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SECRETARY OF THE AIR FORCE

AIR FORCE HANDBOOK 11-203, VOLUME 2

16 MAY 2002

Flying Operations

WEATHER FOR AIRCREWS

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This handbook familiarizes the aircrew member with weather services, charts and codes. Serves as a text for undergraduate pilot and navigator training, all USAF instrument refresher training and flight instruction programs and various individual flying training programs. It is issued to each flying unit and to each instructor and student involved in Undergraduate Pilot Training and other aircrew training courses.

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Chapter 1

AIR FORCE WEATHER

1.1. Introduction. Weather and warfare have been linked together throughout world history. The atmosphere has the ability to either enhance or reduce the performance of aircraft systems. To effectively accomplish the Air Force mission, and maintain the advantage "over" the battlefield, aircrews must have a thorough awareness and understanding of the air or space environment in which they operate. The goal of Air Force Weather (AFW) is to provide the Department of Defense (DoD) the knowledge needed to "exploit the weather for battle." Vast amount of weather information is available to you from various providers via web technology, but the timeliness and reliability can't be guaranteed. Any attempt to capture all of the private sector-information services would be beyond the scope of this publication. Therefore, this text will summarize Air Force and civil government services, charts, and weather codes.

Figure 1.1. Air Force Weather Insignia.

Air Force Weather Mission Statement: *"Deliver the highest quality mission-tailored weather and space environment information, products, and services to our nations combat forces, anytime, anyplace… mud to sun."*

1.2. AFW Organization. AFW services and support are organized under the functional management of the Directorate of Weather, Deputy Chief of Staff for Air and Space Operations, Headquarters United States Air Force (HQ USAF/XOW). AFW operates through a three-tier organizational structure corresponding to the three levels of military operations - strategic, operational and tactical.

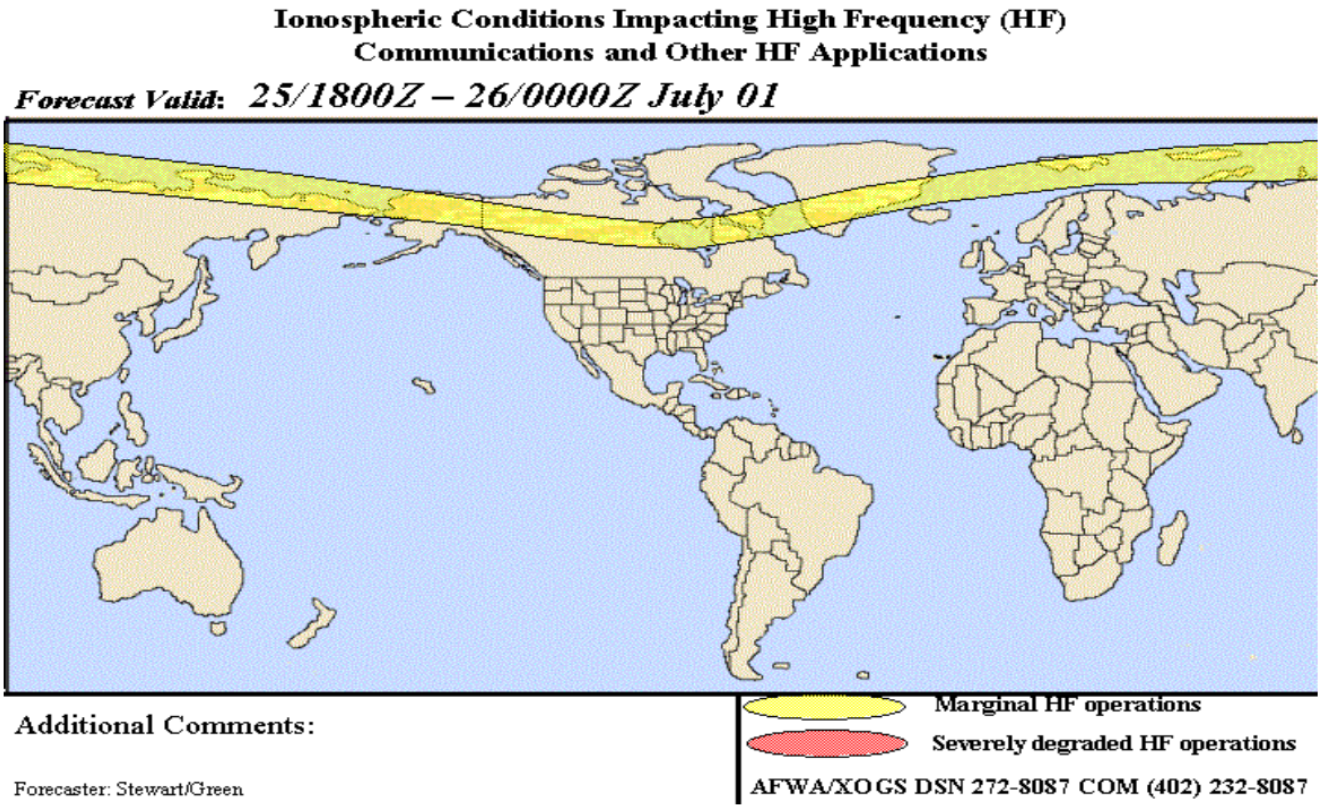
1.3. Strategic Level. AFW's strategic weather units are centers of expertise in providing strategic-level terrestrial and space weather products and support necessary to conduct military operations. The Air Force Weather Agency (AFWA) is the principal strategic weather center, and it also provides select operational and tactical-level support to special operations. Space support is provided primarily by the Space Operations Cell (AFWA/SPACEWOC). Finally, The Air Force Combat Climatology Center (AFCCC) provides centralized climatological data services.

1.3.1. Air Force Weather Agency (AFWA). AFWA, located at Offutt AFB, Nebraska, produces mission-tailored, global weather products and services 24 hours a day to meet the requirements of the DoD. AFWA provides regional, theater-scale meteorological model outputs to operational and tactical-level weather units. AFWA services include meteorological satellite imagery meteorological guid-

ance, aviation, automated flight planning, exercise and special mission support and computations for ballistic missile systems as well as the collection and dissemination of environmental data.

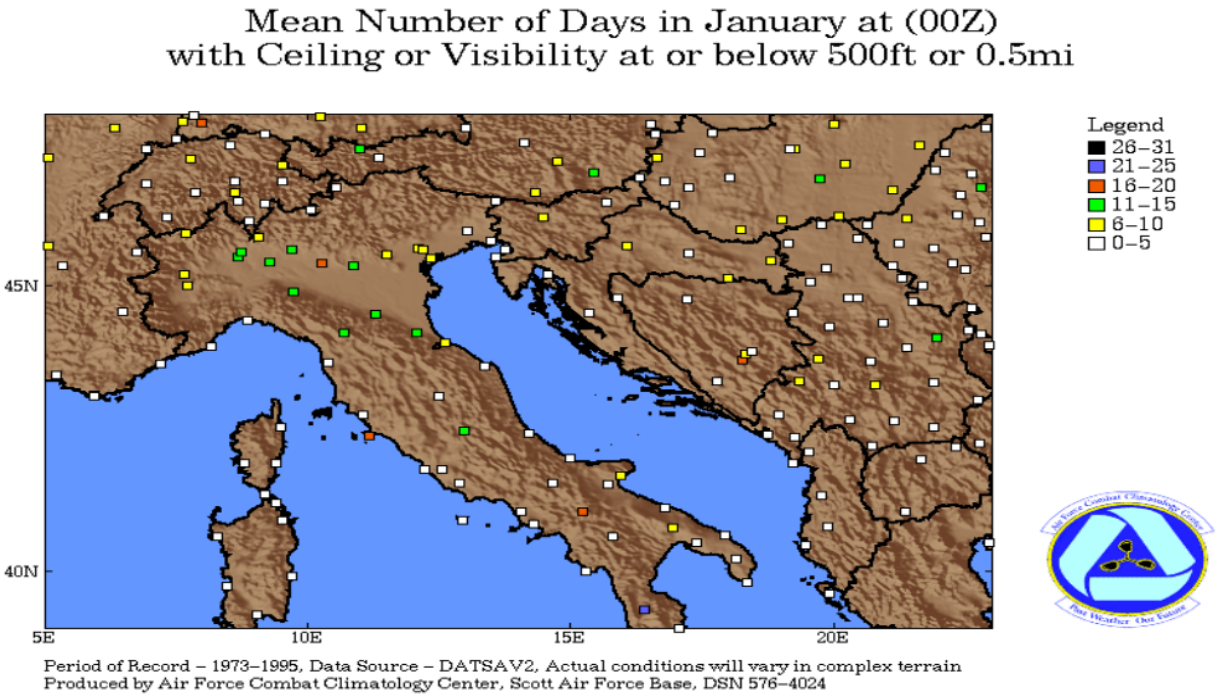
1.3.2. The Space Operations Cell. AFWA/SPACEWOC, located at Offutt AFB, Nebraska, provides space environmental support for worldwide operations. Space Weather (SW) includes the study of solar storms, geomagnetic storms, and ionospheric disturbances. SW agencies process data from ground and space-based sensor networks, analyze models, and forecast the space environment. They provide alerts, warnings, and assessments for operational impacts. Systems routinely supported include satellite vehicle and payload operations, ground and satellite-based communications, navigation, surveillance and weapon system radars, as well as high-altitude reconnaissance aircraft and the Space Shuttle. They predict solar weather effects on ultra-high frequency (UHF)(**Figure 1.2.**), radar, and Global Positioning System (GPS) navigation signals. To receive space weather data, submit your request for support through your local supporting Combat Weather Team (CWT) or Operational Weather Squadron (OWS).

Figure 1.2. UHF Impacts Forecast.



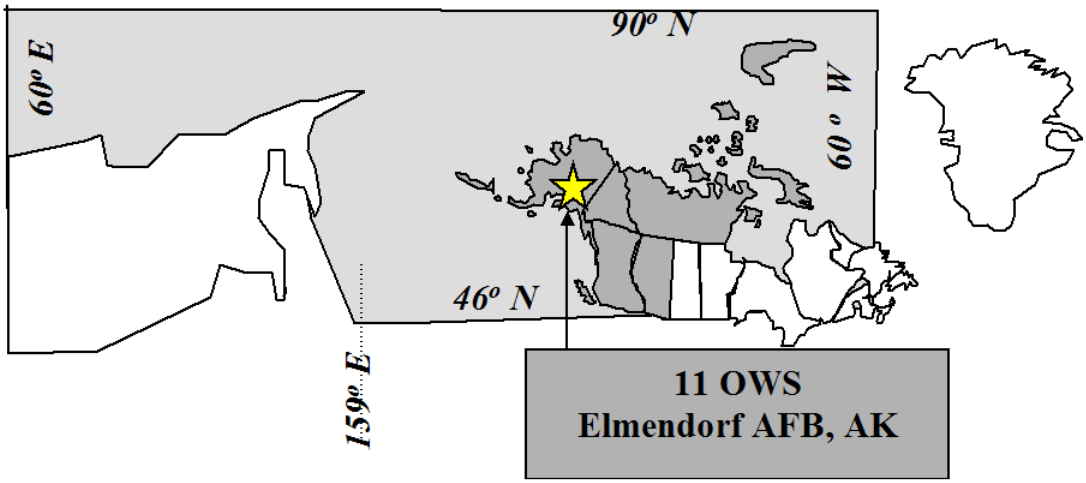
1.3.3. The Air Force Combat Climatology Center (AFCCC). The Air Force Combat Climatology Center (AFCCC), located in Asheville, NC, collects worldwide climatological data to create products that provide critical information based on past weather (**Figure 1.3.**). Examples of climatological products include typical target weather conditions, frequency of weather limitations at deployed locations, weather limitations on weapon system employment, and crosswind studies. Military planners use this information to maximize the advantage of the weather to the warfighter and minimize the impact of adverse conditions on friendly operations. Coordinate with your local CWT or OWS to request AFCCC support.

Figure 1.3. Sample Climatology Product.



