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SECRETARY OF THE AIR FORCE

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Flying Operations

WEATHER FOR AIRCREWS – PRODUCTS AND SERVICES

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This handbook familiarizes the aircrew member with weather services, charts, and codes. It serves as a text and informational guidance for flight training programs, all U.S. Air Force instrument refresher training, flight instruction programs, and various unit and individual flying training programs. It applies to all Army and Air Force (AF) units and personnel, including the Air Force Reserve Command (AFRC), and Air National Guard (ANG). This regulation also applies to the Active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated. The information contained in this publication meets or exceeds the information contained in FM 1-230, dated 30 September 1982 which will be rescinded with the publication of this interservice publication. Support described may also be applied to aviation within the U.S. Army and its reserve components of the Army Reserve and the Army National Guard. It is issued to each instructor and student involved in undergraduate flight training programs as well as to each flying unit. This handbook, when used with related flight directives and publications, provides weather guidance for visual and instrument flight under most circumstances. It is not a substitute for sound judgment. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using AF Form 847, *Recommendation for Change of Publication;* route AF Form 847 from the field through the appropriate functional office in your chain of command.

Ensure that all records created as a result of processes prescribed in this publication are maintained according to Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of according to the AF Records Disposition Schedule in the Air Force Records Information Management System.

SUMMARY OF CHANGES

Interim Change 5 revises **Table 2.2**, Aircraft Turbulence Category. B1-B was identified as being incorrectly categorized as a Turbulence Category IV aircraft and is now correctly categorized as a Turbulence Category III aircraft. RC-135 was identified as being incorrectly categorized as a Turbulence Category II aircraft and is now correctly categorized as a Turbulence Category III aircraft. TC-135 and WC-135 have been added to the table, under Turbulence Category III. OC-135 has been deleted from the table following retirement from service. Note 8 has been added to clarify that Turbulence Category III applies to all RC-135 Model Series aircraft.

Chapter 1

AIR FORCE WEATHER OPERATIONS, SUPPORT AND SERVICES

1.1. Introduction. Linked throughout history, military operations have succeeded or failed based on the ability of commanders to incorporate environmental conditions into their tactics. Just as weather has had effects on past operations, the atmosphere also has the ability to either enhance or reduce the performance of aircraft and weapon systems. To effectively accomplish the AF mission, and maintain the advantage in the operational environment, aircrews must have a thorough awareness and understanding of the air or space domains in which they operate. AF weather personnel deliver accurate, consistent, relevant, and timely environmental information, products, and services as part of the joint team. The goal is to provide the AF, Army and other Department of Defense (DoD) organizations and their personnel the knowledge needed to exploit the weather for military operations. Weather operations facilitate characterization and exploitation of the air and space environment through the processes of collection, processing, analyzing, predicting, tailoring, and integrating weather information into the commander's decision making cycle, mitigating the effect weather may have on military operations. Vast amounts of weather data and information are available to you from various unofficial providers via web technology, but the timeliness and reliability is not guaranteed, especially for sparsely populated overseas locations. This text will summarize AF and government services, charts, and weather codes from authoritative sources.

1.2. Strategic and Global. AF strategically-focused units provide worldwide atmospheric and space weather products and support necessary to conduct military operations.

1.2.1. Headquarters, United States Air Force. The Director of Weather Operations (HQ USAF/A3W) functionally manages weather operations, services and support for the AF, Army and specified DoD organizations. This includes weather policy, weather resources, interagency and interservice coordination of meteorological and space environmental matters, integration into strategic and wartime planning scenarios.

1.2.2. 2nd Weather Group (2 WXG). 2 WXG, through its subordinate squadrons, produces global weather products and services to meet the requirements of the AF, Army and specified DoD missions including dedicated weather history (climatology), current global weather analysis, global weather predictions, and space environment characterization and forecasts. Specific services relevant to aircrews include meteorological satellite imagery, meteorological guidance, aviation automated flight planning, and computations for ballistic missile systems. Additionally, the Space Weather Flight, and globally dispersed solar observing locations, provide 24-hour, 7 days per week, space environmental support for worldwide operations as a specialized function. Space weather includes the analysis and predicted effects of solar storms, geomagnetic storms, and ionospheric disturbances. Products include alerts and assessments that may impact operations. Space weather can adversely affect high frequency communications, Ultra High Frequency (UHF) satellite communications, precision navigation and timing, surveillance and weapon systems, as well as high-altitude reconnaissance aircraft, to include radiation dosages.

1.2.3. 618th Air Operations Center (AOC). The 618 AOC, Tanker Airlift Control Center (TACC), provides weather products, services, and briefings for mission planning and execution phases managed by 618 AOC (TACC) for strategic airlift and air refueling crews operating worldwide. These include mission execution forecasts for U.S. Transportation Command-tasked missions and other selected missions flown by Air Mobility Command (AMC) and AMC-gained Air Reserve Component (ARC) flying units.

1.2.4. 23rd Special Operations Weather Squadron (23 SOWS). The 23 SOWS is Air Force Special Operations Command's (AFSOC) reachback weather squadron. It is responsible for providing 24/7 global weather support and services to specified Joint, Army and Air Force Special Operations Forces missions.

1.3. Regional. In order to eliminate duplication within space and time, regional products are produced and/or further tailored from global information and products.

1.3.1. Operational Weather Squadrons (OWSs), or specified organizations, provide centralized operational-level support primarily through, and in coordination with, AF weather personnel assigned or deployed within the respective region or theater. OWSs are generally aligned to support a geographic Combatant Commander's Area of Responsibility (AOR), or portion, thereof. OWS support is oriented toward AF and Army service component missions and include regional and theater scale forecasts, drop and landing-zone/range/air refueling/target forecasts, flight weather briefings, weather watches, warnings, and advisories, and Terminal Aerodrome Forecasts (TAFs) for designated airfields within their region. The OWS provides briefing support to transient aircrews or aircrews not supported by a designated Weather Flight (WF), or equivalent. **AF Visual Aid (AFVA) 15-137, *Air Force Operational Weather Squadron Areas of Responsibility*,** illustrates current OWS AORs. OWS phone numbers are in the DoD Flight Information Publication (FLIP) Supplement and Flight Information Handbook (FIH).

1.3.2. Geographic AOCs. Within an AOC, weather personnel supporting geographic AOCs are typically administratively aligned under the combat operations division but integrate weather throughout all AOC divisions and operations. The size of the weather support element is flexible and responsive to the changing requirements of the operation. For example, at a geographic AOC, weather personnel support other specialty teams, such as the battlefield coordination detachment and the joint personnel recovery center. The AOC's weather element normally reaches back to a supporting OWS for a significant portion of weather information needed to support AOC operations.

1.4. Local. Typically at the base or tactical level, weather organizations organize as a WF within an Operations Support Squadron (OSS) to support AF operations or as a WF or Detachment in a Weather Squadron (WS) to support Army operations. The WFs and Detachments are the main direct support to the combat or combat support mission. WFs provide aircrew and flight safety briefings, Pilot-to-Metro Service (PMSV) support, Mission Weather Products (e.g., Commander Update Briefs, planning forecasts, and Tactical Decision Aids [TDAs]), MISSIONWATCH (deliberate process for monitoring weather or space conditions for specific mission-limiting factors), METWATCH (deliberate continuous process for monitoring weather or space conditions in a general area or region), and surface weather observations. Other responsibilities include providing resource protection products in the form of weather watches, warnings and advisories for AF, Army and specified DoD assets and providing mission-tailored weather briefings for each phase of flight. Briefings are available in-person, via telephone/fax or, in some circumstances, other remote video or teleconferencing capabilities. Most WFs are only manned for weather briefing services during airfield hours at controlled military airfields. If weather services are unavailable at your location, contact the regional OWS or an approved source.

1.4.1. Reserve Component Weather Support. Reserve component weather personnel consist of those forces within the ANG and AFRC. These resources primarily support AF and Army wartime deployment and employment requirements. AFRC also conducts tropical storm weather reconnaissance. Selected ARC resources will support rotational (i.e., Air and Space Expeditionary Force) commitments on a volunteer basis and sustainment missions as requirements dictate. To the maximum extent possible, ARC personnel will train with and support their wartime units. Most ANG weather personnel are designated as combat support to Army National Guard units.

1.5. OWS-WF-Aircrew Interface. It is highly likely that your main interaction as an aircrew member is with the local WF and the regional OWS. Mission support improvement and mission success depends on the continuous interchange between the OWS, WF and the aircrew. OWSs create products and monitor weather for its theater AOR. OWS personnel develop long-term weather knowledge and sustain a persistent presence of International Civil Aviation Organization (ICAO)/World Meteorological Organization-qualified aeronautical meteorological forecasters that improve theater forecast quality and mission support. An example of OWS-WF interface occurs during the forecast process. An OWS coordinates forecast content with the local WF before issuing the TAF for their aerodrome. The WF monitors the TAF and notifies the OWS when observed conditions may drive a TAF amendment based on operational or other established criteria.

1.6. WF-Aircrew Interaction. Interaction between WFs and aircrews is crucial to the enhancement of mission support. WFs work with aircrews to learn aircraft capabilities, tactics, techniques and procedures along with mission profiles to ensure WF personnel and leadership understand weather mission impacts. WFs use this information to create Mission Weather Products (MWPs) that enable decision makers to plan and execute weather-optimized courses of action (COAs) at every decision point in the mission planning and execution process. Ensuring post-mission feedback from aircrews is a critical step in relating encountered weather features to evaluate effectiveness of each MWP. WFs use this to adjust future products, including the next "go", and other services resulting in improved mission support.

1.6.1. Weather Briefings. Weather briefings are a three-phase process: planning, mission execution, and post-mission debrief. Your home installation WF is the primary source for weather briefings, however some MAJCOMs have established a centralized flight weather briefing facility for certain missions. If the WF is unavailable or the aircrew is away from home base, use the regional OWS to obtain or update your weather brief. OWSs support transient aircrews or aircrews without WF support. Aircrews should use other approved sources only when the primary points of contact are unavailable to provide support. **Table 1.1** provides a prioritized list of authorized weather sources to obtain weather briefings. Contact information for the servicing OWS and base WFs in the region of operations are located in Section C of the FIH. Aircrews obtain briefings in-person, via telephone, or on-line depending on the situation. It is imperative aircrews obtain a mental picture of the airspace. Ask yourself, "How will weather affect my flight or weapon system performance?" Understanding weather's operational impacts is essential to mission success, especially if emergency actions become necessary. Spend the time needed to gather data, especially when adverse weather is a factor. Forming this mental picture of the weather situation is often vital to a successful mission. Never hesitate to consult weather personnel about any item that you believe needs clarification.

Table 1.1. Prioritized List of Authorized Weather Sources.

1. Home/Local Installation OSS weather flight or MAJCOM-designated centralized briefing facility (or equivalent)
2. Regional OWS (Note: Contact information for the servicing OWS and/or installation weather flight is located in Section C of the FIH)
3. Other DoD weather sources (i.e., U.S. Navy/U.S. Marine Corps)
4. Other published MAJCOM-approved weather sources
5. Other U.S. Government (USG) weather facilities/services (i.e., NWS, FAA)
6. Foreign Government Weather Service (Use only when DoD military resources or USG services are unavailable outside U.S. territory)

1.6.1.1. Web-based Aircrew Briefings. Web-based programs and portals provide a means to facilitate the aviator's understanding of weather affecting their mission, not to replace the input or weather personnel. Aircrews using these tools should contact weather personnel to obtain additional information, clarify the products, or to ask questions. These web-based tools provide the standard weather data, graphics, satellite, and RADAR information. This includes airfield observations, forecasts, winds, and applicable weather hazards, pilot reports, and current weather warnings. WFs include information on how to access and use web-based tools in the Instrument Refresher Course and can provide additional training upon request.

1.6.1.2. DD Form 175-1, *Flight Weather Briefing.* The DD Form 175-1 is the standard briefing form. WFs and OWSs may use this form, or a MAJCOM or another locally-derived alternative; but, whether you receive a verbal or written briefing, it should cover much of the data contained on this form. Some blocks may not be completed or extra information may be added. Alternatively, many bases produce a mission execution forecast or weather flimsy that serves as a weather briefing used by multiple flights during local flying missions. In some cases, this may substitute for an individual weather brief for your flight. See **Attachment 2** for an example of the DD Form 175-1 and explanation of the form data.

1.6.1.3. Requesting Weather Briefings. A unit flight scheduler will usually notify the WF of all planned flights. If your flight is not scheduled with the WF, provide upcoming flight notification by website, phone, or other locally established procedures. Transient aviators or aircrews without WF support should request OWS support on-line or by phone if web access is not available. OWSs need a minimum of 2-hours notification to prepare a weather briefing, however real-world short-notice requirements (e.g., Aeromedical Evacuation) will still be fulfilled but may cause delays for other aircrews. You should never leave your home base without knowing whom to contact for weather support and updates. Military weather briefing facilities and phone numbers are listed in the FLIP and are available at the WF. When requesting a briefing be prepared to provide as much information as possible. At a minimum include:

Table 1.2. Minimum Information Required for Weather Briefing.

Your name (Always identify yourself as a crew member)
Aircraft type/call sign
En route plan (stops, low levels, landing zones, targets, ranges, etc)
Proposed altitude
Estimated time of departure/return
Destination
Estimated time of arrival at destination
Alternates as required
Contact Information (e-mail, fax, etc., for delivering briefing)

1.6.2. Mission Weather Products (MWP). MWPs fuse theater and small-scale products with operations, enabling the direct inject of weather impacts into planning and/or execution. MWPs are living documents and any/all feedback will be applied to internal processes to enhance training, weather personnel proficiency, and product accuracy. MWPs include flight weather briefings, Intelligence Preparation of the Operational Environment (IPOE) products, mission planning briefs, environmental inputs to mission analysis, environmental staff estimates, and any other weather product prepared to meet the needs of a supported unit.

1.6.3. Post-Mission Debrief. After pre-mission interface with the WF, the post-mission debrief is the next best way an aircrew can influence and improve weather support. Aircrew-provided feedback of actual weather encountered helps the WF evaluate the mission execution forecast process and improve support and product accuracy. Furthermore, since airborne crews see a broader horizon and experience phenomena which may not be apparent from the ground-based sensing systems or observers, feedback is extremely important to the next "go". Debriefings can be made in person (ideally), via telephone, locally established procedures, or other available means.

1.6.4. Pilot-to-Metro Service Voice (PMSV). The PMSV is the UHF/VHF radio contact or phone patch used to obtain updates on current and/or forecast weather conditions and as a means for aircrews to provide weather inputs encountered en route. The FIH has PMSV facility locations, frequencies, and instructions. WFs will immediately respond to all PMSV contacts. Only qualified personnel will respond to PMSV calls, although trainees may respond with proper supervision. Weather personnel will not vector aircraft.

1.7. Civil Aviation Weather Services. Providing weather services to aviation within U.S. territory is a shared effort between the National Weather Service (NWS), the Federal Aviation Administration (FAA), the DoD, and other aviation-oriented groups and individuals. The following paragraphs discuss the civilian weather agencies of the U.S. Government and their services to the aviation community. When aircrews are unable to contact their supporting WF or OWS, they may use NWS, FAA, or other DoD services or published MAJCOM-approved sources according to AF Instruction (AFI) 11-202, Volume 3, *General Flight Rules,* and AFMAN 11-217, Volume 1, *Instrument Flight Procedures.* Pilots should be aware that unlike military weather forecasts, these products are not tailored to specific military aircraft or missions; therefore, e.g., turbulence and icing hazard conditions will be more generalized.

1.7.1. Volcanic Ash Advisory Centers (VAAC). The NWS operates two of the nine global VAACs: One in Anchorage, Alaska, and the other in Washington, DC, at the National Centers for Environmental Prediction. The VAACs provide specialized volcanic ash advisory products, both text and graphic, and coordinate with surrounding VAACs in Asia, Europe, and the Southern Hemisphere on long-lived volcanic ash plumes. These forecasts are authoritative and may not be altered by military personnel.

1.7.2. National Hurricane Center (NHC). As one of the National Centers for Environmental Prediction (NCEP), the NHC (and Joint Typhoon Warning Center east of the dateline in the Pacific Ocean) produce authoritative forecasts for hurricanes and tropical cyclones so USAF forecasters may not deviate from those official products.

1.7.3. Center Weather Service Unit (CWSU). CWSUs are units of NWS meteorologists under contract with the FAA that are stationed at and support the FAA's Air Route Traffic Control Centers (ARTCCs). CWSUs provide timely weather consultation, forecasts, and advice to managers within ARTCCs and to other supported FAA facilities. This information is based on monitoring, analysis, and interpretation of real-time weather data at the ARTCC through the use of all available data sources including RADAR, satellite, Pilot Weather Reports (PIREPs), and various NWS products such as TAFs and inflight advisories. Special emphasis is given to those weather conditions hazardous to aviation or which would impede the flow of air traffic within the National Aerospace System (NAS). Rerouting of aircraft around hazardous weather is based largely on forecasts provided by the CWSU meteorologist. They issue the following products in support of their respective ARTCC: Center Weather Advisories and Meteorological Impact Statements.

1.7.4. Weather Forecast Offices (WFOs). NWS WFOs provide warnings and forecasts throughout the U.S. and it's territories, including Puerto Rico and Guam. These 122 offices are responsible for providing TAFs to over 630 airports.

1.7.5. Flight Service Station (FSS)/Automated Flight Service Station (AFSS). FSSs and AFSSs provide pilot weather briefings, en route weather, receive and process Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) flight plans, relay air traffic control clearances, and issue Notices to Airmen. They also provide assistance to lost aircraft and aircraft in emergency situations, and conduct VFR search-and-rescue services. Aircrews can access the FSS/AFSS services listed below via radio or phone as printed in the FLIPs.

1.7.5.1. Hazardous In-flight Weather Advisory Service (HIWAS). HIWAS is a national program continuously broadcasting (24 hours per day) hazardous weather information over selected navigational aids (NAVAIDs). The broadcasts include advisories such as Airman's Meteorological Information (AIRMETs), Significant Meteorological Information (SIGMETs), convective SIGMETs, and urgent PIREPs. These broadcasts are only a summary of the information, and pilots should contact an FSS/AFSS or En Route Flight Advisory Service (EFAS) for detailed information. The HIWAS broadcast area is defined as the area within 150 NM of the HIWAS outlets. HIWAS broadcasts are not interrupted or delayed except for emergency situations, when an aircraft requires immediate attention, or for reasonable use of the voice override capability on specific HIWAS outlets in order to use the limited Remote Communications Outlet (RCO) to maintain en route communications. An announcement is made for no hazardous weather. When a HIWAS broadcasts an update, a one-time HIWAS update announcement is made on all communications/NAVAID frequencies except emergency, EFAS, and navigational frequencies already dedicated to continuous broadcast services. In the event a HIWAS broadcast area is out of service, an announcement is made on all communications/NAVAID frequencies except on emergency, EFAS, and navigational frequencies already dedicated to continuous broadcast services.

1.7.5.2. En Route Flight Advisory Service (EFAS). The purpose of EFAS, radio call "FLIGHT WATCH" (FW), is to provide en route aircraft with timely and pertinent weather data tailored to a specific altitude and route using the most current available sources of aviation meteorological information. When conditions dictate, EFAS specialists provide information on weather for alternate routes and/or altitudes to assist the pilot in the avoidance of hazardous flight conditions. The pilot is advised to contact the adjacent flight watch facility when adverse weather conditions along the intended route extend beyond the Flight Watch Area (FWA). EFAS is provided on 122.0 MHz to aircraft below FL180. An assigned distinct frequency is used to provide EFAS to aircraft at FL180 and above. This frequency can also be used for communications with aircraft below FL180 when communication coverage permits.

1.7.5.3. Telephone Information Briefing Service (TIBS). TIBS is a service prepared and disseminated by selected Automated Flight Service Stations. It provides continuous telephone recordings of meteorological and aeronautical information. Specifically, TIBS provides area and route briefings, as well as airspace procedures and special announcements, if applicable. It is designed to be a preliminary briefing tool and is not intended to replace a standard briefing from a flight service specialist. The TIBS service is available 24 hours a day and is updated when conditions change. The phone numbers for the TIBS service are listed in the Airport/Facility Directory.

Chapter 2

WEATHER PRODUCTS

Section 2A—GRAPHIC CHARTS

2.1. Overview. Graphical analysis and forecast products provide the most efficient means of relaying complex weather information to a wide audience. To improve effectiveness, optimized graphical forecasts provided by an OWS facilitate military decisions and depict features or thresholds unique to military operations. For these reasons, AFI 15-128, *Air Force Weather – Roles and Responsibilities*, states that OWSs provide the authoritative source for environmental characterizations for their assigned geographic regions. Although internet-enabled graphical forecast charts are available from a variety of government or civilian sources, the differences in specification, amendment and depiction standards vary greatly from AF standardized products. As outlined in **Table 1.1**, do not use civilian (government or commercial) products for military decisions under routine circumstances. The preferred source for obtaining graphical forecast products on either NIPRNET or higher security enclaves is through the primary weather portal service, AF Weather Web Service (AFW-WEBS), or OWS homepages until AFW-WEBS integrates those websites. (AFW-WEBS offers users dynamic content generation with multiple overlay and mapping presentations whereas OWS websites generally specialize in presenting static imagery with a limited degree of overlay capability.) NOTE: Development is underway to provide access via mobile applications, such as those referred to as the "electronic flight bag".

2.2. Accessing Air Force Graphic Products. Users may access AF weather graphics through AFW-WEBS, at **https://weather.af.mil** for NIPRNET or **https://weather.af.smil.mil** for SIPRNET. OWS websites may be accessed from the AFW-WEBS main page or from the list in **Table 2.1** AFW-WEBS does require users to register for an account and is Common Access Card-enabled.

Table 2.1. OWS Website Addresses.

15 OWS, Scott AFB – Northeastern NORTHCOM: https://15ows.us.af.mil
17 OWS, Hickam AFB – PACOM and Alaskan NORTHCOM: https://17ows.us.af.mil
21 OWS, Kapaun – EUCOM and AFRICOM: https://21ows.us.af.mil
25 OWS, Davis-Monthan AFB – Western NORTHCOM or SOUTHCOM: https://25ows.us.af.mil
26 OWS, Barksdale AFB – Southern NORTHCOM: https://26ows.us.af.mil
28 OWS, Shaw AFB – CENTCOM: https://28ows.us.af.mil

2.3. Standard Weather Symbols. Weather phenomena presented on graphical analysis and forecast products are displayed on C2 systems in a standardized depiction and color coding scheme to ensure common understanding by DoD and coalition partners. The latest version of MIL-STD-2525, *Joint Military Symbology,* defines commonly used representations. Figures **2.1**, **2.2, and 2.3** illustrate the most common MIL-STD depictions for planning and executing aviation operations. Products depicting these features are available as static imagery or dynamic (e.g., common operating picture overlay) content. Meteorological depictions from non-DoD sources may not employ the same symbology or the symbols could have different meaning. Use caution when viewing these sources, especially if the products do not have a legend, e.g., date/time group

(DTG). Graphical products may also be available as high-resolution products with non-MIL-STD depictions. These products will employ color filled regions and a legend to facilitate ease of use.

Figure 2.1. Line Types and Colors for Commonly Used Isopleths on Air Force Standard Graphics.

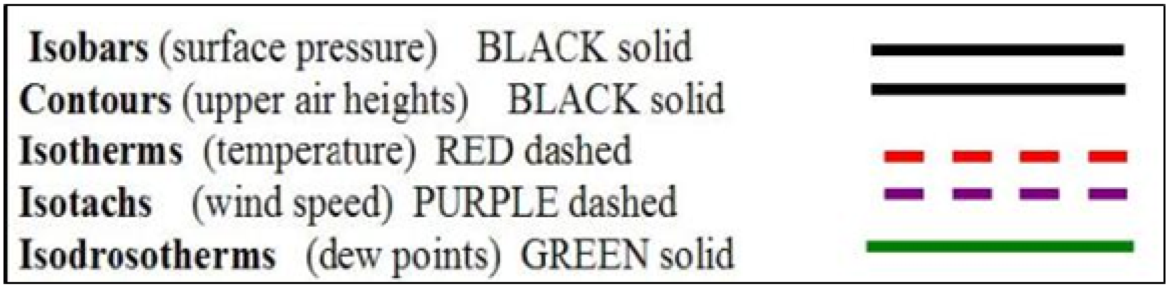
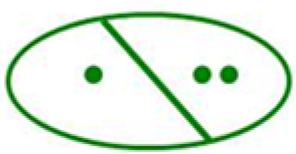


Figure 2.2. Standard Shading and Color Fill for Bounded Areas of Weather.

