather organizations are assigned characterization duties for a specific functional area such as special operations forces, national intelligence community, volcanic ash detection, spacelift/space operations, or climatology. These units will coordinate to the maximum extent possible with the OWS having characterization responsibility for a given geographic area. While there is always some forecasting involved in any mission execution product, the intent is that the EU will not replicate the efforts of those organizations which are both equipped and manned to accomplish a thorough characterization of the atmosphere. Units organized as EU assigned to a management headquarters weather squadron or subordinate to an operations support squadron do not routinely function as characterization units. EUs apply environmental characterizations to specific missions and provide military decision makers with impacts and actionable information to maximize host/parent unit mission execution and resource protection actions.

2.2. Processes and Procedures. Characterization units will employ logical, repeatable processes and procedures to collect, analyze and predict mission critical thresholds in the terrestrial or space environment in accordance with mission descriptions and assigned geographic or functional areas of responsibility. Characterization unit leadership will:

2.2.1. Conduct and document, at a minimum, an annual review of processes and procedures (e.g., SOPs, OIs) to ensure accuracy.

2.2.2. Conduct and document, at a minimum, an annual review of all processes and procedures (e.g., SOPs, OIs) for which they are position qualified.

2.2.3. Establish and document, at a minimum, a continuous improvement process for the following core processes: collection, analysis and prediction.

2.2.4. Formally document both quality assurance and forecast review processes.

2.2.5. Cross feed best practices and lessons learned to other characterization units through the AFWA Standardization and Evaluation Division (AFWA/A3V) for standardization across the functional community.

2.3. Collection Process. Collection is the essential component of worldwide and regional databases from which characterization units derive weather products. Characterization units

collect terrestrial and space environmental information from across the globe. A continual collection of weather and space data contributes to the accuracy of products.

2.4. Analysis Process. Characterization units will develop a systematic analysis process to determine the current state of the atmosphere. Analysis entails building a coherent, integrated depiction of the past and current state of the natural environment over a specified region. Characterization units provide effective analysis of collected weather data (terrestrial and space) to help ensure the accuracy of products. These data are processed and assimilated into environmental databases to provide battlespace awareness and inputs for decision-making and predictions. Analysis will drive forecast decision trees throughout the process. The procedures for analyzing data may vary depending on the data and parameters, and methods may include visually inspecting data and producing analysis products.

2.5. Prediction Process. This process guides weather forecasters in developing a prediction of the future state of the atmosphere. Characterization units will include the following items in the forecast processes and procedures:

2.5.1. Continuity and Persistence.

2.5.2. Climatology.

2.5.3. Numerical Weather Prediction (NWP) Models. NWP output will be evaluated every 3 hours through an objective verification process to identify model deviations from the sensed environment and evaluate the run-to-run consistency of meteorological models to improve the forecast processes. Model verification products will be used, along with subjective techniques such as continuity and extrapolation, as a guide for adjusting forecasts.

2.5.4. Ensembles. Characterization units employ Ensemble Prediction Suites (EPS) as a tool to assess credibility of weather data identified by single model forecasts. Characterization of credible data will enhance military decision making processes when provided to units serviced by characterization units for exploitation purposes.

2.5.5. Forecast Techniques and Rules of Thumb (ROT). Characterization units will document, evaluate and review biennially, all forecast techniques and rules of thumb. Characterization units will integrate validated forecast techniques and rules of thumb into forecast processes.

2.5.6. Forecast Worksheets/Checklists. Forecasters will utilize forecast worksheets and checklists in order to work logically and consistently through the forecast process. When developing worksheets/checklists/decision aids, characterization units will:

2.5.6.1. Design worksheets/checklists to help forecast specific terrestrial or space weather parameters.

2.5.6.2. Integrate location specific forecast reference material, forecast tools and techniques for different seasons and atmospheric patterns as applicable.

2.5.6.2.1. Review forecast reference material seasonally for forecast application updates.

2.5.6.2.2. Ensure relevant, specific, and tailored forecast reference material, as required in AFI 15-128, *Air Force Roles and Responsibilities*, is included in

qualification training and reviewed by training flight weather personnel on a semi-annual basis.

2.5.6.3. Provide a summation of forecast reasoning employed for developing the forecast.

2.5.6.4. Document significant changes to forecast products as a result of collaboration with exploitation units.

2.5.6.5. Host worksheets on primary and backup OWS sites for continued tier 1 support as required in AFI 15-128.

2.6. Dissemination.

2.6.1. The 2d Systems Operations Squadron (2SYOS) at Offutt AFB is the primary agency responsible for weather enterprise collection and dissemination activities. 2SYOS operates and maintains enterprise transmission and storage systems operating at multiple levels of security classification.

2.6.2. Characterization units will process meteorological data and prepare weather products using Air Force approved production systems. Air Force standard weather production systems will be used to disseminate characterization products, weather watches, warnings, advisories, and other products or services via an Air Force standard communication node, web services, and/or subscription services.

2.6.3. Characterization units will make every effort to make environmental data and products available for dissemination via systems and data networks approved by combatant or joint commands. These efforts will apply to units participating in joint, coalition, or combined operations within the characterization unit's AOR when cross-system and/or cross-network data transfer is available.

2.7. Meteorological Watch (METWATCH). This is a deliberate continuous process for monitoring terrestrial weather or the space environment in an area or region. The purpose of a METWATCH is to identify when and where observed conditions significantly diverge from forecast conditions, determine courses of action to update or amend a forecast product or group of products, and notify designated agencies. Characterization units will:

2.7.1. Establish and maintain a prioritized threat-based METWATCH process for all locations for which it is responsible for issuing products (i.e., warnings, watches, and advisories), and employ Risk Management (RM) steps to identify weather threats impacting characterization products and maximize effectiveness of resources.

2.7.2. Monitor and identify changes in weather conditions that cross critical weather thresholds, as outlined in the installation data page for the supported unit, and evaluate forecast products/reasoning when conditions are not occurring as forecast.

2.7.3. Amend forecast per product amend criteria and coordinate with exploitation units per established procedures.

2.7.4. Develop METWATCH procedures to include the following:

2.7.4.1. Identify primary METWATCH data sources, document forecast methods, and standardize methods of obtaining weather situational awareness.

2.7.4.2. Identify weather products and services affected by unexpected changes to forecasted conditions. At a minimum, characterization units that have METWATCH responsibilities will have prioritized procedures for Watches, Warnings, and Advisories (WWAs), Terminal Aerodrome Forecasts (TAFs), Military Operating Area Forecasts (MOAFs), and flight hazards.

2.7.4.3. Outline the actions to take when forecast conditions change during the METWATCH. Specify the units to contact and primary and backup contact methods (e.g., telephone, e-mail, phone patch).

2.8. Aircraft Mishaps. Upon notification of an aircraft or ground mishap, the OWS will provide pertinent data to the investigating authority by any and all coordinated means or media. This data will include, but is not limited to observations, TAFs, WWA, hazards charts, Meteorological Satellite (METSAT) imagery, and available RADAR data (including Velocity Azimuth Display (VAD) wind profiles). This will include data from the time of the event through the previous 12 hours for the region of operations, and subsequent 6 hours after event.

2.9. Chemical, Biological, Radiological, Nuclear, High-Yield Explosive (CBRNE). OWSs will:

2.9.1. Provide products and services specified in the regionally responsible Air Force OWS section of Table A4.38 in AFI 10-2501 *Air Force Emergency Management Program Planning and Operations*.

2.9.2. Execute items 5-9 of WF section of Table A4.38 in AFI 10-2501 *Air Force Emergency Management Program Planning and Operations* when the installation WF is absent or unavailable.

Chapter 3

OWS CHARACTERIZATION PRODUCTS

3.1. General. OWS type units, to include the 612 SPTS/OWF, are organized, trained, and equipped to conduct weather operations and provide weather products and information for operations in its AOR defined in AFVA 15-137, *Operational Weather Squadron Areas of Responsibility*. Other characterization units are also organized, trained, and equipped to conduct weather operations and provide weather products and information for operations in their functional areas of responsibility.

3.1.1. **Operational Production.** Characterization units will develop procedures to conduct the core processes of collect, analyze and predict the environmental conditions.

3.1.1.1. All meteorological symbols, isopleths, and color representations used in the production of graphical analysis/forecast products will be compliant with World Meteorological Organization (WMO) standards or Military standard (MIL-STD) 2525B (see Attachment 4). In the event that the two standards conflict, characterization units will follow MIL-STD 2525B guidance.

3.1.2. Characterization units will establish local procedures to ensure the horizontal consistency between all Forecaster-In-The-Loop (FITL) products.

3.1.3. OWSs will maintain a looping capability of analysis products on their homepage extending back 72 hours from the current posted valid time.

3.1.4. OWSs may automate portions of the analysis products for areas within their AOR not routinely used by the U.S. military.

3.2. Analysis Products.

3.2.1. Surface Analysis.

3.2.1.1. OWSs will produce and make available to operational users, a twice-daily synoptic scale analysis of the 0000Z and 1200Z surface data. OWSs may produce 0600Z and 1800Z analysis products. These products will be available via standard dissemination systems not later than 90 minutes from valid time. OWSs will use satellite and model data where surface data is too limited to produce a useful surface analysis.

3.2.1.2. At a minimum, analysis products will contain all parameters listed in [Table 3.1](#) for polar and mid-latitude regions.

Table 3.1. Polar/Mid-Latitude Analysis Parameters

<i>Polar/Mid-Latitude Parameters</i>
<ul style="list-style-type: none"> - Plotted surface data - Isobars, base value 1000 millibars (mb) at 4-mb intervals - Positions of fronts and troughs - Locations of closed pressure systems with central values and an appropriate H/L symbol - Air mass type and source region - Tropical cyclones - 12-hour continuity of front, troughs, closed pressure systems and other significant weather features

3.2.1.3. Analysis products will contain all parameters listed in **Table 3.2.** for tropical/sub-tropical regions. Note: Under certain conditions, meteorological features in sub-tropical latitudes are best depicted using mid-latitude parameters from **Table 3.3** OWSs will determine when to employ mid-latitude analysis techniques and analyze the charts accordingly.

3.2.1.4. JTWC low-level streamline tropical analysis products are the authoritative product set for their area of responsibility. This product will be available NLT 90 minutes following the release of synoptic data products. Characterization units who also have coverage responsibilities within the JTWC AOR will host these products on their webpage.

Table 3.2. Tropical/Sub-Tropical Analysis Parameters

<i>Tropical/Sub-Tropical Parameters</i>
<ul style="list-style-type: none"> - Streamlines - Confluent & diffluent asymptotes - Cyclonic and anticyclonic circulation centers - Cusps and neutral points - Tropical cyclones - Other significant weather features (e.g., Equatorial Trough, monsoon troughs, axes of tropical waves, shearlines) - 12-hour continuity of cyclonic and anticyclonic circulation centers, tropical cyclones and other significant weather features

3.2.1.5. OWSs will produce a 00Z and 12Z surface analysis synoptic discussion to provide situational awareness for EU forecasters.

3.2.2. Upper Air Analysis.

3.2.2.1. OWSs will:

3.2.2.2. Analyze the minimum required weather parameters, as listed in **Table 3.3**, from the earth's surface up to and including the first layer above the troposphere.

3.2.2.3. Use the 00Z and 12Z plotted rawinsonde data to depict synoptic and mesoscale weather features at 200 (optionally 250 or 300), 500, 700, 850, and 925 mb levels (see exceptions in [Table 3.3](#)).

3.2.2.4. Track 12 and 24-hour continuity of closed circulation centers.

3.2.2.5. Maintain vertical and horizontal consistency of weather features with other weather data (e.g., other pressure levels, satellite imagery, and weather radar).

3.2.2.6. OWSs will use computer generated renderings of assimilated and sensed data in production of analysis products.

Table 3.3. Minimum Required Parameters in OWS Standard Upper Air Analysis

<i>Level</i>	<i>Minimum Parameters</i>
200mb 250mb or 300 mb	<ul style="list-style-type: none"> - Height contours using a base value of 9,000 meters (300 mb), 10,560 meters (250 mb), or 12,000 meters (200 mb) at 120-meter intervals - Closed Highs and Lows with center height values in Polar/Mid-latitude regions, Cyclones and Anticyclones in Tropical/Sub-tropical regions - Color fill (purple) wind speed maxima ≥ 70 kts (in 20 kts increments) - Areas of upper tropospheric divergence (isopleth in blue for values greater than >1.95 radians/sec 10^{-4} s^{-1}) <p>EXCEPTION: May omit if above lowest layer in stratosphere</p>
500 mb	<ul style="list-style-type: none"> - Height contours using a base value of 5,400 meters at 60-meter intervals - Closed Highs and Lows with center height values - Isotherms at 5C° intervals - Moisture areas. Color fill areas with dew point depressions (DPD) of $\leq 5\text{C}^\circ$ or relative humidity 70% or greater
700 mb	<ul style="list-style-type: none"> - Height contours using a base value of 3,000 meters at 30-meter intervals - Closed Highs and Lows with center height values - Isotherms at 5C° intervals - Moisture areas. Color fill areas with $\text{DPD} \leq 5\text{C}^\circ$ or relative humidity 70% or greater
850 mb & 925 mb	<ul style="list-style-type: none"> - Height contours using a base value of 1,500 meters (750 meters for 925 mb) at 30-meter intervals (or as required by season and documented in an Analysis and Forecast Program (AFP)) - Fronts aloft - Closed Highs and Lows with center height values - Isotherms at 5C° intervals (highlight 0C° isotherm) - Moisture areas. Color fill areas with $\text{DPD} \leq 5\text{C}^\circ$ or relative humidity 70% or greater - Low level jet - Streamlines and circulation centers may be used instead of height contours and height centers in tropical regions <p>EXCEPTIONS: May omit analysis for regions within the AOR with surface elevations reaching into these mandatory levels</p>

3.2.2.7. OWSs may:

3.2.2.7.1. Use a meteorological satellite analysis over data-sparse areas.

3.2.2.7.2. Produce an analysis of additional pressure levels or parameters on standard levels (i.e., height fall centers) based on seasonal weather patterns.

3.2.2.7.3. Analyze two levels over tropical areas: low-level (925 or 850 mb) and upper-level(300, 250, or 200 mb).

3.2.2.8. JTWC tropical streamline analysis products are the authoritative product set for their area of responsibility. This product will be available NLT 90 minutes following the release of synoptic data products. Characterization units who also have coverage responsibilities within the JTWC AOR will host these products on their webpage.