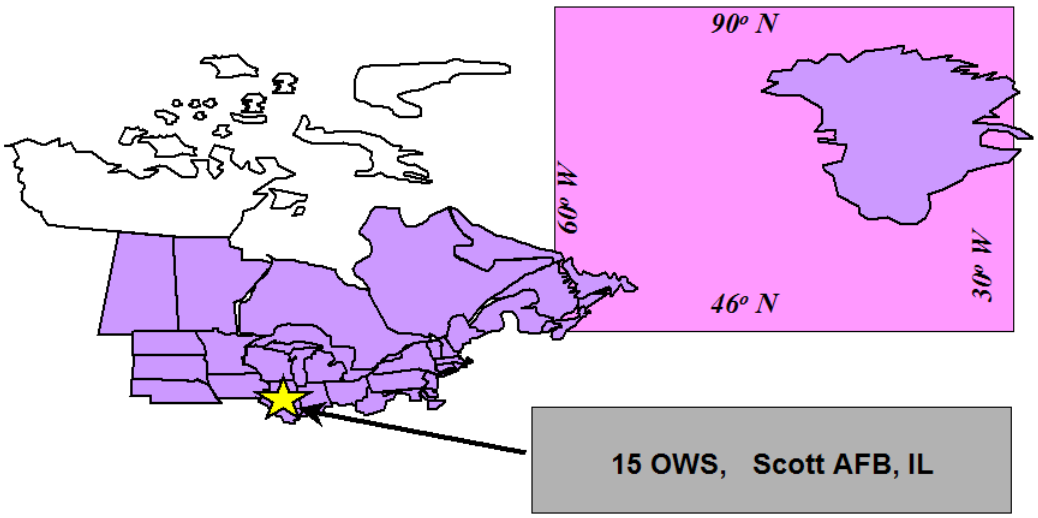
1.4. Operational Level. AFW's Operational Weather Squadrons (OWSs) are theater or regional centers. Eight OWSs provide operational-level support to CWTs, units assigned within, or deployed to, its theater Commander-in-Chief (CINC) geographic Areas of Responsibility (AOR). Staff Weather Officers (SWOs) assigned to USAF Major Commands (MAJCOMs), USA Major Commands (MACOMs), and Unified Commands provide direct support to these Headquarters and oversee AFW support to the Command's forces. OWS support includes: regional and theater scale battlespace forecasts, drop and landing-zone/ range/air refueling/target forecasts, mission executive level briefings, weather watches, warnings, and forecast advisories, and Terminal Aerodrome Forecasts (TAFs) for each base within their region. The OWS provides briefing support to transient aircrews or aircrews not collocated with a CWT. OWS locations and AORs are shown in **Figure 1.4.** through **Figure 1.13.** OWS Phone numbers are in the DoD FLIP Supplement and Flight Information Handbook.

Figure 1.4. 11 OWS AOR Under Command and Control of 611 AOG.



11 OWS AOR: Alaska, including the Aleutians, Arctic Ocean, Canadian provinces of Yukon, Northwest Territories, Nunavut, British Columbia and Alberta.

Figure 1.5. 15 OWS AOR Under Command and Control of AMC TACC.



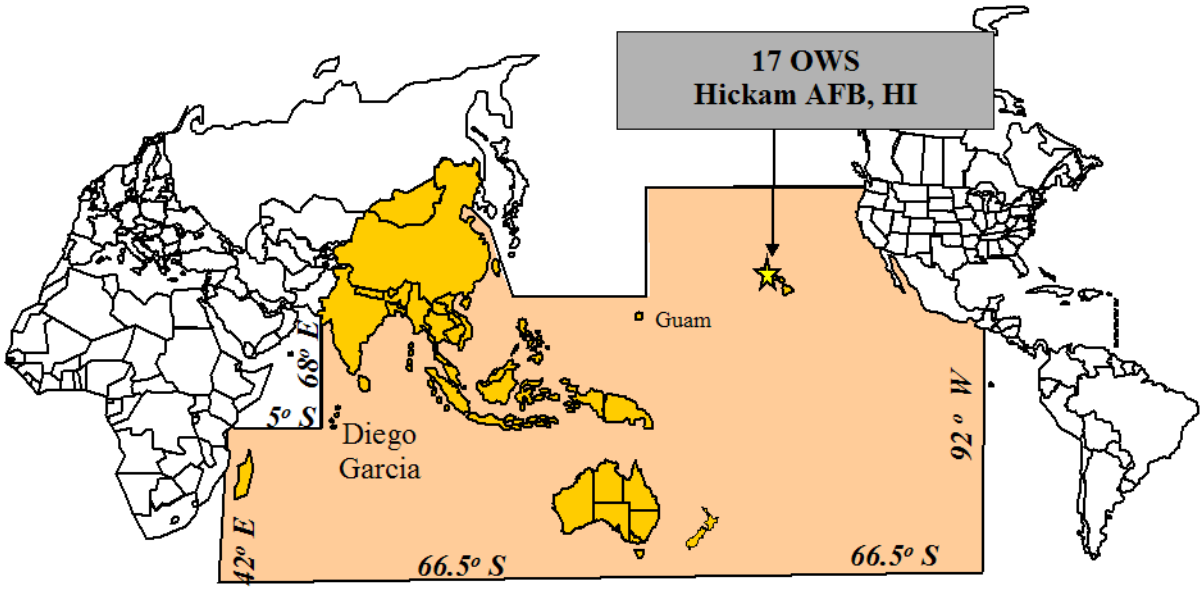
15 OWS AOR: ND, SD, NE, MN, IA, WI, IL, IN, MI, OH, WV, NY, PA, MD, DE, NJ, CT, RI, MA, NH, VT, ME, DC (including Fairfax & Arlington Counties in northern VA), Great Lakes, Central and Eastern Canada – to include Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Newfoundland, Nova Scotia, Labrador, Prince Edward Islands, Greenland, part of North Atlantic and region south of Antarctic circle (66.5^0 S).

* Exceptions:

1) 25 OWS provides support to 90 Space Wing (F.E. Warren AFB) assets within the 15 OWS AOR.

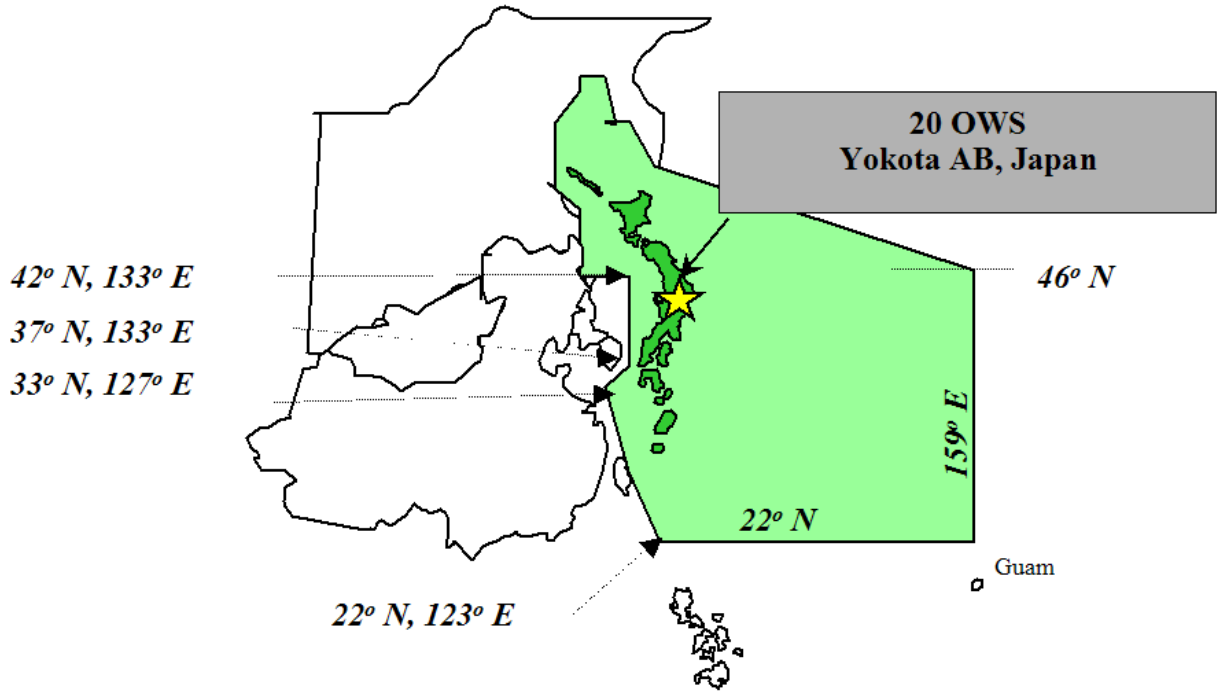
2) 15 OWS AORs extends out to the US Air Defense Identification Zone (ADIZ), circa 200 miles off the U.S. Atlantic coast.

Figure 1.6. 17 OWS AOR Under Command and Control of 502 AOG.



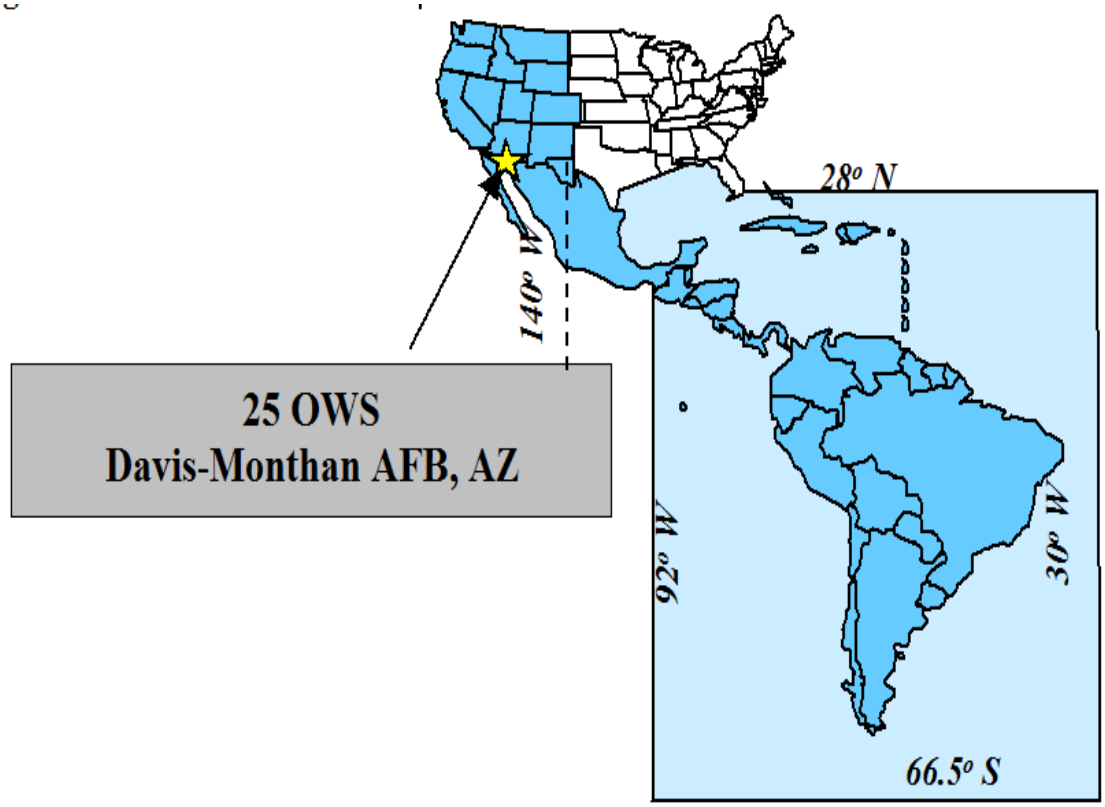
17 OWS AOR: China, Taiwan, Mongolia, Thailand, Vietnam, Laos, Cambodia, Burma, Malaysia, Singapore, India, Nepal, Sri Lanka, Bangladesh, Diego Garcia, Madagascar, Australia, New Zealand, Indonesia, New Guinea, Guam, Hawaiian Islands, tropical and subtropical Pacific including WESTPAC, and most of the Indian Ocean

Figure 1.7. 20 OWS AOR Under Command and control of 605 AOG.



20 WS AOR: Japan, surrounding waters and part of N. Pacific Ocean

Figure 1.8. 25 OWS AOR Under Command and Control of 12 AF.