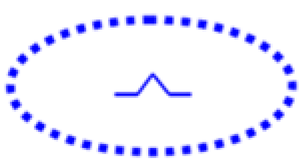
(YELLOW solid line and optional shading)
Areas of Fog: Distribute the appropriate fog symbol over the zone.

(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.



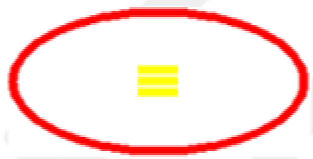
(BLUE dots or dashes: Clear Air Turbulence & Mechanical Turbulence)
(BLUE solid line: Mountain Wave Turbulence)

Figure 2.2. Standard Shading and Color Fill for Bounded Areas of Weather (CON'T).

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 (MSL).

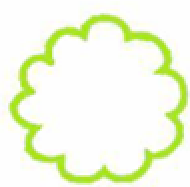


(RED solid line)

Areas of Ceilings less than 2,000 feet and/or Visibility less than 3 miles: Distribute the appropriate weather symbol causing IFR visibility conditions over the zone.

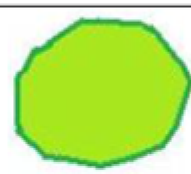
(BROWN/BLACK line)

Cloud Forecasts greater than or equal to 2,000 feet and above: Place bases/tops (AGL) inside cloud area



(GREEN solid or dotted line)

Upper-air/Severe Analysis moisture areas and of ≥ 70% RH on Model Charts



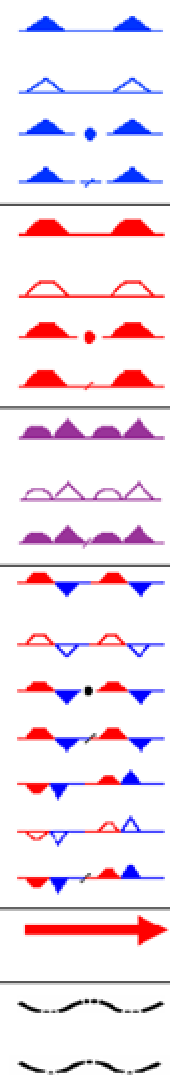
(Color fill/shade in GREEN, border in darker GREEN scalloped line (optional))

Areas of ≥ 90% RH on Model Charts

2.3.1. Fronts. Frontal boundaries are indicated on charts according to **Figure 2.3** The semi-circles and triangles on the frontal line are known as "pips." "Pips" indicate front type and point the heading of the front. Pips on both sides identify a stationary front and suggest little or no movement.

Figure 2.3. Symbols for Meteorologically Significant Features.

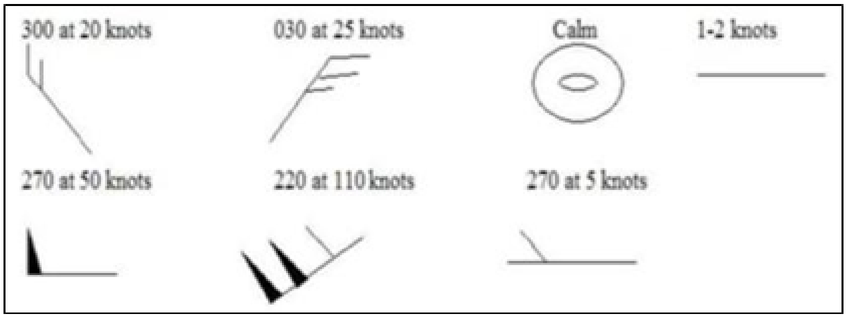
Item	Symbol
(BLUE)	
Cold front at the surface	
Cold front above the surface	
Cold front frontogenesis	
Cold front frontolysis	
(RED)	
Warm front at the surface	
Warm front above the surface	
Warm front frontogenesis	
Warm front frontolysis	
(PURPLE)	
Occluded front at the surface	
Occluded front above 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	



Note: Max wind lines, trough axes, and ridge axes are optional on standard weather charts.

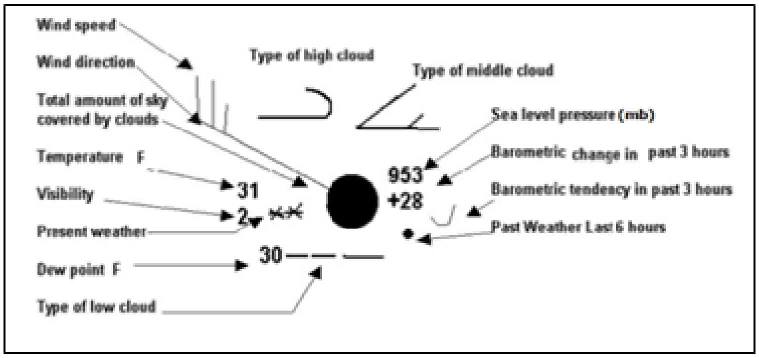
2.3.2. Winds. Wind plots use the "Shaft-Barb-Pennant" method (**Figure 2.4**). The "shaft" or a line represents the direction *from* which the wind is blowing. The barb or pennant represents the wind speed. A short barb represents 5 knots and a long barb represents 10 knots. Pennants are 50-knot winds. Plotted wind directions are to the nearest 10 degrees relative to true north.

Figure 2.4. Sample Wind Plots.



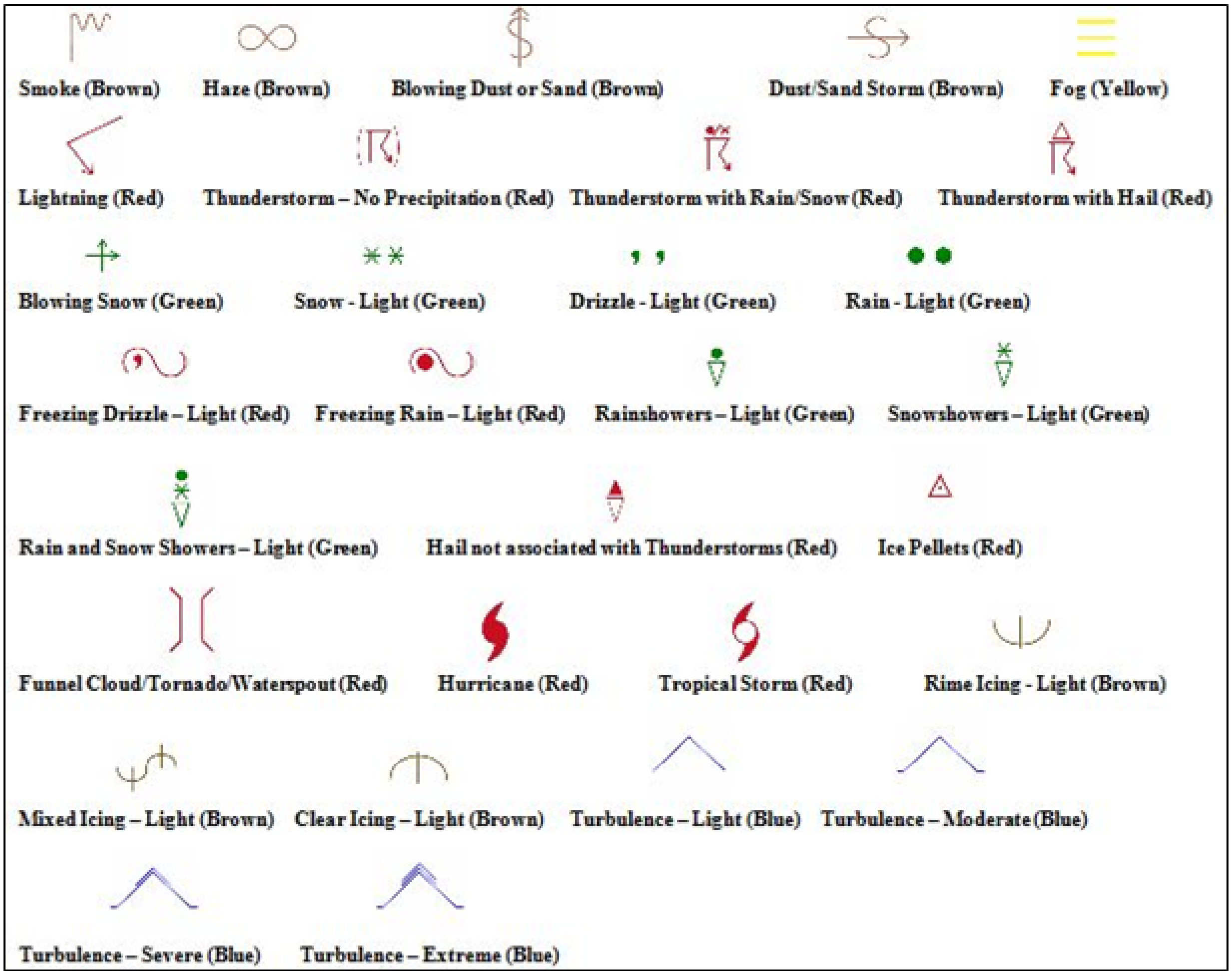
2.3.3. Station Symbols. Station Symbols provide a detailed graphic representation of present weather at individual stations to include cloud type, sky coverage, sea-level pressure in millibars (mb), 3-hour barometric change, pressure, present weather, past 6-hour weather, temperature, dew point, visibility (SM), wind speed (knots) and direction. Weather stations commonly filter the various elements on the station model to make the symbol less cluttered and easier to read. This capability also provides elements that are relevant to the user. Note: Station plots, such as those in **Figure 2.5**, indicate only the height of the lowest cloud base, designated by a representative code based on the height reported in feet above ground level (AGL). An "X" shows sky cover without a height entry. A solidus (/) is encoded for a total surfaced-based obscuration.

Figure 2.5. Complete Station Model.



2.3.4. Weather Symbols. Weather Symbols provide a detailed graphic representation of weather types (**Figure 2.6**).

Figure 2.6. Basic Weather Symbols.



2.3.5. Sky Cover. Shaded circles depict sky cover (Figure 2.7).

Figure 2.7. Sky Condition Symbols.

Sky Condition	Coverage	Symbol
Clear	0/8	
Few	1/8-2/8	
Scattered	3/8 – 4/8	
Broken	5/8 – 7/8	
Overcast	8/8	

2.4. Standard Air Force Weather Graphics.

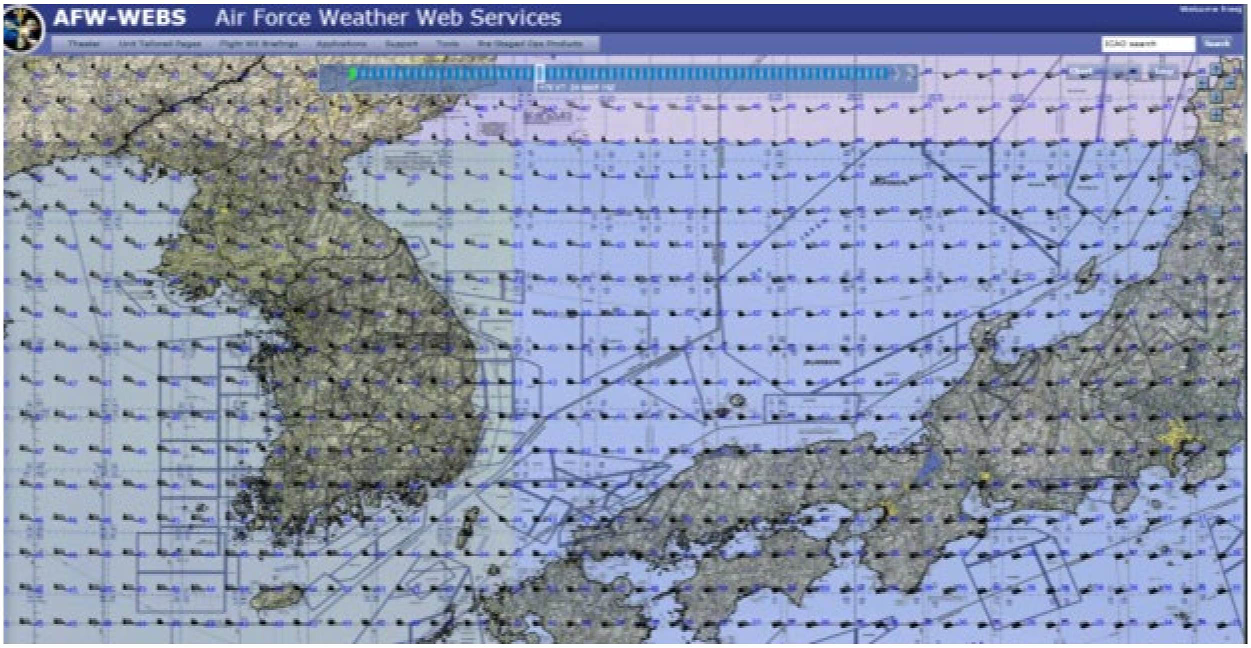
2.4.1. Flight-Level Wind Products. Extracted from meteorological models, flight-level wind products are provided for mission planning and execution. These products are available in varying intervals from surface to over 100,000 feet above mean sea-level (MSL). When viewed via AFW-WEBS, wind products can be displayed on an aeronautical chart, meteorological map, or earth background. Flight-level wind forecasts are also available as gridded data fields for use by machine-to-machine applications generating computer flight plans or mission weather packages for strategic airlift.

2.4.1.1. *How to use this product*. Select the wind forecast product for the nearest flight level and mission valid time. Most mission planning systems use the wind forecast valid for the mid-point of a mission and a flight level most representative of the mission profile. Read the wind speeds using the wind barb breakout in **Figure 2.4** Overlaying aviation hazards with wind forecasts at various flight levels provides a single look at potential mission impacts and assists aviators during mission planning and route optimization.

2.4.1.2. *Strengths*. Recent advances in meteorological modeling have significantly improved the accuracy of flight-level wind forecasts, especially for flight levels above 10,000 feet MSL, providing more accurate forecast data for route planning and fuel consumption calculations.

2.4.1.3. *Weaknesses*. Flight-level wind products are based on meteorological forecast models which provide output at constantly spaced data points. Converting the data points to a constant flight level wind chart requires interpolation between the data points which, in some cases may introduce small errors in forecast winds, especially in layers with dramatic shifts in wind direction or changes in speed. Flight-level winds less than 10,000 feet MSL may have operationally significant errors in some cases due to incomplete modeling of terrain and planetary boundary layer effects; usually wind speed forecasts stronger than actual conditions. Machine-to-machine applications extracting flight level wind forecasts from gridded data may employ simple “nearest data point” systems to populate flight plans and provide winds not as representative of the actual route of flight.

Figure 2.8. Flight Level Wind Product (FL300 Winds with Aeronautical Chart Background) (AFW-WEBS).



2.4.2. Turbulence Products

2.4.2.1. Turbulence Forecasts Products

2.4.2.1.1. *How to use this product*. Turbulence forecasts are graphical depictions of the maximum expected turbulence independent of thunderstorms. These graphics are generated and issued in 3-hour time steps out to the 30-hour point (EUCOM AOR: 6-hour time steps out to 60 hours) and are continuously monitored and amended as required. Extended forecast turbulence products use model information for forecast periods out to120 (EUCOM 144) hours, divided into two levels; low level (below FL180 MSL) and high level (FL180-500 MSL). Plan mitigating strategies for mission routes which intersect a bounded area during the valid period of the forecast. Note: Clear Air Turbulence (CAT) areas on the forecast product will contain information on the base, top, and intensity of turbulence with areas of mountain wave turbulence highlighted and depicted separately.

2.4.2.1.2. *Strengths*. Different types of aircraft have different sensitivities to turbulence. **Table 2.2** lists the turbulence categories for military fixed-wing and rotary-wing aircraft at their typical mission profile and cruise altitude followed by civilian aircraft. Turbulence forecasts in TAFs and hazard charts are specified for Category II aircraft. **Table 2.3** is a guide to convert turbulence intensities for different categories of aircraft. AFLCMC validates and coordinates the authoritative determination.

Table 2.2. Aircraft Turbulence Category.

Aircraft Type (see Note 2)	Common Name	Turbulence Category (see Note 1)

Military Aircraft Turbulence Categories			
Military Identifier	**FAA Identifier**		
AH-1 (see Note 3)	HUCO	Cobra/Huey Cobra	I
OH-58 (see Note 3)	B06	Kiowa	
RQ-7B (see Note 6)		Shadow	
UH-1 (see Note 3)	B212	Iroquois (Huey)	
T-51A	C150	Cessna 150	
TG-15A/B	TG15	Duo Discus/Discus Glider	
AH-64 (see Note 3)	H64	Apache	II
B-2A (see Note 5)	B2	Spirit	
B-52H	B52	Stratofortress	
C-5M	C5	Super Galaxy	
C-9A/C	DC93	Nightingale/Skytrain	
C-20B (see Note 5)	GLF3	Gulfstream III	
C-20H (see Note 5)	GLF4	Gulfstream IV	
C-21A	LJ35	Learjet 35	
C-130 (see Note 7)	C130, C30J	Hercules, Spectre, Commando II, etc.	
C-145A	M28	Skytruck	
C-146A	DO328	Dornier 328 Wolfhound	
C-37A/B	GLF5	Gulfstream V	
C-40B/C (see Note 5)	B737	BBJ, Clipper	
CC-18-180	PA18	Cubcrafters Top Cub	
CH-47 (see Note 3)	H47	Chinook	
CV-22 (see Note 4)	V22	Osprey	
DO-328	DO328	Dornier 328	
E-3B/C/G	E3TF	Sentry	
E-8	E8	JSTARS	
H-3 (see Note 3)	S61	Sea King	
H-53 (see Note 3)	H53	Sea Stallion/Sea Dragon	
H-60 (see Note 3)	H60	BlackHawk/SeaHawk/PaveHawk	
KC-135R/T	K35R	Stratotanker	
PC-12	PC-12	Pilatus PC-12	
T-38A	T38	Talon	

T-41D	C172	Mescalero	
T-53A	SR20	Cirrus/Kaydett	
TG-16A	TG16	DG-1000 Club Glider	
U-21	BE10	King Air	
U-28	PC12	N/A	
UH-72 (see Note 3)	UH72	Lakota	
VC-25	B742	Air Force One	
A-29		EMB 314 Super Tucano	III
B-1B	B1	Lancer	
C-12 J	B190	Airliner	
C-12 C/D/F	BE-20	King Air/Super King Air	
C-17A	C17	Globemaster III	
C27J	C27	Spartan	
C-32A (see Note 5)	B752	Boeing 757, Air Force Two	
EA-6B	A6	Prowler	
EC-130H	C130	Compass Call	
EO-5C		DHC-7-102/103	
E-9A	E9	Bombardier Dash 8, Widget	
E-4B	B742	NAOC	
E-11A	E11	Bombardier Global Express/XRS	
F-15C/D	F15	Eagle	
F-18 (A-D)	F18	Hornet	
F-18 (E/F/G)	F18	Super Hornet (E/F)/Growler (G)	
F-22	F22	Raptor	
KC-10A	DC10	Extender	
KC-46A		Pegasus	
MC-12	MC12	Huron	
MQ-1B/C	MQ1	Predator/Gray Eagle	
MQ-9	MQ9	Reaper	
QF-4		Phantom (Drone)	
RC-26B	SW4	Metroliner	
RC-135	R135	Rivet Joint	
RO-6A		DHC-8-311/315	
RQ-4	RQ4	Global Hawk	
T-1A	BE40	Jayhawk	
TC-135	R135	C-135 Trainer	
WC-135	C135	Constant Phoenix	
T-38C	T38	Talon (for UPT)	
T-6A	TEX2	Texan 2	
U-2S	U2	Dragon Lady	
UV-18B	DHC6	Twin Otter	
UV-20	PC6T	Pilatus Turbo Porter	
A10C	A10	Thunderbolt II	IV
F-15E	F15	Strike Eagle	

F-16C	F16	Fighting Falcon	
F-35A	F35	Lightning II	
Civilian Aircraft Turbulence Categories			
Civilian Identifier	**FAA Identifier**		
C-152	C152	Cessna Aerobat	
C-175	C175	Cessna Skylark	
C-185	C185	Slywagon	
DA-20	DA20	Diamond Katana	**I**
PA-38	PA38	Piper Tomahawk	
PAY-3	PAY3	Piper Cheyenne	
A-300	A306, A30B	Airbus A300	
A-319	A319	Airbus A319	
A-320	A320	Airbus A320	
A-340-200	A342	Airbus A340	
A-340-300	A343	Airbus A340	
A-340-500	A345	Airbus A340	
A-340-600	A346	Airbus A340	
B-200	BE20	Beechcraft Super King Air	
B-350	BE30	Beechcraft Super King Air	
B-727	B721,B722,B72Q,R721,R722	Boeing 727	
B-737-600	B736	Boeing 737-600	
B-737-700	B737, C-40	Boeing 737-700, BBJ	
B-737-800	B738	Boeing 737-800	
B-737-900	B739	Boeing 737-900	
B-747	B741, B742,B743,B74D,B744	Boeing 747	
B-777	B772, B773	Boeing 777	
BE-20	BE20	Beechcraft Super King Air	
C-172	C172	Cessna Skyhawk	
C-182	C182	Cessna Skylane	
C-208	C208	Cessna Caravan, U-27	
C-310	C310	Cessna 310, L-27	
C-402	C402	Cessna 402 Businessliner	
C-414A	C414	Cessna Chancellor	
C-421	C421	Cessna Golden Eagle	**II**
CL-600	CL60	Canadair Challenger 600	
CRJ	CRJ1, CRJ2, CRJ7, CRJ9	Canadair Regional Jet	
DC-8	DC8	Douglas DC 8, Super 62	
G-520	EGRT	Egret	
Gulfstream IV & V	GLF4, GLF5	Gulfstream IV, V	
L-13	L13	Blanik Glider	
L-23	L23	Super Blanik Glider	
LJ-25/35/55/60	LJ25/35/55/60	Learjet 25/35/55/60	

MD-80	MD81, MD82, MD83, MD87, MD88	McDonnell Douglas MD-80	
PA-18	PA18	Piper Super Cub	
SR-20	SR20	Cirrus	
B-737/200	B732	Boeing 737-200	**III**
B-757	B752	Boeing 757-200	
B-767	B762, B763	Boeing 767-200, 767-300	
DC -8 (Super 63)	DC86	Douglas DC 8-60 Series	
DC-10	DC10	McDonnell Douglas DC-10, MD-10	
DHC-6	DHC6	DeHavilland Twin Otter	
E-145	E145	Embraer Regional Jet 145	
JS-41	JS41	BAe Jetstream 41	
MD-11	MD11	McDonnell Douglas MD-11	

Note 1: The Turbulence Categories in this table were derived using aircraft characteristics (wing area, span, sweep, aspect ratio, taper ratio) and typical mission-specific profiles (aircraft weight, airspeed, altitude). The table therefore should be considered authoritative; however, an aircraft's turbulence category may differ from what is stated in the table based on its actual weight, airspeed, and/or altitude. Original source document is AFRL-TR-81-3058. For questions, updates, or aircraft additions, contact AFLCMC/XA, DSN 312-785-2207 and email AFLCMC.XA.WeatherTeam@us.af.mil

Note 2: If an aircraft is not listed, the following conservative Turbulence Categories can be made: Jets and multi-engine prop/turbo-prop aircraft that fly at/above FL180 can be considered Category II. All other aircraft should be considered Category I (not related to AIRMETs/SIGMETs).

Note 3: Turbulence Categories for helicopters is primarily determined from aircrew feedback. The methodology used for fixed-winged aircraft is not applied to helicopters due to their added complexity.

Note 4: The CV-22 displays aspects of flight that include rotor-wing operations and therefore objective gust load calculations and turbulence categorization are not possible for rotor phase of flight (e.g. takeoff/landing).

Note 5: Turbulence categories for aircraft with gust alleviations systems (passive or active) are likely less susceptible to turbulence than their computed category.

Note 6: Turbulence categories for Small UAVs (Mean Aerodynamic Chord < 2 ft), cannot be determined using the Gust Loads Formula and therefore should be considered Category I.

Note 7: This turbulence category applies to all Modified/Basic Mission Designators and Model Series (except for the EC-130H/J models which are CAT III).

Note 8: This turbulence category applies to all Model Series.

Table 2.3. Aircraft Turbulence Intensity Conversion Chart.

	I	II	III	IV
	N	N	N	N
	(L)	N	N	N
	L	(L)	N	N
	L-(M)	L	(L)	N
Turbulence	M	L-(M)	L	(L)
Reported As	M-(S)	M	L-(M)	L
	S	M-(S)	M	L-(M)
	S-(X)	S	M-(S)	M
	X	S-(X)	S	M-(S)
	X	X	S-(X)	S
	X	X	X	S-(X)
	X	X	X	X

N = None ( ) = Occasional (less than 1/3 of the time)
L = Light M = Moderate S = Severe X = Extreme

Note: Use caution when converting extreme turbulence reports between various aircraft types. Extreme turbulence causes a range of effects from a minimum threshold (rapid airspeed fluctuations greater than 25 knots) to a maximum threshold (structural damage). Even though the table considers this, the design is more for the sake of "completeness" rather than observational or scientific evidence.