3.2.3. Standard Analysis of Upper Air Soundings (SKEW-T/Log-P Diagrams).

3.2.3.1. OWS graphical displays will include:

3.2.3.1.1. Temperature and dew point vertical profiles.

3.2.3.1.2. Wind directions and speeds at mandatory and significant reporting levels.

3.2.3.1.3. Tropopause height.

3.2.3.1.4. Additional derived parameters (at a minimum):

3.2.3.1.4.1. Height of the freezing level(s).

3.2.3.1.4.2. Height and speed of the maximum wind.

3.2.3.1.4.3. Lifted Condensation Level (LCL).

3.2.3.1.4.4. Lifted Index (LI).

3.2.3.1.4.5. Total Totals (TT).

3.2.3.1.4.6. Convective Available Potential Energy (CAPE).

3.2.3.1.4.7. Convective Inhibition (CINH).

3.2.3.1.4.8. Convective Condensation Level (CCL).

3.2.3.1.4.9. Showalter Stability Index (SSI).

3.2.3.2. OWSs will provide access to SKEW-T data/diagrams and forecast SKEW-T diagrams for upper air observation sites in their respective AORs.

3.2.4. Severe Weather Analysis.

3.2.4.1. OWS will identify and assess severe weather threats and focus characterization efforts in those areas where conditions are expected to have the most impact on operational units.

3.2.4.2. OWSs will use [Table 3.4](#) as a guide; specific analysis parameters and thresholds may depend on the region and season.

3.2.4.3. Severe weather analysis may be combined with the standard surface and upper air analysis.

Table 3.4. Standard Severe Weather Analysis Parameters

<i>Chart</i>	<i>Standard Parameters</i>
200mb 250mb or 300 mb	<ul style="list-style-type: none"> - Streamlines and axes of diffluent winds - Isotachs in red with a minimum value of 70 knots in 20-knot intervals; label all speed maxima - Height falls (300 mb only) using same procedures as 500 mb - Stratospheric warm sinks/cold domes - Circulation centers (cyclones C, anticyclones A)
500 mb	<ul style="list-style-type: none"> - Axes of maximum wind flow ≥ 50 kts; label all speed maxima - Closed Highs and Lows with center height values - 12-hr. height falls every 30m. If the center exceeds 180m, draw height fall isopleths every 60m. Label center with an X and the maximum value - Isotherms every 2°C - Warm and cold pockets
700 mb	<ul style="list-style-type: none"> - Flow streamlines - Axes of maximum wind flow ≥ 30 kts, label all speed maxima - Isotherms 2° intervals; highlight 0°C isotherm (if applicable) - Circulation centers (cyclones C, anticyclones A) - Dry air intrusions ($\geq 10^\circ\text{C}$ dew point difference) intruding into a significant moisture field (DPD $< 6^\circ\text{C}$ or RH $\geq 70\%$)
850/ 925 mb	<ul style="list-style-type: none"> - Streamlines and axes of confluent winds - Axes of maximum wind flow ≥ 25 kts; label all speed maxima - Isotherms every 2 °C; highlight 0°C isotherm (if applicable) - Thermal ridges and warm/cold pockets. - Axes of Equivalent Potential Temperature (Theta-E) Ridges - Isodrosotherms every 2°C for values $\geq 10^\circ\text{C}$ at 925mb and $\geq 6^\circ\text{C}$ at 850mb - Circulation centers (cyclones C, anticyclones A) - Dry air intrusions ($\geq 10^\circ\text{C}$ dew point difference) intruding into a significant moisture field (DPD $< 6^\circ\text{C}$ or RH $\geq 70\%$)
Surface	<ul style="list-style-type: none"> - Fronts, troughs, and confluent zones. Track fronts until no longer discernible - Dry lines, meso-highs, outflow boundaries, and squall lines - Moisture ridges and axes of maximum moisture advection - Thermal ridges - Isallobars; highlight anallobars (pressure rises) and katallobars (pressure falls) - Tropical depressions and tropical cyclones, as required - Isotherms every 2 °C; highlight 0°C isotherm (if applicable)

3.2.5. METSAT Imagery.

3.2.5.1. Overlay the water vapor imagery on the 200, 250 or 300 mb 00Z & 12Z upper air analysis to outline upper level jet streams and vorticity maxima.

3.2.5.2. Overlay a visible or Infrared (IR) satellite image on the 00Z & 12Z surface analysis to best depict surface features (e.g., fronts, pressure centers, tropical cyclone positions, volcanic eruptions, significant dust/sand events).

3.3. NWP Models.

3.3.1. OWSs will:

- 3.3.1.1. Select the viable model or models for their AOR, factoring in data availability and 16 WS monthly or seasonal model performance metrics.
- 3.3.1.2. Evaluate data on the synoptic scale or mesoscale, depending on model scale and AOR-specific requirements.
- 3.3.1.3. Automate model verification products every 3 hours for all viable models using **Table 3.5** as a minimum. The OWS may create additional verification products.
- 3.3.1.4. Identify and discuss deviations from the representative model data in appropriate forecast discussion bulletin(s).
- 3.3.1.5. Analyze representative model(s) data for the supported AOR.
- 3.3.1.6. Automate as many significant parameters as the capability exists, except for fronts and troughs at the surface.
- 3.3.1.7. Develop processes and procedures for depicting significant features on the representative model using **Table 3.5** and **Attachment 4**.
- 3.3.1.8. Use fine-scale and long-range model data from multiple sources as needed to provide representative products.
- 3.3.1.9. Produce forecast model products at 12-hour intervals starting at the base hour (e.g., 00Z or 12Z) through the 72-hour point for parameters listed in **Table 3.6**
- 3.3.1.10. Develop modified depiction procedures for tropical regions within the AOR. OWSs will document tropical-unique depiction procedures in analysis and forecast procedures. OWSs may include a description of the modified depiction parameters in the data page (see AFI 15-128, 4.1.1) with supported EUs if deemed operationally significant. OWSs may leverage hurricane/typhoon center products if their products are adequate to meet area and type requirements.

Table 3.5. Model Verification Output

<i>Chart</i>	<i>Parameters</i>
Water vapor image with 300mb height contours and isotachs from the model overlaid	<ul style="list-style-type: none"> - Height contours (same as Table 3.3.) - Isotachs – Minimum value of 70kts with a 20-kt interval - Closed Highs and Lows with center height values - Areas of upper level divergence. (Isopleth in blue dashed lines for values ≥ 1.95 radians/sec 10^{-4} s^{-1})
IR or Vis Satellite with model 500 mb vorticity, height contours, highs and lows overlaid. Note: observed 500 mb height contours, highs and lows will be included at 00Z and 12Z	<ul style="list-style-type: none"> - Height contours (same as Table 3.3.) - Closed Highs and Lows with center height values - Vorticity isopleths
IR or Vis Satellite with model 850 mb relative humidity, height contours, highs and lows overlaid. Note: observed 850 mb relative humidity, height contours, highs and lows will be included at 00Z and 12Z	<ul style="list-style-type: none"> - Height contours (same as Table 3.3.) - Closed Highs and Lows with center height values - Relative humidity (same as Table 3.3.)
Model precipitation areas and surface isobars with radar image (if available), observed surface plots, observed surface isobars overlaid	<ul style="list-style-type: none"> - Isobars at 4 mb intervals - Quantitative Precipitation Forecast (QPF) output 0.25 inches (other values may be included as required based on season)

Table 3.6. Weather Parameters Depicted in Model Output

<i>Chart</i>	<i>Parameters</i>
300, 250 or 200 mb Package	<ul style="list-style-type: none"> - Height contours (same as Table 3.3.) - Isotachs – Minimum value of 70kts with a 20-kt interval - Closed Highs and Lows with center height values - Areas of divergence. (Isopleth in blue dashed lines for areas ≥ 1.95 radians/sec 10^{-4} s^{-1})
500 mb Package	<ul style="list-style-type: none"> - Height contours and temperatures (same as Table 3.3.) - Seasonal representative contour; maintain continuity to determine significant weather changes - Closed Highs and Lows with center height values - Vorticity isopleths - Areas of Vorticity advection (positive advection shaded red, negative advection shaded blue) - Significant areas of RH (isopleth in green or green color shade areas of 70% / 90%)
700 mb Package	<ul style="list-style-type: none"> - Height contours and temperatures (same as Table 3.3.) - Closed Highs and Lows with center height values - Isopleth in green or color shade in green areas of RH (70% / 90%) - Contour upward vertical velocity values – Base 0 interval ± 3 microbars/sec - Quantitative Precipitation Forecast (QPF) output 0.25 inches (other values may be included as required based on season)
850 mb Package	<ul style="list-style-type: none"> - Height contours and temperatures (same as Table 3.3.) - High and low centers. Closed Highs and Lows with center height values - Identify areas of RH (70% / 90%) - Wind Barbs - Highlight the 0°C isotherm in blue
925 mb Package	<ul style="list-style-type: none"> - Height contours and temperatures (same as Table 3.3.) - Closed Highs and Lows with center height values - Areas of convergence - Isopleth in green or green color shade RH (area of 70% / 90%) - High and low centers - Highlight the 0°C isotherm in blue
Surface Package	<ul style="list-style-type: none"> - Isobars at 4 mb intervals - Fronts, troughs, pressure centers, and tropical cyclones - Areas of precipitation

3.4. Terminal Aerodrome Forecast (TAF). Aviation forecasts in TAF code provide meteorological information for flight planning and command and control activities for a specific aerodrome complex. Characterization units with TAF production responsibility will produce

TAFs for Air Force or Army controlled airfields and joint base airfields where the Air Force or Army is the supporting Service.

3.4.1. **Support Assistance Requests for TAF service.** Characterization units will adjudicate requests for new TAFs using **Table 3.7** TAF Decision Matrix as a general guide. Supporting and supported commanders will engage, as necessary, on a final decision.

Table 3.7. TAF Decision Matrix

TAF Decision Matrix				
<u>IF:</u>	<u>AND:</u> AF takes airfield observation	<u>AND:</u> Indigenous, coalition, or joint WMO compliant TAF issued	<u>AND:</u> Mission load exceeds 25 US military launch/recovery per 24 hrs	<u>THEN:</u> OWS is responsible for TAF coded forecast
COCOM directed (OPLAN, EXORD, LOI, etc.)	N/A	N/A	N/A	Yes
USAF/US Army has Senior Airfield Authority	Yes	No	Yes	Yes
	No	No	No	No
	Yes or No	Yes	Yes or No	No
	No	No	Yes	Yes
Joint with host nation or FAA	No	Yes	Yes or No	No
	Yes	No	Yes	Yes
	Yes	No	No	No

3.4.1.1. Characterization units may issue TAFs using a KQ identifier on a short-term basis, less than 180 days, during the staffing process for resource determination and allocation.

3.4.1.1.1. Additional 180-day extensions on using a KQ identifier may be requested through AFWA/A3 from the characterization unit's parent MAJCOM.

3.4.2. Location identifiers (KQ Identifiers).

3.4.2.1. Unclassified KQ identifiers will be temporary in nature. Characterization units will initiate a request through their parent MAJCOM to AFWA in order to obtain permanent International Civil Aeronautical Organization (ICAO) identifiers for steady-state (2-years or more) contingency operating locations.

3.4.2.2. AFWA will:

3.4.2.2.1. Centrally manage the KQ ID database.

3.4.2.2.2. Respond to user requests for KQ ID issuance/activation in a timely manner. Routine requests received during normal duty hours will be implemented, including updating of secure web site, within 24 hours of receipt by AFWA.

3.4.2.2.3. Establish, maintain and update a secure, web-accessible repository for user look-up to include classification, KQ ID, ICAO, location name, Latitude/Longitude (degrees/minutes), elevation (feet and meters), and expiration date (if available).

3.4.2.2.4. Immediately respond to mitigate compromised classified KQ IDs.

3.4.2.2.5. Coordinate identification and release of KQ ID data to non-DoD agencies as appropriate.

3.4.2.3. Characterization units producing TAFs will:

3.4.2.3.1. Use established ICAO identifiers for enduring airfields or other military locations within their assigned region or functional area.

3.4.2.3.2. Use KQ identifiers for temporary, contingency, exercise, or classified operating locations.

3.4.3. TAF Production.

3.4.3.1. Characterization units producing TAFs will:

3.4.3.1.1. Develop a TAF production cycle for all locations and coordinate TAF issue times with supported units.

3.4.3.1.2. Issue forecasts valid for a 30-hour period.

3.4.3.1.3. Issue TAF-coded forecasts, at a minimum, every 8 hours within 15 minutes after the file time during airfield operational hours.

3.4.3.1.4. Encode the TAF-coded forecast product IAW AFMAN 15-124, *Meteorological Codes*.

3.4.3.1.5. Collaborate with supported exploitation units prior to TAF dissemination and formally document exploitation unit inputs.

3.4.3.1.6. Disseminate all TAF-coded forecast products (including amendments) via standard production and dissemination systems.

3.4.3.1.7. Disseminate TAF-coded forecasts for limited operation airfields not more than 3 hours before the airfield opens. Deviations from this practice will be by mutual agreement with the supported unit and documented on the installation data page.

3.4.4. TAF-coded Forecast Specification and Amendment.

3.4.4.1. Characterization units will:

3.4.4.1.1. Specify the onset, duration, and intensity for the standard criteria in **Table 3.8** throughout the valid period of the forecast. Forecasts will be amended when conditions do not match specified conditions within **Table 3.8**

3.4.4.1.2. Specify and amend ceiling and visibility categories for US Army or US Air Force flight planning criteria throughout the valid period of the forecast. The lower of the two conditions will determine the ceiling and visibility amendment category.

3.4.4.1.2.1. Use ceiling and visibility specification criteria in **Table 3.9** for TAF-coded forecasts issued for Army airfields.

3.4.4.1.2.2. Use ceiling and visibility specification criteria in **Table 3.10** for TAF-coded forecasts issued for Air Force operating locations.

3.4.4.2. Characterization units issuing forecasts for Joint/Coalition airfields will validate criteria based on operational requirements. Use Air Force ceiling and visibility specification criteria located in **Table 3.10** when Air Force agencies operate the airfield. Characterization units will use Army criteria from **Table 3.9** when Army organizations operate the airfield.

3.4.4.3. Forecasters will employ trend data from standard display systems (e.g., Airfield Sensor Displays) to determine prevailing conditions.