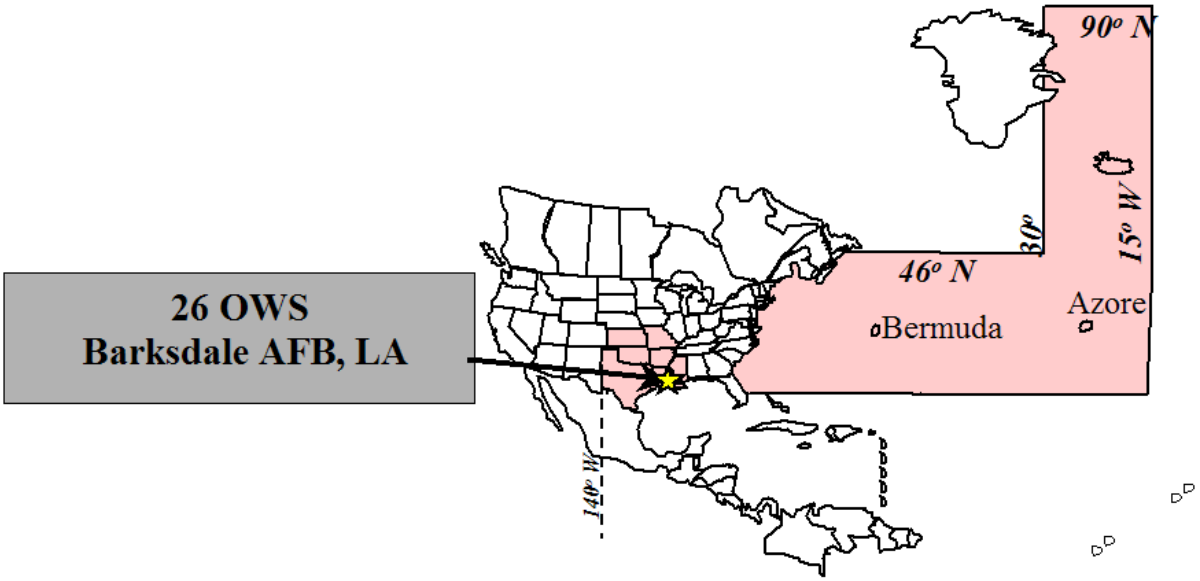


25 OWS AOR: WA, OR, CA, ID, MT, WY, CO, UT, NV, AZ, NM, and western panhandle of TX (west of 140W), USSOUTHCOM AOR, including Mexico, Central and South America, Gulf of Mexico and Caribbean Basin-including the Bahama Islands.

*Exceptions:

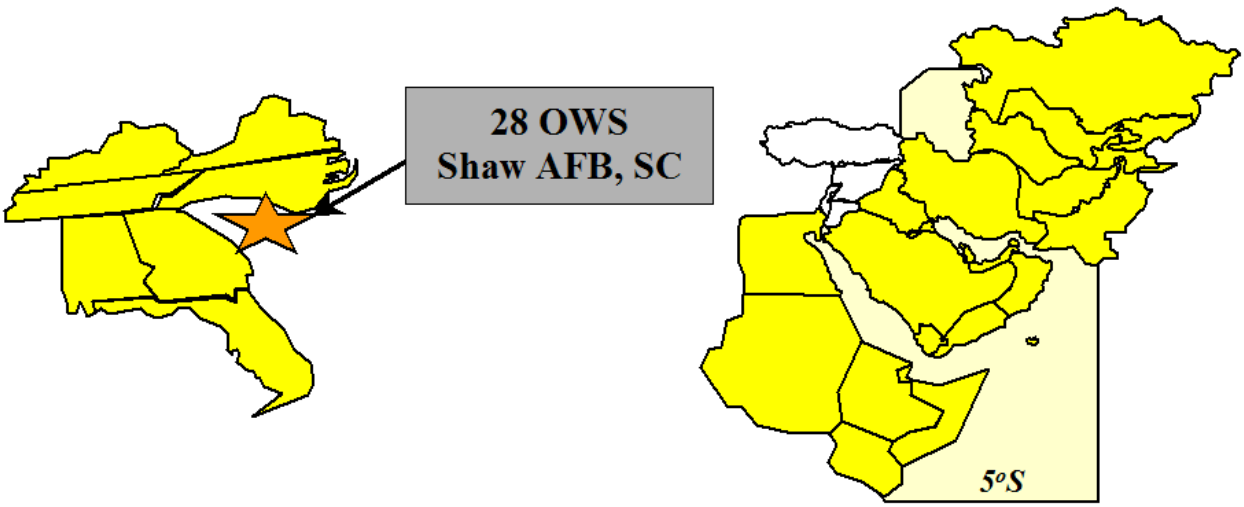
1) 25 OWS provides support to 90th Space Wing (F.E. Warren AFB) assets within the 15 OWS AOR.
2) 25 OWS AORs extends out to the US Air Defense Identification Zone (ADIZ), circa 200 miles off the U.S. Gulf and West coasts.

Figure 1.9. 26 OWS AOR Under Command and Control of 8 AF.



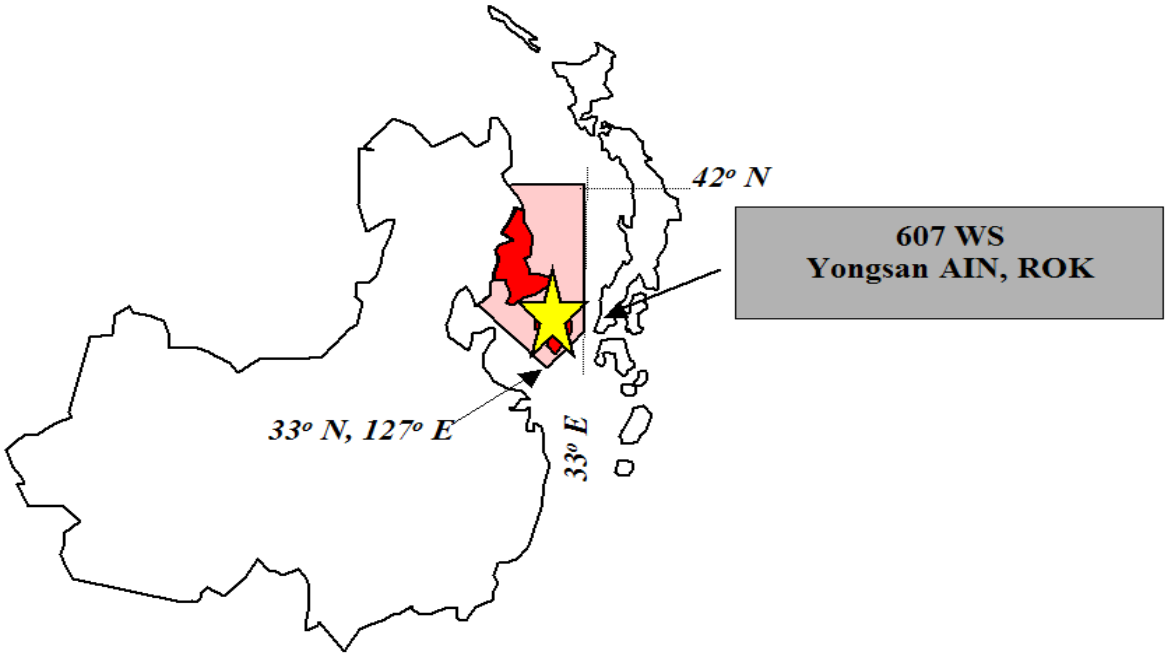
26 OWS AOR: KS, MO, OK, AR, TX (except western panhandle), LA, MS, a portion of USJFCOM AOR to include Bermuda, Iceland, Lajes and a portion of Atlantic Ocean.
* Exception:
26 OWS AOR extends out to the US Air Defense Identification Zone (ADIZ), circa 200 miles off the U.S. TX , LA & MS coasts.

Figure 1.10. 28 OWS AOR Under Command and Control of 9 AF.



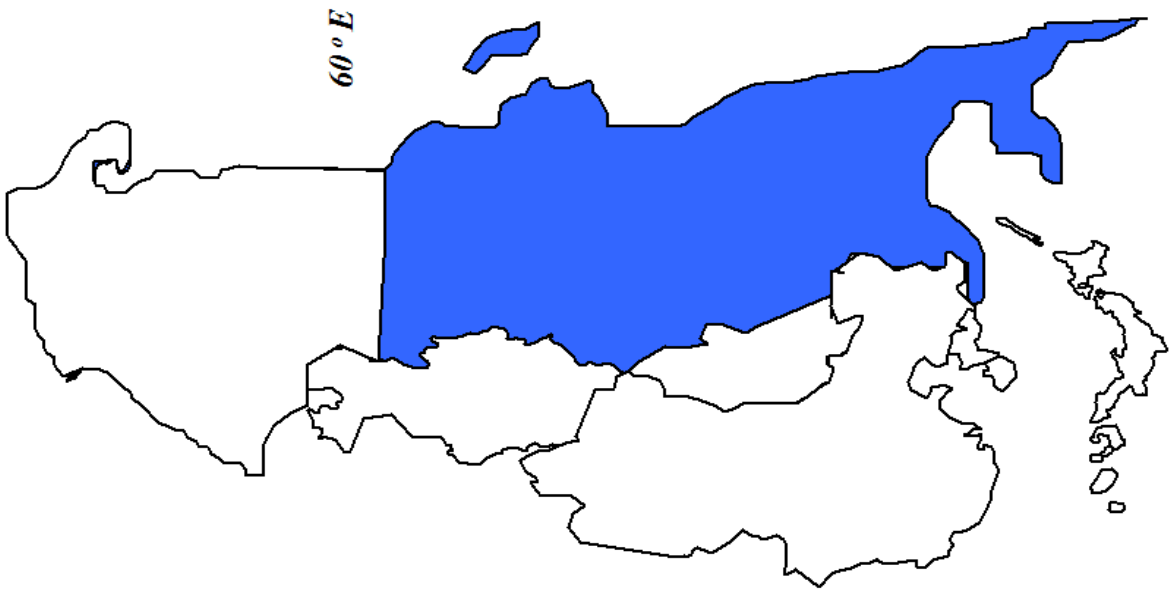
28 OWS AOR: KY, TN, AL, VA*, NC, SC, GA, FL (including Florida Keys), USCENTCOM AOR - Pakistan, Afghanistan, Iran, Iraq, Jordan, Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates, Oman, Yemen, Persian Gulf, Red Sea, Egypt, Sudan, Ethiopia, Kenya, Eritrea, Djibouti, & Somalia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Caspian Sea.
* Exceptions:
1) 15 OWS supports the Washington D.C. area.
2) 28 OWS AORs extends out to the US Air Defense Identification Zone, circa 200 miles off the VA, NC, SC, FL, & AL coasts.

Figure 1.11. 607 WS AOR Under Command and Control of 607 ASOG.