2.4.2.1.3. *Weaknesses*. Clear Air Turbulence (CAT) is a transitory event resulting from the formation and collapse of unstable atmospheric waves and vortices over time. For this reason, turbulent areas on turbulence forecast products depict regions where environmental conditions are most favorable for repetitive generation and collapse of the atmospheric waves and vortices responsible for the majority of turbulence events.

2.4.2.1.3.1. Turbulence charts are specified for Category II aircraft with a clean airframe cruising in level flight at the most efficient cruising airspeed at a "typical" weight with a crew that has taken no precautions to mitigate CAT.

2.4.2.1.3.2. The MIL-STD depiction used in these products degrades product resolution. The minimum resolvable feature on standard products is approximately 60 nautical miles (108 kilometers). Higher definition products rendered as color fills (see **Figure 2.11**) are displayed at significantly finer resolutions as high as 2 to 7 nautical miles (4-12 km) and may be used to execute missions, especially in the lower levels of the atmosphere where mechanical or terrain induced turbulence is more prevalent.

Figure 2.9. Standard Regional-Scale Low-Level Mechanical/CAT Forecast Product, Surface to FL180 Layer (25 OWS).

Figure 2.10. Standard High-Level Turbulence Product (17 OWS).

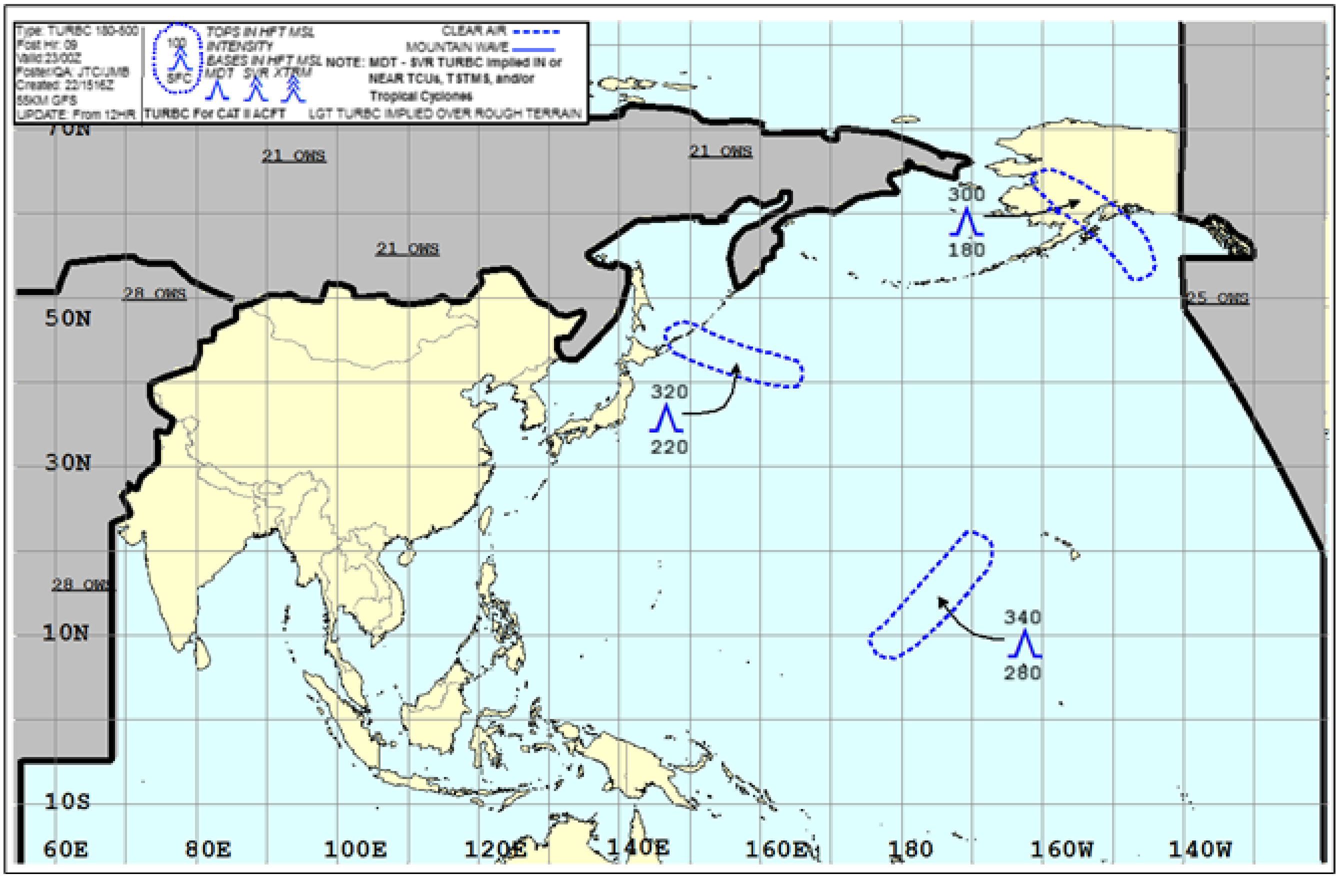
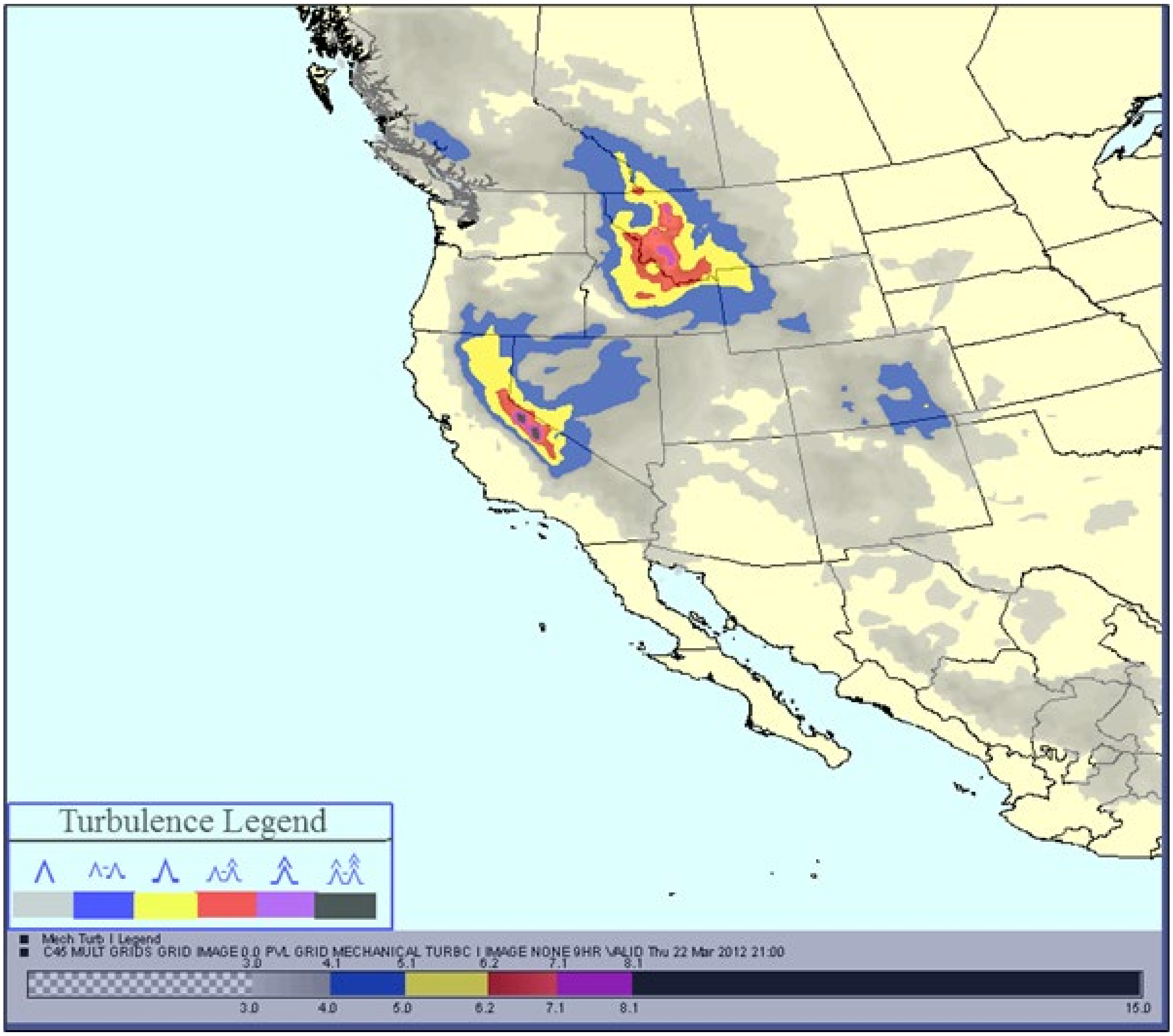


Figure 2.11. High-Resolution CAT Forecast Product (25 OWS).



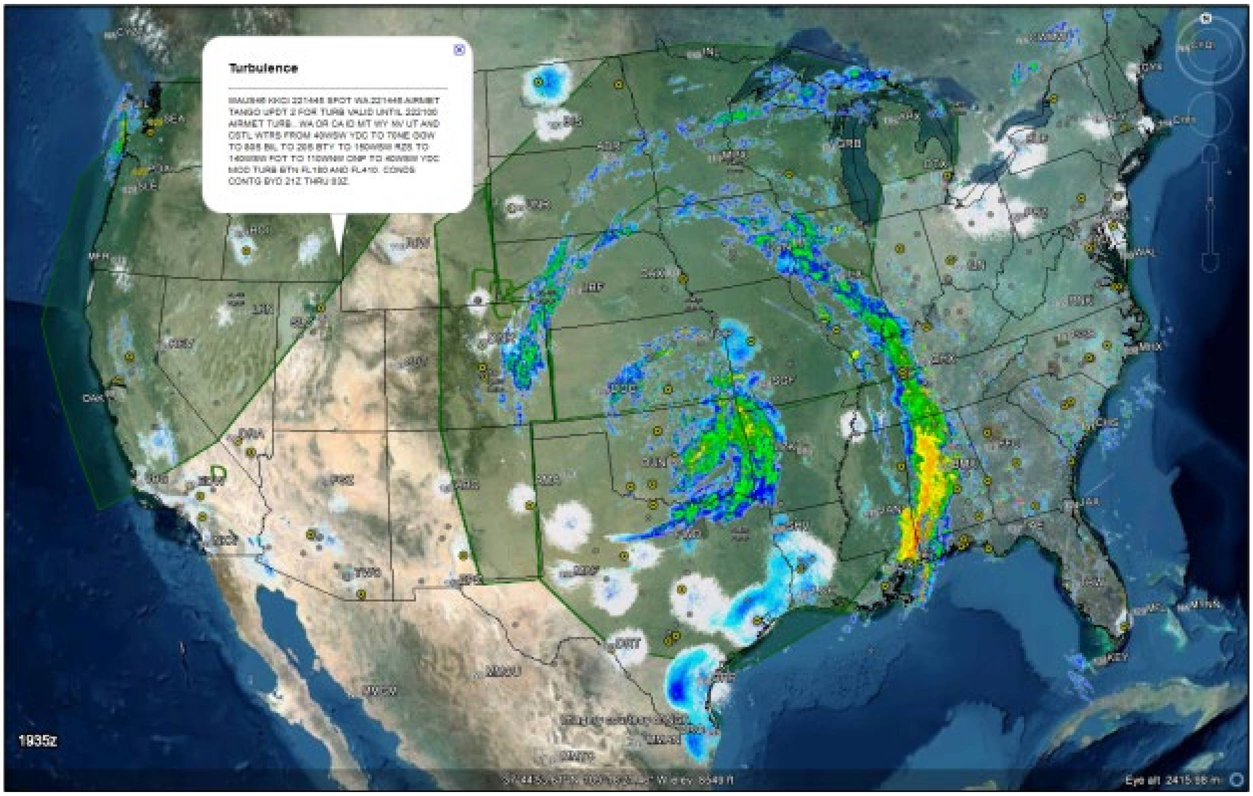
2.4.2.2. AIRMET/SIGMET Summaries.

2.4.2.2.1. *How to use this product*. Use graphical presentations of AIRMET or SIGMET bulletins in the same fashion as other turbulence forecasts. Users should pay close attention to the valid times of the product and apply them if the intended route of flight intersects with the area designated on the product.

2.4.2.2.2. *Strengths*. AIRMETS and SIGMETS are event-based products and rapidly issued, amended, and cancelled, making them a very efficient means of communicating threats.

2.4.2.2.3. *Weaknesses.* AIRMETS and SIGMETS issued in some parts of the world give no consideration to the type of aircraft reporting turbulence; a single report from a light aircraft operating in vicinity of mountains is sufficient to warrant issuing a SIGMET for a much larger geographic area affecting every category of aircraft intending to operate in the airspace.

Figure 2.12. AIRMET Summary Overlaid with a RADAR Mosaic (AFW-WEBS).



2.4.3. Icing Products.

2.4.3.1. *How to use this product*. Icing forecasts depict maximum icing conditions not associated with thunderstorms. Forecaster generated products are issued in 3-hour time steps out to the 30-hour point and are continuously monitored and amended as required. Extended forecast icing products are produced for the 33-120 hour time frame using meteorological models. These forecasts are based on meteorological models and are updated every six hours.

2.4.3.2. *Strengths*. Air Force graphical icing forecast products are tailored for military decisions to ensure a high probability of detection of atmospheric conditions most favorable for icing. Air Force graphical forecasts are sub-divided into low level (surface to FL180) and upper level (FL180-FL500); graphical forecast from civilian agencies are usually not available below FL150. All flight level graphics are measured in MSL. AF weather personnel routinely update graphical forecasts products and amend incorrectly specified icing areas as required. In addition, the underlying digital data fields are updated for consumption by weather-enabled C4ISR systems via machine-to-machine transfer.

2.4.3.3. *Weaknesses*. The MIL-STD depiction used in these products degrades product resolution. The minimum resolvable feature on standard products is approximately 60 nautical miles (108 kilometers). Higher definition products rendered as color fills (see **Figure 2.15**) are displayed at significantly finer resolutions of approximately 2 to 7 nautical miles (4-12 km). Basis of icing intensities depicted on graphical forecast products (civilian or military) focus on an idealized aircraft cruising through the icing area without taking preventative steps to reduce or prevent ice accumulation on the airframe. Aircraft climbing or descending through the icing layer may experience different icing effects than an aircraft cruising through the same layer. Employment of anti-icing or de-icing equipment significantly impacts the accumulation of icing. For these reasons, apply context while evaluating icing forecasts when PIREPS of no icing or lower intensity icing occur in forecasted areas.

Figure 2.13. Icing Forecast Product (28 OWS).

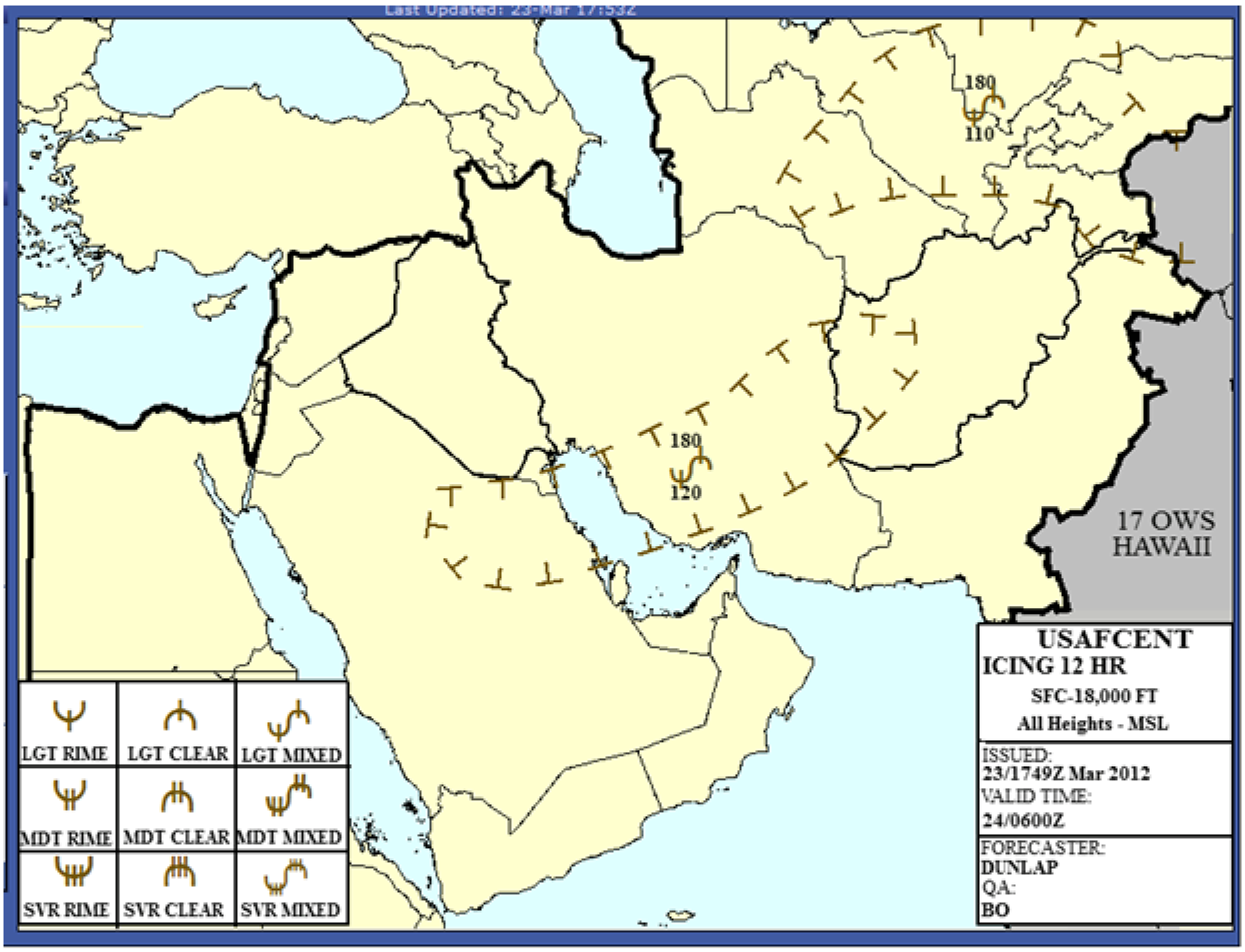


Figure 2.14. Icing Forecast Product Overlaid with a Meteorological Satellite Image and a Surface Chart (AFW-WEBS).

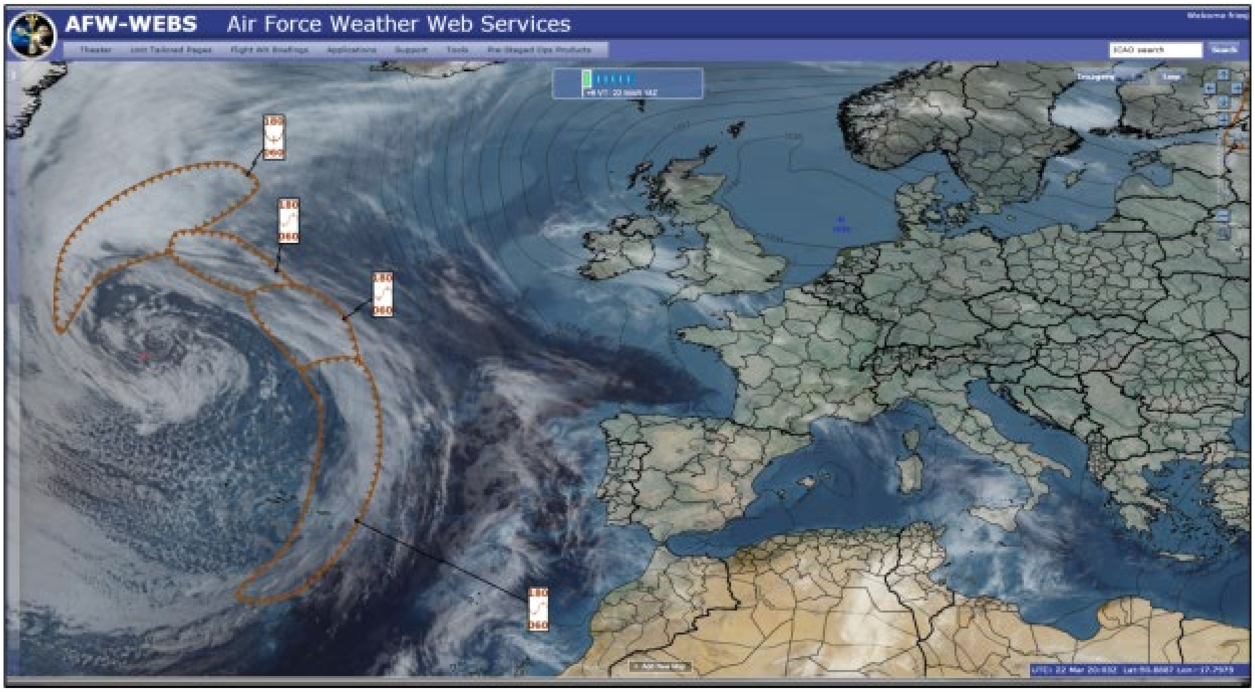


Figure 2.15. Forecast for Any Intensity of Icing, Light or Greater, over the Korean Peninsula Overlaid on an Aeronautical Chart Background (AFW-WEBS).

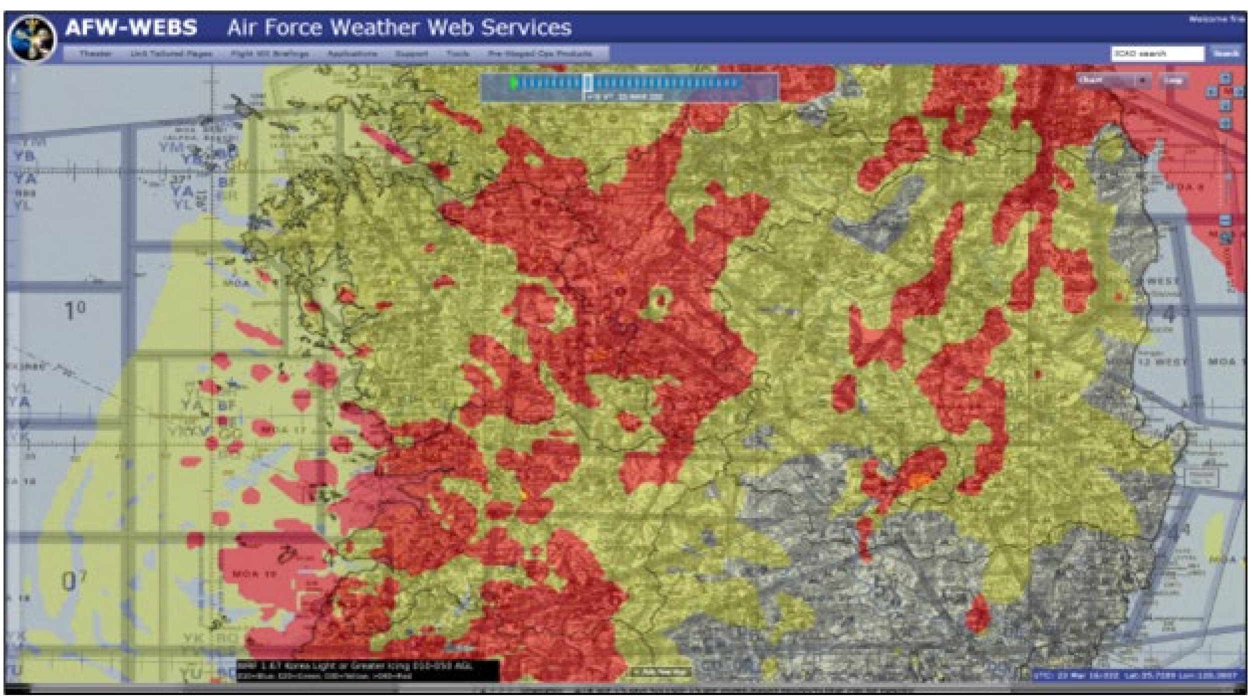


Figure 2.16. Icing Forecast for FL240 (+/- 5,000ft) on AFW-WEBS using Color Fills Overlaid on Meteorological Satellite Image.