3.4.4.3.1. Prevailing conditions are those that persist for at least 30 consecutive minutes.

3.4.4.3.2. Conditions occurring once during a specified time-period for less than 30 consecutive minutes or occurring for an aggregate total of less than 30 minutes of every cardinal hour are temporary.

3.4.4.3.3. During periods of rapidly changing ceilings or visibilities crossing multiple categories, consider conditions occurring for the greatest aggregate total during a cardinal hour the predominant condition for that cardinal hour.

Table 3.8. Standard Specification and Amendment Criteria

Rule	Phenomena	Criteria	Source	Notes, Examples or Applications
1	Surface Winds	<p><u>a. Wind Speed:</u> The difference between the predominant wind speed and the forecast wind speed is ≥ 10 knots</p> <p><u>b. Wind Gusts:</u> The difference between observed gusts and the forecast is ≥ 10 knots</p> <p><u>c. Wind Direction:</u> A change > 30 degrees when the predominant wind speed or gusts are expected to be 15</p>		<p>IF: Forecast winds 23018G25KT</p> <p>THEN: Amend if predominant winds equal or exceed 28 knots, or if observed gusts equal or exceed 35 knots.</p> <p>Amend if predominant winds are 8 knots or less or gusts do not meet 15 knots.</p> <p>Amend for prevailing wind</p>

		knots or greater.		directions outside of the arc extending from 200 through 260 degrees.
2	Icing , not associated with thunderstorms, from the surface to 10,000ft Above Ground Level (AGL)	The beginning or ending of icing first meets, exceeds, or decreases to less than moderate (or greater) thresholds and was not specified in the forecast	AFI 11-202 Vol. 3 and AR 95-1	
3	Turbulence (for weather category II aircraft), not associated with thunderstorms from the surface to 10,000 ft AGL	The beginning or ending of turbulence first meets, exceeds, or decreases below moderate or greater thresholds and was not specified in the forecast	AFI 11-202 Vol. 3 and AR 95-1	
4	Weather Warning Criteria	Occur, or are expected to occur during the forecast period, but were not specified in the forecast Specified in the forecast but are no longer expected to occur during the forecast period		Note: Watches are exempt from this requirement. Forecasters may specify watch criteria in the TAF when, in their judgment, the specific nature of the threat dictates
5	Altimeter Setting	Altimeter setting meets or exceeds 31.00 INS and was not specified in the forecast Altimeter setting, if above, drops below 31.00 INS and was not specified during the forecast period	AFI 11-202 Vol. 3	

		<p>Altimeter setting drops below 28.00 INS and was not specified in the forecast</p> <p>Altimeter setting, if below 28.00 INS, increases above 28.00 INS and was not specified in the forecast</p>		
6	Forecast Weather Advisory Criteria issued for amendable TAF criteria.	<p>Occur, or are expected to occur during the forecast period, but were not specified in the forecast</p> <p>Specified in the forecast but are no longer expected to occur during the forecast period</p>		Note: Advisories issued for an area not including the terminal aerodrome forecast area are exempt from this policy.
7	Thunderstorms	Incorrect forecast start or end time	AFI 11-202 Vol. 3 and AR95-1	
8	Specification of Temporary Conditions	<p>Forecast conditions specified as temporary become predominant conditions.</p> <p>Forecast conditions specified as temporary do not occur during the cardinal hour as forecast</p> <p>Forecast conditions specified as temporary are no</p>	AFI 11-202 Vol. 3 and AR95-1	

		longer expected to occur		
9	Changes to Predominant Conditions (BECMG or FM group)	Forecast change conditions occur before the beginning of the specified period of change and are expected to persist Forecast change conditions do not occur within 30 minutes after the specified time. Forecast change conditions are no longer expected to occur		
10	Representative Conditions	Forecast conditions are not considered representative of existing or forecast conditions and amending the forecast improves safety, flight planning, operations efficiency, or assistance to in-flight aircraft		

Table 3.9. US Army Aviation Ceiling and Visibility Specification and Amendment Criteria

Rule	Category	Ceiling	Visibility	Source
1	D	Greater Than or Equal to (GTE) 1500ft	Visibility GTE 4800M (3SM)	AR 95-1. Aircrew must file for an alternate if conditions are less than 1500/3
2	C	Less Than (LT) 1500ft but GTE lowest published landing minimum plus 400ft	Visibility LT 4800M (3SM) but GTE lowest published landing minimum plus 1600M/1SM	AR95-1. Airfield weather conditions must equal or exceed these criteria to qualify as an alternate when flight filing
3	B	LT lowest published landing minimum plus 400ft but GTE lowest published landing minimum	LT lowest published landing minimum plus 1SM (1600M) but GTE lowest published airfield landing minimum	AR95-1. Airfield does not qualify as an alternate for flight planning but is still suitable for arrival providing a suitable alternate is available
4	A	LT lowest published airfield landing minimum	LT lowest published airfield landing minimum	AR 95-1. Airfield is not a suitable destination

Note 1. Forecasts will specify when conditions decrease to less than, or if below, increase to equal or exceed the categories in the table.

Note 2. Forecast category is determined by the lower ceiling or visibility value.

Note 3. Use prevailing surface visibility to determine forecast category.

Note 4. 5000 meters may be substituted for 4800 meters at Outside the Continental United States (OCONUS) locations based on the host-nation national practice.

Table 3.10. US Air Force Ceiling and Visibility Specification and Amendment Criteria

Rule	Category	Ceiling	Visibility	Source:
1	E	GTE 2000ft	GTE 4800M (3SM)	AFI 11-202 Vol 3. Aircrew must file for an alternate if forecast conditions are less than 2000/3
2	D	LT 2000ft but GTE 1000ft	LT 4800M (3SM) but GTE 3200M (2SM) or lowest published visibility minima, whichever is greater	AFI 11-202 Vol 3. Airfield qualifies as an alternate
3	C	LT 1000ft and GTE lowest published landing minimum plus 500ft	LT 4800M (3SM) but GTE 3200M (2SM) or lowest published visibility minima, whichever is greater	AFI 11-202 Vol 3. Airfield qualifies as an alternate
4	B	LT the lowest published landing minimum plus 500 ft and GTE the lowest published landing minimum	LT 3200M (2SM) but GTE the lowest published airfield landing minimum	AFI 11-202 Vol 3. Airfield does not qualify as an alternate for flight planning but is still suitable for arrival providing a suitable alternate is available
5	A	LT the lowest published airfield landing minimum	LT the lowest published airfield landing minimum	AFI 11-202 Vol 3. Airfield is not a suitable destination

Note 1. Forecasts will specify when conditions decrease to less than, or if below, increase to equal or exceed the categories in the table.

Note 2. Forecast category is determined by the lower ceiling or visibility value.

Note 3. Use prevailing surface visibility to determine forecast category.

Note 4. 5000 meters may be substituted for 4800 meters at Outside the Continental United States (OCONUS) locations based on the host-nation national practice.

Note 5. For Air Force operations, category A minima may be replaced with pilot weather categories in MAJCOM supplements to AFI 11-202 Vol 3.

Note 6. Air Force rotary wing criteria may be substituted when rotary wing aircraft are the primary aircraft assigned at the TAF location as stated in AFI 11-202 Vol 3.

Example. If the lowest published landing minima for an airfield is 200 ft or 1/2SM visibility, then for Army operations Category B is 600 ft or 1600M (1 SM) and for Air Force operations Category B is 700 ft or 3200M (2SM).

3.5. OWS Standard Forecaster-in-the-Loop (FITL) Graphics Products.

3.5.1. Extended Forecast. Characterization units will provide a 120-hour forecast product for all TAF sites and other point locations documented with support agencies.

3.5.1.1. The first 30 hours of this extended range forecast will be extracted from the TAF.

3.5.1.2. Days 2 – 5 (or longer) will be extracted from meteorological models, and modified as required by a forecaster for significant weather events not properly specified.

3.5.1.3. Extended forecasts will be posted to the OWS webpage at least once daily in a standardized, exportable format and will contain the following information:

3.5.1.4.1. Generalized sky condition/weather.

3.5.1.4.2. Maximum and minimum temperature.

3.5.1.4.3. Predominant wind condition.

3.5.1.4.4. Precipitation type.

3.5.2. OWSs will:

3.5.2.1. Generate product suite in [Table 3.11](#) valid at 3-hour intervals out to 30 hours using the following rule set. All graphical products, except theater thunderstorm forecast, will be valid at a point in time and consistent with the spatial resolution of the model selected by the OWS for its AOR and clearly labeled with the spatial resolution of the depicted weather parameters.

3.5.2.1.1. One hour prior to each valid period, update the next two product sets (i.e., next valid “Current” and “Current+3-hour”). Update additional product sets as deemed necessary.

3.5.2.1.2. Create a new product set for the 30-hour point, every three hours.

3.5.2.2. Produce model-rendered products from 33-120 hours or greater (as applicable) at the temporal resolution of the model.

3.5.2.3. Produce Clouds and Horizontal Weather Depiction (HWDs) products from gridded data fields.

Table 3.11. FITL Graphic Product Suite

<i>Products</i>	<i>Weather Parameters</i>	<i>Threshold Values</i>		<i>Map Depictions</i>
Theater Icing Forecast (Mean Sea Level (MSL))	- Mesoscale icing (outside thunderstorms). Rime, Clear (CLR) mixed (MXD) icing (surface - 18,000 and 18,000 - 50,000 (to the nearest 1,000 feet))	- Light (LGT) - Moderate (MDT) - Severe (SVR)		- As defined in Attachment 4
Theater Turbulence Forecast (MSL)	- Mesoscale turbulence (outside thunderstorms). Mechanical, Mountain Wave (MTN Wave), Clear Air Turbulence (CAT) (surface - 18,000 and 18,000 - 50,000 (to the nearest 1000 feet))	- Light (LGT) (Surface to 18,000 only. Note: If no requirement exists, OWSs may omit LGT) - Moderate (MDT) - Severe (SVR) - Extreme (EXTRM)		- As defined in Attachment 4
Theater Thunderstorm Forecast	- Theater-scale convective activity - 3 hour time period	Maximum instantaneous coverage	Blocks on DD Form 175-1	- Maximum tops (MSL)

(MSL)		ISOLD: 1 - 2% FEW: 3 - 15 % SCT: 16 - 45 % NMRS: > 45 %	1 - 2 % 3 - 15 % 16 - 45 % > 45 %	- Amount of coverage (ISOLD, FEW, SCT, NMRS) - Thunderstorm symbol (optional stand-alone thunderstorm prognosis)
Horizontal Weather Depiction (AGL)	- Ceiling and Visibility	AGL Areas: - < 2,000/3 (USAF fixed-wing IFR)	- As defined in Attachment 4	
Theater Surface Pressure, Fronts, and Weather Forecast	- Mesoscale surface pressure centers and values, fronts, troughs - Significant weather - Tropical cyclone positions (as required, from official tropical cyclone forecast centers).	- As displayed. Fronts maintained as long as air mass discontinuity exists	- As defined in Attachment 4	
Theater Cloud Forecast	- Mesoscale depiction of ceilings above 5,000ft AGL extending to the tropopause	- Broken (BKN) or Overcast (OVC) cloud cover	- As defined in Attachment 4.	

3.5.2.4. OWSs will refine all areas without causing the chart to be filled or covered in a way that will cause confusion, impede, or reduce the effectiveness of the chart. OWSs

are not required to produce standard FITL graphics products covering regions not routinely used by the U.S. military (low use areas), but will have processes and procedures in place for users to request, and the OWS to produce and disseminate, standard FITL graphics for these areas if needed. OWSs will produce a separate chart using automated model output products for those areas deemed “low use areas”. Characterization units will employ standard forecast techniques maintained by AFWA/A3 to mediate digital data fields. AFWA/A3 will publish these weather techniques and procedures in a standardized format approved by AF/A3O-W for use in the field.

3.5.2.5. MSL Heights. All forecast heights on OWS thunderstorm, icing, turbulence products, and the cloud tops on theater cloud products will be depicted using MSL values. OWSs will take into account the geography changes in the AOR to prevent forecasting MSL bases below general terrain heights. This does not include the small-scale changes in terrain heights (e.g., differences between mountain peaks in close proximity), which EUs will integrate into the mission execution forecast process to further refine forecasts.

3.5.2.6. AGL Heights. The OWS HWD and theater cloud forecast products will depict cloud bases as AGL height depictions.

3.5.2.7. METWATCHING and Amending FITL Graphics Products. OWSs will METWATCH and amend standard graphics products for the criteria listed in **Table 3.12**. Use perishable data (such as Pilot Reports (PIREPS), observations, radar data, and METSAT imagery) and NWP output available at forecast hours after the production cycle to METWATCH and amend products as required.

Table 3.12. Amendment Criteria for OWS Standard FITL Graphics Products

<ol style="list-style-type: none"> 1. Moderate or greater icing incorrectly depicted in horizontal extent, vertical extent, type, intensity, or time of occurrence. 2. Moderate or greater turbulence incorrectly depicted in horizontal extent, vertical extent, intensity, or time of occurrence. 3. Lines or organized clusters of thunderstorms, not easily circumnavigated (usually described as Numerous thunderstorms) incorrectly depicted on the forecast. 4. Thresholds listed in Table 3.11. incorrectly forecast. 5. Vertical extent incorrectly forecast by $\geq 2,000$ ft below 10,000AGL, $\geq 5,000$ ft above 10,000MSL. 6. Horizontal extent incorrectly forecast by ≥ 90 nautical miles. 7. Graphical depiction is not representative of existing or forecast conditions.

3.5.2.8. Collaborate with bordering OWSs and mesh all FITL products to provide horizontal consistency within areas of responsibilities.

3.5.2.9. If disagreements exist on the depiction of hazardous weather between AORs, the OWS responsible for the AOR with the upstream conditions will decide the depiction.

The OWS responsible for the downstream AOR will represent the upstream conditions on the affected FITL Graphics products.