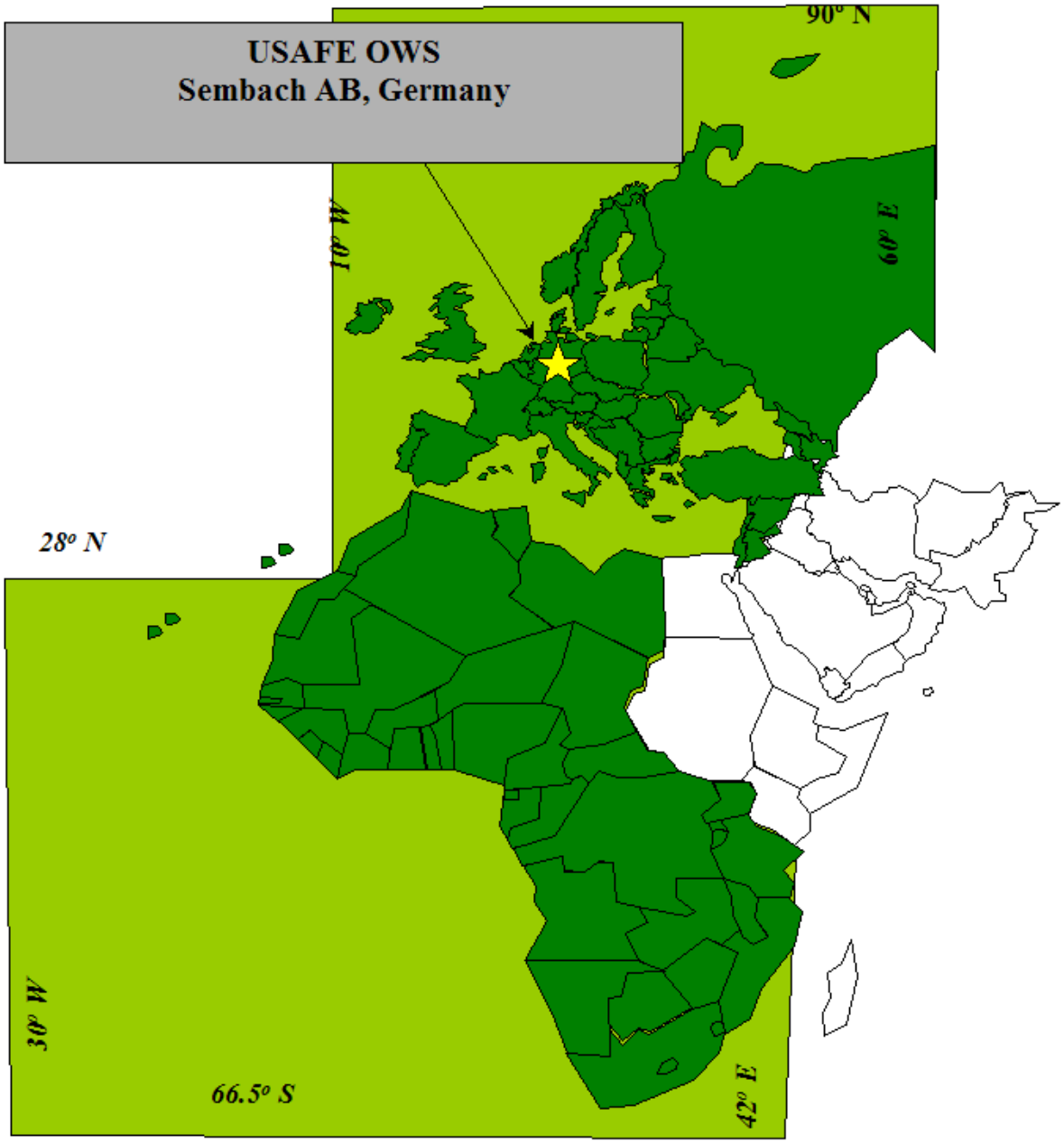
607 WS AOR: North & South Korea, and surrounding waters.
NOTE: No longer an "Operational" WS this AOR will be assumed by 20 OWS in Nov 02

Figure 1.12. AFWA AOR Under Command and Control of AF/XO.



AFWA AOR: Russia east of 60º E (Ural Mountains) - Siberia

Figure 1.13. USAFE OWS AOR Under Command and Control of USAFE/DO.



USAFE OWS AOR - Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Former Yugoslav Republic, Malta, Moldova, Monaco, Netherlands, Norway, Poland, Portugal, Romania, Russia (west of 60^0 E - Ural Mts), San Marino, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Vatican City, Baltic Sea, Mediterranean Sea, Black Sea, Cyprus, Turkey, Syria, Lebanon, Israel, Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Cote D'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Lesotho, Liberia, Libya, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe

1.5. Tactical Level. AFW support to operational USAF and USA field units is organized for tactical, mission-specific operations. A Combat Weather Team (CWT) is a generic term used to describe a weather team providing mission tailored products and services to a supported unit. CWTs are normally organized as Weather Flights (WF) under Operations Support Squadrons (OSS) for USAF operations, or may be organized as Detachments (Det) or Combat Weather Squadrons (CWS) under Air Support Operations Groups (ASOG) for USA operations. CWTs deploy with operational warfighters as required. The CWT is the cornerstone of support to operational field unit mission. It is likely your interactions will be limited to contact with the CWT and OWS. CWTs provide aircrew and flight safety briefings, Pilot-to-Metro Service (PMSV) support, mission-tailored products (Mission Execution Forecasts (MEF)), MISSIONWATCH (monitors supported customer's flying areas, routes, and missions), METWATCH (monitors OWS produced forecasts, issues "observed" weather advisories and warnings), surface observations, Tactical Decision Aids (TDAs), and Integrated Weather and Environment Decision Aid (IWEDA) to predict go/no go weather thresholds. Other responsibilities include resource protection for DoD personnel and assets by keeping commanders abreast of weather watches, warnings and advisories. Briefers provide tailored aircrew briefings for each phase of flight. Briefings are available in-person, via telephone or in some circumstances closed circuit monitor. Most CWTs do not maintain a continuous 24-hour briefing and forecasting service. If weather services are unavailable at your location, contact the regional OWS or MAJCOM approved source.

1.5.1. Air National Guard (ANG) and Air Reserve Component (ARC) Weather. These resources primarily support Air Force and Army wartime deployment and employment requirements. Selected ARC resources will support rotational (i.e., Aerospace Expeditionary Force (AEF)) taskings 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.

1.6. OWS-CWT-Aircrew Interface. The continuous interface between the OWS, CWT, and aircrew is essential for mission support improvement and mission success. OWSs create products and monitor weather for its CINC's AOR. Thus, OWS technicians develop long-term weather knowledge for the AOR. This improves theater forecast quality and mission support. One example of OWS-CWT interface occurs during the forecast (TAF) process. OWSs' coordinate forecast content with the local CWT before issuing the TAF for the CWT's base. CWTs monitor the TAF and notify the OWS when conditions are met requiring a TAF amendment. Deployed CWTs will use the AOR OWS for support. Thus, an aircrew deployed within its CINC's AOR is serviced by the same OWS and/or CWT as home base. If your assigned CWT is not deployed with you, it still must arrange your TDY weather support. OWSs will support aircrews in their AOR when no CWT is assigned or available.

1.6.1. CWT-Aircrew Interface. CWT-aircrew interface enhances mission support. CWTs work with aircrews to learn aircraft capabilities, mission profiles and tactics. This ensures CWTs understand mission impacts. CWTs use this information to determine the best mission support products. CWTs can show you how these products are used to create MEFs resulting in a more knowledgeable aircrew. Post-mission feedback of the weather encountered vice the MEF allows CWTs to evaluate effectiveness. CWTs use this to adjust future MEFs resulting in improved mission support.

Chapter 2

GRAPHIC CHARTS

2.1. Overview. Graphic charts are produced by multiple sources within both the military and civilian arena. Thus, details for the variety of charts is beyond the scope of this publication. This is to give a broad-brush description of some of the symbols and products you will encounter. Most civilian and all military units producing graphic products will use standard weather symbols, line types, color representations, and isopleths. No product will provide all the needed operational information. Use products in combination and with weather technician input.

2.2. Standard Weather Symbols . These representations, symbols, and isopleths commonly used are defined in MIL-STD-2525B, *Common Warfighting Symbology*. **Figure 2.1.** depicts lines and colors for isopleths. **Figure 2.2.** shows shading and color fill for bounded areas of specific weather parameters. **Figure 2.3.** shows fronts and other weather features. **Figure 2.4.** depicts criteria and shading for USAF produced Military Weather Advisory (MWA) products.

Figure 2.1. Recommended Line Types and Colors for Commonly Used Isopleths.

Isobars (surface pressure) BLACK solid
Contours (upper air heights) BLACK solid
Isotherms (temperature) RED dashed
Isotachs (wind speed) PURPLE dashed
Isodrosotherms (dew points) GREEN solid

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

(GREEN solid lines and solid or cross-hatching)

Zones of Continuous Precipitation: Precipitation symbol may be distributed over the zone (e.g., drizzle, rain, or snow). Color shade in RED for freezing precipitation.

(GREEN solid line and single hatching)

Zones of Intermittent Precipitation: Precipitation symbol may be distributed over the zone (e.g., rain showers, snow showers).

Figure 2.2 Continued.

(YELLOW solid line and shading)

Areas of Fog: Fog symbol may be distributed over the zone.

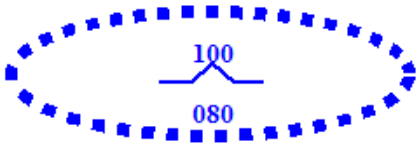
(BROWN solid line and shading)

Areas of Dust, Duststorms, Sandstorms, or Haze: Phenomena symbol may be distributed over the zone.

(Thunderstorms—RED line with dash or dot)

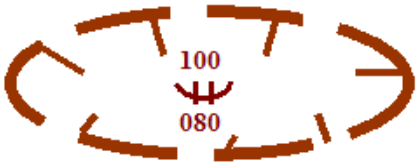
(Rain/Snow Showers—GREEN line with dash or dot)

Thunderstorm-Convective Areas: Convective weather symbol may be distributed over the zone with the height of the thunderstorm top or the prevailing visibility over the symbols.



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

Turbulence Areas: symbol may be distributed over the zone with bases and top height in hundreds of ft.



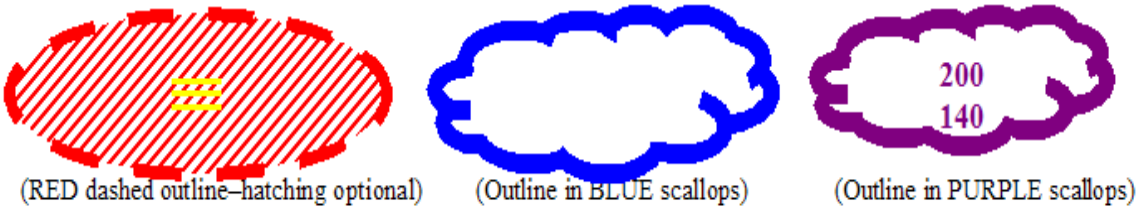
(BROWN intersecting line segments)

Icing Areas: Icing symbol may be distributed over the zone with bases and top height in hundreds of ft.

(GREEN solid line with diagonal dashes)

Non-Convective Continuous or Intermittent Precipitation Areas: symbol may be distributed over the zone.

Figure 2.2 Continued.



Areas of Ceilings Less Than 1500 Feet and/or Visibility Less Than 3 Miles (RED): Weather symbol causing IFR may be distributed over the zone. **Ceilings less than 3,000 feet but greater than or equal to 1500 feet and/or Visibility Less Than 5 Miles but greater than or equal to 3 Miles (BLUE). Ceilings less than 10,000 feet but greater than or equal to 3000 feet (Purple) with cloud bases/tops inside.**

2.2.1. Fronts. "Pips" indicate front type and point *toward* the movement direction. Pips on both sides identify a stationary front and suggest little or no movement (**Figure 2.3.**).

Figure 2.3. Symbols for Frontal Zones and Other Weather Features.

Item	*Symbol*
(BLUE) Cold front at the surface	
Cold front above the surface	
Cold front frontogenesis (developing)	
Cold front frontolysis (dissipation)	
(RED) Warm front at the surface	
Warm front above the surface	
Warm front frontogenesis (developing)	
Warm front frontolysis (dissipation)	
(PURPLE) Occluded front at the surface	
(ALTERNATE RED & BLUE) Quasi-stationary front at the surface	
Quasi-stationary front above the surface	
Quasi-stationary occluded front at the surface	
Quasi-stationary occluded front above the surface	
(RED or BLACK) Jet Stream Max Wind Line	
(BLACK) Axis of trough	
Axis of ridge	
(BLUE) Highs	**H**
(RED) Lows	**L**

Figure 2.4. Standard Criteria and Shading for Military Weather Advisory (MWA) Products.

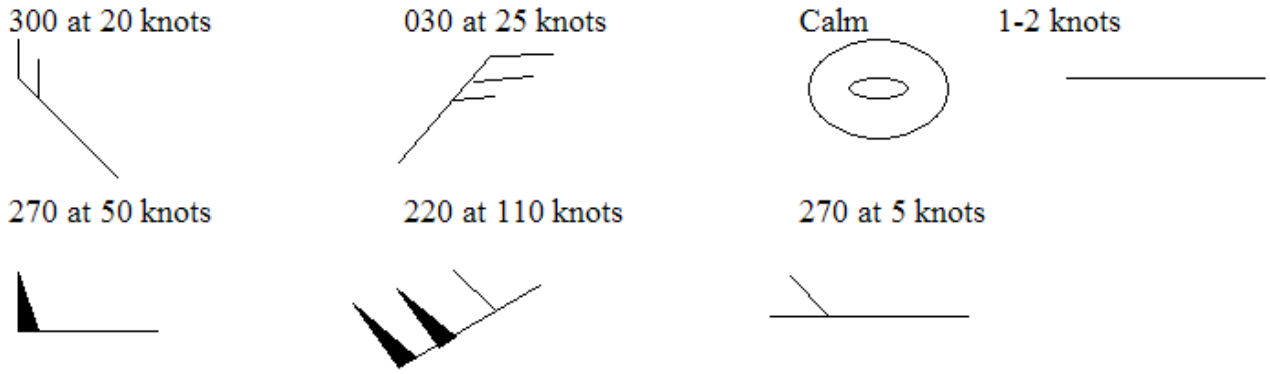
CONVECTIVE WEATHER	
Criteria	**Shading/Solid Bounded**
Tornadoes and severe thunderstorms	**RED**
Severe thunderstorms—hail >/= ¾" and/or winds >/= 50 kts	**BLUE**
Moderate thunderstorms—hail ½"-5/8" and/or gusts 35-49 kts	**GREEN**
General thunderstorms—hail < ½" and/or gusts< 35 kts	**ORANGE**
NONCONVECTIVE WEATHER	
Criteria	**Shading/Solid Bounded**
Surface winds, not associated with Thunderstorms, >/= 35 kts	**BLACK**
Heavy rain (>/= 2" in </= 12 hrs)	**WHITE OR HATCHED PURPLE**
Heavy snow (>/= 2" in </= 12 hrs)	**WHITE OR HATCHED PURPLE**
Freezing precipitation (regardless of type or intensity)	**BROWN**

Thunderstorm **COVERAGE:** Total Area Effected (TAA). Implied 1-hour maximum coverage.