2.4.4. Thunderstorm Products.

2.4.4.1. Thunderstorm Forecasts.

2.4.4.1.1. *How to use this product*. Air Force standard thunderstorm forecast products depict the total area affected and the maximum instantaneous thunderstorm coverage over a 3-hour period starting with the valid time. Thunderstorm forecast graphics provide military decision makers with the maximum storm tops and the broadest coverage within the forecast area for the valid period. See **Table 2.4** for a breakdown of the coverage categories. Areas specified with numerous coverage (NMRS) are generally considered to be those in which thunderstorms are not easily circumnavigated while still leaving proper avoidance distance at altitude. Mission profiles intersecting areas designated at risk for thunderstorms may need to be adjusted to avoid the thunderstorm threat depending on the area coverage of the threat. Operating in thunderstorms is generally restricted in all AF 11-2 Mission Design Series (MDS) instructions and Army Regulation (AR) 95-1, *Army Regulation Aviation Flight Regulation*s and most publications restrict takeoffs and landings when thunderstorm activity is within 5NM of an airfield. In addition to lightning; severe turbulence, severe icing, hail, and wind shear are implied when operating in or near thunderstorms. These forecasts, issued in 3-hour blocks for both mission planning and execution within the first 30-hour time frame, are continuously monitored and amended for rapidly changing or unforecast conditions. Products for the 33-120 hour time frame use meteorological model forecasts and are not amended, but reissued as the meteorological models update each 12-hour period.

Table 2.4. Thunderstorm Forecast Coverage.

Isolated (ISOLD)	Maximum instantaneous coverage of 1-2%
Few (FEW)	Maximum instantaneous coverage of 3-15%
Scattered (SCT)	Maximum instantaneous coverage of 16-45%
Numerous (NMRS)	Maximum instantaneous coverage greater than 45%

2.4.4.1.2. *Strengths*. Thunderstorm forecast products are consistently monitored and adjusted when conditions are not correctly specified in the original forecast. The graphical forecast is a compilation of the 3 hours for the valid period of the forecast which enables weather personnel to depict thunderstorms with short life cycles. Thunderstorm coverage values on the graphical thunderstorm forecast are the same as those used in flight weather briefings and no conversion is necessary. Thunderstorm coverage and maximum tops are more extensive than similar products from civilian sources which may only depict organized thunderstorm complexes or thunderstorms which intersect international routes or airways.

2.4.4.1.3. *Weaknesses*. The graphical thunderstorm forecast cannot be used as a stand-alone product. The forecast graphic depicts a 3-hour compilation, or time phasing, of an entire area affected by thunderstorms during the 3-hour valid period of the forecast graphic. Taken in isolation, the thunderstorm graphic will generally provide a pessimistic representation of any single time frame within the 3-hour time phased window. **Figure 2.17** shows how an organized area of rapidly moving thunderstorms will be depicted on the thunderstorm forecast; at first glance it would seem that the entire area shown within the MIL-STD display is covered with 3-15% thunderstorms, but since the thunderstorms are moving through the area, it may be possible to operate in the western regions of the area late in the valid period or in the eastern portions of the region early on in the valid period of the forecast. **Figure 2.19** depicts lightning strike location and timing data overlaid on a meteorological map background.

Figure 2.17. Rapidly Moving Area of Thunderstorms Depicted on an Air Force Standard Thunderstorm Forecast Product.

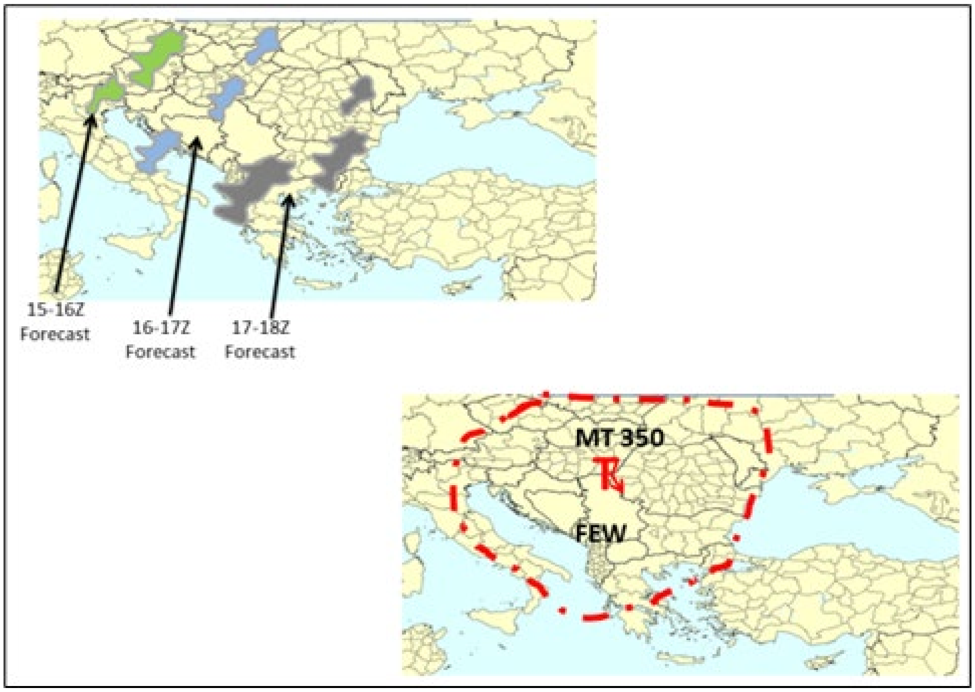


Figure 2.18. Standard Thunderstorm Forecast Product (21 OWS).

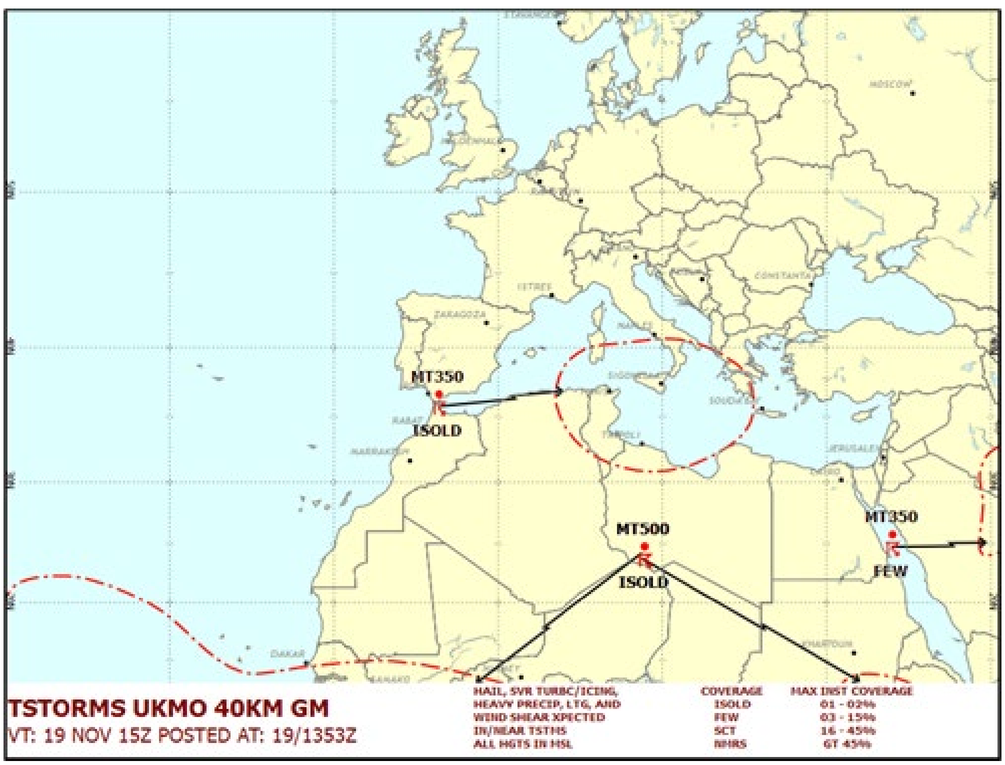


Figure 2.19. Thunderstorm Forecast with Lightning Strike Data (AFW-WEBS).

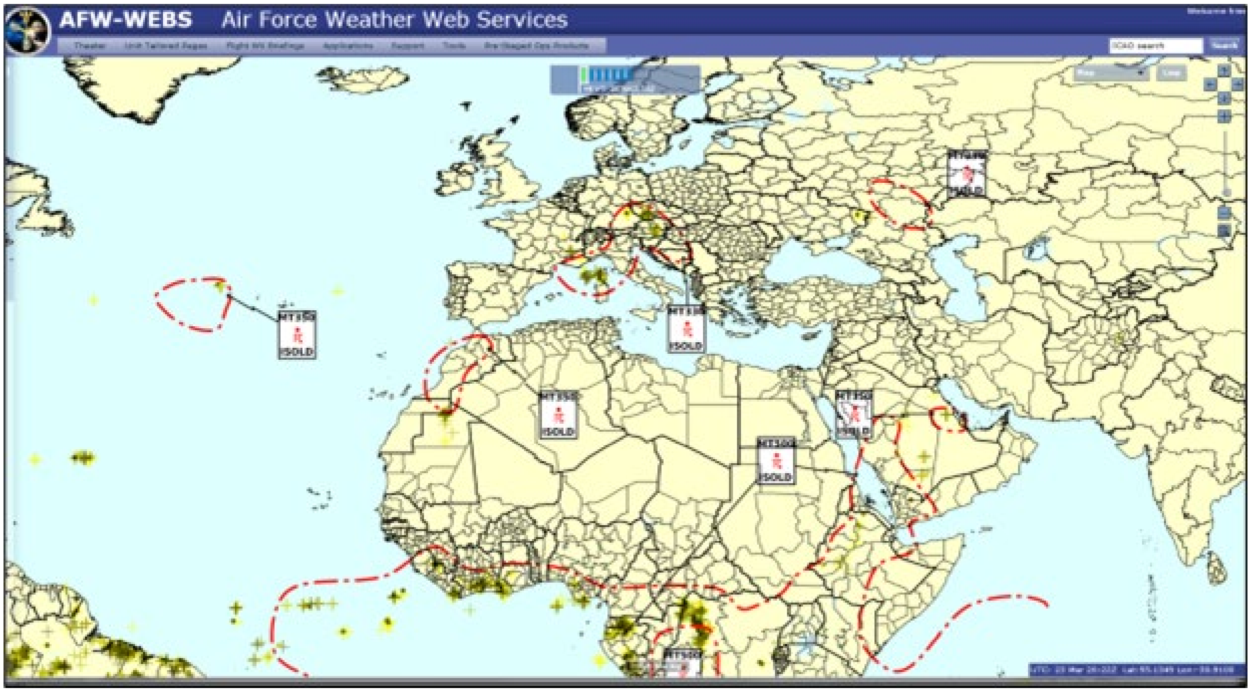
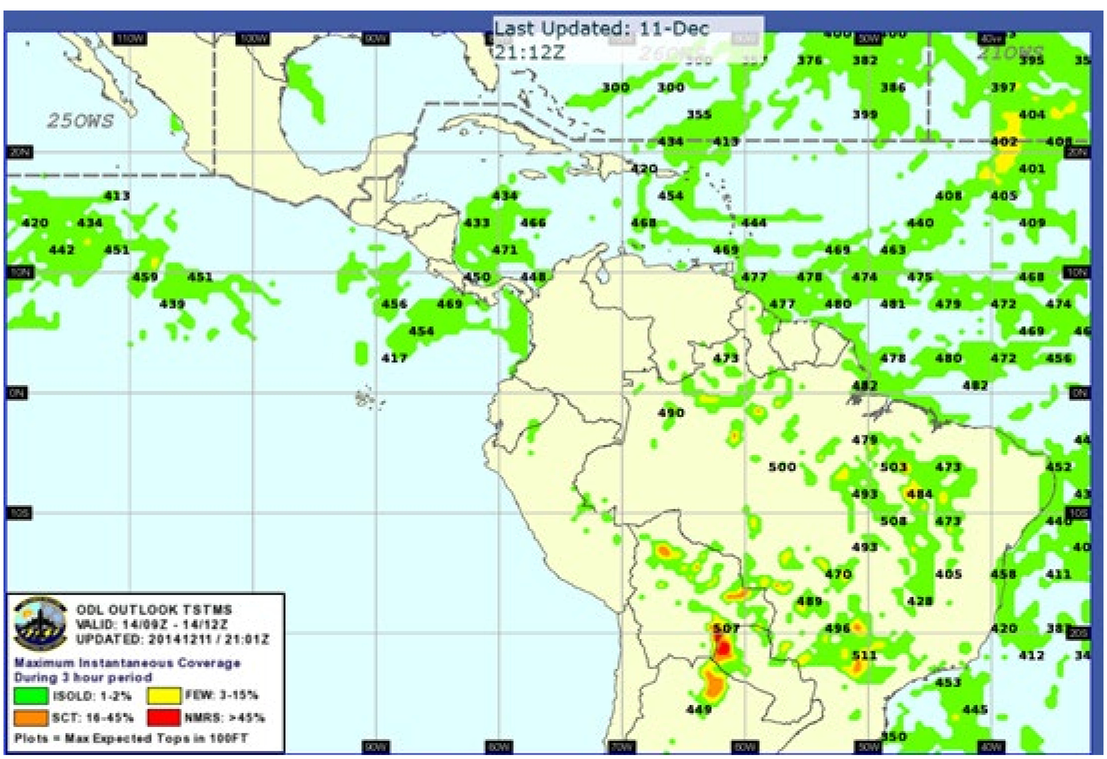


Figure 2.20. SOUTHCOM Area High-Resolution Extended Period Thunderstorm Forecast (Color-fill Method of Depiction).



2.4.4.2. Weather RADAR mosaics. RADAR mosaics are compilations from multiple RADARs within a network with slightly different sample times, so a mosaic date and time stamped for a specific valid time may contain RADAR data from some RADARs in the network that is slightly older (usually not more than 10 minutes). Imagery from single site RADARs are more suited for making critical decisions regarding resource or force protection actions.

2.4.4.2.1. *How to use this product*. RADAR mosaics, looped or overlaid with other forecast products, improve situational awareness and assist in short-term decision making. These products depict the RADAR returns at any point in the atmosphere during the valid period of the product and are color coded to quickly highlight precipitation type or areas with the strongest RADAR returns (**Figure 2.21**). **Figure 2.22** also shows the RADAR mosaic accompanied by storm reports and current OWS warnings for a Total Force location in CONUS. More detailed information on ground weather RADAR is found in **Section 2E**.

2.4.4.2.2. *Strengths*. Produced and displayed in near real time, this product is an efficient and effective means of relaying weather RADAR information.

2.4.4.2.3. *Weaknesses*

2.4.4.2.3.1. Many parts of the world lack sufficient RADAR coverage to create mosaics. In some cases, host nations treat RADAR data as proprietary and delay release to the international aviation community for several minutes after collection. Paying customers may receive the data in near real time.

2.4.4.2.3.2. Even in dense RADAR networks, terrain blocking, interference from wind power generators, or other beam propagation effects may cause “dead spots” or gaps in RADAR coverage. These areas may appear as echo free when RADAR detectable features are actually present.

Figure 2.21. Weather RADAR Mosaic Showing Precipitation Type (15 OWS).

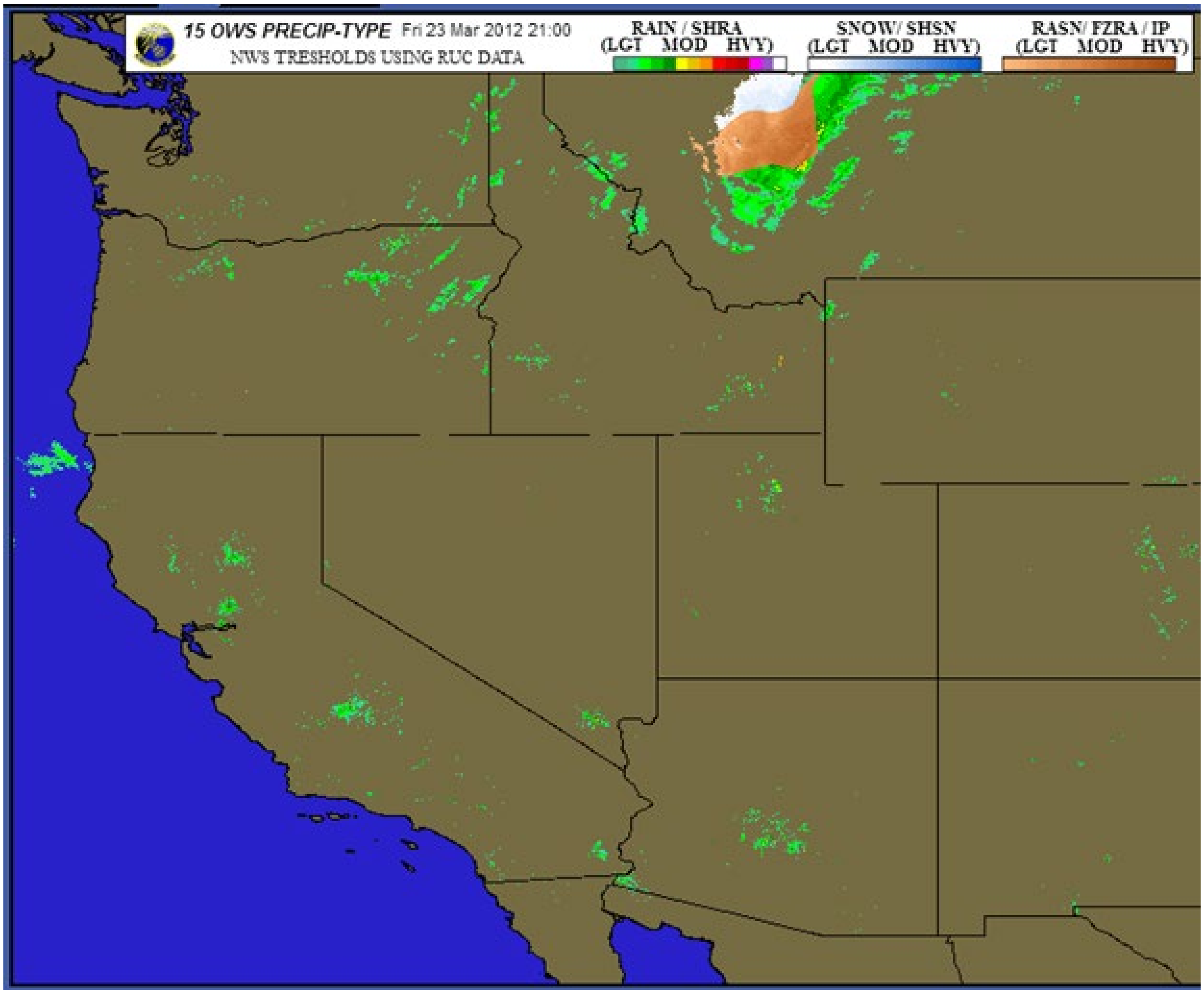
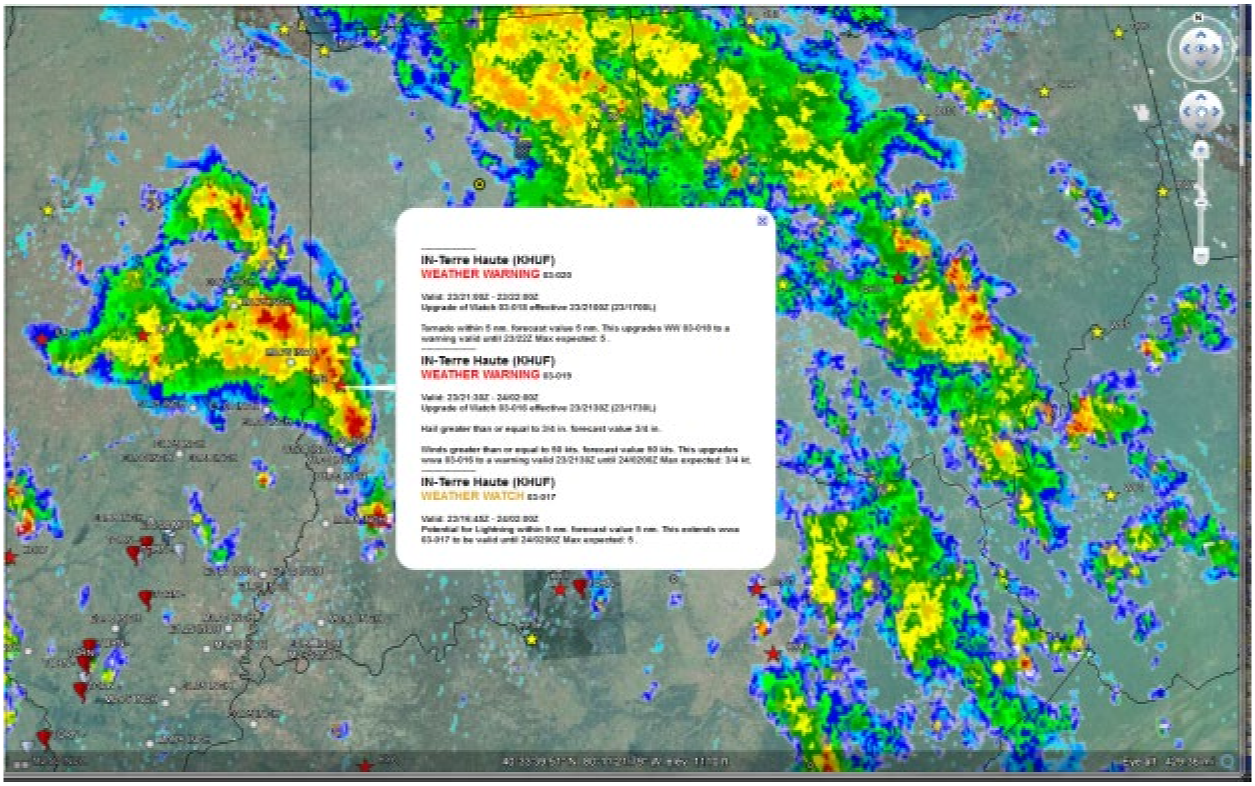


Figure 2.22. Weather RADAR Mosaic (AFW-WEBS).



2.4.4.3. Lightning Summaries

2.4.4.3.1. *How to use this product*. Use lightning data in concert with other products to gather a complete picture of the threats posed by the natural environment. When overlaid with RADAR or satellite imagery, lightning data can be used to quickly determine the location, movement, and intensity of thunderstorms. **Figure 2.23** displays lightning strikes from the preceding 60 minutes and is overlaid on a meteorological satellite image. Lightning strikes are color-coded based on the time observed.

2.4.4.3.2. *Strengths*. Lightning data can be quickly collected, geolocated, and displayed for situational awareness and to facilitate personnel protection and flight safety decisions.

2.4.4.3.3. *Weaknesses.*

2.4.4.3.3.1. The most common lightning detection systems in use today rely on ground stations to detect the electromagnetic signatures of cloud-to-ground lightning strikes and record the position, strength and polarity of the signal from the lightning strike. The more ground stations that detect the strike, the more accurate the geographic placement of the strike will be.

2.4.4.3.3.2. Lightning detection systems collect cloud-to-ground lightning with varying capabilities for collecting cloud-to air, in-cloud, or cloud-to-cloud lightning posing a direct hazard to airborne aircraft.

Figure 2.23. Lightning Summary Product (AFW-WEBS).