3.6. OWS Automated Products.

3.6.1. OWSs will produce the Surface Wind Chill Temperature and Heat Stress Index product seasonally (as applicable).

3.6.2. Surface Wind Chill Temperature products are not required for tropical climatic zones.

3.6.3. Heat Stress Index products are not required for Polar climatic zones.

3.6.4. Freezing-level chart parameters may be combined with theater icing forecasts in the Standard FITL Graphics suite.

Table 3.13. OWS Automated Products

<i>Weather Parameters</i>	<i>Minimum Threshold Values</i>
Freezing Level	Height of the freezing level in 2,000ft increments.
Surface Wind Speed	Wind plots in 5-knot intervals.
Surface Temperature	Base 0 ⁰ C, interval 3C°. Units may substitute equivalent Fahrenheit temperatures.
Surface Wind Chill Temperature	Base -5 ⁰ C incremented every 5 ⁰ C below that value. NOTES: - OWSs may adjust thresholds to meet mission requirements for Polar climatic zones in the AOR. - Units may substitute equivalent Fahrenheit values provided the product legend clearly indicates units of measure.
Heat Stress Index	Base 25 ⁰ C incremented every 5 ⁰ C above that value. NOTES: - OWSs may produce additional heat stress products to meet mission requirements in the AOR (e.g., Fighter Index of Thermal Stress). - Units may substitute equivalent Fahrenheit values provided the product legend clearly indicates units of measure.

3.6.5. OWSs may utilize more than one NWP model when developing products.

3.6.6. OWSs will depict all forecast periods provided by the model used.

3.6.7. OWSs may produce additional automated products based on coordinated/validated supported user requirements.

3.7. Military Operation Area Forecast (MOAF) and Joint Operational Area Forecast (JOAF).

3.7.1. Characterization units will provide grid extraction in 25km resolution or the maximum model resolution for the following weather elements: cloud cover, winds, temperature, flight level visibility, turbulence, icing, and thunderstorms for AR tracks, routes, and operating areas for use in mission planning and execution forecasts.

3.7.2. Characterization units may issue routine alphanumeric (A/N) MOAFs/JOAFs for high-use military operating areas as directed by the characterization unit's parent MAJCOM.

3.7.3. Development of a MOAF/JOAF will be based on validated Support Assistance Request (SAR) requirements and capabilities of products and services derived from characterization units.

3.7.4. MOAF/JOAF will clearly identify heights as AGL and/or MSL.

3.7.5. A/N MOAFs/JOAFs for higher-altitude flying areas (usually for altitudes above 10,000ft) and IFR Military Training Routes will depict forecast heights as MSL values.

3.7.6. Characterization units will amend MOAFs/JOAFs for the minimum criteria listed in **Table 3.14**.

Table 3.14. Minimum Amendment Criteria for data MOAFs/JOAFs

1. Vertical extent incorrectly forecast within 1,000 feet above and below for all higher-altitude MOAFs/JOAFs.
2. Horizontal extent incorrectly forecast within 25 miles either side for all higher-altitude MOAFs/JOAFs.
3. Representativeness for all MOAFs/JOAFs.

3.8. Meteorological Discussions.

3.8.1. OWSs will:

3.8.1.1. Produce and disseminate standardized meteorological analysis and forecasts discussions based on the 00Z and 12Z synoptic analysis issued as soon as applicable model solutions are available.

3.8.1.2. Use topics listed in **Table 3.15** in discussion products. The amount of detail required for each item will depend on the degree of situational awareness required by the end users of the product.

Table 3.15. Minimum Items Included in OWS Discussion Bulletins

<ul style="list-style-type: none"> - Current air masses - Current upper air pattern - Significant synoptic and regional weather features - Significant weather features in current meteorological satellite imagery - Departures/deviations and identification of the NWP model - Model verification 	<ul style="list-style-type: none"> - Hazardous weather in the AOR to include severe weather, turbulence, icing, precipitation, winds, low ceilings/visibilities, and other items deemed significant to the OWS forecaster - Space weather (if relevant to daily operations) - Pertinent OWS operations information (e.g., scheduled outages and product availability), if applicable
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3.9. Duty Priorities. Characterization units will develop duty priorities based on mission requirements.

3.10. MISSIONWATCH. The characterization unit's flight weather briefing section will conduct RM-based MISSIONWATCH on missions assessed as at risk IAW guidance provided in Chapter 1 of this publication and AFMAN 15-129 Volume 2.

Chapter 4

WEATHER PRODUCTS FOR RESOURCE PROTECTION

4.1. General. Characterization units conduct a continuous meteorological watch to identify and assess emerging and imminent threats to installations for which they have forecast responsibility. Special Weather Statements (SWS) and WWAs are special notices provided by the characterization unit resulting from both the forecast and METWATCH processes to assist military decision makers with resource and resource protection decisions. SWSs provide advance notice of widespread hazardous weather conditions that have the potential to affect military installation(s). Watches and warnings provide notice of weather events posing a hazard to life or property. Advisories provide specific notice to an operational agency of environmental phenomena with the potential to impact operations.

4.1.1. WWA Procedures. Applicable characterization units produce, disseminate, and amend SWSs and WWAs to inform supported installations/sites of potential and observed weather conditions that require protective actions. Characterization units will discuss credible threats to an installation with the affected EU to assist them in influencing mission planning and execution activities prior to onset.

4.1.1.1. Characterization units will:

4.1.1.1.1. Issue WWAs in a standard format and numbering scheme via the standard Air Force dissemination system for the following installations:

4.1.1.1.1.1. Active duty USAF and Army installations.

4.1.1.1.2. Expeditionary operating locations in their AORs.

4.1.1.1.3. Guard and Reserve installations.

4.1.1.1.4. Homeland Defense sites and operations.

4.1.1.1.5. Special sites of national interest (e.g., The White House).

4.1.1.1.6. Major Continental United States (CONUS) Lock and Dam facilities.

4.1.1.1.7. Joint, Coalition, and North Atlantic Treaty Organization (NATO) munitions storage areas.

4.1.1.1.8. Spacelift operations and assets including government, military, and commercial facilities.

4.1.1.1.9. Joint Bases where the Air Force or Army is the supporting component.

4.1.1.2. Use WWA text pre-loaded into the Air Force dissemination system to ensure continuity. Specific text may vary by location. Text will be brief and clearly describe weather conditions in terms understood by all users of the product.

4.1.1.3. Include maximum hail size, maximum rain/snow accumulation, or maximum wind speed as applicable in warnings and advisories. Additional criteria may be specified by supported agencies.

4.1.2. Only one warning will be in effect at a given time (and will include multiple warning criteria as required) except for forecast tornado warnings and/or observed lightning warnings.

4.1.3. Warnings take precedence over advisories for the same phenomena. Forecast advisory/warning valid for the same phenomena will not be valid for the same time. Conversely, warnings and multiple forecast advisories for different phenomena may be valid for the same time.

4.1.4. Watches are stand alone products based upon potential and are unaffected by warnings or advisories for the same phenomena.

4.1.4.1. Mandatory watch criteria include: tornados, severe thunderstorms, damaging winds, lightning within 5NM, and freezing precipitation as the potential warrants.

4.1.4.2. Additional watch criteria may exist based upon supported agency requirements.

4.1.5. Upgrading and downgrading warnings and advisories.

4.1.5.1. A warning is upgraded by adding a phenomena or crossing to a higher threshold. A warning is downgraded by removing a phenomena or crossing to a lower threshold.

4.1.5.2. Forecasted warnings or advisories will use the Integrated Weather Warnings Capability (IWWC) default wording for upgrading and downgrading warnings or advisories.

4.1.6. Forecasted warnings and advisories will maintain horizontal consistency with TAF and other forecast products. Watches are not required to be included in the body of the TAF-coded forecast depending on circumstance.

4.1.7. OWSs will coordinate annually with each EU/supported agency in their AOR and maintain an installation data page of WWA thresholds/desired lead-times and mission impacts. **Table 4.1.** provides default thresholds and desired lead-times for OWS to use when WF/supported agency does not specify a DLT or state a specific threshold. Exploitation units will coordinate with their supporting OWS and supported organization leadership to determine required desired lead-times for the supported organization.

4.1.7.1. Characterization units will maximize the use of watches within their effected regions until conditions warrant the issuance of a warning to meet desired lead-times for the supported organizations. Watches should be issued at a minimum of one hour before a warning is issued, with the exception of the lightning watch, which should be issued with at least 30 minutes before the lightning warning is issued. Issue warnings at the desired lead times specified by the supported unit.

4.1.7.2. Characterization units will use the default minimum desired lead-times in **Table 4.1** only if the supported organization does not specify a minimum DLT.

Table 4.1. Weather Warning Defaults

Weather Threat	Threshold	Impact	Default Lead-time (Note 1)
Tornado	Tornado / Funnel cloud (detected by radar or visually observed) AND threatening warned location / aerodrome complex	Immediate threat of catastrophic damage to personnel and property	15 minute advance notice of onset and duration of tornadic thunderstorm activity See Note 2,4
Severe Thunderstorm	<u>Damaging Wind</u> AF: GTE 50 kts Army: GTE 45 kts associated with thunderstorms -AND/OR- <u>Damaging Hail</u> AF: GTE ¾ inch Army: GTE ½ inch at the warned location / aerodrome complex	Immediate threat to exposed personnel High risk of damage to facilities and exposed aircraft and equipment	1 hour advance notice of severe thunderstorm onset, duration, and intensity See Note 2
Moderate Thunderstorm	<u>High Wind</u> GTE 35 knots and less than severe criteria associated with thunderstorms -AND/OR- <u>Large Hail</u> GTE ¼ inch and less than severe criteria at the warned location aerodrome complex	Increased risk to exposed personnel Increased risk of damage to unsecured property Increased risk to flightline activities and damage to exposed aircraft or vehicles	1 hour advance notice of thunderstorm onset, duration, and intensity See Note 3
Damaging Winds	Surface winds not associated with thunderstorms meeting or exceeding damaging wind threshold. AF: 50 knots Army: 45 knots	Immediate threat to exposed personnel Increased risk of damage to facilities and equipment	1 hour advance notice of onset, duration, and intensity of wind event See Note 3
Strong Wind	Surface Winds not	Increased risk to exposed	1 hour advance notice of

	<p>associated with Thunderstorms GTE 35 knots (or locally determined threshold) and less than severe threshold</p>	<p>personnel</p> <p>Increased risk of damage to unsecured property</p> <p>Increased risk to flightline activities and damage to exposed aircraft or vehicles</p>	<p>onset, duration and intensity</p>
<p>Freezing Precipitation</p>	<p>Threshold determined by local emergency management agencies</p> <p>Default parameter: Liquid precipitation of any type and intensity falls and produces glaze ice on exposed surfaces</p>	<p>Range of impacts dependent on precipitation type and intensity</p> <p>Examples: Light freezing drizzle increases risk of unsafe driving conditions and disrupts flightline or maneuver activities Effects can be mitigated</p> <p>Moderate or greater intensity freezing rain (ice storm) poses significant risk of damage to facilities and rapidly creates hazardous conditions for personnel and vehicle movement that cannot easily be mitigated</p>	<p>1 hour advance notification of onset, duration, and character (type and intensity of precipitation)</p> <p>See Note 3</p>
<p>Heavy Snow</p>	<p>Threshold determined by local Emergency management agencies</p> <p>New snowfall of a measurable amount (as determined by emergency management agencies) during a specified time period</p> <p>If no local threshold exists use 2" in 12 hours</p>	<p>Disrupts personnel movement or flight line activities</p>	<p>1 hour advance notice of the period meeting or exceeding the heavy snow threshold</p> <p><u>Example:</u> Emergency management determines that 2" of new snow in a six hour period poses a credible threat to the installation. OWS will provide 1 hour advance notice of precipitation events meeting the</p>

			threshold. Warning will be issued at least one hour prior to the indicated onset of the period of measurable snowfall accumulation. Warning text will indicate maximum expected snowfall accumulation during the period specified in the warning
Blizzard	All of the following must occur: a) Surface visibility less than or equal to ¼ mile/400 meters b) Considerable falling and/or blowing snow c) Sustained wind speeds or gusts ≥ 30 knots d) Duration ≥ 3 hours	Imposes significant risk to personnel movement Significant risk to maneuver or flight line activities	1 hour advance notice of onset, duration, and character (persistent or intermittent) of conditions meeting or exceeding threshold
Heavy Rain	Threshold determined by local emergency management agencies Default parameter: New liquid precipitation accumulation of a measurable amount (as determined by emergency management agencies) during a specified time period If no local threshold exists use 2" in 12 hours	Increased threat of flash flooding or systemic flooding posing credible threat to unprotected resources and personnel Disrupts flightline and maneuver activities Imposes increased risk on personnel movement	1 hour advance notice of the period meeting or exceeding the heavy rain threshold <u>Example:</u> Emergency management agencies determine that 4" of rain in a nine hour period poses a credible threat to the installation. OWS will provide 1 hour advance notice of precipitation events meeting the threshold. Warning will indicate onset, duration, and anticipated maximum rainfall accumulation
Sandstorm	Winds carrying sand particles from the surface to no more than fifty feet above the surface, prevailing	Disrupts personnel movement and aviation operations	1 hour advance notice of the period meeting or exceeding threshold

	visibility < 5/8 to 5/16 statute miles (1000 to 500 meters). For prevailing visibility of < 5/16 statute miles (500 meters), the storm is considered a heavy sandstorm		
Duststorm	Winds carrying dust particles from the surface to approximately ten thousand feet above the surface, prevailing visibility < 5/8 to 5/16 statute miles (1000 to 500 meters). For prevailing visibility of < 5/16 statute miles (500 meters), the storm is considered a heavy duststorm	Disrupts personnel movement and aviation operations	1 hour advance notice of the period meeting or exceeding threshold
Lightning	Lightning within 5 statute miles	Immediate threat to exposed personnel	As observed

Note 1. Lead-time requirement determined by needs of the military decision making process at the affected installation. Default lead-times will be used when a local requirement has not been specifically stated.

Note 2. Mandatory EU Severe Weather Action Plan (SWAP) criteria.

Note 3. EU SWAP activities dictated by local policy.

4.1.8. Verification. Warnings and advisories will be verified using all available sources of representative sensed or observed data or subjective analysis (when appropriate) within an expanding radius around a specific geographic location based on the desired lead-time requirement of the warning or advisory product (see **Figure 4.1.**). Unit leadership will ensure verification sources are credible. The greater the lead-time requirement levied on the characterization unit, the wider the radius around the point location employed in data collection for verifying warnings and advisories. Employing a flexible verification range acknowledges limitations in the state of the meteorological art and provides a measure of accuracy similar to delivery error components of weapons delivery metrics resulting in determination of a circular error probability (CEP). Although loosely based on these concepts, the results are familiar to military decision makers employing weather warning and advisory products to conduct operations and protect resources and personnel.