Geographical Coverage of Effected Area in AOR (TAA)	**Blocks on DD Form 175-1**	**Coverage**	**Standard Contraction on MWA**
01-24%	01-02%	Isolated	**ISOLD**
25-49%	03-15%	Few	**FEW**
50-74%	16-45%	Scattered	**SCT**
75-100%	46-100%	Numerous	**NMRS**

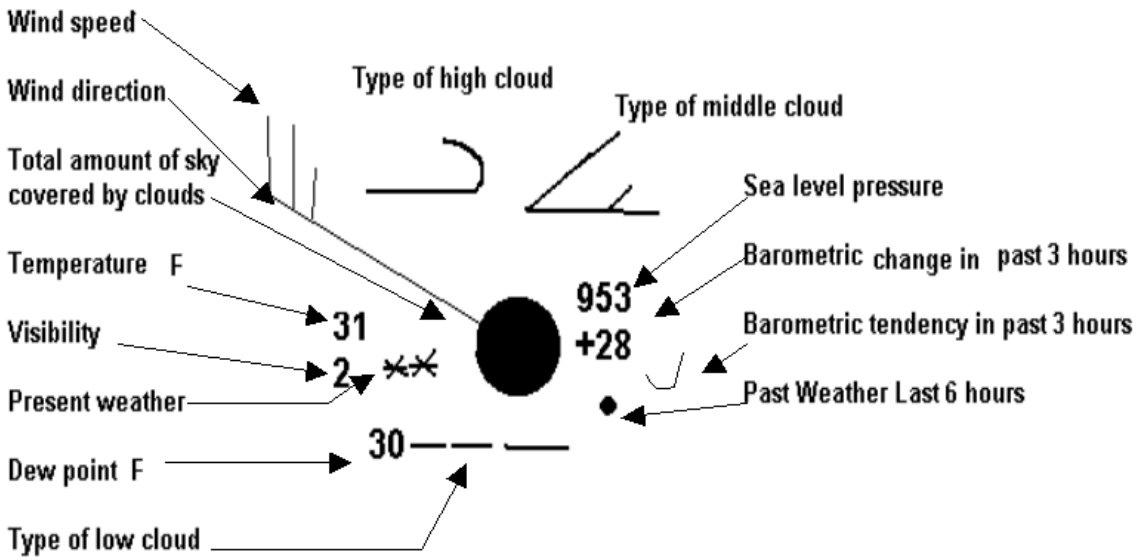
2.2.2. Winds. Wind information plotted uses the "Shaft-Barb-Pennant" method (**Figure 2.5.**). The FROM direction which the wind is blowing is represented by the "shaft" or a line. The wind speed is represented by the barb or pennant. A short barb represents 5 knots and a long barb represents 10 knots. Pennants are 50-knot winds. Wind directions are plotted to the nearest 10 degrees relative to true north.

Figure 2.5. Sample Wind Plots.



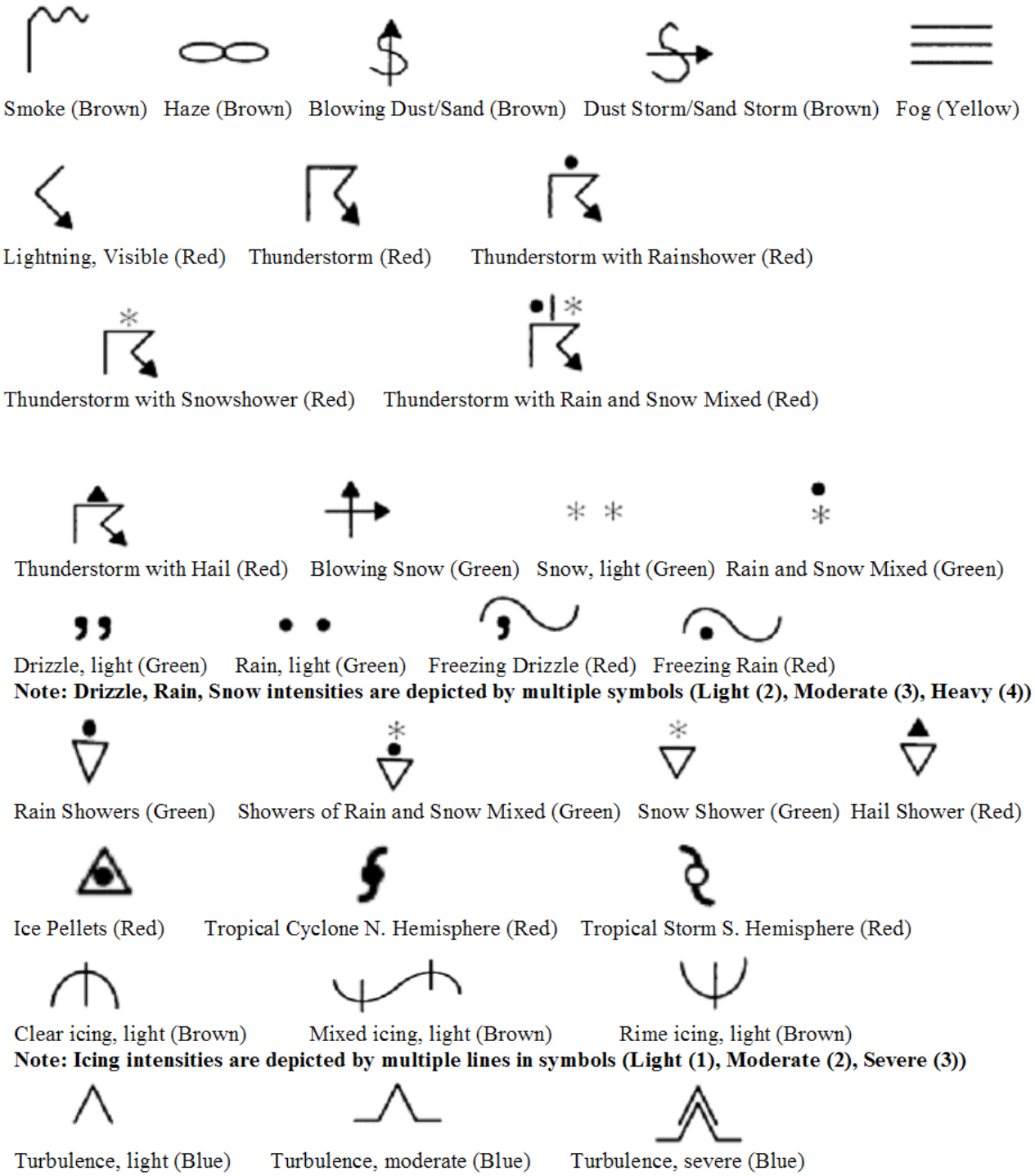
2.2.3. Station Symbols. Station Symbols provide a detailed graphic representation of present weather at individual stations to include cloud type, sky coverage, sea-level pressure (mb), 3-hour barometric change, pressure, present weather, past 6-hour weather, temperature, dew point, visibility (sm), wind speed (kts) and direction. Weather stations commonly use software packages to 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. A complete station model is below (**Figure 2.6.**).

Figure 2.6. Station Model.



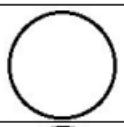
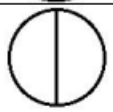
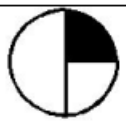
2.2.4. Weather Symbols. Weather Symbols provide a detailed graphic representation of weather types (**Figure 2.7.**).

Figure 2.7. Basic Weather Symbols.



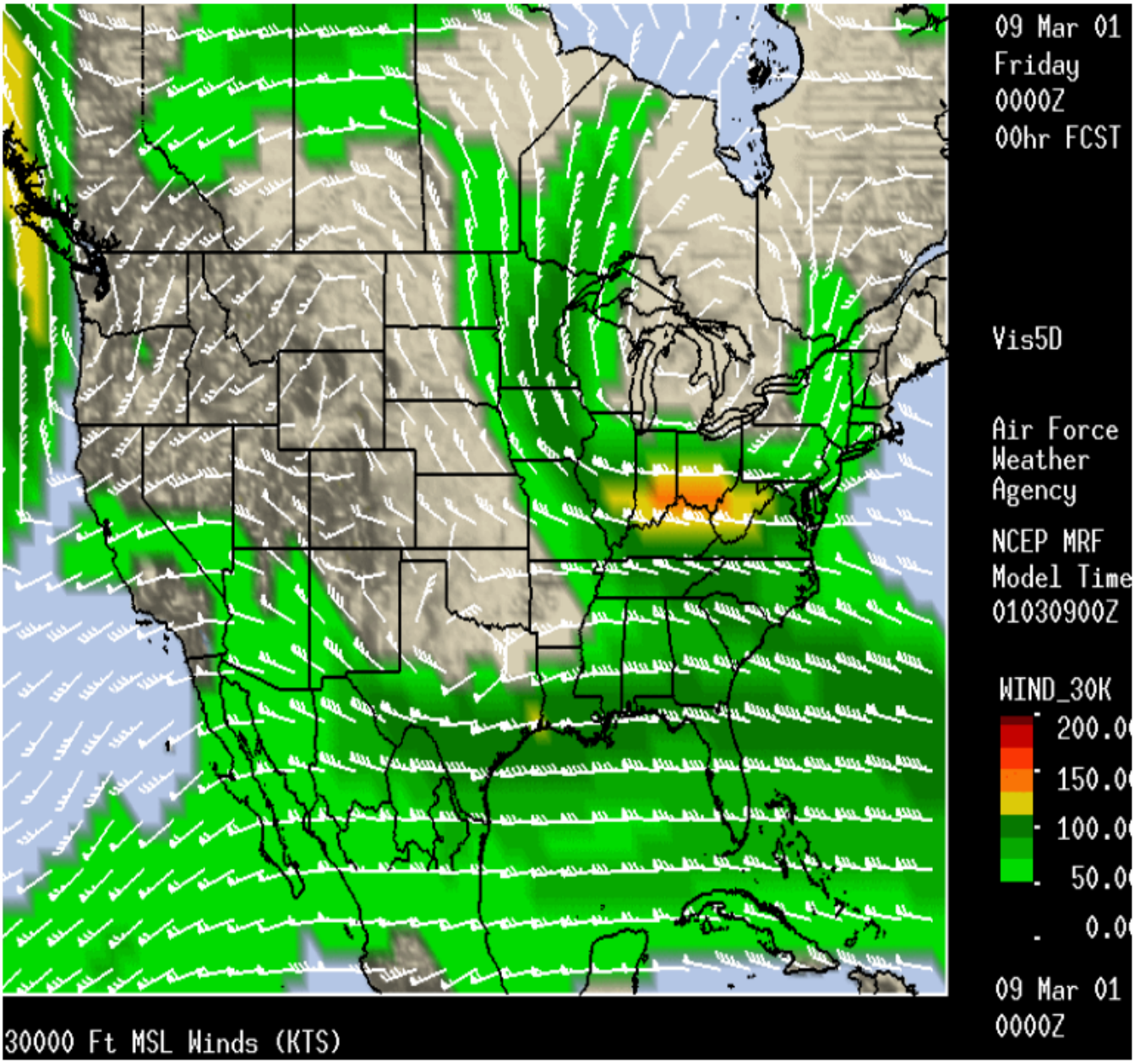
2.2.5. Sky Cover. Shaded circles depict sky cover (**Figure 2.8.**). Cloud base or heights are depicted in hundreds of feet AGL. Ceiling height is entered with broken or overcast sky cover. Sky cover without a height entry is shown by an "X". A height entry for an obscured sky is the vertical visibility. No height is entered for a partially obscured sky with no cloud layer above.