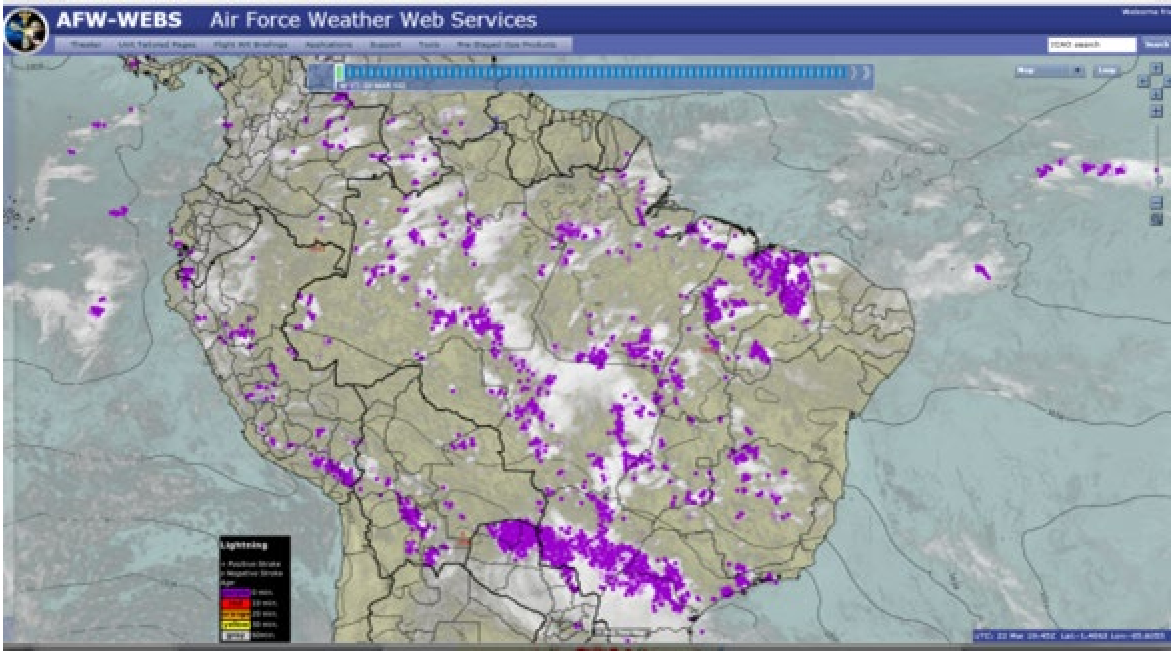
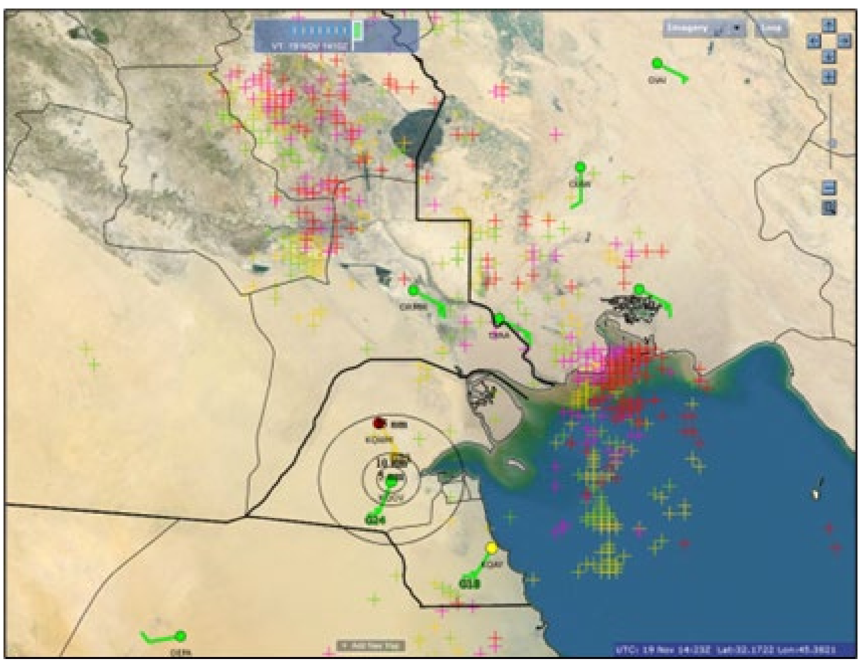


Figure 2.24. Lightning Display Product (AFW-WEBS).



2.4.5. Ceiling and Visibility Forecast Products.

2.4.5.1. *How to use this product*. These forecast products show the lowest ceiling or visibility condition during the cardinal hour of the marked forecast valid time. Mission profiles that intersect a bounded area during the valid period of the forecast can expect to experience cloud ceilings or visibilities less than or equal to the criteria specified in the forecast. These point-in-time forecasts depict the predominant combined ceiling and visibility conditions at the cardinal hour of the forecast and are monitored for significant deviation from anticipated conditions. The entire product suite is updated every six hours. **Note:** This product set is not produced by the 21 OWS.

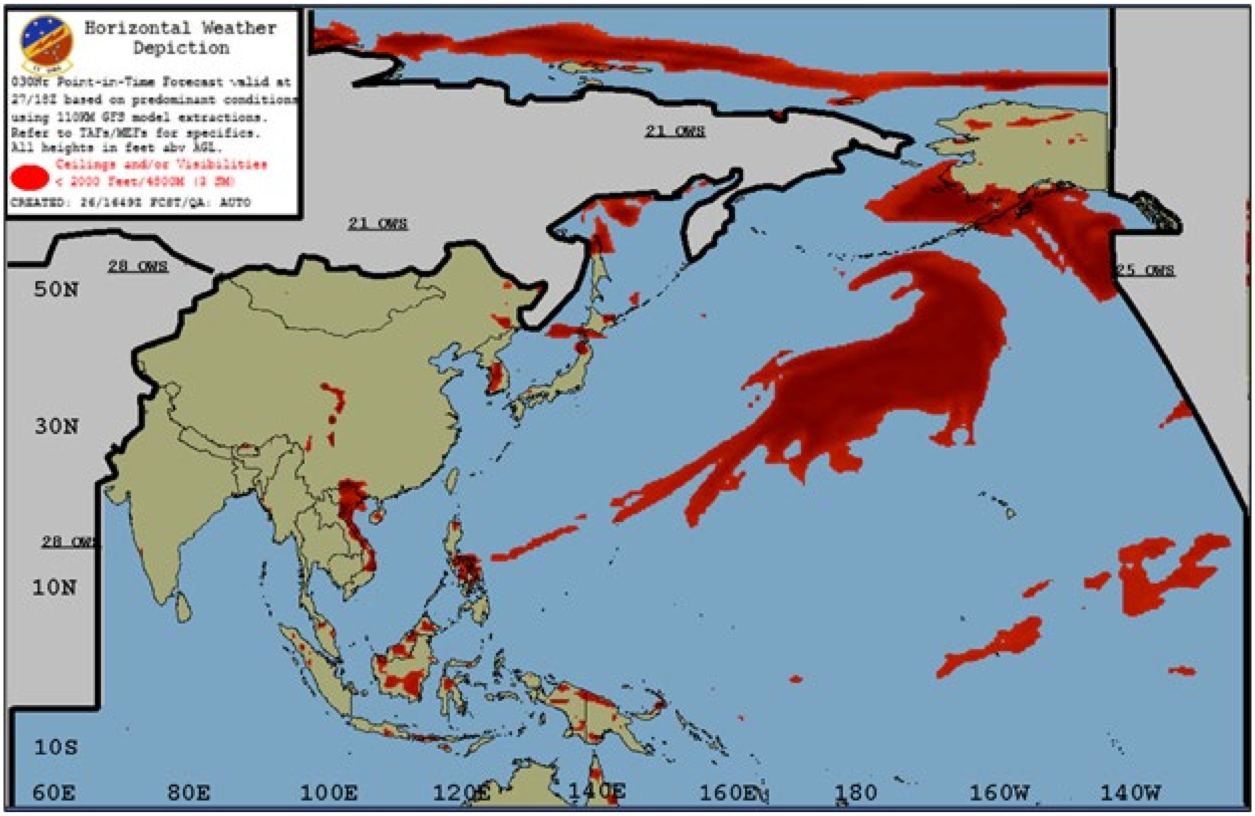
2.4.5.2. *Strengths.*

2.4.5.2.1. These forecast products are tailored for military aircraft using the mission planning criteria from AFI 11-202V3 or AR 95-1. By comparison, similar looking forecast products from civilian agencies are scaled to accommodate general aviation ceiling and visibility criteria that are not completely compatible with military decision making. Areas on AF standard products marked with red color fills designate areas with forecast ceiling or visibility conditions prompting an aircrew to file for destination alternates on an instrument flight plan.

2.4.5.2.2. AF graphical forecast products are available at a greater frequency than similar looking products from civilian sources and are continuously revised or amended during rapidly changing conditions. Civilian forecasts, such as those from the Aviation Weather Center are issued four times a day valid in 6-hour increments out to 24 hours and are not amended for rapidly changing or unexpected conditions. Rather than amend graphical forecasts, civilian agencies issue AIRMETS and SIGMETS to supplement the graphical forecasts. AF weather personnel monitor the graphical forecasts and will amend the products for significant deviations as required; the entire suite is routinely updated on six-hour intervals. In addition, the underlying digital data fields are updated for consumption by weather-enabled C4ISR systems via machine-to-machine transfer.

2.4.5.3. *Weaknesses*. Point-in-time depictions require user interpolation for mission profiles intersecting ceiling/visibility areas in time frames between the valid time of the forecast. NOTE: Temporary conditions are not depicted in this forecast product.

Figure 2.25. Ceiling and Visibility Forecast (17 OWS).



2.4.6. Surface and Sensible Weather Forecast Products.

2.4.6.1. *How to use this product*. These products depict common weather elements for situational awareness. The sensible weather areas (rain, rain showers, snow, etc.) depict the total area affected for the designated weather phenomena during the cardinal hour of the valid time of the forecast product. These point-in-time forecasts are issued in 3-hour time steps for both mission planning and execution with the first 30-hour time frame continuously monitored and amended for rapidly changing or unforecasted conditions. The products issued for the 33-120 hour time frame are based on meteorological model forecasts and are not amended, but will be reissued as the underlying meteorological model is updated. In most cases, the longer range forecasts will be updated at least every 12 hours and perhaps as frequently as every 6 hours.

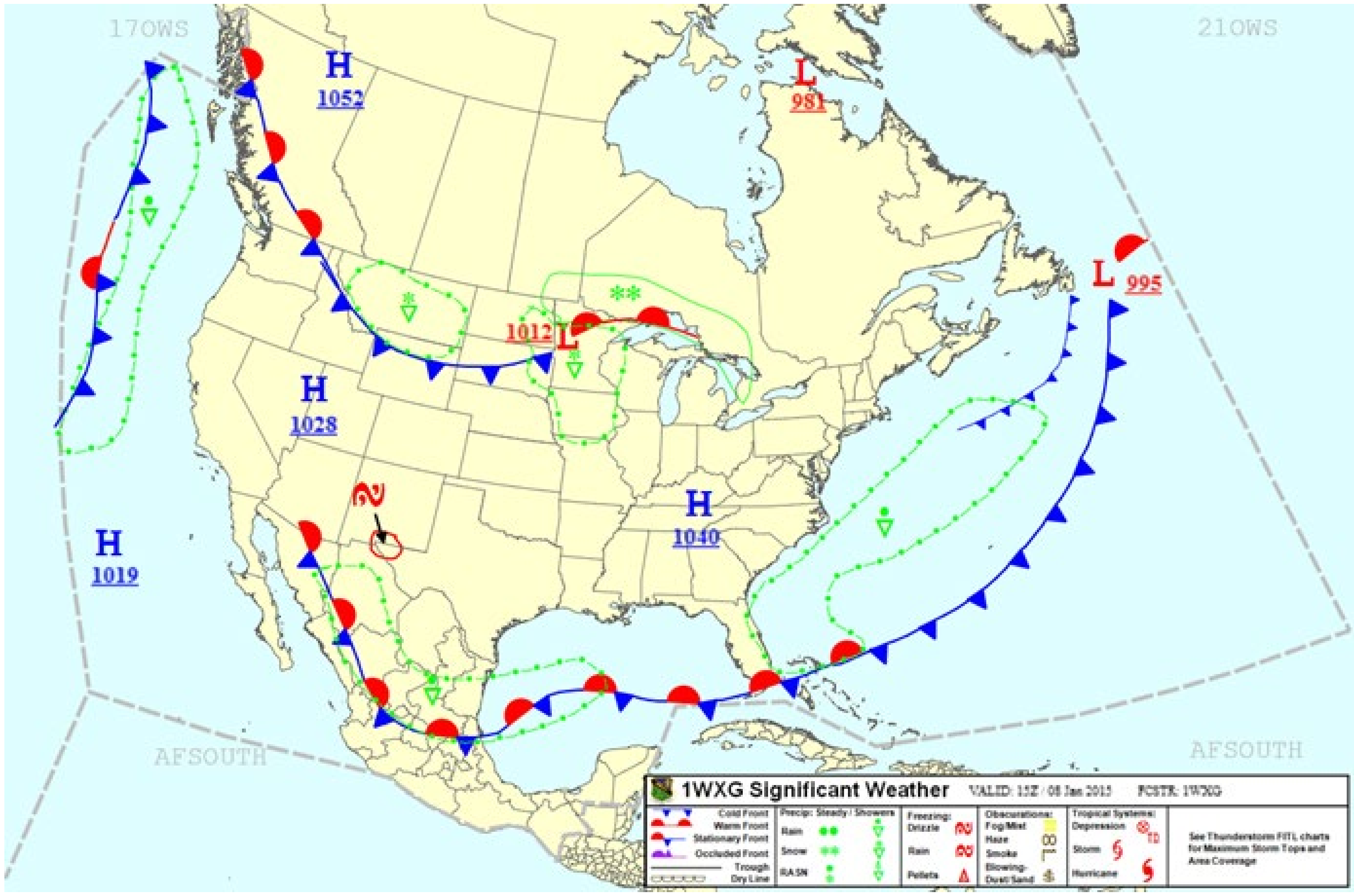
2.4.6.2. *Strengths*. This product is easily understood and simple to use.

2.4.6.3. *Weaknesses.*

2.4.6.3.1. Weather personnel manually render surface fronts and sensible weather fields through the first 30 hours of the forecast period. Machine rendering of surface fronts is not practicable at this time. Forecasts for hours 33-120 do not contain surface frontal boundaries.

2.4.6.3.2. Surface fronts on AFW-WEBS globally fused products may not always line up on the boundary between two OWS regions of responsibility. These mismatches are due to translation differences between the AFW-WEBS mapping system and the map projections used at the different OWSs when the products were originally created. Development and fielding of better rendering technologies will minimize these geospatial rendering errors. Sensible weather fields are created via a separate process not subject to rendering errors when fused into a global view.

Figure 2.26. Standard Surface Features and Weather Forecast (CONUS).



Section 2B—TEXT PRODUCTS

2.5. Aviation Routine Weather Report (METAR) Code. METAR is the observation code used to report meteorological conditions for aviation operations. Full code details are found in AFMAN 15-111. Elements within the METAR report include: wind, visibility, runway visual range, present weather, sky condition, temperature, dew point, and altimeter setting. Plain language information (Remarks) may be appended to the report. METAR was adopted by international agreement for worldwide use, but each country can modify the code (e.g., use statute miles versus meters for surface prevailing visibility). The majority of METAR observations are collected, compiled, and transmitted by airfield automated sensing systems with minimal to no human involvement. AF weather personnel perform detailed augmentation and backup/supplementing of the airfield observing system when sensors are inoperative or when conditions that cannot be sensed by the system are expected or are occurring. Weather personnel are typically present when the associated tower is manned at controlled airfields.

2.5.1. Report Type. Every observation taken and transmitted via the global telecommunications system is designated with the METAR data type. Scheduled METAR observations (i.e., hourly observations) are taken and transmitted between 55-59 minutes past the hour. Special (SPECI) reports are unscheduled METAR observations taken when a predefined condition criteria change occurs. Manual observing locations may compile and disseminate "Special" or "Local" observations for condition changes significant to a given airfield's operations. Locals are not disseminated to users outside of the aerodrome. Automated airfield observing systems do not take "Local" observations; every observation is a METAR or SPECI.

Figure 2.27. METAR Observation Code.

METAR KBLV 011657Z AUTO 25015G30KT 210V290 3/8SM R32L/1000FT FG BKN005 01/ M01 A2984 RMK AO2 SLP034

2.5.2. Location. 4-character identifier; **KBLV** (Scott AFB) is the location/station. The first letter identifies the area (**Table 2.5**). A worldwide identifier list is in *Location Indicators* (ICAO).

Figure 2.28. METAR Observation Code specifying Station Identifier.

METAR **KBLV** 011657Z AUTO 25015G30KT 210V290 3/8SM R32L/1000FT FG BKN 005 01/M01 A2984 RMK AO2 SLP034

Table 2.5. Regional Identifier Prefix.

Prefix code	Region
A	Western South Pacific
B	Iceland/Greenland and Kosovo
C	Canada
D	West Africa
E	Northern Europe
F	Southern Africa
G	Northwestern Africa
H	Northeastern Africa
K	United States (excluding Alaska and Hawaii)
L	Southern Europe, Israel, and Turkey
M	Central America and Mexico
N	South Pacific
O	Southwest Asia (excluding Israel and Turkey)
P	Eastern North Pacific
R	Western North Pacific
S	South America
T	Caribbean
U	Russia and former Soviet states
V	South Asia (except Pakistan, mainland Southeast Asia, Hong Kong, and Macau
W	Maritime Southeast Asia (except the Philippines)
Y	Australia
Z	East Asia (excluding Hong Kong, Japan, Macau, South Korea, and Taiwan)

2.5.3. Date and Time of Issuance. See AFMAN 15-111.

2.5.4. Automated Meteorological Observation System Designators and Correction Modifiers. **AUTO** refers to an observation taken from an unattended Automated Meteorological Observation System (AMOS) i.e., AN/FMQ-19, AN/TMQ-53, Automated Surface Observing System (ASOS). **AO1** is an AMOS without a rain vice snow discriminator. **AO2** is an AMOS with a rain vice snow discriminator. **AO2A** indicates that a human observer is logged on to the observing system and augmenting or backing up the airfield observing system.

2.5.4.1. Determining Augmentable Observation Elements. AF weather personnel typically only augment for those items listed in **AFMAN 15-111, Table 3.1.,** and those that would adversely impact flight/ground operations, based on local requirements. These criteria are those that may be unreliably measured by an automated sensor. AF weather personnel use manual observing methods (e.g., prevailing visibility reporting, thunderstorm reporting) when augmenting an AMOS. AF weather personnel will also back-up specific observation elements that are missing or incorrect due to sensor and/or communication failures.

Figure 2.29. METAR Observation specifying an Automated Observation with Human Augmentation.

METAR KBLV 011657Z **AUTO** 25015G30KT 210V290 3/8SM R32L/1000FT FG BKN005 01/M01 A2984 RMK **AO2** SLP034

2.5.5. Wind Speed and Direction. See AFMAN 15-111. Reported wind direction is the direction from which the winds are blowing. Wind direction relayed by air traffic control agencies is in magnetic north. The wind will be reported as prevailing, gust, or squall. Prevailing (sustained) is the most common and is the average direction/speed over the 2 minutes immediately preceding the observation. Gusts are a sudden, brief increase in speed (with a vari-ation of 10 knots or more between peaks and lulls) during the 10 minutes immediately preceding the observation. Squalls are characterized by a very large variation in wind speeds, with showers or thunderstorms often accompanying it. The term "squall" is used when the wind speed increases by at least 16 knots and is sustained at 22 knots or more for at least 1 minute. The first three wind group digits will be the true (from) direction to the nearest 10 degrees and the next two digits are speed. If winds are gusting, the next two or three digits immediately following the letter "G" will be the gust speed or peak wind speed. Example: The 25015G30KT group is the wind direction and speed. Therefore, 250 degrees is the direction (true), 15 knots is the sustained wind speed and 30 knots is the gust.

Figure 2.30. METAR Observation Specifying Winds.

METAR KBLV 011657Z AUTO **25015G30KT** 210V290 3/8SM R32L/1000FT FG BKN005 01/ M01 A2984 RMK AO2 SLP034

2.5.6. Wind Variability. See AFMAN 15-111.

2.5.7. Visibility. Visibility reports in Air Force METAR observations provide the prevailing visibility at the airfield observing system visibility sensor. See AFMAN 15-111. Prevailing visibility at other sensor locations (usually the inactive end of the runway) is carried in a METAR as a surface discontinuity group. Example: 3/8SM (statute miles) is the prevailing visibility. To convert from statute miles to meters, use this formula: meter(s) = statute mile(s) x 1609.344

Figure 2.31. METAR Observation Specifying Visibility.

METAR KBLV 011657Z AUTO 25015G30KT 210V290 **3/8SM** R32L/1000FT FG BKN005 01/ M01 A2984 RMK AO2 SLP034

2.5.8. Runway Visual Range (RVR). RVR is reported when the prevailing visibility is one statute mile or less and/or the RVR for the designated runway is 6,000 feet/1500 meters or less. Based on a ten-minute average, RVR follows the visibility and begins with "**R.**" See AFMAN 15-111.

2.5.9. Type of Weather. See AFMAN 15-111.

2.5.10. Clouds. See AFMAN 15-111. Clouds are reported in eighths for coverage and hundreds of feet AGL for heights. Some automated systems do not report cloud bases above 12,000 feet.

Figure 2.32. METAR Observation specifying Sky Condition.

```
METAR KBLV 011657Z AUTO 25015G30KT 210V290 3/8SM R32L/1000FT FG BKN005
01/ M01 A2984 RMK AO2 SLP034
```

2.5.11. Temperature and Dew Point. After sky condition is the temperature and dew point (Celsius). Temperature and dew point affect pressure altitude and density altitude, which are used to determine runway length needed and helicopter power settings. See AFMAN 15-111.

2.5.12. Altimeter Setting. See AFMAN 15-111. International locations may report altimeter settings in hectopascals (hPa) or millibars (mb). To convert from inches of mercury (in Hg) to mb or hPa, use this formula: mb/hPa = in Hg * 33.8639.

2.5.13. Remarks (RMK). Remarks may be encoded in plain language and will contain any supplementary data. See AFMAN 15-111.

2.6. Terminal Aerodome Forecast (TAF). Terminal forecasts for Air Force and Army airfields are provided by the OWS in the AF standard code form to provide advance notice of changes in weather conditions within a designated aerodrome complex. TAFs include weather phenomena within a 5-statute mile radius around the center of a runway complex and cover a period of time up to 30 hours. Forecast parameters include: wind, prevailing visibility, precipitation and/or obstruction to visibility, sky coverage (eighths), icing, turbulence, minimum altimeter setting and pertinent plain language remarks. Full code details are found in AFMAN 15-124.

2.6.1. Location. See AFMAN 15-124**.**

2.6.2. Type of Report. **TAF** is an airport forecast for a specific period (usually 30 hours). See AFMAN 15-124.

2.6.3. Forecast Date and Valid Times. See AFMAN 15-124. In a civilian TAF (KSTL), the next two groupings following the identifier are the date/time the **forecast was prepared** (**05** is the date, and **1155Z** is the **issuance time**) and the **forecast valid times (from 5/12Z to 6/18Z).** In a military TAF (KBLV), the group following the ICAO identifier will be the valid period of the forecast (**from 5/12Z to 6/18Z**). With the advent of internet based weather data retrieval and display systems, it is possible that the computer may be displaying a TAF product stored in the computer cache, so it is very important to verify the date/time group of the forecast to ensure it is the most current product.

Figure 2.33. Example TAF specifying Forecast Date and Valid Time.

```
KSTL 051155Z 0512/0618 14008KT 5SM BR BKN030 WS010/18025KT
TEMPO 0513/0516 1 1/2SM BR
FM 051600 16010KT P6SM NSW SKC
FM 060000 20014G20KT 4SM –SHRA OVC 020
PROB30 0600/0606 2SM -TSRA OCV008CB
FM 060830 21015KT P6SM NSW SCT040
```

2.6.4. Change Groups. See AFMAN 15-124. The first line in any TAF shows the initial or current conditions prevailing at the airfield; subsequent groups indicate an operationally significant change in weather conditions. The type of change group designates the characteristic of the change. TEMPO, or “temporary groups,” indicates temporary fluctuations to the forecast meteorological conditions expected to occur at least once during the specified time period, for less than 30 consecutive minutes, and to cover less than half of the period. BECMG, or "becoming groups," designates a gradual change in predominant weather conditions starting at the date time group specified in the TAF and concluding at the end time specified in the TAF. The time period described by a BECMG group in an AF-issued TAF will usually be for one hour and never exceed two hours. Foreign meteorological services permit two or more hour-long BECMG groups. TAFs generated by NWS forecast offices do not use BECMG groups. FM (or "from groups"), designate a more rapid change in the environmental conditions, usually taking place in less than 30 minutes. FM groups specify the time in hours and minutes when the change in conditions is complete; in the example from the KSTL TAF, FM060000 indicates a rapid change to the weather conditions that will occur by 06/0000Z whereas later in the TAF period, the from group FM060830 indicates a rapid change in predominant conditions concluding by 06/0830Z. Foreign meteorological services and the NWS employ PROB groups to indicate the probability of specified conditions to occur during the time frame of the change group. In the example provided, the NWS forecast office issuing the KSTL forecast is specifying that there is a 30% probability of thunderstorm conditions with a prevailing visibility of 2 statute miles between 06/0000 and 06/0600Z. NWS forecasts will not contain PROB groups in the first 9 hours of a forecast and AF forecasts will not use PROB groups in TAF products.

Figure 2.34. TAF Change Group Examples.