4.1.8.1. WWA products will specifically state the area affected by the WWA product. Normally, this is a 5 nautical mile circle around the center of a runway complex, a point within a range complex, or a specific location. The area enclosed by a 5NM circle around the point is known as the specification distance and considered “at the location” for verification of WWA products. WWA products issued for an area such as a missile field, exercise area, or maneuver area are geographically irregular in dimension and may not be associated with a specific point like an airfield complex. Weather events occurring within the geographic confines of the area are considered “at the location” for verification purposes and there is no CEP.

4.1.8.2. Observed warnings and advisories are verified using sensed or observed data within the specification distance from the point location. For example, a warning for lightning within 5NM of an airfield is issued and simultaneously verified based on lightning strikes, radar returns within the specification distance, or reporting TS as a weather type in the body of an observation.

4.1.8.3. Warnings and advisories issued with lead-times are verified using an expanded verification radius, not to exceed 15nm, around the affected location using the graph in **Figure 4.1**. The verification radius is completely independent of specification distance and is employed to ensure adequate sampling of the environment for verification purposes only.

4.1.8.3.1. Characterization units will omit reporting locations within the verification radius that are not representative of the location receiving WWA products. Document these sites in forecast reference material or SOPs. For example, wind reports from a meteorological reporting station within the verification radius at a higher elevation than the warned location will be excluded because wind speeds at that elevation do not accurately represent conditions at the warned location

4.1.8.3.2. Characterization units will employ all data available from representative sources of sensed or observed data within the verification radius to objectively verify warnings and advisories. Sensed data from Doppler radars, mesonets, environmental monitoring systems, tactical air traffic control (ATC) systems, forward armament and refueling points, other sensing systems, or storm spotter reports are considered objective data for evaluating and verifying WWA products. Unofficial reports from credible sources (e.g., law enforcement and fire and rescue personnel) within the verification radius of the warned location will only be used to verify warnings and advisories when unit leadership determines the reports are credible based on corroborating objective weather data or subjective analysis of relevant weather data.

4.1.8.3.3. In cases where objective verification is not possible, inadequate, or misrepresentative, characterization units may analyze available data to determine if the event actually occurred. In situations where units use subjective verification, they will also take responsibility for a missed occurrence of the weather threat if these phenomena are reported with no WWAs in effect at that time.

4.1.8.4. Units issuing WWAs will verify each phenomenon separately except as indicated below.

4.1.8.4.1. Severe thunderstorm and moderate thunderstorm warnings will be verified upon first occurrence of either wind or hail threshold at the warned location. Occurrence of either of the specified criteria in severe thunderstorm and moderate thunderstorm warnings verifies these warnings; the criteria are “bundled” for verification purposes.

4.1.8.4.2. Verify a lightning watch as if it were a forecast WWA product with a 30-minute desired lead-time. Lead-time will be based on the issued time of the watch subtracted from the time of first occurrence of the lightning within specification distance of the warned location.

4.1.8.5. Verify heavy precipitation warnings using measurements from the airfield observing system, Doppler radar precipitation measurements, other rain gauges, or storm reports in the verification radius for the warned location.

4.1.8.5.1. Heavy rain warnings specifying an accumulation in a specified time period. These warnings will be verified using a summation of the one-hour precipitation measurements from the airfield observing system. Collect the one-hour amounts reported by the airfield observing system commencing with the cardinal hour that the warning was issued and indicate on a weather warning verification tracker when the specified precipitation total was reached. Continue to collect the one-hourly accumulations during the valid period of the warning and enter the total liquid precipitation received during the valid period of the warning into the verification database.

4.1.8.5.2. Characterization units will use accumulated reports of six-hourly, 12-hourly, or summary of the day during the valid period of the warning for verifying heavy rain warnings at locations where the characterization unit does not have access to the hourly rain gauge data from an airfield observing system. Actual time of occurrence may be estimated based on interpolations from the rate of accumulation in METAR or Synoptic reports.

4.1.8.5.3. Characterization units with access to WSR-88D Doppler radar data will use radar generated precipitation total products to supplement direct measurements from a rain gauge, and verify precipitation accumulation warnings provided the data has been evaluated for accuracy (account for high reflectivity phenomena such as hail or bright band contamination of the data). Characterization units may use radar measured precipitation products from other radar types if the data are considered reliable.

4.1.8.5.4. Characterization units may use reports of flooding or visible damage within the area covered by a warning as subjective verification of a heavy rain warning.

4.1.8.5.5. Heavy snow warnings will specify a threshold snow accumulation over a specified period of time and will be verified using manually observed snowfall totals from Air Force, sister service, coalition partners, or host nation sources where the capability exists.

4.1.8.5.6. In the absence of manual snowfall totals, characterization units will convert one-hour liquid precipitation measurements into hourly snow equivalent using Table 12.1. in AFMAN 15-111, *Surface Weather Observations*. Collect the one-hour

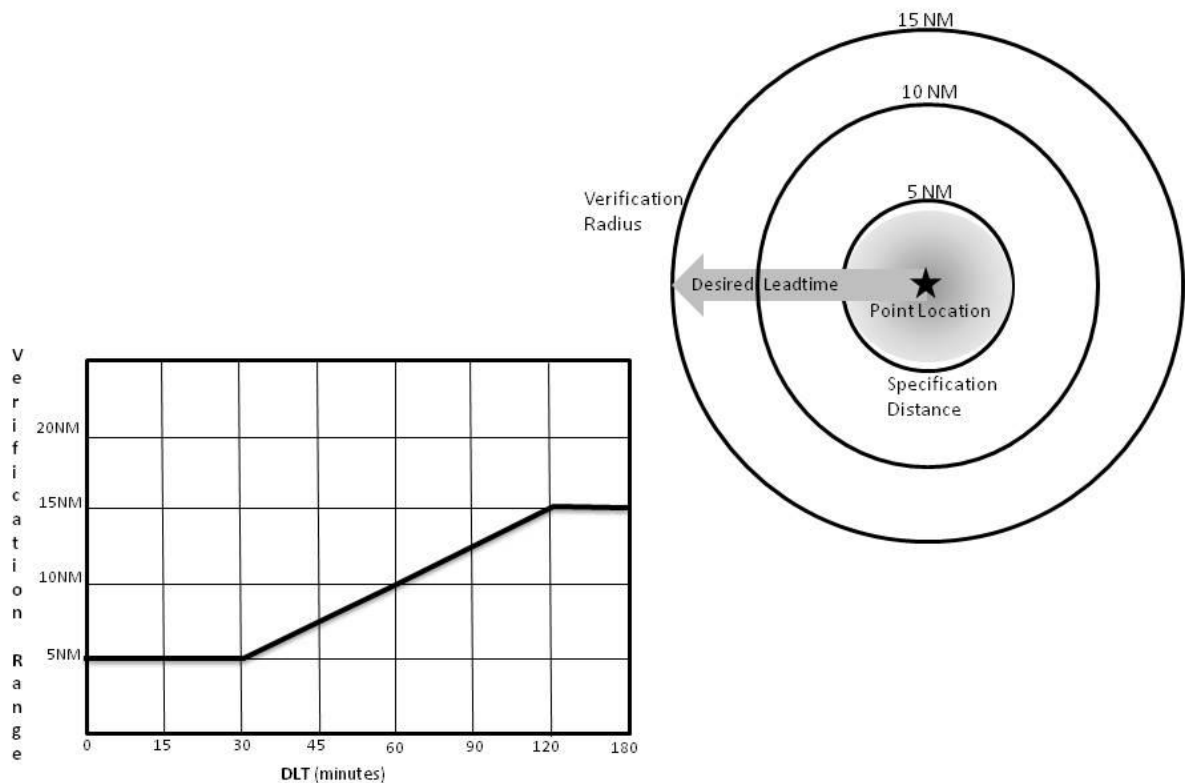
amounts reported by the airfield observing system commencing with the cardinal hour that the warning was issued, and indicate on a weather warning verification tracker when the specified snowfall total was reached. Continue to collect the one-hourly accumulations during the valid period of the warning and enter the total snowfall and liquid precipitation received during the valid period of the warning into the verification database.

4.1.8.5.7. Weather radar data is unreliable for determining snowfall and will not be used to objectively verify heavy snow warnings. Characterization units may use radar reflectivity returns to subjectively evaluate heavy snowfall warnings to justify warnings that do not verify by other means.

4.1.8.5.8. Characterization units will use accumulated reports of six-hourly, 12-hourly, or summary of the day during the valid period of a heavy snow warning at locations where the characterization unit does not have access to hourly data from an airfield observing system. Actual time of occurrence may be estimated based on interpolations from the rate of accumulation in METAR or Synoptic reports. Use the observation date/time group on METAR reports with Snow increasing rapidly remarks (SNINCR s/tt) to verify heavy snow warnings when either value in the remark meets or exceeds the warning threshold.

4.1.8.6. Characterization units will verify all WWAs transferred to them from a sister unit or an EU during/after a disruption in services and enter the verification data in the Air Force weather dissemination system.

4.1.8.7. Document sound meteorological reasoning used in determining the need for all forecast WWAs in the appropriate spaces provided in the Air Force weather dissemination system.

Figure 4.1. Determining Verification Radius based on Desired Lead-Time Requirement

4.1.8.8. Warnings and advisories fall into one of four verification categories.

4.1.8.8.1. Hit:

4.1.8.8.1.1. Issued and verified within 10% of the threshold w/in 5nm radius of the affected location with at least 75% desired lead-time.

4.1.8.8.1.2. Issued and verified within the verification radius with at least 75% of desired lead-time. Characterization units may accept 50% of desired lead-time outside of 11 nautical miles for convective systems transiting the verification radius at speeds of 30 knots or greater.

4.1.8.8.2. Push / Miss: Not issued; occurred w/in lead-time verification radius but not w/in 5 nm radius. Note: a push warning is an event considered significant to meteorologists but did not impact the mission at the warned location.

4.1.8.8.3. Miss:

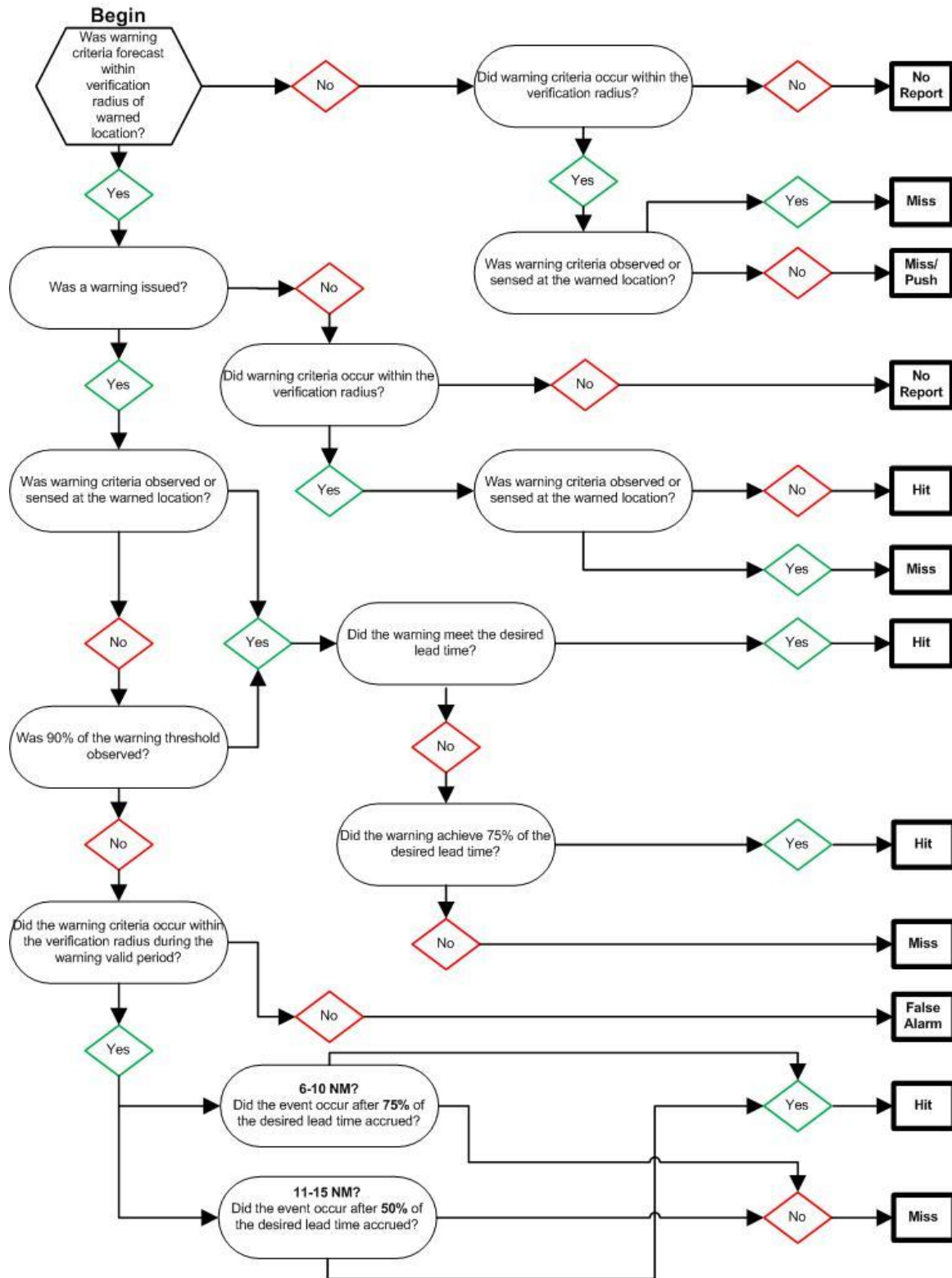
4.1.8.8.3.1. Not issued but event occurred w/in 5 nm radius or lead-time verification radius of the affected location.

4.1.8.8.3.2. Occurred within the verification radius but did not provide at least

75% desired lead-time. Note: characterization units may accept 50% lead-time outside of 11 nautical miles from the warned location in the event of convective systems moving at speeds of 30 knots or greater through the verification range of the warned location.

4.1.8.8.4. False Alarm: Issued but event did not occur w/in the 5nm radius or lead-time verification radius of the affected location.

Figure 4.2. Weather Warning and Advisory Verification Process



4.1.9. Lead-time Computation

4.1.9.1. Actual lead-time is the time elapsed between the issue time of the warning and advisory and the first time of occurrence.

4.1.9.2. Actual lead-time computation for warnings and advisories that are downgrades from an existing warning or advisory is based on the issue time of the first warning or advisory provided there is no break in coverage. Ensure there is no break in coverage and a “DOWNGRADE” remark is appended to the new warning or advisory. If a break in coverage does occur, actual lead-time will be computed from the new issue time.