Figure 2.8. 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	

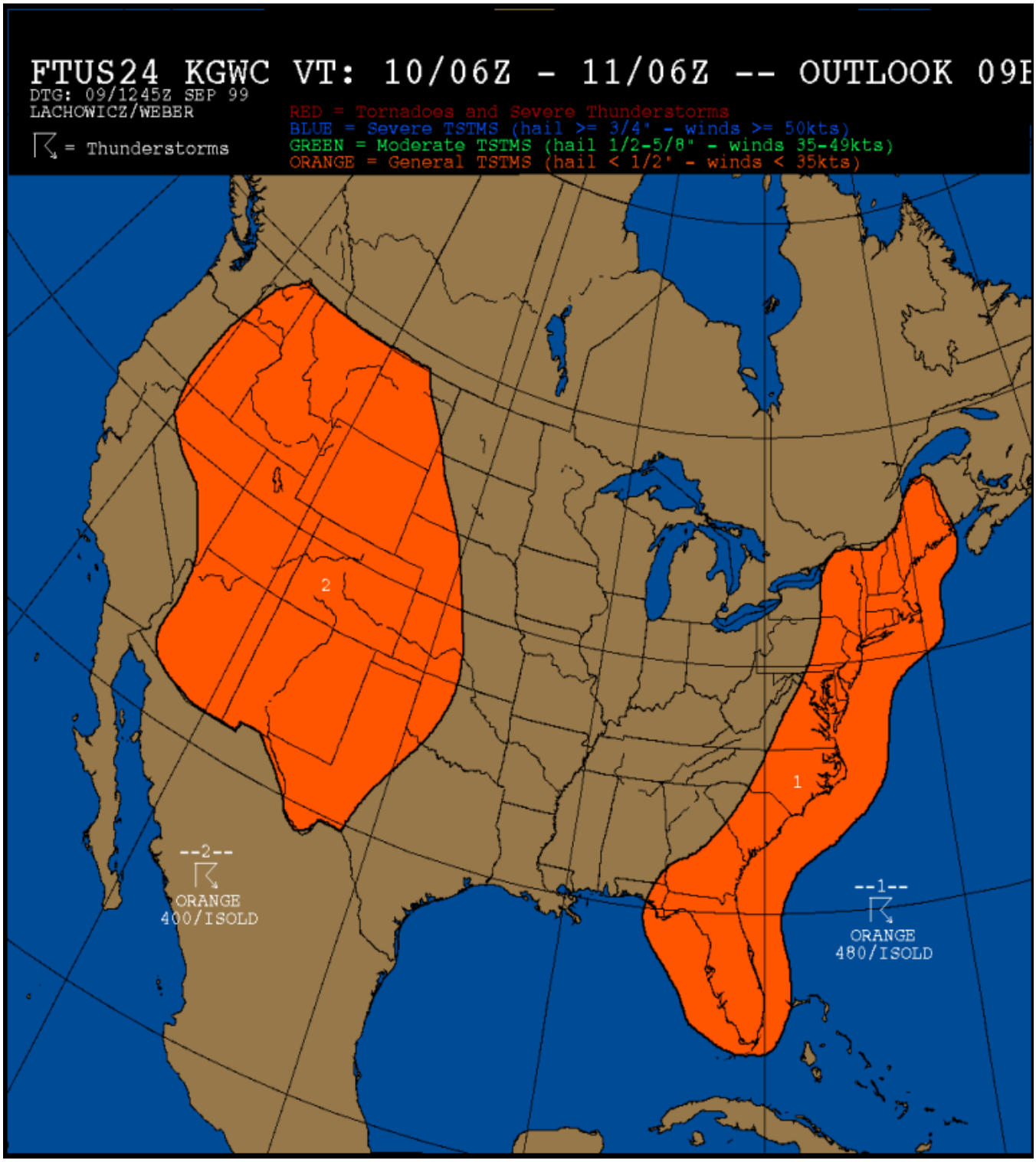
2.3. AFWA Graphic Products . AFWA generates a variety of graphic products. AFWA will also combine and integrate OWS products to develop seamless, hemispheric products. A complete list and all AFWA forecaster-machine products can be found on the Joint Air Force and Army Weather Information Network (JAAWIN) at: **https://weather.afwa.af.mil**. Examples of AFWA Graphics are shown in **Figure 2.9.** - **Figure 2.10.**

Figure 2.9. 30,000 ft Winds.



2.3.1. Military Weather Advisory. The Military Weather Advisory (MWA) (**Figure 2.10.**) is a graphic depicting possible adverse weather and is updated every 6-8 hours. Use the contents of this advisory strictly as a preflight aid to identify areas of severe weather. **Figure 2.4.** shows the key for hazards forecasted. Hazard areas are enclosed by solid lines and identified by block letters. Always reference the MWA before every flight!! Always receive periodic updates from enroute advisory services (i.e., PMSV, ATC, etc.).

Figure 2.10. CONUS MWA Thunderstorm Chart.



2.4. OWS Graphic Products. OWSs will develop graphic products (Sample products **Figure 2.13.** to **Figure 2.15.**) to support operations in its AOR (Sample list in **Figure 2.12.**). Complete OWS product lists

are displayed on its web page. If you do not have CWT support, contact the OWS. To find your AOR's OWS use paragraph **1.4.** and **Figure 2.11.**

Figure 2.11. OWS Websites.

OWS	LOCATION	WEBSITE
11 OWS	Elmendorf AFB, AK	**http://weather.elmendorf.af.mil/**
15 OWS	Scott AFB, IL	**https://15ows.scott.af.mil/**
17 OWS	Hickam AFB, HI	Not Available at print time
20 OWS	Yokota AB, Japan	**http://www.yokota.af.mil/orgs/weather/index.shtml**
25 OWS	Davis-Monthan, AFB, AZ	**https://25ows.dm.af.mil/**
26 OWS	Barksdale, AFB, LA	**https://26ows.barksdale.af.mil/**
28 OWS	Shaw AFB, SC	**https://28ows.shaw.af.mil/**
USAFE	Sembach AB, GE	**https://ows.sembach.af.mil/**

NOTE: **Websites subject to change, see Flight Information Handbook for current data.**

Figure 2.12. Sample of OWS Graphic Products.

Product	Weather Parameters	Threshold Values
Theater Icing Forecast Time Phased (TP) 12/18/24/30/36/48	Icing outside thunderstorms. Rime, Clear (CLR) mixed (MXD) icing (surface - 50,000 ft MSL to the nearest 1000 ft).	- Light (LGT). - Moderate (MDT). - Severe (SVR). - Height of Freezing Level.
Theater Turbulence Forecast - TP 12/18/24/30/36/48	Turbulence. Mechanical, Mountain Wave (MTN WV), Clear Air (CAT) turbulence (surface – 50,000 ft MSL to the nearest 1000 ft).	- Moderate (MDT). - Severe (SVR). - Extreme (EXTRM).
Horizontal Weather Depiction (HWD) - Point in Time (PIT) 12/18/24/30/36/48	Ceiling and Visibility	< 3000/5 (USAF alt required). < 1500/3 (USAF IFR).
Theater Surface Pressure, Fronts and Weather Forecast - PIT 12/18/24/30/36/48	Pressure centers and values, fronts, troughs, Tropical cyclone positions Sensible weather	As displayed. Fronts maintained as long as air mass discontinuity exists.
Theater Cloud Forecast - PIT 12/18/24/30/36/48	Cloud ceilings (low, middle, and high clouds between 5,000 and Tropopause (about 55,000 ft MSL).	Broken (BKN) or Overcast (OVC) Cloud cover.
Theater Thunderstorm Forecast - TP 12/18/24/30/36/48	Theater scale activity	See **Figure 2.4.**

2.4.1. Surface Graphics. OWSs continuously create surface weather graphics for its AOR (**Figure 2.13.**). These will depict frontal positions, locations of pressure system centers and precipitation areas, type and intensity. These are made available to all CWTs supporting AOR military operations. In tropical regions, streamlines are used in place of isobars and circulation centers instead of pressure centers. CWTs visually integrate real-time surface weather observations, radar, satellite imagery and other data with AFWA and OWS surface analyses.

Figure 2.13. Surface Map From 15 OWS.

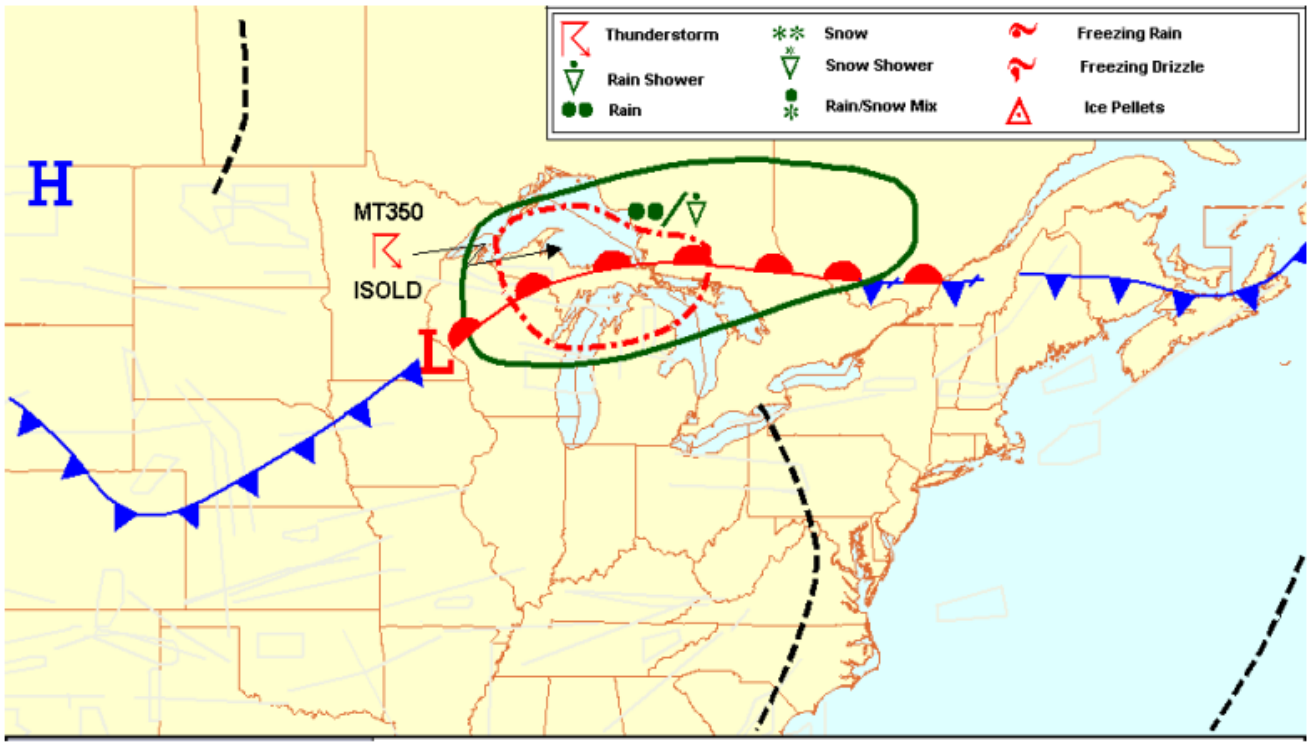


Figure 2.14. SWA HWD From 28 OWS.