KSTL 051155Z 0512/0618 14008KT 5SM BR BKN030 WS010/18025KT
TEMPO 0513/0516 1 1/2SM BR
FM 051600 16010KT P6SM NSW SKC
FM 060000 20014G20KT 4SM –SHRA OVC 020
PROB30 0600/0606 2SM -TSRA OVC008CB
FM 060830 21015KT P6SM NSW SCT040

KBLV 0512/0618 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 0513/0514 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 0514/0516 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 0516/0517 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 0518/0519 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 0520/0521 30008KT 9999 SKC QNH2950INS TX08/0618Z TNM01/0611Z

2.6.5. Wind Speed and Direction. See AFMAN 15-124. **VRB** represents wind directions that are variable due to several factors: 1) forecasting a wind direction with great reliability due to thunderstorms is not possible, 2) wind speeds are 6 knots or less and the direction cannot be determined, or 3) wind direction is varying for more than 60 degrees. The latter has a group depicting the direction range (i.e. 210V300). **Example**: **14005KT, 16010KT, VRB15G30KT, 29008KT, 31012G22KT and 30008KT** are the **direction and speed** groups**.** In the first group, **140** degrees (true) is the direction, **05** knots is speed. **VRB** are winds with variable directions (thunderstorms) at **15 KT**, with **30 KT gusts.**

Figure 2.35. TAF Wind Examples.

KBLV 0512/0618 **14005KT** 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 0513/0514 **16010KT** 3200 -SHRA OVC020 QNH2959INS
TEMPO 0514/0516 **VRB15G30KT** 1600 TSRA BKN008CB OVC020
BECMG 0516/0517 **29008KT** 3200 -RA OVC030 620304 QNH2958INS
BECMG 0518/0519 **31012G22KT** 9999 NSW SCT040 520004 QNH2952INS
BECMG 0520/0521 **30008KT** 9999 SKC QNH2950INS TX08/0618Z TNM01/0611Z

2.6.6. Forecast Visibility. See AFMAN 15-124.

2.6.7. Forecast Weather. See AFMAN 15-124.

2.6.8. Clouds. See AFMAN 15-124.

2.6.9. Icing Conditions. See AFMAN 15-124. Icing forecasts are for phenomena not associated with thunderstorms. When multiple layers of icing occur or the coding appears complex, consult weather personnel for clarification.

2.6.10. Turbulence Conditions. AFMAN 15-124. The turbulence group is for surface up to 10,000 feet, non-thunderstorm associated, CAT II aircraft. When multiple layers of icing occur or the coding is complex, consult weather personnel for clarification.

2.6.11. Lowest Altimeter Setting. AFMAN 15-124. Forecast minimum altimeter settings are only found in military forecasts. These begin with **QNH** (minimum) and end with **INS** (inches). **Example: QNH2958INS, QNH2952INS and QNH2950INS** are read as **minimum altimeter** setting of **29.58**, **29.52** **and** **29.50** **inches of mercury**, respectively. Internationally, some countries use hectopascals or millibars (Q1016) to measure pressure. See Section 2.5.12 for conversions. **Note:** minimum altimeter is not included in TEMPO groups. Minimum altimeter forecast during TEMPO groups is in previous BECMG group encompassing the time period.

2.6.12. Forecast Volcanic Ash. Volcanic ash is included when U.S. assets fall within the boundaries of a VAAC ash-plume forecast. Volcanic ash is encoded with the contraction, **VA**, followed by the 3-digit height of the base of the volcanic ash, and the height of the top of the volcanic ash layer (both heights in hundreds of feet AGL). **Example**: **VA100200** is **volcanic ash** with a base height of **100** (10,000 feet above the ground) and a plume top of **200** (20,000 feet above the ground).

Figure 2.36. Volcanic Ash Remark.

CCCC 1016/1122 24010KT 9999 FEW100 **VA100200** QNH2992INS

2.6.13. Forecast Wind Shear. See AFMAN 15-124.

2.6.14. Temperatures. See AFMAN 15-124. Forecast high and low temperatures are routinely found only in military TAFs.

2.7. Pilot Reports (PIREPs). A PIREP is an aircrew report of weather conditions at altitude. The FIH has the format for transmittal by aircrews. PIREPs are extremely important to operations since airborne crews can see a broader horizon and experience phenomena which may not be apparent from ground-based sensing systems or observers. For example, cloud bases and tops, turbulence and icing may only be evident to airborne crew but the levels at which these occur are meteorologically significant to other aircrews and the forecast process. Air traffic control facilities may also submit PIREPs for worldwide dissemination. PIREPS can be viewed in text or graphical format on AFW-WEBS.

2.7.1. PIREP Text. The format includes a "message type" (**UUA: urgent; UA: routine**) and text element indicators preceding data groups. Aircraft position is relative to an ICAO or VHF NAVAID (omni-directional radio range [VOR] or combined VOR/Tactical Air Navigation [VORTAC] facility) with a six-digit group giving the relative bearing (first three digits) and distance (last three digits) from the ICAO or NAVAID. "**DURC**" (during climb) or "**DURD**" (during descent) may be used as applicable. Full code details can be found in AFMAN 15-124.

Figure 2.37. PIREP Indicators.

/OV Indicates **aircraft position /TM** Time of observation (Z) **/FL** Altitude (flight level) **/TP** Type of aircraft **/SK** Sky cover **/WX** Visibility and weather (visibility to nearest statute mile in CONUS and nearest kilometer overseas)) **/TA** Temperature (C) **/WV** Wind direction and speed (six digits) **/TB** Turbulence (includes intensity, type, and altitude) **/IC** Icing (includes intensity, type, and altitude) **/RM** Remarks clarifying coded elements and adds significant data.

Table 2.6. Elements for Issuance of Urgent PIREPs (UUA).

Tornado/waterspout (+FC) or funnel cloud (FC)
Severe icing
Severe/extreme turbulence, including CAT
Widespread duststorm/sandstorm
Low-level windshear
Hail (GR or GS)
Volcanic eruption and/or ash (VA), in the air or on the ground
Any condition that, in the judgment of the person entering the PIREP into the system, would present an extreme hazard to flight.
Example: Routine PIREP 45 nautical miles northwest (315 degrees) of Scott AFB at 2224Z, and an unknown flight level. Aircraft is a C-21, observed a broken line of thunderstorms aligned north to south with occasional lightning from cloud to cloud and from cloud to ground. Cloud bases are at 3,000 ft, unknown total sky cover and cloud tops at 34,500 feet.

Figure 2.38. PIREP Example.

KBLV UA/OV KBLV 315045/TM 2224/FL UNKN/TP LR35/RM BKN LN TSTMS N-S OCNL LTGCCCG 030 UNKN 345.

2.8. Significant Meteorological Information (SIGMET). Non-Convective SIGMETs are a concise description of the occurrence or expected occurrence of specified en route weather phenomena which may affect the safety of aircraft operations. SIGMETs are an unscheduled product issued any time conditions reaching SIGMET criteria are occurring or expected to occur within a 4-hour period.

Table 2.7. Non-Convective SIGMET Hazards.

Severe (or greater) turbulence
Severe icing
Widespread duststorm
Widespread sandstorms
Volcanic ash

Figure 2.39. Non-Convective SIGMET Example.

```
SFOR UWS 100130
SIGMET ROMEO 1 VALID UNTIL 100530
OR WA
FROM SEA TO PDT TO EUG TO SEA
OCNL MOGR CAT BTN FL280 AND FL350 EXP DUE TO
JTSTR.  CONDS BGNG AFT 0200Z CONTG BYD 0530Z AND
SPRDG OVR CNTRL ID BY 0400Z
```

2.9. Convective SIGMET. Convective SIGMETs are issued by time and region, and specify aviation hazards associated with thunderstorms. Convective SIGMETs are issued hourly and are valid for 2 hours or until superseded. If no Convective SIGMET criteria exist, then the bulletin will be issued saying "CONVECTIVE SIGMET…NONE." Convective SIGMETs cover one of three areas: Eastern (E), Central (C), and Western (W), defined by longitudinal boundaries of 87 and 107 degrees west. An hourly outlook is issued for each region. The outlook is a 2-6 hour forecast of expected Convective SIGMET issuances and is updated as required. See FAA AC-00-45, Section 6, for detailed information regarding Convective SIGMETs.

Table 2.8. Convective SIGMET Hazards.

A line of thunderstorms at least 60 miles long with thunderstorms affecting at least 40 percent of its length.
An area of active thunderstorms affecting at least 3,000 square miles covering at least 40 percent of the area concerned and exhibiting a very strong RADAR reflectivity intensity or a significant satellite or lightning signature.
Embedded or severe thunderstorm(s) expected to occur for more than 30 minutes during the valid period regardless of the size of the area.
Tornado, hail greater than or equal to 3/4 inch, or wind gusts greater than or equal to 50 knots are reported.
Indications of rapidly changing conditions, if in the forecaster's judgment, they are not sufficiently described in existing Convective SIGMETs.

Figure 2.40. Convective SIGMET Example.

```
WSUS31 KKCI 271455
SIGE
CONVECTIVE SIGMET 33E
VALID UNTIL 1655Z
MI WI LM
FROM 30NNE GRB-30ESE TVC-40NW MBS-40SSE GRB-30NNE GRB
AREA EMBD TS MOV FROM 21020KT. TOPS TO FL360.
WRN PTN MOV FROM 35010KT.
```

2.10. Airmen's Meteorological Information (AIRMET). An AIRMET is a concise description of the occurrence or expected occurrence of operational interest and potentially hazardous to aircraft having limited capability. AIRMETs concern weather of less severity than that covered by SIGMETs and usually affect at least a 3,000 square mile area. AIRMETs are issued every 6 hours, while unscheduled updates and corrections are issued as necessary. Use of larger regional coverage means that only a small part of the area could be affected at any given time. Graphical AIRMETs (G-AIRMETs) are graphical forecasts of en route weather hazards valid at discrete times no more than 3 hours apart for a period of up to 12 hours. Forecasts valid for the first 6 hours correspond to the text AIRMET bulletin while forecasts valid for the 6-12 hours correspond to the text bulletin outlook.

Table 2.9. AIRMET Designators.

Sierra Bulletin (reserved for IFR and mountain obscuration)
1. Ceilings less than 1,000 feet and/or visibility less than 3 miles affecting over 50% of the area
2. Extensive mountain obscuration
Tango Bulletin (reserved for wind related phenomena)
1. Moderate turbulence
2. Sustained surface winds of 30 knots or more
3. Non-convective low-level wind shear
Zulu Bulletin (reserved for icing and freezing level data)
1. Moderate icing
2. Freezing levels

Figure 2.41. AIRMET Example.

```
DFWT WA 201445 AIRMET TANGO UPDT 3 FOR TURB VALID UNTIL 202100 AIRMET
TURB AR LA TN MS AL KY FROM CVG TO HNN TO HMV TO GQO 50SW ABY TO 40W
CEW TO LEV TO LCH ELD TO ARG TO CVG OCNL MOD TURB BLW FL180 DUE TO
STG LOW/MID LVL WNDS ASSOCD WITH LOW
```

Section 2C—METEOROLOGICAL SATELLITE (METSAT) IMAGERY

2.11. METSAT. METSATs provide from space a wealth of flight planning information – e.g., cloud top heights, thunderstorms, turbulence, jet stream locations, fog, and terrain features. While most people would recognize some of these features, consult with your weather technicians for an in-depth analysis. Weather personnel rely on two types of METSATs for weather information – polar orbiting and geostationary.

2.11.1. Polar orbiting METSATs, such as those launched through the Defense Meteorological Satellite Program, circle the Earth in a sun-synchronous orbit about 850km (450 miles) high, providing most mid-latitude locations two passes a day with overlap at upper latitudes.

2.11.2. Geostationary METSATs, such as the Geostationary Operational Environmental Satellites, orbit over a fixed point along the Equator. These orbits, at approximately 42,000km (22,300 miles) high, provide the user with enough images to animate except at high latitudes.

2.12. Imagery Types. Weather personnel use five different types of satellite imagery: visible, infrared, multi-spectral, microwave, and water vapor.

2.12.1. Visible Satellite Imagery. Visible satellite sensors record solar radiation reflected from the Earth. The recorded data is then converted into an image that looks approximately the same as a photograph (**Figure 2.42**).

2.12.2. Infrared (IR) Satellite Imagery. All objects emit some amount of infrared radiation. Infrared sensors detect radiation emitted from the Earth and its atmosphere. The energy emitted by individual objects is directly proportional to the temperature of the object (**Figure 2.43**). Standard infrared pictures show the coldest temperatures as white (such as cirrus cloud tops) and the warmest temperatures (such as land and water) as black. The temperatures in between are displayed on a gray scale. Some imagery may be color enhanced to highlight the contrast. Small temperature differentials between over-lapping elements make analysis difficult (i.e. warm stratus cloud tops and fog over warm land/water, or cold stratus clouds over snow-covered terrain).

2.12.3. Multi-spectral Imagery (MSI). MSI combines Visual and IR into a color-enhanced 3-dimensional image (Figures **2.44 and 2.45**) used to discriminate between low, mid, and high-level clouds, as well as fog.

2.12.4. Microwave Imagery. Microwave imagery is used to see through cirrus to detect lower clouds, calculate ocean surface winds, rain rates, snow coverage/depth and soil moisture. Microwave imagery can produce RADAR-like images of weather systems, such as severe storms and hurricanes (**Figure 2.46**).

2.12.5. Water Vapor (WV) Imagery. WV sensors view radiation at wavelengths that are readily absorbed by water vapor in the atmosphere (**Figure 2.47**). This allows an image of the concentration of atmospheric water vapor to be taken without interference from surface features or other clouds. WV can detect moisture movement into (or out) of a region even in the absence of clouds.

Figure 2.42. Visible Imagery, Sunset near Hawaii Showing Terminator (Day-Night Line).

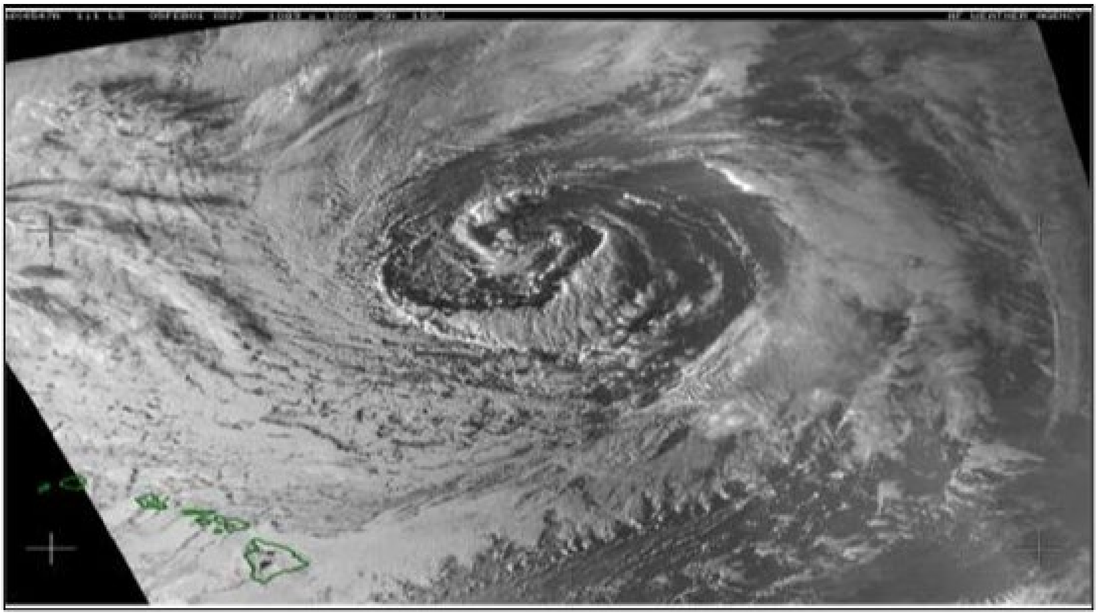


Figure 2.43. IR Imagery Is Not Visible Light Dependent (No Terminator Seen) and Low (Warmer) Clouds Are Not as Bright as Visual Imagery.

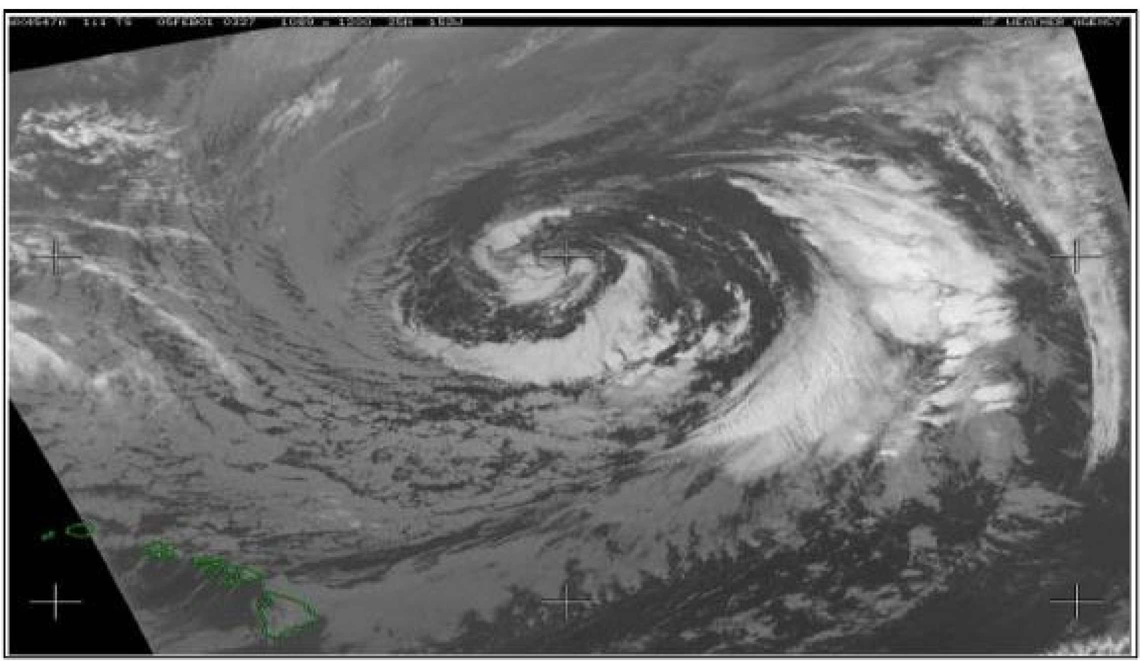


Figure 2.44. MSI Showing Low Clouds as Yellow and High Clouds as Blue.

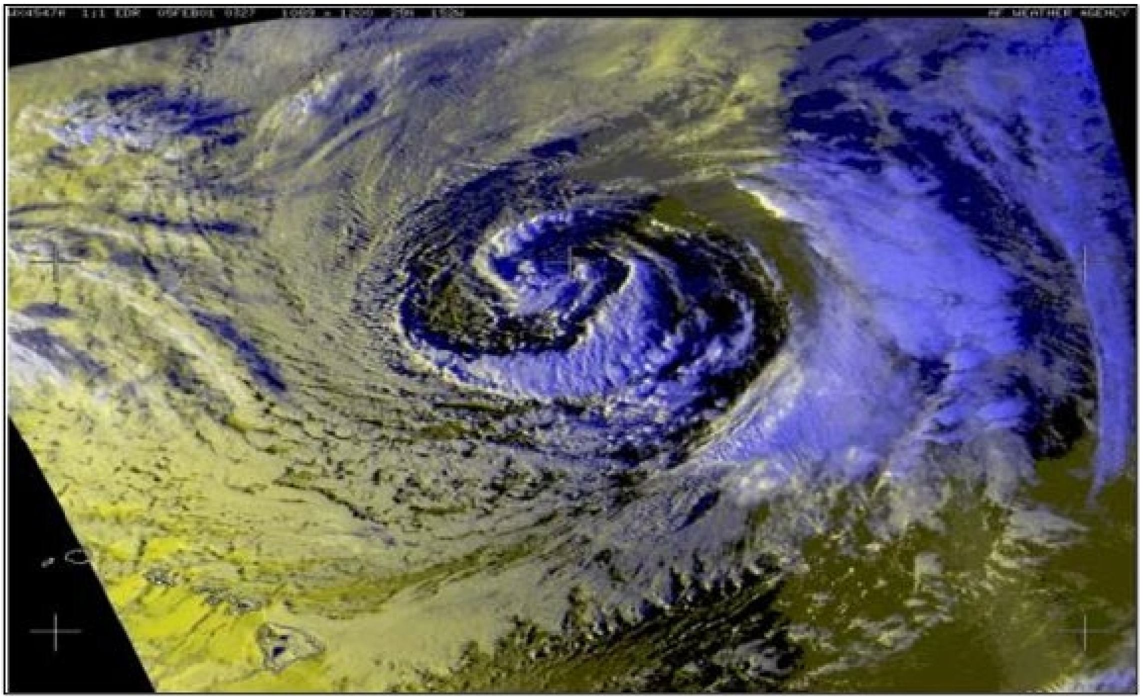


Figure 2.45. MSI Showing Lifted Dust as Bright Pink.

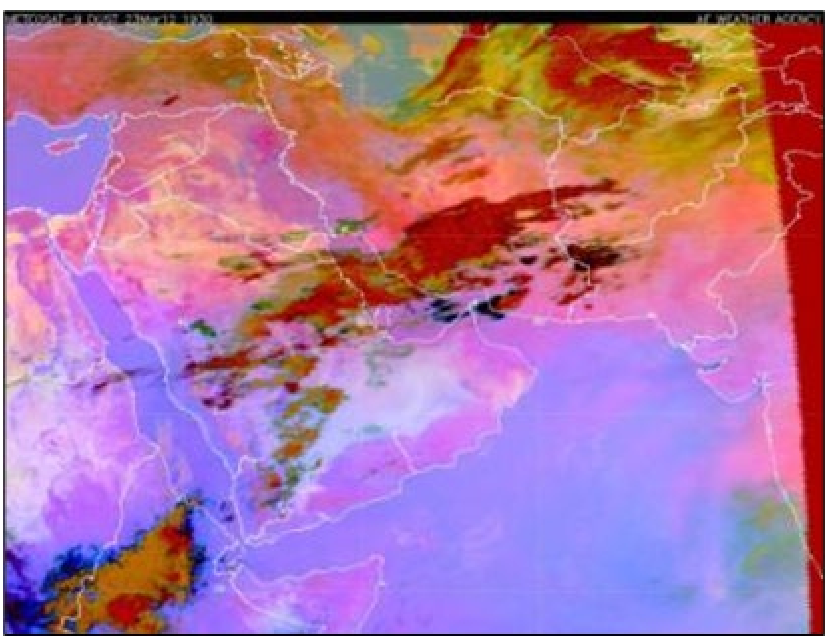


Figure 2.46. Microwave Imagery Showing Low (Warmer) Clouds as Bright White.