4.1.10. In addition to the verification procedures described in paragraph 4.1.8, characterization units will continue to use legacy verification techniques IAW AFI 15-114, *Functional Resource and Weather Technical Performance Evaluation* until further guidance is issued.

4.1.11. Provide WWAs using the rules and information in **Tables 4.2 and 4.3**.

Table 4.2. Rules for Issuing WWAs

1. A Watch is not a substitute for a Warning. Units will issue Warnings, as required, regardless of whether or not a Watch had previously been issued.
2. All Watches and WWs are issued for specific and distinct locations.
 - The area affected by a Watch or Warning will be clearly indicated in the text of the Watch/WW.
 - Watches may be issued for an area larger than the corresponding Warning (Watch for base X and surrounding local flying area, WW for the aerodrome).
 - WW normally affect an area no larger than 5 nautical miles (nm) radius (except for lightning warnings that have a minimum radius of 5 nm). Document deviations in supported agency data pages or parent MAJCOM plans or instructions.
 - Watches and WWs for Military Operating Areas (e.g., training areas, ranges, and missile complexes) may cover larger areas.
3. The lightning watch and the observed lightning warning are separate entities and do not supersede previously issued Watches or WWs for other criteria.
4. A separate valid time will be specified for each criterion when warranted.
 - All times used in a Watch or WW will be expressed in Coordinated Universal Time (UTC) and Local Time.
 - **Exception:** A valid time is not used in observed warnings. In place of valid time, the following statement is used: "*Valid until further notice.*"
5. Do not issue a forecast WWA for a single unforecasted event that is not expected to persist or recur. Account for this as a miss.
6. Characterization unit will issue observed warnings when EU is not on duty, as capability exists.
7. More than one advisory may be in effect at the same time for the same location, but only one will be in effect for a particular phenomenon at the same time.
8. Under rare circumstances EUs may, without prior coordination, issue WWs to facilitate resource protection actions when sufficient time does not exist to communicate a change in weather with the characterization unit. EUs will forward pertinent information to the servicing characterization unit to ensure the warning is entered into the Air Force weather dissemination system.
9. EUs will issue observed WWAs to include lightning warnings while on duty.

Table 4.3. Rules for Amending, Extending, and Canceling WWAs

1. When a Warning or advisory no longer adequately describes the phenomenon's expected occurrence, issue a completely new warning or advisory with a new number.
 2. WWAs may be extended provided the extension is issued prior to the expiration of the original notice.
 3. Clearly state how the amended or extended WWA affects any previously issued notice.
 4. Cancel WWAs when previously forecast/observed conditions are no longer occurring and are not expected to recur.
 5. Lightning Watches are canceled only when the potential for lightning within the next 30 minutes is no longer forecast. Do not cancel if there is potential for another thunderstorm within 30 minutes.
 6. Cancel WWs for OBSERVED LIGHTNING when thunderstorms have dissipated or passed beyond the area covered by the Warning and lightning is no longer occurring within 5NM of the installation. For lightning warning cancellations, include a statement indicating its affect on any previously issued warnings, such as "WEATHER WARNING #XX-XXX remains in effect" or "WEATHER WATCH #XX-XXX FOR LIGHTNING REMAINS IN EFFECT."
- Note:** The EU, or OWS when the EU is off duty, will cancel the lightning warning.

4.1.11.1. Weather Advisories.

4.1.11.1.1. Advisories provide specific notice to an operational agency of environmental phenomena impacting operations. Weather advisories issued with an advance notice requirement are known as a Forecast Weather Advisory (FWA) and advisories issued to provide notice of an event's occurrence are known as an Observed Weather Advisory (OWA). EUs will coordinate advisory requirements with the servicing OWS for criteria or phenomena for which a local capability to forecast does not exist and will include in local Mission Weather Product (MWP) as required.

4.1.11.2. Characterization units will issue FWAs for specific criteria, where sensing capability exists, as documented in the data page.

4.1.11.2.1. Characterization units will not issue OWAs when the EU is on duty.

4.1.11.2.2. OWAs that impact flight operations will not be issued when the airfield is closed or during non-duty hours, but may be issued for hazards that affect airfield operations.

4.1.11.2.3. When several units require Weather Advisories (WAs) for similar criteria, characterization units may consolidate advisories to the extent possible without compromising the requirements of supported agencies.

4.2. WWA Backup Procedures.

4.2.1. When the primary notification system is inoperable, weather agencies issuing WWAs will record notification and verification on an AF IMT 3807, *Watch/Warning Notification and Verification*, or on an AF IMT 3806, *Weather Watch Advisory Log*, as applicable, until a

global database capability is restored. Instructions for completing the AF IMT 3807 and 3806 are found in attachments 5 and 6 respectively.

4.2.2. In the event a WWA does not reach the intended agency, the issuing authority is responsible for notifying ATC and the Command and Control (C2) authority responsible for the Installation Notification and Warning System, (per AFI 10-2501, *Emergency Management Planning and Operations*) as identified in the supported agency data page. In the event additional notifications are required, they will be documented in the supported agency data page.

4.3. Other Products.

4.3.1. SWS. OWSs will issue SWS products to notify military decision makers of widespread severe weather events affecting military installations serviced by the OWS. SWSs will be routinely updated as conditions warrant.

4.3.1.1. SWS is a stand-alone product normally issued 48-72 hours in advance of the forecast event.

4.3.1.2. SWS will be an A/N product describing the type, onset, duration, and area impacted by the event and will be disseminated via common user communications.

4.3.1.3. SWS may also include graphical depiction of the forecast event.

4.3.1.4. OWSs will communicate the potential of significant weather events to supported WFs (as applicable) for evaluation, prior to dissemination of SWSs to the WF's supported parent/host unit(s).

4.3.2. Space Weather. Characterization units will host on their webpage, appropriate theater-specific space weather products issued by the 2d Weather Squadron (2 WS).

4.3.3. Volcanic Ash. Characterization units will host appropriate theater-specific volcanic ash products on their webpages. The primary source is the WMO volcanic ash advisory centers (VAACs). If responsible VAAC cannot produce the volcanic ash products, then the 2WS will be the primary source. Characterization units will include remarks in text forecasts horizontally consistent with the VAAC products where applicable.

4.3.4. Characterization units may produce additional products to meet WF requirements based on specific operational necessities as documented on the data page.

4.3.5. Characterization units may leverage unique products from other meteorological agencies to include US, civilian, and military agencies (e.g., Naval worldwide oceanographic products), and foreign nation products. These products will be displayed directly or will exist as links to the operational products hosted elsewhere.

4.3.6. OWSs will provide a summary of severe weather events in their AOR for the Air Force Director of Weather and MAJCOM functional managers.

4.3.6.1. The 1 WXG will consolidate subordinate unit reports into a single submission.

4.3.6.2. The report will summarize verification data for tornados, damaging wind, and damaging hail events and their respective lead-times for the warnings covering those events. See example in **Figure 4.3**.

4.3.6.3. Report will contain hits, misses, and false alarms at main operating locations, missile fields, tethered aerostat sites, and significant locations in the OWS region.

Figure 4.3. Sample Daily Severe Weather Storm Report Format

<p>Summary of severe weather at AF/Army Total Force installations in CONUS during 01 June 11 1200Z - 02 Jun 11 1200Z.</p> <p>Tornado:</p> <ul style="list-style-type: none"> - Tornado 5NM SW of Westover AFB, MA (KCEF) on 01 June 11/2032Z -- Tornado warning issued with 8 min lead time (DLT 10 min) -- Verified by SPC storm report 42.14N 72.76W -- HIT by rule: Threshold observed within specification distance with GT 75% DLT -- No damage reported <p>Winds:</p> <ul style="list-style-type: none"> - 53 knots at Holloman AFB, NM (KHMN) on 02 June 11/0339Z -- Damaging wind warning (GTE 50 knots) issued with 1 hr 16 min lead time (DLT 2 hrs) -- KHMN Peak Wind in METARs 40 knots; 53 kts observed on inactive sensor before FMQ-19 failed -- MISS by rule: Threshold observed at warned location with LT 75% DLT -- No damage reported ATTM <ul style="list-style-type: none"> - 62 knots 5NM NNW of Edwards AFB, CA (KEDW) on 01 June 11/2029Z -- No damaging wind warning issued, threat correctly assessed as confined to higher elevations -- Strong wind warning (35-49 knots) in effect for the KEDW aerodrome -- Verified based on report from non-network mesonet sensor 34.91N 117.90W -- HIT by rule: Threshold correctly characterized within verification range but not at warned location -- No damage reported <p>Hail:</p> <ul style="list-style-type: none"> - 1 inch hail 1NM NE of the White House on 01 June 11/2223Z -- Damaging hail warning (GTE 3/4 inch) issued with 2 hr 36 min lead time (DLT 2hrs) -- Verified by SPC storm report 38.97N 76.98W -- HIT by rule: Credible report within specification distance meeting DLT -- No damage reported <p>Hits: 3 Misses: 1 False Alarms: 2</p>

4.4. Disseminating Weather Products

4.4.1. Characterization units will:

4.4.1.1. Post all OWS products and those made available from other sources (e.g., Space products, leveraged products, etc.) on its Non-Classified Internet Protocol Router Network (NIPRnet) webpage, and post mission-essential products on its SECRET Internet Protocol Router Network (SIPRnet) (if available) and JWICS (if available) webpage as needed to meet supported user requirements.

4.4.1.2. Transmit required products and data via common-user communication and satellite communication networks, as required for supported operations in their AOR.

4.4.1.3. Disseminate TAFs to WFs and other supported users (if applicable) using AF dissemination systems. Characterization units may use MAJCOM-approved theater specific, or joint dissemination systems as required.

4.4.1.4. Post a summary of current Characterization unit-issued WWAs to its NIPRnet/SIPRnet webpages.

Chapter 5

TROPICAL SUPPORT OPERATIONS

5.1. Tropical Support Operations. Tropical cyclones pose a significant threat to lives, property, and operations. Military decision makers at affected installations are driven by directive to take time-phased actions to evacuate or shelter personnel and aviation assets that are largely influenced by forecast elements. Characterization units provide detailed information based on the official track forecast to facilitate efficient and effective evacuation, survival, and post event reconstitution activities. Horizontal consistency between national centers, characterization units, Air and Space Operations Centers (AOC), and WFs is critical to successful planning and execution of military operations driven by tropical cyclone events. The National Hurricane Operations Plan clarifies terms and establishes policies, procedures, and responsibilities in the Atlantic and the Eastern and Central Pacific westward to 180 degrees longitude. Pacific Air Force Instruction (PACAFI) 15-101, *Weather Support for PACAF*, provides information for the Pacific Ocean west of 180 degrees longitude and the Indian Ocean.

5.1.1. Procedures. Characterization units will fully exploit on-line forecast resources provided by tropical cyclone forecast centers (i.e., the Tropical Prediction Center (Miami, FL), the Central Pacific Hurricane Center (Honolulu, HI), and the Joint Typhoon Warning Center (Pearl Harbor, HI)).

5.1.1.1. Characterization units will not deviate from the official forecast position, track, movement, forecast cone, and maximum wind speed associated with a tropical cyclone except for the following.

5.1.1.1.1. Warnings and advisories issued for feeder band convective activity (away from the storm center) may exceed forecast maximum wind for that time period.

5.1.1.1.2. Characterization units may adjust forecast wind speeds if terrain, foliage, and land use data for an affected location indicates higher or lower wind speeds than originally forecasted.

5.1.1.2. OWSs will depict tropical cyclone centers, and caveat that moderate to severe flight hazards are implied in and near tropical cyclones. The non-convective flight hazards in areas where synoptic-scale features interact with the tropical cyclone will be depicted on graphical charts.

5.1.1.3. Characterization units will perform METWATCH responsibilities and serve as the primary liaison between the tropical cyclone forecast centers and EUs.

5.1.1.4. Queries for tropical storm information from non-operational sources will be directed to publically available products from responsible forecast agencies (National Weather Service (NWS), National Hurricane Center (NHC), etc).

5.2. Tropical Cyclone Threat Assessment Product (TC-TAP). The purpose of the TC-TAP is to provide a standardized product for exploitation units to use in assisting installation commanders and Emergency Management personnel in making decisions on the evacuation and sheltering of aircraft and personnel, and on other mitigation actions.

5.2.1. OWSs will produce a coordinated TC-TAP for supported locations within their area of responsibility (AOR) expected to experience sustained winds \geq 35-knots during the next 96 hours as a result of a tropical cyclone. Characterization units will provide site-specific TC-TAP information as requested by exploitation units.

5.2.2. The TC-TAP will contain, at a minimum, the following:

5.2.2.1. Time and date product was produced and the NHC/CPHC/Joint Typhoon Warning Center (JTWC) bulletin number/ identifier used to create the product.

5.2.2.2. Onset and duration of sustained 35-knot and 50-knot winds.

5.2.2.3. Peak wind and time of occurrence, including gusts.

5.2.2.4. Onset and duration of operationally significant (locally determined) crosswinds, including gusts for the primary instrumented runway. Use 25-knot crosswinds as the default.

5.2.2.5. Closest point of approach of the storm relative to the installation.

5.2.2.6. Forecast cone product.

5.3. Preparation/Dissemination of TC-TAP. OWSs will:

5.3.1. Use approved software applications.

5.3.1.1. The standardized software for producing TC threat assessments is the tropical cyclone software contained in the baseline OWS Production System.

5.3.1.2. The TC-TAP will be valid through a minimum of 96 hours and updated as new information is received from the NHC, CPHC, and/or JTWC.

5.3.2. Develop procedures to expeditiously disseminate the TC-TAP information to all applicable organizations. Ensure TC-TAP information is consistent from initial dissemination through actual posting of the information on the webpage.

Chapter 6

CONTINUITY OF OPERATIONS

6.1. Continuity of Operations. Characterization units must be prepared to continue mission-essential functions without significant interruption during a national security emergency or other disruptive conditions, such as major equipment/communications outages or evacuations. To ensure continuity of operations during these situations, units will develop processes to use alternate equipment/systems, operate from alternate locations, or arrange transfer of critical functions to other organizations. Units aligned to provide continuity of operations support for another unit must be capable of providing the support and be fully prepared to assume the responsibility in minimum time. Characterization units will:

- 6.1.1. Establish and formally document continuity of operations processes and procedures.
- 6.1.2. Provide a copy of the continuity of operations documents to all organizations tasked to provide backup support.
- 6.1.3. Make continuity of operations documents available to supported units upon request IAW parent MAJCOM policies and procedures.
- 6.1.4. Review and update continuity of operations processes and procedures, consistent with MAJCOM continuity of operations policies or as necessary, to reflect substantive changes in operations.
- 6.1.5. Exercise continuity of operations processes quarterly. Real world events meet this requirement if properly evaluated and documented, to include lessons learned.