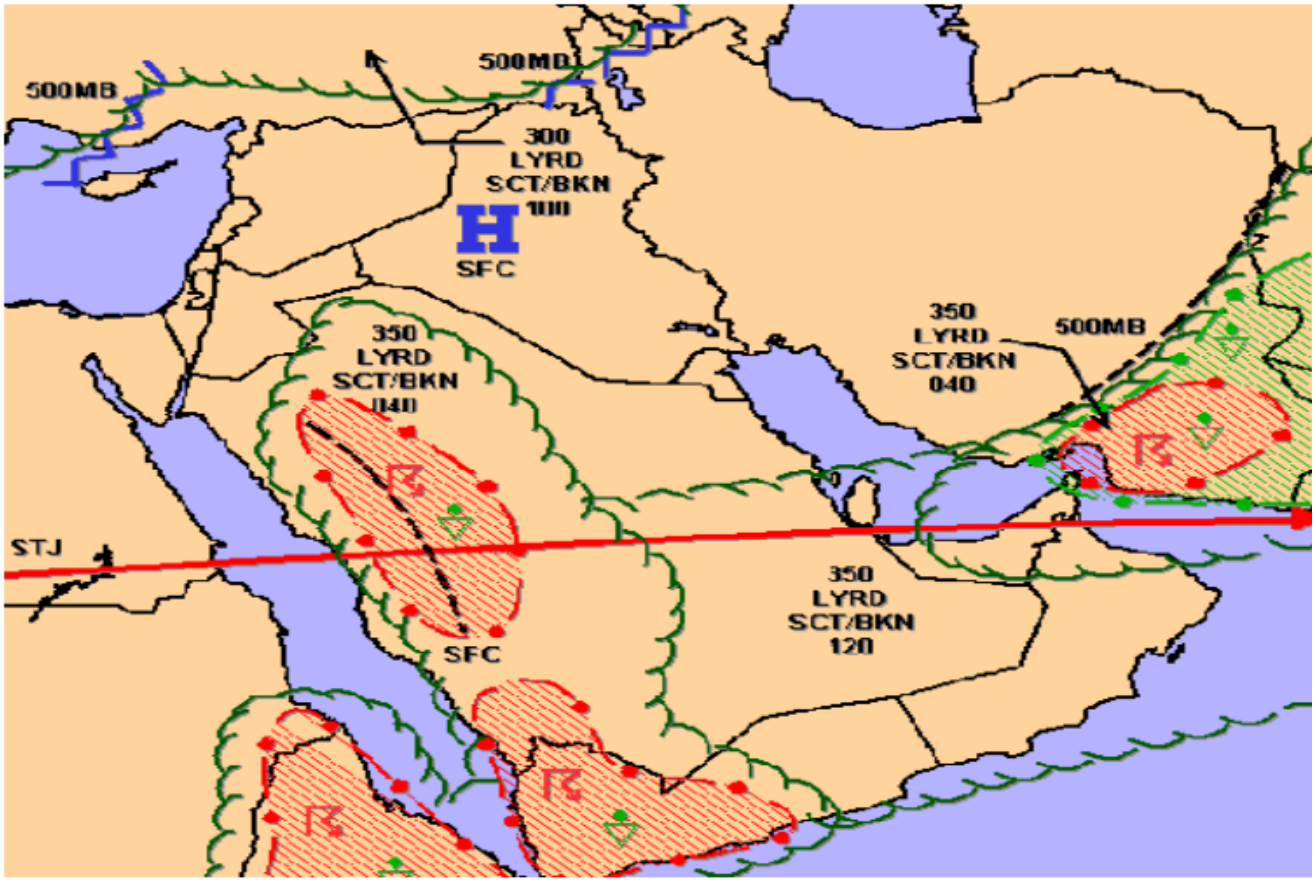
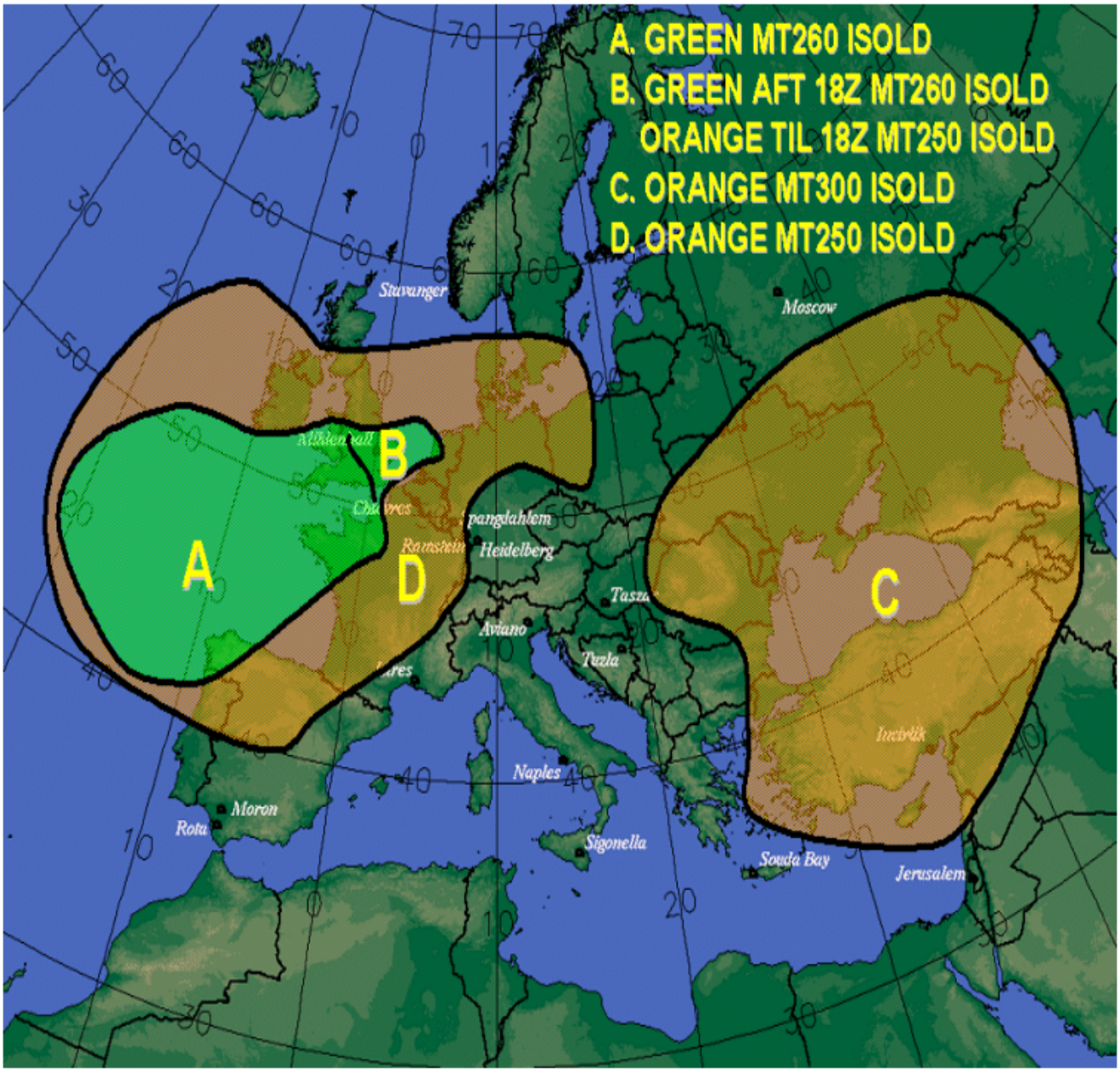


Figure 2.15. Thunderstorm Forecast From USAFE OWS.



2.5. Graphics Availability. All OWSs will produce a suite of "standard products" analogous to the previous examples, and each OWS may produce other mission specific products. OCONUS data unavailability may limit creation of some products. Once you arrive at a new location, contact the CWT to find out what products are available for your AOR. CWTs can provide information on the types of products available, production and amendment cycles, and answers on product information displayed.

2.5.1. Other Graphic Websites. There is a multitude of civilian-created weather products available on the Internet. Descriptions and addresses are well beyond the scope of this handbook. If you can't use a CWT or OWS web site and must use a civilian site, ensure it is MAJCOM approved before proceeding. You should contact your CWT or OWS for verbal information to support the data from whatever site you're using.

Chapter 3

TEXT PRODUCTS

3.1. METAR Code. Aviation Routine Weather Reports (METAR) is the observation code used to report meteorological data. Full code details are found in AFMAN 15-111, *Surface Weather Observations*. 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 (i.e. use meters vice miles).

3.1.1. Report Type . **METAR** is a scheduled observation taken between 55-59 minutes past the hour (a.k.a. hourly observation). **SPECI** (Special Report) is an unscheduled observation taken when a predefined condition criteria change occurs. “Local” Observations are taken for condition change significant to a given airfield’s operations. Locals are not disseminated outside of the local base.

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

SPECI KBLV 011715Z 25015G30KT 210V290 3SM BKN015 01/M01 A2984 RMK SLP034

3.1.2. Location. 4-character identifier; **KBLV** (Scott AFB) is the location/station. The first letter identifies the area (**Figure 3.1.**). A worldwide identifier list is in *Location Indicators* (International Civil Aviation Organization (ICAO)).

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

Figure 3.1. Common ICAO Prefixes.

Prefix	Geographic Region	Examples
K	CONUS	KADW (Andrews AFB, MD)
L	Mediterranean/South Europe	LIYW (Aviano AB, Italy)
P	Pacific	PGUA (Anderson AB, Guam)
M	Mexico, West Caribbean	MMAA (Acapulco, Mexico)
E	Northern Europe	EGUN (RAF Mildenhall, UK)
T	East Caribbean	TJNR (Roosevelt Roads NAS, PR)
S	South America	SLLP (La Paz, Bolivia)
O	Southwest Asia	OERY (Riyadh AB, Saudi Arabia)
R	Far East	RKSO AB (Osan AB, South Korea)
B	Greenland	BIKF (NAS Keflavik, Iceland)
C	Canada	CYYR (Goose Bay, Canada)
H	East Africa	HDAM (Djibouti, Djibouti)

3.1.3. Date and Time of Issuance. The 7-character group after the identifier is the date and time of issuance. The first two digits are the date; the last four digits are time (UTC).

Example: 01 is the date of the month, **1657** is the time, "**Z**" is the time designator.

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

3.1.4. ASOS Designators and Correction Modifiers. AUTO refers to an observation taken from an unattended **Automated Surface Observation System (ASOS). AO1** is an ASOS without a rain vice snow discriminator. **AO2** is an ASOS with a rain vice snow discriminator. **COR** is an observation corrected for an error. Disregard the previous transmission.

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

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

3.1.5. Wind Speed and Direction. Reported wind direction is in magnetic north because runways and aircraft instruments are oriented toward magnetic north. Winds transmitted long-line are reported in knots (kts) and true direction. 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 (10 mins OCONUS) immediately preceding the observation. Gusts are a sudden, brief increase in speed (with a variation of 10 knots or more between peaks and lulls) during the 10 minutes immediately preceding the observation. A squall is characterized by a very large variation of wind speed. It is often accompanied by a shower or thunderstorm. The term "squall' is used when the 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** kts is the sustained wind speed and **30** kts is the gust.

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

3.1.6. Wind Variability. Wind variability is reported if the direction varies by 60 degrees and speeds greater than 6 kts. This group has the direction extremes, separated by "**V**."

Example: 210 and **290** are the two directional limits.

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

3.1.7. Visibility. Prevailing visibility is the greatest horizontal visibility observed throughout at least half the horizon circle, and is not necessarily continuous. Sector visibility is reported in Remarks, if it differs from the prevailing and is less than 3 miles. Overseas locations will report visibilities in meters vice statute miles. The largest reportable metric value is 9999. This equates to visibility which is greater than 9000 meters (7 statute miles or greater).

Example: **3/8SM (statute miles)** is the prevailing visibility**.** See **Attachment 2** for Statute Miles to Meters Conversion Chart

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

3.1.8. Runway Visual Range. Runway Visual Range (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/1830 meters or less. Based on a ten-minute average, RVR follows the visibility and begins with "**R.**" Locations without ten-minute average capability will use a one-minute average to report locally and RVRNO longline. The runway heading will follow the "**R,**" thus, "**32L**" represents runway 32-Left (C-Center, R-Right). The last four digits report the visibility in feet (meters used overseas).

Example: RVR reads "runway visual range for **32 L**eft is **1,000 ft**."

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

Examples of RVR code:

M0600FT	RVR is less than 600 feet. (**M**=less than)
P6000FT	RVR is greater than 6,000 feet. (**P** = greater than)
R06L2000V4000FT	Indicates variable, if the RVR is variable between two thresholds. R06L/2000V4000FT is RVR for 6 Left is variable between 2,000 and 4,000 feet.