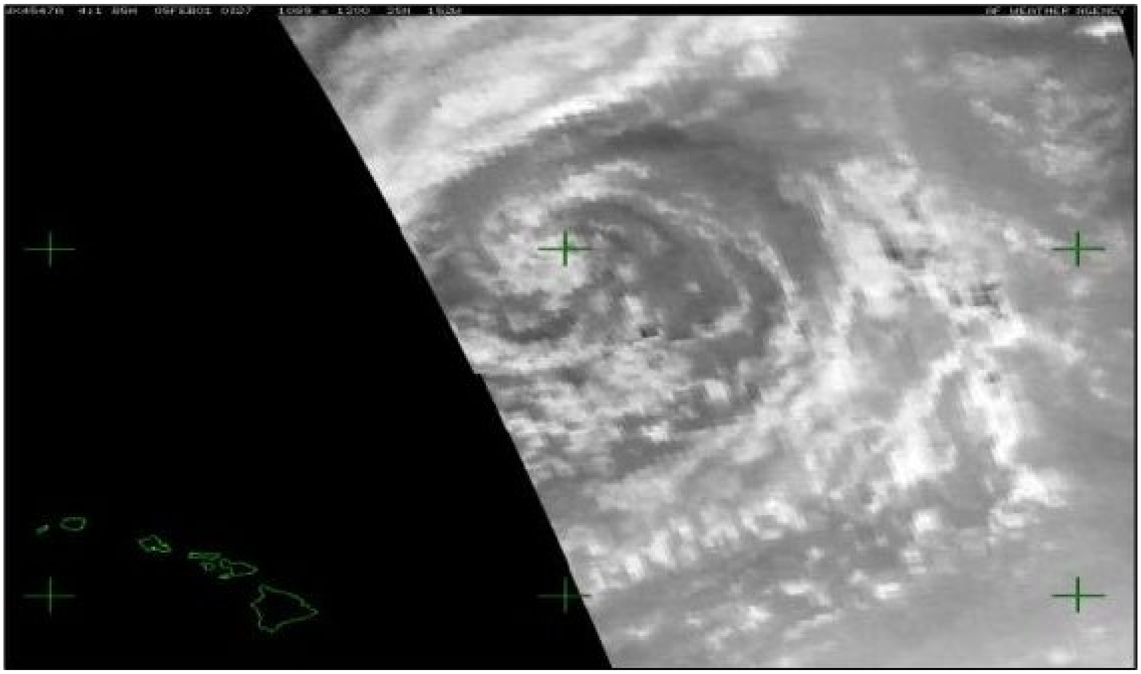
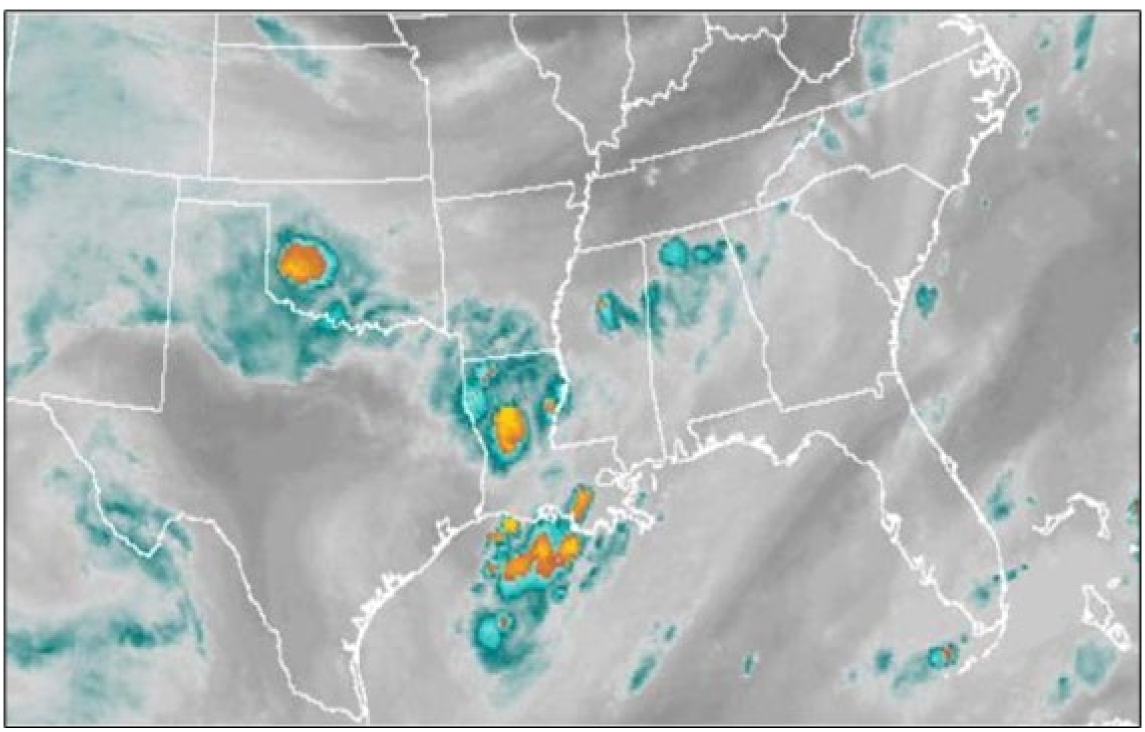


Figure 2.47. Water Vapor Image Where Colored Areas Contain Ample Mid- and/or Upper Level Water Vapor.



Section 2D—SPECIAL SUPPORT PRODUCTS

2.13. Special Support Product Types. Weather technicians can provide a broad variety of special support products. Products used for any given mission depend on the aircraft type and mission profile. Low-level tactical airlift missions require different products than strike missions using precision-guided munitions. Examples of special support products are Space Support, TDAs, volcanic ash advisories and forecasts, Computer Flight Plans (CFPs), blowing dust imagery, and snow coverage/depth charts. Aircrews can find Space Support (including solar and lunar data) and volcano products on OWS or AFW-WEBS websites. CFPs can be requested by following your MAJCOM's directives. TDAs are usually classified and may be available over the secure web. Local weather personnel can provide an in-depth orientation to the specific special support products used for your wing's mission and how to acquire them.

2.14. TDAs. Weather personnel use TDAs to translate weather data into mission impact descriptions (e.g., stoplight charts or "go/no go" charts), or to compute weapon system acquisition and lock-on ranges, illumination levels, and temperature contrasts between the target and background. TDAs products may range from simple look-up tables and graphs to complex software programs. Aircrews and Intelligence personnel interaction with the weather personnel is essential to obtain the necessary mission and target data required to generate TDAs. These TDAs may be used in mission planning to assist weapon system choice based on weather impacts and/or as part of the Army's Intelligence Preparation of the Battlefield process to gain situational awareness. TDA output is often classified because it discloses details of the mission or performance of the weapon system.

2.14.1. Target Acquisition Weather Software (TAWS). TAWS output predicts the impact of weather and time of day on the performance of electro-optical weapons and navigation. These predictions assist mission planners when evaluating tactics and making "go/no go" decisions. TAWS can calculate sunrise/set, moonrise/set, and illumination levels for Night Vision Goggle operations, to include atmosphere-induced effects on illumination. DoD employs a standardized algorithm for solar and lunar calculations, therefore aircrews must employ caution when using other sources and consider time zones (Note: Calculations for Army operations are often converted to local time; whereas AF operations employs the Universal Time Coordinate). It offers decision aids tailored for routes and areas.

Table 2.10. Sample Solar and Lunar Data.

Scotia, Schenectady County, New York (longitude W74.0, latitude N42.8): Friday 23 March 2001 Eastern Standard Time						
SUN (EST)	Begin Morning Nautical Twilight 05h 26min	Sunrise 05h 54min	Sun transit 12h 03min	Sunset 18h 12min	End Evening Nautical twilight 18h 41min	
MOON (EST)	Moonset 15h50min	preceding day Moonrise 05h41min	Moon transit 11h12min	Moonset 16h 51min	Moonrise 06h 06 min on following day	Moon Phase: waning crescent with 2% of the Moon's visible disk illuminated

2.14.2. Integrated Weather Effects Decision Aid. This is a rule-based TDA application to provide critical friendly and threat weapon systems performance impacts (both positive and negative) for Army and some Air Force mission planning and execution.

2.15. Volcanic Ash Advisory Products. The effects of a volcanic eruption can greatly impact operations and damage aircraft, particularly engines. VAAC products are the authoritative source for volcanic ash products. VAAC products vary by AOR. The AF provides instantaneous eruption notification and supplements the VAAC products for a consistent worldwide analysis. Products are available on AFW-WEBS in the forms of: a text bulletin (**Figure 2.48**), animated graphics (**Figure 2.49**) and/or an 8-panel forecast (**Figure 2.50**).