Chapter 7

SPACE WEATHER CHARACTERIZATION

7.1. General. Space weather describes the conditions in space that affect the near-Earth space environment, satellites, and ground based systems used by the military and civil sectors. Space weather is a consequence of the behavior of the Sun, the nature of Earth's magnetic field and atmosphere, and our location in the solar system. Just as AFW organizations characterize, exploit, and tailor the terrestrial weather for military operations, they have the same responsibility for space weather.

7.2. 2d Weather Squadron (2 WS). 2 WS is the Air Force's characterization unit for space weather. 2 WS will:

- 7.2.1. Operate the Air Force's Solar Electro Optical Observing Network.
- 7.2.2. Maintain space weather modeling capabilities.
- 7.2.3. Provide event level alerts and warnings to DoD organizations.
- 7.2.4. Provide routine bulletins, notices, and data which characterize the current state of space weather.
- 7.2.5. Work closely with other national space weather partners to leverage available resources to characterize space weather.
- 7.2.6. Coordinate space anomaly assessments with the 21st Operations Support Squadron Weather Flight (21 OSS/OSW) and 614th Air and Space Operations Center Weather Specialty Team (614 AOC/CODW).
- 7.2.7. Maintain a Space Weather Catalog that describes all the space weather products issued.
- 7.2.8. Respond to space weather support requests submitted through the SAR process.
- 7.2.9. Upon notification of a space anomaly, save all pertinent space weather data necessary to completely reconstruct the environmental picture at the time of the anomaly.

JOHN W. HESTERMAN III, Maj Gen, USAF
Assistant DCS, Operations, Plans and Requirements

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Abbreviations and Acronyms

A3O—W - Director of Weather

AF—Air Force

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFMD—Air Force Mission Directive

AFPD—Air Force Policy Directive

AFP—Analysis and Forecast Program

AFS—Air Force Specialty

AFVA—Air Force Visual Aid

AFW—Air Force Weather

AFWA—Air Force Weather Agency

ANG—Air National Guard

AOC—Air and Space Operations Center

AOR—Area of Responsibility

ATC—Air Traffic Control

BKN—Broken

C2—Command and Control

CBRNE—Chemical, Biological, Radiological, Nuclear, and High-yield Explosive

CEP—Circular Error of Probability

COA—Course of Action

CONUS—Continental United States

COOP—Continuity of Operations Plan

DoD—Department of Defense

DPD—Dew Point Depression

EPS—Ensemble Prediction Suite

EXTRM—Extreme

FITL—Forecaster-in-the-Loop

FWA—Forecast Weather Advisory

GTE—Greater Than or Equal

HWD—Horizontal Weather Depiction

IAW—In Accordance With

ICAO—International Civil Aviation Organization
ISOLD—Isolated
JFC—Joint Force Commander
JMO—Joint Meteorological and Oceanographic Officer
JOAF—Joint Operational Area Forecast
JTWC—Joint Typhoon Weather Center
LCL—Lifted Condensation Level
LGT—Light
LI—Lifted Index
LT—Less Than
MAJCOM—Major Command (Air Force)
MDT—Moderate
METOC—Meteorological and Oceanographic
METSAT—Meteorological Satellite
METWATCH—Meteorological Watch
MISSIONWATCH—Mission-Scale Meteorological Watch
MOAF—Military Operating Area Forecast
MSL—Mean Sea Level
MWP—Mission Weather Product
MXD—Mixed
NATO—North Atlantic Treaty Organization
NIPRNet—Non-Classified Internet Protocol Router Network
NHC—National Hurricane Center
NMRS—Numerous
NWP—Numerical Weather Prediction
OCONUS—Outside the Continental United States
OPR—Office of Primary Responsibility
OPVER—Operational Verification
ORM—Operational Risk Management
OVC—Overcast
OWA—Observed Weather Advisory
OWS—Operational Weather Squadron

PIREPS—Pilot Reports
QPF—Quantitative Precipitation Forecast
ROT—Rule of Thumb
SAR—Support Assistance Request
SCT—Scattered
SIPRnet —SECRET Internet Protocol Router Network
SVR—Severe
SWAP—Severe Weather Action Plan
SWS—Special Weather Statement
SYOS—Systems Operations Squadron
TAF—Terminal Aerodrome Forecast
TTPs—Tactics, Techniques, and Procedures
USAF—United States Air Force
VAAC—Volcanic Ash Advisory Center
VAD—Velocity Azimuth Display
WA—Weather Advisory
WARNVER—Warning Verification
WF—Weather Flight
WMO—World Meteorological Organization
WS—Weather Squadron
WST—Weather Specialty Team
WW—Weather Warning
WWA—Watch, Warning, and Advisory

Terms

Air Force Weather Agency (AFWA)— A strategic weather center at Offutt AFB NE, providing atmospheric data and analysis/forecast products required by the regional OWSs and the WFs worldwide. AFWA provides the centralized repository for global observations and forecasts that are data based at AFWA and, in turn, disseminated to DoD weather data users worldwide. In addition to global observations and forecasts collected from worldwide sources, AFWA collects meteorological satellite data from multiple sources. Based on global analysis of available data, AFWA creates global analysis and forecast products to meet the forecast requirements of its supported users.

Analysis and Forecast Program (AFP)— A systematic and consistent approach to weather forecasting. The AFP identifies techniques and tools used to forecast individual weather

elements, describes requirements for locally prepared work charts/composites, and explains refinements and application of centralized products.

Climatology— The historical records of weather conditions measured or observed at a specific location is known as climatology. Some data go back over 100 but generally a 10- to 25-year history is more common. Climatology is useful in planning operations beyond 5 to 7 days. It usually describes the average (or mean) conditions such as high and low temperatures and extremes.

Desired Lead Time (DLT)— The total amount of time required to disseminate a forecast WWA from the supporting OWS through the local dissemination tree to all affected end-users plus the amount of advance notice a supported organization requires to complete mandatory protective actions before the onset of a particular weather phenomenon.

False Alarm— When a lightning watch, weather warning, or forecast weather advisory is issued and the specified criteria do not occur during the specified valid time.

Forecaster—In-the-Loop (FITL) - Term covering a range of human activities to ensure forecast

information is meteorologically sound. FITL activities span a broad spectrum from a basic review and editing of information to a detailed production process resulting in forecaster— created weather products such as graphical forecast products or mission specific environmental impacts decision aids.

FITL Graphics (Standard)— A suite of weather products depicting standardized criteria, created by

forecasters in an Operational Weather Squadron for a specific geographic region. These products represent the sum of the forecasting activities for basic weather parameters necessary for creation of mission execution forecasts.

Forecast Weather Advisory (FWA)— A weather advisory issued when the supported user requires advance notification of an impending weather condition with sufficient time to allow for protective actions.

Forecast Worksheet— Tool used to document, track, and evaluate past and future weather events. It may contain forecast rules-of-thumb, question and answer discriminators, decision logic trees, etc., to help develop a forecast.

Horizontal Consistency— Weather data provided in one product that is consistent to data provided in another product for the same area and time. For example, TAFs must be consistent with all other products, including the current observation, weather warnings, weather advisories, lightning watches, etc. Elements within each TAF must also be consistent, for example, if heavy snow showers are forecast, the visibility will be restricted appropriately. Strong gusty winds or hail would generally be expected if severe thunderstorms were forecast. Product consistency prevents supported users from receiving conflicting information.

ICAO Identifier— A specifically authorized 4-letter identifier assigned to a location. The ICAO is not to be confused with the Routing Identifier used by the Automatic Digital Weather Switch to transmit addressed messages including Automated Response to Queries. Routing IDs may not always match a station ICAO and can have 5 characters.

Installation Data Page— A document defining the specific environmental support requirements, technical data, reference material, and contact information for each organization receiving TAF and WWA support from the OWS.

International Civil Aviation Organization (ICAO)— A United Nations organization specializing in international aviation and navigation.

Issue Time— The time when an agency is notified of a watch, warning, or advisory. When more than one agency is notified, the issue time is the time the last agency is notified. Follow-up notifications are not considered when determining issue time.

Joint Operational Area Forecast (JOAF)— The JOAF, as approved by the Joint Meteorological and Oceanographic (METOC) Officer (JMO), is the official planning forecast for all components of the joint force. It is issued at the Joint Force Commander (JFC) level to ensure that all components are aware of what the JFC is using to plan the coordinated battle. Significant deviations from the JOAF will be coordinated with the JMO. Components and individual units will use the JOAF as the point of departure to tailor METOC information and to develop tailored mission execution forecasts. The JOAF may include a forecast database when needed for tactical decisions used in planning.

Lead Weather Unit— The weather unit having overall responsibility for coordinating air and space

weather support, issuing the weather support LOI, and providing or arranging forecasts for the Controlling MWP.

Main Operating Location— For the purposes of this instruction, a main operating location is a military installation operated by the US Department of Defense for which the primary flying mission is conducted by a DoD unit and the service is the primary agent responsible for Air Traffic Control. Generally, main operating locations serviced by an OWS are designated as Air Force Bases, Air Reserve Bases, Air National Guard Bases, or Army Air Fields.

Mesoscale— Systems which vary in size horizontally from 1 to 500 nautical miles (2 to 926 kilometers) and have a duration from tens of minutes to several hours (e.g., low level jets, squall lines, thunderstorms, clear air turbulence, or land-sea breezes).

METWATCH (Meteorological Watch)— A deliberate process for monitoring terrestrial weather or the space environment in an area or region. The purpose of a METWATCH is to identify when and where observed conditions significantly diverge from forecast conditions and determining courses of action to update or amend a forecast product or group of products and designated agencies notified. Strategic and Operational level weather units typically conduct METWATCH activities.

Military Operating Area Forecast (MOAF)— A forecast guidance product that provides the weather or space environmental conditions for a specific area in which military operations are occurring.

Missed Lightning Watch, Weather Warning, or Forecast Weather Advisory— When specified lightning watch, weather warning, or forecast weather advisory criteria occur but a corresponding lightning watch, weather warning, or forecast weather advisory is not issued for the event.

Mission Weather Product (MWP)— Any weather product or group of weather products generated by an Exploitation Unit that is integrated into the military decision making process. MWPs may be planning or execution products and are not limited to aviation missions.

Mission Execution Forecast Process (MEFP)— A systematic, repeatable process for tailoring weather products and forecasting mission-limiting meteorological parameters and providing decision quality environmental information for an operational end user. This process provides a basic framework for fusing perishable meteorological data, operational and strategic forecast products, and an understanding of the supported user's tactics which will be applied to any mission their supported user may undertake. The MEFP describes an end-to-end process incorporating management steps, forecast development, mission meteorological watch, and post-mission analysis of the information provided.

Mission Profile— describes a mission's operating platform(s), route, flight level(s), weapons systems, equipment, target(s), tactics/techniques/procedures (TTPs), and timing.

MISSIONWATCH (Mission Meteorological Watch)— A deliberate process for monitoring terrestrial weather or the space environment for specific mission-limiting environmental factors. The

MISSIONWATCH process identifies and alerts decision—makers to changes affecting mission success.

Numerical Weather Prediction (NWP)— The processes involved in representing the atmospheric

system with fundamental mathematical equations, which can be solved in discrete time steps to achieve a numerical forecast of the parameters (e.g., pressure, temperature, humidity) used to define the state of the atmosphere.

Objective Verification— A set of predetermined meteorological criteria used to determine the accuracy of a forecast product.

Observed Weather Advisory (OWA)— A weather advisory issued when a particular weather event first occurs and the supported user does not require advanced notification of the observed weather phenomenon.

Observed Weather Warning— A weather warning issued when a particular weather event first occurs and the supported user does not require advanced notification of the observed weather phenomenon.

Operational Risk Management— The systematic process of identifying hazards, assessing risks, analyzing risk control measures, making control decisions, implementing risk controls, and supervising and reviewing the process.

Operational Weather Squadron (OWS)— A characterization unit comprised of management, technician, and training personnel responsible for providing regional weather support. Their mission is to produce fine-scale tailored weather forecast products and services to supported users within their area of responsibility (AOR).

Pilot Report (PIREP)— A report of in-flight weather provided by an aircrew member.

Severe Thunderstorm— A thunderstorm presenting a threat to lives or property that requires agencies to enhance resource protection measures. Generally, thunderstorms producing hail greater than or equal to $\frac{3}{4}$ inch diameter and/or surface wind greater than or equal to 50 knots.

Severe Weather— Any weather condition that poses a hazard to property or life.

Severe Weather Action Procedures (SWAP)— Actions taken by a weather unit to enhance the unit's response capability during a severe weather event. Actions include, but are not limited to, recalling personnel or reallocating resources from other tasks to provide focused support during a severe weather event.

Special Weather Statement (SWS)— An environmental characterization providing advance notice of widespread hazardous weather conditions offering potential to affect military installation(s) in a specified geographic area. Special Weather Statements are provided by characterization units to improve situational awareness and facilitate risk management activities by military decision makers.

Subjective Verification— A review to determine meteorological soundness by comparing the product in question with other weather data and products.

Support Assistance Request (SAR)— Used to request specialized weather, space environmental, or climatological support from the Air Force Weather Agency (AFWA), 14 WS, MAJCOMs, or Operational Weather Squadrons (OWS).

Synoptic Scale— Systems which vary in size horizontally from 100 to 1,000 nautical miles and have a duration of tens of hours to several days (e.g., migratory high and low pressure systems, frontal systems, or tropical cyclones).

Terminal Aerodrome Forecast (TAF) - Is a standard text forecast containing the cloud cover, cloud heights, and visibility for general flight rule conditions (IAW AFI 11-202, Volume 3, General Flight Rules; and AR 95-1, Flight Regulations), as well as wind, altimeter, and other weather parameters needed to sustain the landing and takeoff of aircraft.

Valid Time (VT)— The time in which a weather watch, warning, or advisory is in effect. The start time of the VT is when the phenomenon is expected to first occur. The end time of the VT is when the phenomenon is expected to cease and no longer occur.

Weather Advisory (WA)— A special product notifying an end user when an established environmental condition effecting operations is occurring or is expected to occur.

Weather Warning (WW)— A special notice to notify installation personnel when an established

weather condition of such intensity as to pose a hazard to life or property is occurring or is expected to occur. Weather warnings provide concise information outlining environmental threats and are used by operational commanders to make resource protection decisions.







Weather Watch (WATCH)— A special notice to notify installation personnel/supported units of a potential for environmental conditions of such intensity as to pose a hazard to life or property. Weather Watches indicate a potential for environmental threats and are used by installation personnel/supported units to make force protection and risk management decisions.

Attachment 2

STANDARD WEATHER REPRESENTATION AND SYMBOLS

A2.1. General Instructions. Line types and colors for commonly used isopleths are depicted in **Figure A2.1**. The standard depictions for bounded areas of specific weather parameters are illustrated in **Figure A2.2**. **Figure A2.3** contains the standard symbols for frontal zones and other weather features.

Figure A2.1. Recommended Line Types and Colors for Commonly Used Isopleths

Isobars (Surface)	BLACK solid	
Contours (upper air)	BLACK solid	
Isotherms	RED dashed	
Isotachs	PURPLE dashed	
Isodrosotherms	GREEN solid	
Thickness	RED dashed*	

(* Only on products without isotherms)

Figure A2.2. Standard Depictions for Bounded Areas of Weather



(YELLOW solid line and optional shading)

Areas of Fog: Distribute the appropriate fog symbol over the zone.



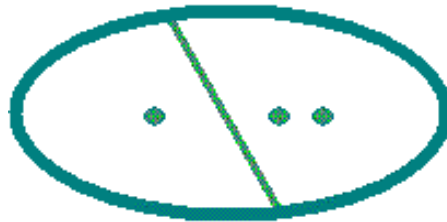
(BROWN solid line and optional shading)

Areas of Dust, Duststorms, Sandstorms, or Haze: Distribute the appropriate phenomena symbol over the zone.



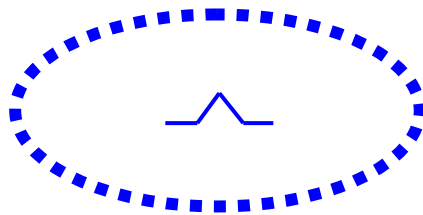
(Thunderstorms—RED line with dash or dot)
 (Rain/Snow Showers—GREEN line with dash or dot)

Thunderstorm-Convective Precipitation Areas: Distribute the appropriate convective weather symbol over the zone with the height of the thunderstorm top, if applicable.



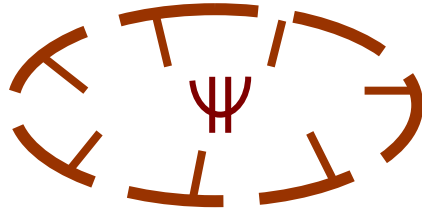
(GREEN/RED solid line)

Non-Convective Continuous or Intermittent Precipitation Areas: Distribute the appropriate precipitation symbol over the zone. Color in RED for freezing precipitation. Optional: Cross hatch continuous and single hatch intermittent precipitation.



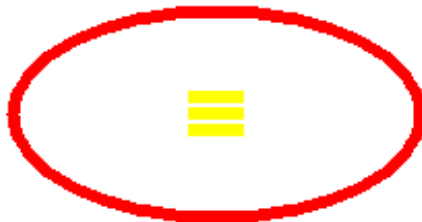
(BLUE dots or dashes: Clear Air Turbulence & Mechanical Turbulence)
 (BLUE solid line: Mountain Wave Turbulence)

Turbulence Areas: Distribute the appropriate turbulence symbol over the zone with the height of the bases and tops (MSL).



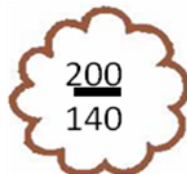
(BROWN intersecting line segments)

Icing Areas: Distribute the appropriate icing symbol over the zone with the height of the bases and tops.



(RED solid line)

Areas of Ceilings less than 1500 feet and/or Visibility less than 3 miles: Distribute the appropriate weather symbol causing IFR visibility conditions over the zone.



Cloud Forecasts greater than or equal to 1500 feet and above: Outline in BROWN scalloped line and place bases/tops inside cloud areas.



Upper-air/Severe Analysis moisture areas and of $\geq 70\%$ RH on Model Charts: Bound in light GREEN scalloped line.






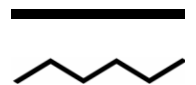




Areas of $\geq 90\%$ RH on Model Charts: Color fill/shade in GREEN, border in darker GREEN scalloped line (optional).



Dry areas on upper-air/model charts: Bound in BROWN scalloped line.

Figure A2.3. Symbols for Frontal Zones and Other Weather Features

Item	Symbol
(BLUE) Cold front at the surface	
Cold front above the surface	
Cold front frontogenesis	
Cold front frontolysis	
(RED) Warm front at the surface	
Warm front above the surface	
Warm front frontogenesis	
Warm front frontolysis	
(PURPLE) Occluded front at the surface	
Occluded front above the surface	
Occluded front frontolysis	
(ALTERNATE RED & BLUE) Quasi-stationary front at the surface	
Quasi-stationary front above the surface	
Quasi-stationary front frontogenesis	
Quasi-stationary front frontolysis	
Quasi-stationary occluded front at the surface	
Quasi-stationary occluded front above the surface	
Quasi-stationary occluded front frontolysis	
(RED or BLACK) Jet Stream maximum wind line	
(BLACK) Instability line	
Shear line	

<p>(ORANGE) Near-Equatorial Tradewind Convergence Zone, formerly called the Inter-Tropical Convergence Zone. Note: The separation of the two horizontal lines gives a quantitative representation of the width of the Near Equatorial Tradewind Convergence. The diagonal lines may be added to indicate areas of activity.</p>	
<p>(ALTERNATE RED & GREEN) Inter-tropical discontinuity</p>	
<p>(BROWN) Sub-tropical discontinuity</p>	
<p>(BLACK) Axis of trough Axis of ridge</p>	
<p>(BLUE) Highs/Anticyclones</p>	<p>H/A</p>
<p>(RED) Lows/Cyclones</p>	<p>L/C</p>
<p>Positive Vorticity Advection/Convergence Vorticity troughs Positive Vorticity Centers</p>	<p>Shade RED RED trough symbol RED X</p>
<p>Negative Vorticity Advection/Divergence Vorticity ridges Negative Vorticity Centers</p>	<p>Shade BLUE BLUE ridge symbol BLUE X</p>
<p>(RED) Tropical Depression</p>	
<p>(RED) Tropical Storm</p>	
<p>(RED) Hurricane/Typhoon</p>	
<p>Tropical Storm Wind Areas and Date/Time Labels</p>	

Attachment 3

INSTRUCTIONS FOR COMPLETING AF IMT 3807, WATCH/WARNING NOTIFICATION AND VERIFICATION

A3.1. General Instructions. Unit leaders may use these instructions as guidance in preparing local procedures for logging weather watches and warnings. Enter all times in UTC.

A3.1.1. **Block 1. Number.** Enter the locally specified number, or numbers when a watch and corresponding warning have different numbers (e.g., Watch # A4-008, WW # 4-002).

A3.1.2. **Block 2. Location.** Enter the location (installation or area) for which the watch/warning is valid.

A3.1.3. **Block 3. Date.** Enter the issue date of the watch/warning.

A3.1.4. **Block 4. Issued By.** Enter the name or initials of the individual who issues the watch/warning.

A3.1.5. **Block 5. Verified By.** Enter the name or initials of the individual who verifies the warning.

A3.1.6. **Block 6. Criteria:**

A3.1.6.1. **Watches/Warnings Are Issued For The Following.** Enter the watch/warning criteria.

A3.1.6.2. **Desired Lead-Time.** Enter the desired lead-time.

A3.1.6.3. **Valid Period.** Enter the valid period of the watch/warning on the appropriate line (opposite the criteria for which the watch/warning is issued). The ending time for observed lightning will reflect the estimated duration.

A3.1.6.4. **Forecast.** Enter the specific value or category forecast if different than that listed in the watch/warning criteria block. For example, if the threshold is for winds greater than 35 knots, but the forecast is for 40 knots, specify 40 knots in this block.

A3.1.6.5. **Verification.** See paragraph 4.1.8. for verification procedures.

A3.1.6.5.1. **Occurred.** Enter the time the weather element first occurred within the area covered by the warning. For WVs issued for winds 50 knots or greater, or hail 3/4 inch or greater that do not occur within the area covered by the warning but DO occur within 10 nautical miles, use the time the event occurred within 10 nautical miles. If the weather element did not occur, leave blank and indicate the nonoccurrence in the Did Not Occur block.

A3.1.6.5.2. **Did Not Occur.** Check those weather elements that did not occur.

A3.1.6.5.3. **Lead-Time.** Enter the actual lead-time of each verified weather element. In cases where a warning downgrades an earlier warning that did not verify (with no break in coverage), compute actual lead-time using the issue time of the earlier warning.

A3.1.6.5.4. **Timing Error.** Enter the timing error if a lead-time was computed.

A3.1.6.6. **Text.** Enter the text and valid period of the watch or warning as disseminated to customers. Overprinting the text of standardized watch warning criteria (with blanks for specific values) may improve relay times. For example, overprint:

**THUNDERSTORMS WITH _____ WINDS AND _____ INCH HAIL OR
WINDS _____ KNOTS NOT ASSOCIATED WITH THUNDERSTORMS**

This space may also be used to document extension information.

A3.1.6.7. Block 7. Dissemination:

A3.1.6.7.1. **Agency.** List all agencies notified of the watch or warning. Include the primary dissemination system and all agencies not on the primary dissemination requiring notification. Some agencies on the primary dissemination system may require a backup call to verify receipt (indicated by an *); do not use the time of backup calls in verification statistics.

A3.1.6.7.2. **Contact.** List primary and secondary means of contacting the agencies, for example, N-TFS/x1234.

A3.1.6.7.3. **Agency Criteria.** Mark the watch/warning criteria for each agency.

A3.1.6.7.4. **Watch Issued.** Enter the dissemination/notification time, the initials of the forecaster issuing the watch, and the initials of the person receiving the watch if that agency requires a backup call or is not on the primary dissemination system.

A3.1.6.7.5. **Watch Cancelled.** Enter the dissemination/notification time, the initials of the forecaster cancelling the watch, and the initials of the person receiving the cancellation if that agency requires a backup call or is not on the primary dissemination system. If the watch runs full term, enter an appropriate remark such as "allowed to expire" or "ATE."

A3.1.6.7.6. **Warning Issued.** Enter the dissemination/notification time, the initials of the forecaster issuing the warning, and the initials of the person receiving the warning if that agency requires a backup call or is not on the primary dissemination system.

A3.1.6.7.7. **Warning Cancelled.** Enter the dissemination/notification time, the initials of the forecaster cancelling the warning, and the initials of the person receiving the cancellation if that agency requires a backup call or is not on the primary dissemination system. If the warning runs full term, enter an appropriate remark such as "allowed to expire" or "ATE."

A3.1.6.8. **Block 8. Remarks.** Use for miscellaneous information.

A3.1.6.9. **Block 9. Pertinent Observations** (back of form). List all pertinent observations, both "official" and "unofficial," radar information if available, and other information that verifies and/or justifies the watch/WW, or provides reasoning why the warning was not cancelled when it did not verify. Include available information (i.e. radar information, off-duty observer reports, locally reported weather conditions) used to verify warnings for winds greater than or equal to 50 knots or hail greater than or equal to 3/4 inch (or the substituted local severe weather thresholds where different) that are

reported or observed within *10 nautical* miles rather than in the area covered by the warning.

A3.1.6.10. **Block 10. Forecast Review and Comments** (back of form). Use for forecast review information. AF weather leaders can use this space to include written comments on weather watches and warnings.

Attachment 4

INSTRUCTIONS FOR COMPLETING AF IMT 3806, WEATHER WATCH ADVISORY LOG

A4.1. General Instructions. Unit leaders may use these instructions as guidance in preparing local procedures for logging forecast and observed weather advisories. Enter all times in UTC.

A4.1.1. **Date.** Enter the month and year.

A4.1.2. **Issued.** Enter the issue DTG.

A4.1.3. **Valid.** Enter the valid time of the WA. Leave blank for observed WAs.

A4.1.4. **Terminal or Area.** Enter the installation or area for which the advisory is being issued. Enter the locally assigned WA number (e.g., WA # 05-A05).

A4.1.5. **Text.** Enter the text of the advisory.

A4.1.6. **Dissemination.** Use this section to enter information for the initial issuance, extensions, and cancellations of WAs. If the WA is allowed to expire, enter a remark such as "allowed to expire" or "ATE" in one of the time blocks. Use the Remarks block or back of the form if needed.

A4.1.6.1. **Agency.** Enter the agencies notified of the WA. Include the primary dissemination system and all agencies not on the primary dissemination system that must be notified. **Note:** Minimize individual notification calls to no more than three.

A4.1.6.2. **Time.** Enter the time each agency was notified.

A4.1.6.3. **Initials.** Enter the initials of the individual receiving the WA information, if required. This is normally used for agencies not on the primary dissemination system and for follow-up calls.

A4.1.6.4. **Forecaster.** Enter the name or initials of the forecaster issuing, extending, or canceling the WA.

A4.1.7. **Remarks.** Use as required.

A4.1.8. **Verification.** Verify all forecast WAs either objectively or subjectively as determined by unit leaders. For WAs containing multiple phenomena, verify each phenomenon separately.

A4.1.8.1. **Occurred.** Check "Yes, No, or Not Applicable."

A4.1.8.2. **Lead-Time.** Enter the actual lead-time. Lead-time is not required for observed WAs, downgrades of previously verified WAs or WAs with no break in coverage, or extensions unless the WA has not yet verified. In cases where a WA downgrades an earlier warning or advisory that **DID NOT** verify (with no break in coverage), compute the lead-time using the issue time of the earlier warning or advisory.

A4.1.8.3. **Timing Error.** Enter the calculated timing error, if required.

A4.1.8.4. **Verified By.** Enter the initials of the individual verifying the advisory.

A4.1.8.5. **Comments/Remarks.** Enter enough meteorological reasoning and information, such as observations, radar reports, and PIREPs, to verify and/or justify the WA. This includes information to verify the WA objectively or subjectively.