Figure 2.48. Sample Text Volcanic Ash Bulletin.

```
FVAW21 KGWC 271732
VOLCANIC ASH ERUPTION UPDATE

VOLCANO: COLIMA  341040

LOCATION: 1930N -10337W   AREA: MEXICO-MEXICO

SUMMIT ELEVATION: 12631 FT (3850 M)

1. ACTIVITY SUGGESTS ASH EMISSIONS LIKELY, BUT ASH IS NOT IDENTIFIABLE
   ON LATEST METSAT IMAGE.

2. ERUPTION DETAILS: CONTINUOUS ASH/STEAM EMISSIONS.
   TRAJECTORY: ANY ASH TO FL200 WILL MOVE NE-E AT 30KTS.

3. REMARKS: ASH NOT VISIBLE ON LATEST METSAT IMAGE.

   HYSPLIT DETAILS: HYSPLIT MODEL FORECAST IS CURRENT AND POSTED TO
   AFW-WEBS. TRAJECTORY OF HYSPLIT MODEL FORECAST CANNOT BE VERIFIED DUE
   TO CLOUD COVER OVER THE AREA.

4. FOR FURTHER INFORMATION SEE LATEST FVXX KNES BULLETIN AND WVMX MMMX
   SIGMET.

   WEBSITE INFO: FOR HYSPLIT MODEL FORECAST BASED ON GFS DATA SEE
   HTTPS://WEATHER.AF.MIL/AFW_WEBS/VOLCANICEVENTS (ALL UPPER CASE).

   FOR OFFICIAL VAAC FORECAST VISIT
   WWW.OSPO.NOAA.GOV/PRODUCTS/ATMOSPHERE/VAAC/ (LOWER-CASE EXCEPT FOR P
   IN PRODUCTS). EACH VAAC IS ACCESSIBLE FROM THIS PAGE BY CLICKING YOUR
   AREA OF INTEREST ON THE MAP.

5. THIS BULLETIN WILL BE UPDATED BY 28FEB2015 AT 0000Z.

PREPARED BY COLON/QC BY HATCHER
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Figure 2.49. Animated Volcanic Ash Graphics (AFW-WEBS).

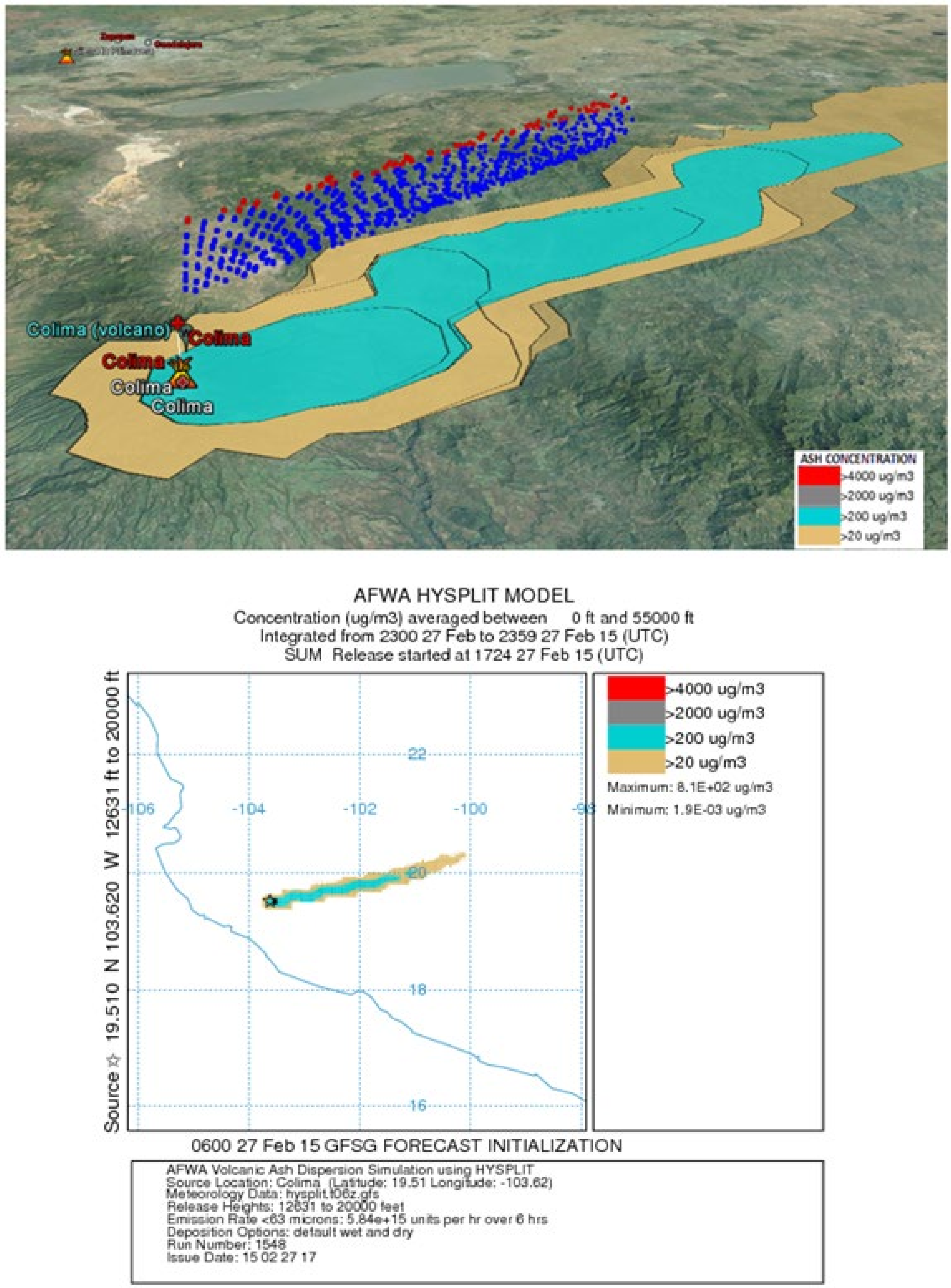
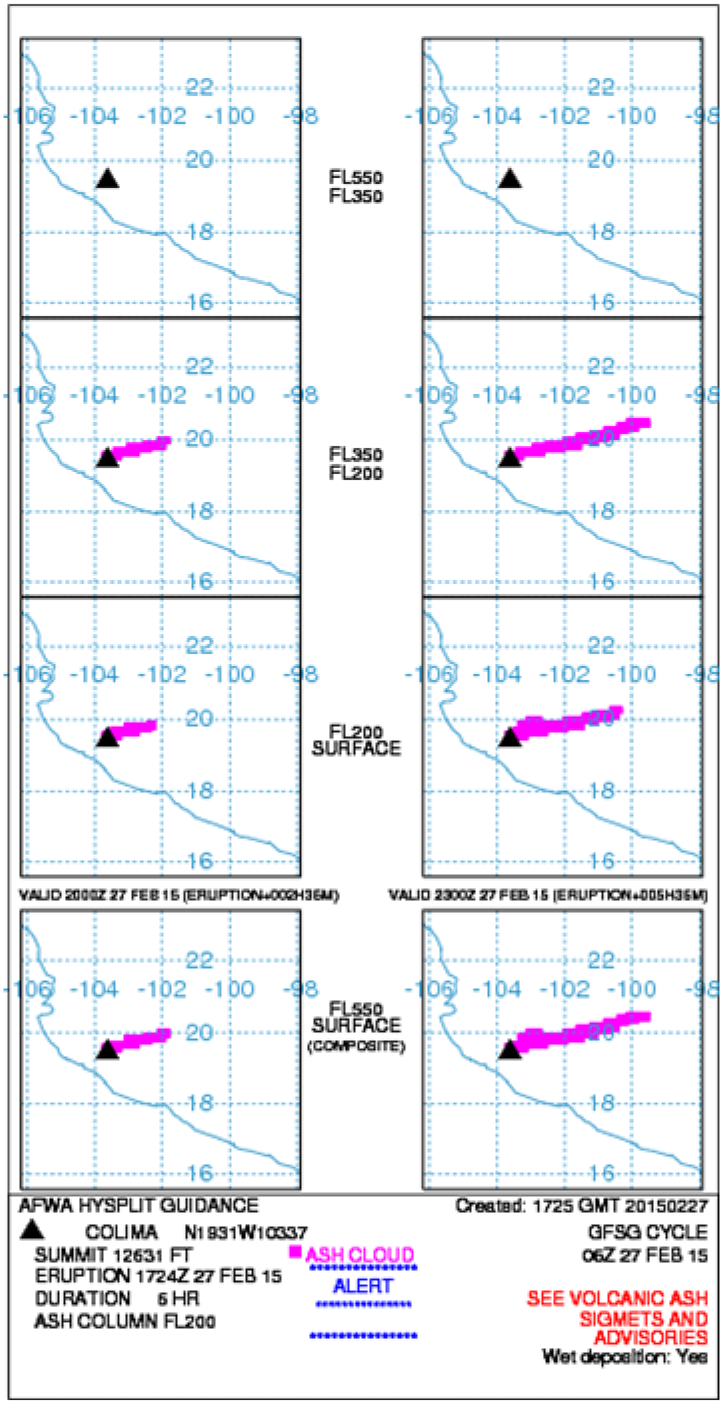


Figure 2.50. Volcano Ash Alert 8-Panel Forecast (AFW-WEBS).



Section 2E—GROUND WEATHER RADAR AND PRODUCTS

2.16. Ground Weather RADARs. Imagery and data from weather RADARs are valuable tools for obtaining situational awareness and identifying weather threats. Modern RADARs employ sophisticated signal processing techniques to improve detection and provide detailed imagery. This enables weather personnel to interrogate weather and non-weather features to help characterize the state of the natural environment. Products, data, and imagery from weather surveillance RADARs are readily available via commercial, government, or military websites to meet the majority of mission planning and execution needs; additionally, detailed imagery is available to weather personnel via dedicated image and data processing terminals to assist in threat identification and weather warning activities.

2.16.1. Weather Surveillance RADAR Networks. Many nations operate a network of weather surveillance or storm detection RADARs and provide U.S. forces with access to data or imagery; the most familiar RADAR data source is the Weather Surveillance RADAR, 1988 Doppler (WSR-88D) fielded under the Tri-Agency Next Generation RADAR (NEXRAD) program operating in the CONUS, Alaska, Hawaii and select territories and U.S. military bases. Doppler weather RADAR networks are also operated by Canada, many European Union nations, Japan, South Korea and Australia; these nations release some of their weather RADAR imagery or data for use by U.S. Forces. Other nations may operate single site Doppler or non-Doppler RADARs with limited access by U.S. Forces. In addition to fixed RADAR systems, the AF has a small inventory of portable weather RADARs for expeditionary use. Data from these RADARs is typically not networked and the RADAR site may not be operating 24/7 depending on mission needs. In addition to the portable RADAR sets, weather RADAR returns that have been “stripped” from tactical air control RADAR systems may be available for display at forward operating locations or bare bases.

2.16.2. Basic Weather RADAR Products. Doppler-enabled weather surveillance RADARs are the most complex of weather RADAR systems and provide a variety of specialized imagery for interrogation of weather conditions. Doppler RADARs provide three main categories of information: reflectivity, velocity, and derived products based on the reflectivity and velocity returns. RADAR reflectivity products will be most commonly used to make the majority of decisions for aviation operations. Weather personnel will use the other categories of products to interrogate threats and make decisions affecting weather watch, warning or advisory services.

2.17. Reflectivity Products. Reflectivity data is normally displayed in a plan position indicator fashion with the RADAR antenna position in the center of the display, but it can also be displayed as a vertical cross section. The most common presentation displays the RADAR returns on azimuth and range bearings from the antenna at ranges out to 248NM from the RADAR antenna. Advanced Doppler RADARs employ new beam geometry and signals processing which: 1) minimizes display error; 2) provides weather personnel with a better approximation of the physical state of the precipitation (liquid or frozen); and 3) better estimates the precipitation’s droplet size, shape, and distribution.

2.17.1. Base Reflectivity Products.

2.17.1.1. *How to use this product*. Base reflectivity products depict the RADAR returns along a single elevation cut through the atmosphere (the antenna angle at time of collection). This product is compiled by grouping the RADAR returns into data bins along the scan azimuth and displaying the strongest return on a graphical display. The RADAR product is available in a variety of resolutions; the most common for flight briefing purposes is .54NM which offers a concise view of the RADAR returns out to 124NM from the RADAR antenna. The full capability of the WSR-88D Doppler RADAR depicts

RADAR reflectivity returns in .13NM data bins out to 248NM maximum range. (See **Figure 2.49**)

2.17.1.2. *Strengths*. Base reflectivity products depict fine-scale features and color coding of the product identical to that of the composite reflectivity products and draws the user's attention to the strongest RADAR returns. The most commonly used products are those collected from the three lowest elevation scans of the RADAR (normally 0.5, 1.5, and 2.4 degrees elevation) since these elevation cuts provide the best views of near surface and lower tropospheric conditions most responsible for significant weather. Most modern weather surveillance RADARs operate in clear air or precipitation mode depending on circumstance. Clear air mode permits identification of weather features such as cold fronts, sea breeze fronts, or other wind shift lines. Biological targets (flocks and swarms of bats, birds, insects, etc.) are readily visible in clear air mode products as well as non-meteorological returns such as smoke plumes and chaff release. If in doubt about the content of any RADAR product, consult with weather personnel.

2.17.1.3. *Weaknesses.* Images from the lower elevation scans may be contaminated with ground clutter in the early morning hours or in nearby storm environments due to anomalous propagation of the RADAR beam. Strong to intense RADAR returns with minimal to no motion should be viewed skeptically. Images from higher elevation cuts (8.5 degrees and higher) normally show RADAR returns 30-60NM from the RADAR even though the product display extends to 120NM. _Additionally, due to the continually rising nature of the RADAR beam (the lowest slice is elevated by 0.5 degrees), targets close to the ground near the edge of the RADAR's range may be missed. For example, at 100 NM from the RADAR site, the RADAR beam is over 10,000 feet AGL, and thus misses any features below.

2.17.2. Composite Reflectivity Products.

2.17.2.1. *How to use this product*. Composite reflectivity is created by processing the base reflectivity data from three volume scans to produce an image of the highest reflectivity value at each data geographic resolution point. Designed to provide situational awareness, composite reflectivity is a "one glance" product highlighting areas with the greatest reflectivity. (See **Figure 2.52**)

2.17.2.2. *Strengths*. Composite reflectivity products are easy to understand; color coding of the reflectivity values is designed to highlight areas of potential concern. Red, magenta, and white color-filled regions represent areas with reflectivity normally associated with significant weather.

2.17.2.3. *Weaknesses*. This product should not be used in isolation as it may obscure storm structure features. Reflectivity returns may be associated with severe convective storms, heavy stratiform rain, or non-precipitation echoes (i.e., biological targets or terrain effects due to anomalous propagation of the RADAR beam). Likewise, the reflectivity may obscure lower level signatures, such as light precipitation.

2.17.3. **Other reflectivity products** . There are varieties of reflectivity RADAR products created by the various RADAR systems that may be used in flight weather briefings. These products are usually derived by post-processing the RADAR reflectivity returns and are used to assist in feature interrogation and threat assessment by skilled weather personnel.

2.17.3.1. Echo Tops. The most common derived product depicts thunderstorm precipitation echo tops. This product is color coded for ease of use and is used to rapidly identify precipitation complexes with significantly high altitude development. (See **Figure 2.53**)

2.17.3.1.1. *How to use this product*. Echo tops products are available as standard resolution and "super resolution" products. The most common product used in flight weather briefings resolves echo tops at 1.1NM resolution and is color coded for quick reference.

2.17.3.1.2. *Strengths*. The product is easy to read and fairly self-explanatory.

2.17.3.1.3. *Weaknesses*. The echo tops product represents the height of RADAR returns exceeding 18dBz (the minimum sensitivity of previous generation analog weather surveillance RADARs) to facilitate storm interrogation. For this reason, cloud tops are generally significantly higher than the heights displayed on the echo tops product. The product may have a "stair stepped" appearance due to RADAR beam geometry effects that are enhanced by the way the algorithm creating this product collects and displays data.

Figure 2.51. Doppler Base Reflectivity.

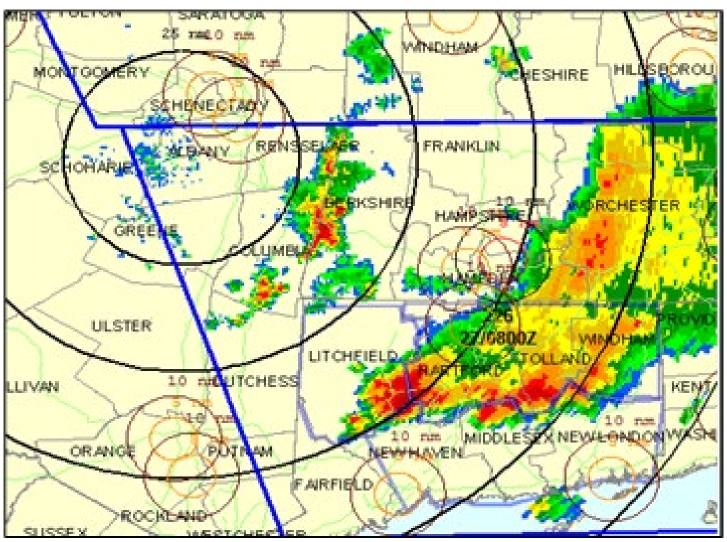


Figure 2.52. Doppler Composite Reflectivity (Same Time and Location as Figure 2.51.

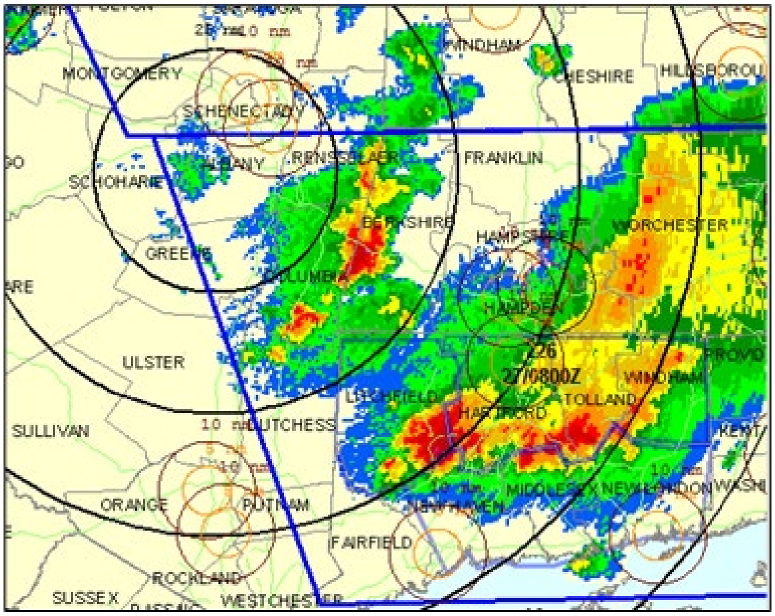
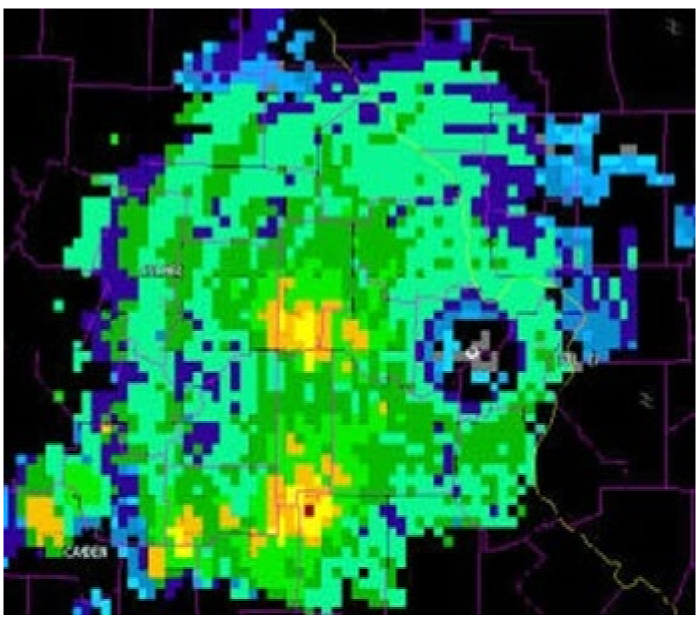


Figure 2.53. Doppler Echo Tops.



2.18. Velocity Products. Modern RADARs employ RADAR pulse strategies and signal processing schemes to provide measurements of atmospheric motion. The RADAR products generated to depict these motions are velocity products. The CONUS WSR-88D network is the most extensive network of Doppler weather surveillance RADARs in the world and the product set provided is representative of the types of velocity products encountered elsewhere. Doppler RADARs provide wind profiles of the atmosphere near the RADAR site or provide plan position view images of larger scale atmospheric motions. AF weather personnel are trained to interrogate these images and identify thunderstorm dynamics and locate weather features such as wind shift lines, frontal boundaries, or areas of low-level wind shear. **Note:** Weather personnel are trained to interpret Doppler velocity products. Do not attempt to interpret a velocity product without the assistance of qualified personnel.

2.18.1. Base Velocity Products. The most common velocity product is the base velocity product. This product depicts the average radial velocity in the data bins arrayed down an azimuth (See **Figure 2.54**).

2.18.1.1. *How to use this product*. Base velocity products are color coded to show the inbound and outbound radial velocity relative to the RADAR antenna site which is in the center of the image. Unlike conventional weather charts and diagrams which depict the direction from which the wind is blowing, base velocity products show the direction towards which the air is moving.

2.18.1.2. *Strengths*. This product is color coded to highlight areas with the highest radial velocities within the scanned range of the RADAR. The scale of the product allows trained users to rapidly appraise the relative motion of the atmosphere over a wide area. Velocity couplets are areas of inbound and outbound radial velocities in close proximity to one another. The couplets are key elements in identifying wind shear, microbursts and for determining thunderstorm severity.

2.18.1.3. *Weaknesses*. Skill and experience is required to effectively employ information extracted from these products in military decision making. Since velocity is relative to the RADAR antenna, maximum wind speeds may be significantly greater than the indicated velocity and determining a wind direction can be difficult. In addition, these products are based on single elevation cuts and are subject to the same negative effects of RADAR beam geometry and propagation effects listed for the base reflectivity products (see **paragraph 2.17.1.3**).

2.18.2. Velocity Azimuth Display (VAD) Wind Profile (VWP**)**. A VWP is created by post processing the radial velocity data and compiling an upper level wind picture of the atmosphere within a 20NM radius from the Doppler RADAR antenna complex (See **Figure 2.55**).

2.18.2.1. *How to use this product*. VWP depicts atmospheric velocities in a format resembling a vertical wind cross section. This product also offers the output from the preceding 10 volume scans of the RADAR to provide time continuity; the vertical array of wind barbs on the right side of the image is the most recent data. Wind barbs are color coded to represent data reliability; wind barbs color coded yellow or red have been created from radial velocity fields with higher degrees of variability than those color coded blue or green. Gusty winds or wind fields with directional variability are common in the atmosphere.

2.18.2.2. *Strengths.* This product is intuitive and easy to use in determining climb winds or locating low-level wind shear.

2.18.2.3. *Weaknesses*. 1) The product displays the derived winds in a sample volume nearest to the RADAR antenna and may not be representative of conditions at a more distant point. 2) Data fields marked with "ND" indicate sections of the atmosphere with insufficient volume of RADAR scatterers to accurately derive a wind; significant wind speeds may still be encountered in that layer. 3) Derived winds on the VWP may be significantly less than environmental conditions if the 20NM sample volume around the RADAR antenna is disrupted by a wind shift. This effect is most common during the period immediately surrounding passage of a strong frontal boundary when there is significant deviation in wind fields north or south (or east or west) of the RADAR antenna array. Consult with trained weather personnel when the derived wind data is ambiguous.

2.18.3. Other Velocity-based RADAR Products. Weather personnel employ many other velocity-based products to interrogate the character of the environment, determine storm structure and dynamic effects or verify features detected on RADAR reflectivity-based products. Normally these products are not used in flight weather briefings.

Figure 2.54. Base Velocity with Wind Speed in Knots.

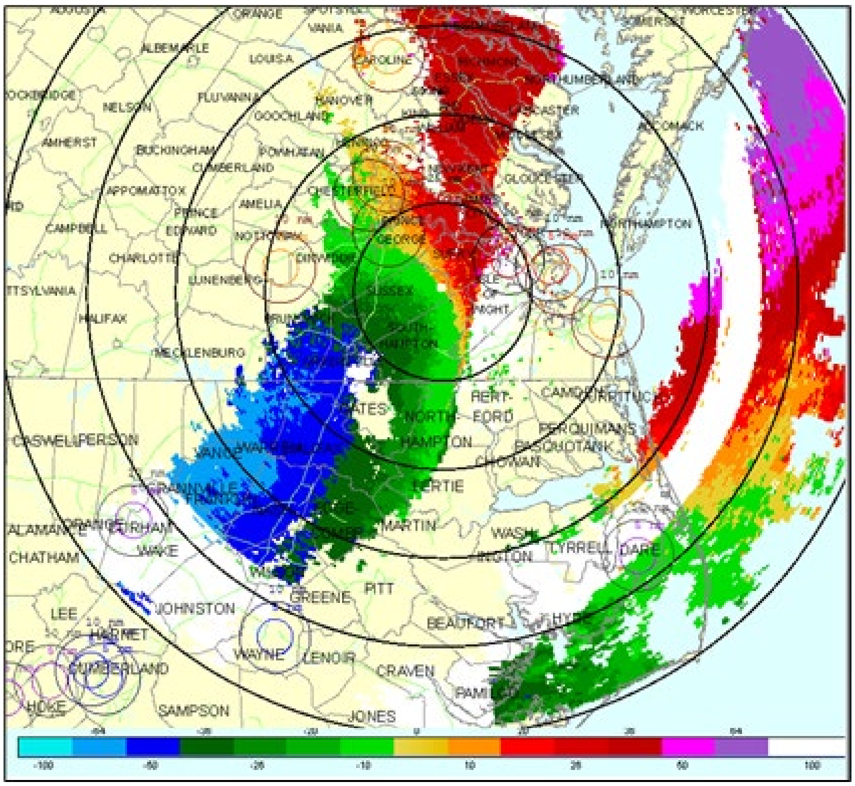
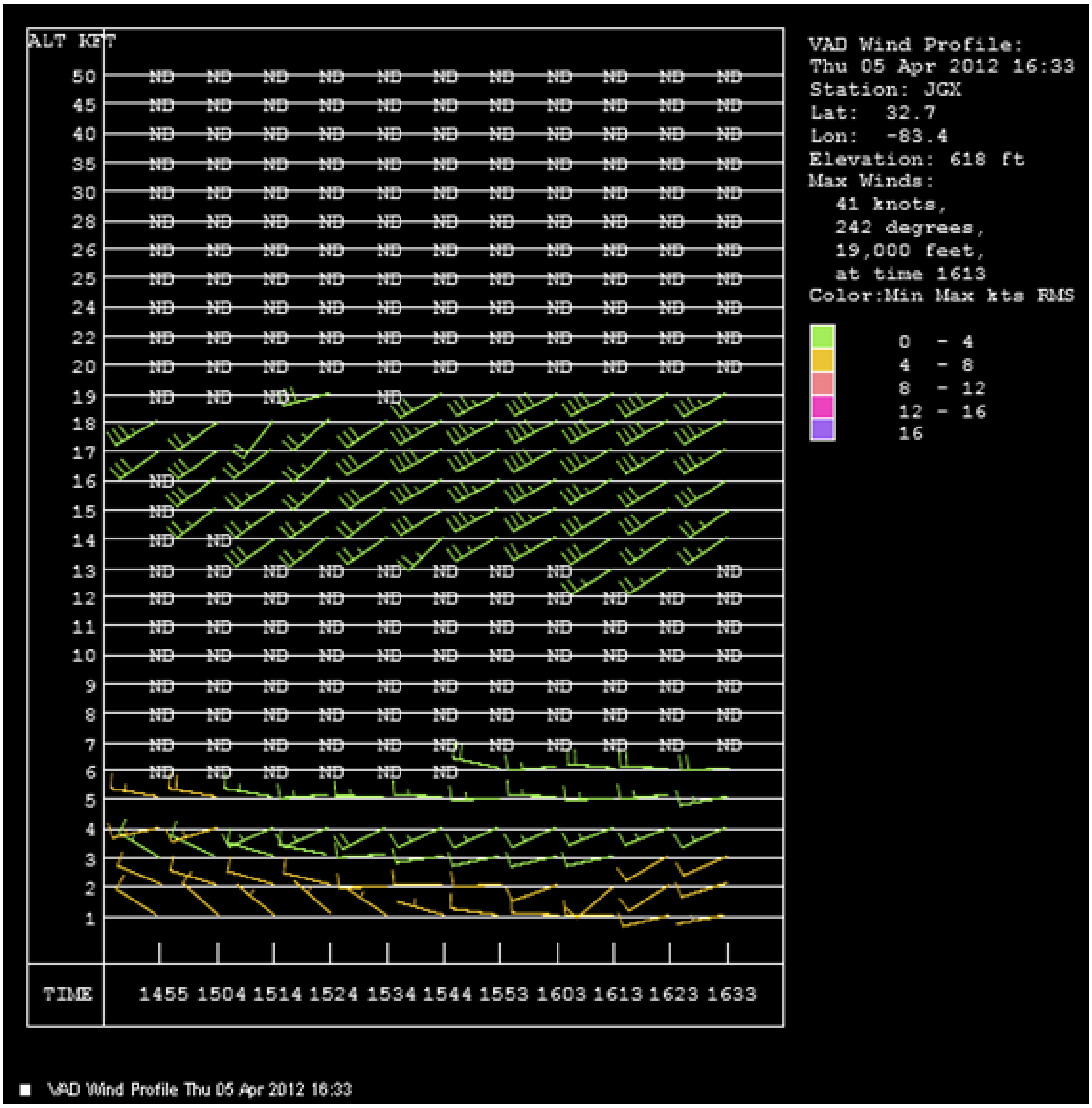


Figure 2.55. Doppler RADAR-derived VAD Wind Profile.



TOD D. WOLTERS, Lt Gen, USAF
DCS, Operations, Plans and Requirements

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Adopted Forms

AF Form 847, *Recommendation for Change of Publication*

DD Form 175-1, *Flight Weather Briefing*

Abbreviations and Acronyms

AF—Air Force

AFH—Air Force Handbook

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFRC—Air Force Reserve Command

AFSOC—Air Force Special Operations Command

AFSS—Automated Flight Service Station

AFRICOM—Africa Command

AFVA—Air Force Visual Aid

AFW-WEBS—Air Force Weather Web Services

AGL—Above Ground Level

AIRMET—Airman's Meteorological Information

AMC—Air Mobility Command

AMD—Amendment

AMOS—Automated Meteorological Observation System

ANG—Air National Guard

AOC—Air Operations Center

AOR—Area of Responsibility

AR—Army Regulation

ARC—Air Reserve Component

ARTCC—Air Route Traffic Control Center

CAT—Clear Air Turbulence

CENTCOM—Central Command

CFP—Computer Flight Plan

CONUS—Continental United States

CWSU—Center Weather Service Unit

DoD—Department of Defense

DTG—date/time group

EFAS—En Route Flight Advisory Service

EUCOM—European Command

FAA—Federal Aviation Administration

FIH—Flight Information Handbook

FL—Flight Level

FLIP—Flight Information Publication

FSS—Flight Service Station

HIWAS—Hazardous In-flight Weather Advisory Service

ICAO—International Civil Aviation Organization

IFR—Instrument Flight Rules

IR—Infrared

LCL—Lifted Condensation Level

MAJCOM—Major Command (Air Force)

METSAT—Meteorological Satellite

METAR—Aviation Routine Weather Report

METWATCH—Meteorological Watch

MISSIONWATCH—Mission Meteorological Watch

MSI—Multi-spectral Imagery

MSL—Mean Sea Level

MWO—Meteorological Watch Office

MWP—Mission Weather Product

NAS—National Aerospace System

NAVAID—Navigational Aid

NEXRAD—Next Generation RADAR

NORTHCOM—Northern Command

NWS—National Weather Service (United States)

OPR—Office of Primary Responsibility

OSS—Operations Support Squadron

OWS—Operational Weather Squadron

PACOM—Pacific Command

PIREP—Pilot Weather Report

PMSV—Pilot-to-Metro Service Voice

RCR—Runway Condition Reading

RSC—Runway Surface Condition

RVR—Runway Visual Range

SIGMET—Significant Meteorological Information

SOUTHCOM—Southern Command

SPECI—Aviation Selected Special Weather Report

TACC—Tanker Airlift Control Center

TAF—Terminal Aerodrome Forecast

TAWS—Target Acquisition Weather Software

TDA—Tactical Decision Aid

TIBS—Telephone Information Briefing Service

UHF—Ultra High Frequency

USAF—United States Air Force

USG—United States Government

VAAC—Volcanic Ash Advisory Center

VAD—Velocity Azimuth Display

VFR—Visual Flight Rules

VHF—Very High Frequency

VOR—VHF Omni—directional Range

VWP—VAD Wind Profile

WA—Weather Advisory

WF—Weather Flight

WFO—Weather Forecast Office

WS—Weather Squadron

WV—Water Vapor

Terms

AIRMET—NWS in-flight weather advisories concerning weather phenomena that are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualification. AIRMETs concern weather of less severity than that covered by SIGMETs or convective SIGMETs.

Amendment—Used as a message modifier when transmitting an aerodrome forecast amendment.

ICAO Identifier—A specifically authorized 4-letter identifier assigned to a location and documented in ICAO Document 7910.ICAO. DoD weather personnel may use identifiers beginning with "KQ" to indicate supplementary or military-unique locations.

Isopleth—Line drawn on a weather map connecting points of equal value of a weather parameter. Examples include isobars (equal barometric pressure), isotherms (equal temperature), isotachs (equal wind speed) and isodrosotherms (equal dew points)

METWATCH—Task of monitoring aerospace weather for a route, area, or terminal and advising concerned organizations when phenomena that could affect their operations or pose a hazard to life or property are observed or about to occur.

Mission Weather Product (MWP)—A customized weather product providing atmospheric and space weather information for a specific mission, or set of missions. It fully integrates aerospace weather with the supported entity's tactics, weapon systems, environmental sensitivities of equipment, and other operational requirements.

MISSIONWATCH—Task of monitoring of aerospace weather for a specific mission (i.e., ground, air or space) and informing supported entities when unforeseen mission-limiting phenomena could affect operations.

Notice to Airmen—A notice containing information concerning the establishment, condition, or change in any aeronautical facility, service, procedures, or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

Operational Weather Squadron (OWS)—An organization comprised of technical leadership, management, and technician personnel responsible for providing regional weather support. The unit mission is to produce fine-scale tailored weather forecast products and services for end users and to facilitate military decision-making within a designated Area of Responsibility (AOR).

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

Severe Thunderstorm—A thunderstorm that produces hail greater than or equal to 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.

Significant Meteorological Information (SIGMET)—NWS in-flight weather advisories issued concerning weather significant to the safety of all aircraft. There are convective and non-convective SIGMETs.

Weather Advisory—A special notice provided to a supported user when an established weather condition that could affect its operation is occurring or is expected to occur.

Weather Warning—A special notice provided to a supported user when an established weather condition of such intensity as to pose a hazard to life or property, and requires protective action, is occurring or is expected to occur.

Weather Watch—A special notice provided to supported user that alerts them of a potential for weather conditions of such intensity as to pose a hazard to life or property for which the end user must take protective action.

Weather Flight (WF)—An umbrella term covering an AF entity below squadron level providing functional weather support or services. Typical designation includes within an Operational Support Squadron, Operational Weather Squadron, Weather Squadron, and numbered Weather Flights within the ANG.

Attachment 2

SAMPLE DD FORM 175-1, FLIGHT WEATHER BRIEFING

PART I: MISSION TAKEOFF DATA:
1. DATE
2. ACFT TYPE/NO. (Aircraft type and identification, i.e. radio call sign, mission number or last three digits of tail number)
3. DEP PT/ETD (Departure ICAO and estimated time of departure)
4. RWY TEMP (Runway Temperature in °C, unless otherwise requested)
5. DEWPOINT (°C, unless otherwise requested)
6. TEMP DEV (Temperature deviation in °C, unless other requested)
7. PRES ALT (Pressure altitude)
8. DENSITY ALT (Density altitude)
9. SFC WIND (Surface Wind - Magnetic direction for local and true direction for remote locations)
10. CLIMB WINDS (Entered in true direction)
11. LOCAL WEATHER WATCH/WARNING/ADVISORY (Weather watches, warnings or advisories valid for ETD +/- 1 hour)
12. RSC/RCR (Latest reported Runway Conditions Reading (RCR) for departure)
13. REMARKS/TAKEOFF ALTN FCST (Any remark on weather affecting take-off and climb [i.e., inversions, icing and turbulence])
PART II: EN ROUTE & MISSION DATA (25 miles of either side and 5000 Ft vertically of flight path)
14. FLIGHT LEVEL/WINDS/TEMPERATURE (Flight Level is entered in three digits)
15. SPACE WEATHER (Mission impacts to equipment)
16. SOLAR/LUNAR (Enter the location for where the information is provided [i.e., target, destination, etc.])
17. CLOUDS AT FLT LEVEL (Appropriate block will be checked)
18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY
(Statute miles and will include the phenomenon that could potentially restrict visibility)
19. MINIMUM CEILING - LOCATION (Hundreds of feet AGL and geographical location)
20. MAXIMUM CLOUD TOPS - LOCATION (Geographical location of more than 4/8ths coverage (exclusive of thunderstorms) in hundreds of feet MSL)
21. MINIMUM FREEZING LVL – LOCATION (in MSL or at SFC)
22. THUNDERSTORMS (Height of thunderstorm tops, coverage percentage, and applicable weather watches/weather warnings, or other data source)
23. TURBULENCE (not associated with thunderstorms) (Geographic location, levels, intensity)
24. ICING (not associated with thunderstorms) (Geographic location, area, levels, intensity, advisory identification number [usually date time group])

25. PRECIPITATION (Geographic location, levels, intensity, identification number of bulletin [usually date/time group])
PART III: AERODROME FORECASTS (Destination Data)
26. DEST/ALTN (Destination and alternate)
27. VALID TIME (Forecast will be valid through +/- 1 hour of ETA)
28. SFC WIND (True direction provided for off-station and magnetic for local)
29. VSBY/WEA (Lowest prevailing visibility and weather forecasted during the valid period)
30. CLOUD LAYERS (Lowest prevailing sky condition expected during the valid period)
31. ALTIMETER (The lowest altimeter setting expected during the valid period)
PART IV: COMMENTS/REMARKS
32. Briefed RSC/RCR (For Destination/Alternate)
33. PMSV (PMSV frequency and/or phone patch number)
34. Attachments (Check appropriate box)
35. Remarks (May include any other significant data)
PART V: BRIEFING RECORD
36. WX BRIEFED TIME (Time briefing was completed)
37. FLIMSY BRIEFING NO (Briefing package, flimsy or CFP identification)
38. FORECASTER'S INITIALS (Name or initials of the weather personnel providing the briefing)
39. NAME OF PERSON RECEIVING BRIEFING (Name and rank)
40. VOID TIME (Army and Navy use only)
41. EXTENDED TO/INITIALS (Time extension for Flight Brief and briefer's initials; Army and Navy use only)
42. WX RE-BRIEFED TIME/INITIALS (Re-brief time and briefer's initials)
43. WX DEBRIEF TIME/INITIALS (Time of weather debrief and the briefer's initials)

Figure A2.1. DD Form 175-1, Flight Weather Briefing.

FLIGHT WEATHER BRIEFING

PART I - TAKEOFF DATA

1. DATE	2. ACFT TYPE/NO.	3. DEP PT/ETD	4. RWY TEMP	5. DEWPOINT	6. TEMP DEV	7. PRES ALT	8. DENSITY ALT
		Z	°F/C	°F/C		FT	FT

9. SFC WIND	10. CLIMB WINDS	11. LOCAL WEATHER WATCH/WARNING/ADVISORY	12. RSC/RCR
M T			

13. REMARKS/TAKEOFF ALTN FCST

PART II - ENROUTE & MISSION DATA

14. FLT LEVEL/WINDS/TEMP ☐ SEE ATTACHED

15. SPACE WEATHER	NO IMPACT	MARGINAL	SEVERE
FREQ			
GPS			
RAD			

16. SOLAR/ LUNAR	LOCATION
BMNT Z	
SR Z	MR Z
SS Z	MS Z
EENT Z	ILLUM %

17. CLOUDS AT FLT LEVEL ☐ YES ☐ NO ☐ IN AND OUT

18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY ☐ YES ☐ NO TYPE

19. MINIMUM CEILING - LOCATION	20. MAXIMUM CLOUD TOPS - LOCATION	21. MINIMUM FREEZING LVL - LOCATION
FT AGL	FT MSL	FT MSL

22. THUNDERSTORMS

CHART

	NONE	AREA	LINE
ISOLATED 1 - 2%			
FEW 3 - 15%			
SCATTERED 16 - 45%			
NUMEROUS - MORE THAN 45%			

HAIL, SEVERE TURBULENCE & ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS.

LOCATION

23. TURBULENCE

CHART

	NONE	IN CLEAR	IN CLOUD
LIGHT			
MODERATE			
SEVERE			
EXTREME			

LEVELS

LOCATION

24. ICING

CHART

	NONE	RIME	MIXED	CLEAR
TRACE				
LIGHT				
MODERATE				
SEVERE				

LEVELS

LOCATION

25. PRECIPITATION

CHART

	NONE	DRIZZLE	RAIN	SNOW	PELLET
LIGHT					
MODERATE					
HEAVY					
SHOWERS					
FREEZING					

LOCATION

PART III - AERODROME FORECASTS

26.	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS	31. ALTIMETER	RWY TEMP	PRES ALT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	FT
DEST/ALTN	Z TO Z	M T			INS	°F/C	INS

PART IV - COMMENTS/REMARKS

32. BRIEFED RSC/RCR ☐ YES ☐ NOT AVAILABLE | 33. PMSV | 34. ATTACHMENTS ☐ YES ☐ NO

35. REMARKS

PART V - BRIEFING RECORD

36. WX BRIEFED TIME	37. FLIMSY BRIEFING NO.	38. FORECASTER'S INITIALS	39. NAME OF PERSON RECEIVING BRIEFING
Z			
40. VOID TIME	**41. EXTENDED TO/INITIALS**	**42. WX REBRIEF TIME/INITIALS**	**43. WX DEBRIEF TIME/INITIALS**
Z	Z	Z	Z

DD FORM 175-1, OCT 2002 PREVIOUS EDITION MAY BE USED. Reset Adobe Professional 7.0