3.1.9. Type of Weather. If there is any precipitation or obstruction to visibility, it will be found in the group of data following the visibility. The absence of weather or an obscuration group indicates that neither phenomenon has occurred at the time of the observation. In this example, "**FG**" represents "Fog." To define a weather group, look for these key elements (*one or more may be omitted*): intensity (symbol preceding the code), proximity, descriptor, precipitation description, obscuration (other than precipitation), and other. See Weather and Obscuration Conversion Table (**Figure 3.2.**).

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

Figure 3.2. Weather Obscurations.

Step 1: Intensity (preceding group)	**Step 3: Description**	**Step 4: Precipitation**	**Step 5: Obscuration to Visibility**	**Step 6: Other**
Light (-)	**MI Shallow**	**DZ Drizzle**	**FG** Fog (vsby <= 5/8 mile	**PO** dust/sand whirls
Moderate No sign	**PR** Partial (covering only part of the sky	**RA** Rain	**BR** Mist (vsby>= 5/8 mile)	**SQ** Squalls
Heavy (+)		**SN** Snow	**FU** Smoke	**FC** Funnel cloud (S) ex. Tornado or Waterspout
+ can also mean " a well developed dust/sand storm, whirl, dust devil tornado or waterspout	**BC** Patches	**SG** Snow Grains	**VA** Volcanic Ash	**SS** Sandstorm
	DR Low Drifting	**IC** Ice Crystals	**DU** Dust	**DS** Dust Storm
	BL Blowing	**PL** Ice Pellets	**SA** Sand	**DS** Dust Storm
	SH Showers	**GR** Hail (>5 mm or .2")	**HZ** Haze	
Step 2: Proximity	**TS** Thunderstorm	**GS** Small hail (<5 mm or .2")	**PY** Spray	
In the Vicinity **VC (10 NM)**	**FZ** Freezing	**UP** Unknown Precipitation (ASOS only)		
Examples:				
TSRA - thunderstorm, moderate rain	**-RA FG - light rain, fog**	**BLPY -blowing spray**	**VCSH - showers in the vicinity**	**FZDZ - freezing drizzle**
+SN - heavy snow	**BR HZ - mist, haze (vis >= 5/8 mi.)**	**BCFG - patchy fog**	**+DRSN - heavy snow, drifting**	**BCFG - patchy fog**

3.1.10. Clouds. Clouds are reported in eighths for coverage and hundreds of feet AGL for heights. Automated systems do not report cloud bases above 12,000 feet.

Sky coverage (eighths) (NOTE: * Denotes a “Ceiling”):

SKC	0 (Sky clear, NOTE: ASOS will use CLR for no clouds below 12,000 ft)
FEW	Trace-2
SCT	3-4
* BKN	5-7
* OVC	8
TCU	Towering Cumulus present
CB	Cumulonimbus/thunderstorm present
*VV	Vertical Visibility (indefinite ceiling)

Example: **BKN005** represents a **BROKEN** ceiling at **500** feet AGL.

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

3.1.11. Temperature and Dew Point. After sky condition is the temperature and dew point (Celsius). These affect runway length needed and helicopter power settings.

Example: The first two digits **01** are the temperature and the second two digits or **M01 or -1C** are the dew point. An “**M**” in the field means “minus” or below zero. See **Attachment 3** to convert from Celsius to Fahrenheit.

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

3.1.12. Altimeter Setting. Altimeter setting is a 5-character group after the temperature/dew point. Starts with “**A**” and is in hundredths of an inch of mercury (U.S.).

Example: **A2984** represents **29.84** inches of mercury. International locations may report altimeter settings in hectopascals or millibars. **Attachment 4** has conversions from inches.

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

3.1.13. Remarks. Remarks (RMK) may be encoded in plain language and will contain any supplementary data. **Caution:** Do not confuse METAR RMK 5xxxx (3 hr pressure tendency) or 6xxxx (6-hr precipitation amounts) with the TAF 5xxxx (turbulence) and 6xxxx (icing).

Example: The remark **SLP** is the sea level pressure in millibars (hectopascals) to the nearest tenth. Place a “10” or “9” before the group and a decimal before the last digit (use 10 if the 3 digit value is 400 or less). The group in the example would read “**1003.4 millibars**.”

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

3.2. Aerodrome Forecast (TAF). Forecasts advise of expected conditions, hazardous weather and assist in determining mission fuel needs. The TAF is a forecast for a particular terminal covering a period of time up to 24 hours. A TAF contains a forecast of 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 can be found in AFMAN 15-124, *Meteorological Codes*. OWSs are primarily responsible for AOR airfield TAFs. If National Weather Service or indigenous weather service issues a TAF meeting supported unit requirements, an OWS TAF is not issued.

3.2.1. Type of Report. TAF is an airport forecast for a specific period (usually 24 hours). **AMD** (Amended TAF) is issued and supersedes the previous TAF because the TAF is no longer representative of the current or expected weather. Below, the TAF was **amended at 1820Z. COR** (Corrected TAF) is a TAF that has been corrected and supersedes previous TAFs. The AMD was **corrected at 1825Z.** Refer to the time in the last text line for the current forecast.

TAF
KBLV **AMD** 051812 VRB15G30KT 0800 TSRA BKN008CB OVC020 QNH2958INS
BECMG 1819 29008KT 1600 -RA OVC030 620304 QNH2958INS VCTS
BECMG 1920 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z
AMD 1820.

TAF
KBLV **AMD COR** 051812 VRB15G30KT 0800 TSRA BKN005CB OVC020 QNH2958INS
BECMG 1819 29008KT 1600 -RA OVC030 620304 QNH2958INS VCTS
BECMG 1920 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z
AMD COR 1825.

3.2.2. Location. The 4-character ICAO is the location. **KBLV** (Scott AFB, IL) is the location.

TAF
KBLV 051212 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

3.2.3. Forecast Date and Valid Times. 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 **1130Z** is the **issuance time**) and the **forecast valid times (from 5/12Z to 6/12Z).** In a military TAF (KBLV), the group following the ICAO identifier will be the preparation date (time is omitted) and valid times of the forecast (**from 5/06Z to 6/06Z)**.

TAF
KSTL **051130Z 051212** 14008KT 5SM BR BKN030 WS010/18025KT
TEMPO 1316 1 1/2 SM BR FM 1600 16010KT P6SM NSW SKC BECMG 2224 20013G20KT 4SM SHRA OVC020 PROB40 0006 2SM TSRA OVC008CB BECMG 0608 21015KT P6SM NSW SCT040

TAF
KBLV **050606** 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

3.2.4. Change Groups. The type of change and times expected are encoded with **TEMPO, FM** and **BECMG**. **TEMPO 1316** is a "**Temporary condition between 13Z and 16Z.**" **FM i**s "**from**" and indicates a rapid change, and supersedes the previous line conditions. **FM 1600** is read "**From 16Z.**" **BECMG** represents "**becoming**" or a "gradual change" in the predominant condition by the end time listed. **BECMG 2224** is "**Becoming from 22Z to 24Z**." **PROB40** (civilian use only) represents a **40% probability** of associated weather conditions occurring. **PROB40 0006** 2SM TSRA 0VCOO8CB is read "**40% probability between 00Z and 06Z** of 800 overcast cumulonimbus clouds, visibility 2 statute miles in moderate thunderstorms."

TAF
KSTL 051130Z 051212 14008KT 5SM BR BKN030 WS010/18025KT **TEMPO 1316** 1 1/2 SM BR **FM 1600** 16010KT P6SM NSW SKC **BECMG 2224** 20013G20 KT 4SM SHRA OVC020 **PROB40 0006** 2SM TSRA OVC008CB **BECMG 0608** 21015KT P6SM NSW SCT040

3.2.5. Wind Speed and Direction. After valid time is forecast wind direction/speed. The first three digits are the true direction to the nearest 10 degrees. The last two digits are the sustained speed in knots (**KT)**. Internationally, winds may be kilometers per hour (KMH) or meters per second (MPS). **Gusts** are depicted by "**G**." **VRB** are winds with variable directions: that can't be forecasted with confidence due to thunderstorms, are less than 6 kts, or 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** kts is speed. **VRB** are winds with variable directions (thunderstorms) at **15KT**, with **30 KT Gusts.**

TAF
KBLV 051212 **14005KT** 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 **16010KT** 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 **VRB15G30KT** 1600 TSRA BKN008CB OVC020
BECMG 1617 **29008KT** 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 **31012G22KT** 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 **30008KT** 9999 SKC QNH2950INS TM01/11Z 08/18Z

3.2.6. Forecast Visibility. Military and overseas locations forecast visibilities in meters (the group after the winds). 9999 is the maximum value forecasted and indicates visibility greater than 9000 meters (7 statute miles or greater). Overseas locations may use "**CAVOK**" (ceiling and visibility OK). This indicates no significant weather, visibility is 10 km or greater and ceilings greater than 5,000 ft. Civilian CONUS TAFs use statute miles (SM).

Example: Military - **8000, 3200, 1600, 3200** and **9999** are the visibilities in **meters**.

TAF
KBLV 051212 14005KT **8000** BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT **3200** -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT **1600** TSRA BKN008CB OVC020
BECMG 1617 29008KT **3200** -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT **9999** NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT **9999** SKC QNH2950INS TM01/11Z 08/18Z

Example: Civilian CONUS - **5SM, 1-1/2SM, P6SM, 4SM, 2SM and P6SM** are the forecast visibilities in **statute miles**. **P** means **plus 6SM** or unrestricted visibility.

TAF
KSTL 051130Z 051212 14008KT **5SM** BR BKN030 WS010/18025KT
TEMPO 1316 **1 1/2 SM** BR FM 1600 16010KT **P6SM** NSW SKC BECMG 2224 20013G20 KT **4SM** SHRA OVC020 PROB40 0006 **2SM** TSRA OVC008CB BECOMG 0608 21015KT **P6SM** NSW SCT040

3.2.7. Forecast Weather. Forecast weather is found in the group following the visibility. Absence of a weather group indicates that no weather is expected during the forecast period.

Example: **BR** is **Mist, -SHRA** is **Lt Rain Showers, TSRA** is **Thunderstorms** with moderate **Rain, -RA** is **Light Rain,** and **NSW** (no significant weather) is used to indicate the weather listed in the previous group is no longer expected to occur. **NSW** does NOT indicate the absence of clouds or hazards pertinent to your aircraft type. See **Figure 3.2.** for full decode list.

TAF
KBLV 051212 14005KT 8000 **BR** FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 **-SHRA** OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 **TSRA** BKN008CB OVC020
BECMG 1617 29008KT 3200 **-RA** OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 **NSW** SCT040 510004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

3.2.8. Clouds. Forecast cloud coverage in eights and height in hundreds of feet.

Sky coverage (eighths) (NOTE: * Denotes a “Ceiling”):

	SKC	Sky clear
	FEW	Trace-2
	SCT	3-4
*	BKN	5-7
*	OVC	8
	CB	Cumulonimbus/thunderstorm
*	VV	Vertical Visibility (indefinite ceiling)

Example: **FEW030, OVC020, BKN008CB, OVC030, SCT040 and SKC** is **3,000 Few, 2,000 Overcast, 800 Broken (Cumulonimbus Clouds), 4,000 Scattered** and **Sky Clear**.

TAF
KBLV 051212 14005KT 8000 BR **FEW030** QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA **OVC020** QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA **BKN008CB OVC020**
BECMG 1617 29008KT 3200 -RA **OVC030** 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW **SCT040** 520004 QNH2952INS
BECMG 2021 30008KT 9999 **SKC** QNH2950INS TM01/11Z 08/18Z

3.2.9. Icing Conditions. The icing group is for surface up to 10,000 ft, non-thunderstorm associated, and is prefixed with a **6.** To decode (**Figure 3.3.**):

1. Look for the icing designator “**6**” that follows the cloud group (**6** 2 0 3 0 4).

2. The next digit will determine the icing type and intensity (6 **2** 0 3 0 4).

3. Next three digits determine the base of the icing layer in hundreds of feet (6 2 **0 3 0** 4).

4. The next digit determines thickness in thousands of feet (6 2 0 3 0 **4**), add to base to determine icing conditions top. Example: **Light icing in cloud (RIME), 3,000 - 7,000 ft**.

TAF
KBLV 051212 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 **620304** QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

Figure 3.3. Icing Codes.

	Icing Intensity
Code	**Decode**
0	**Trace or none**
1	**Light icing (mixed)**
2	**Light icing in cloud (RIME)**
3	**Light icing in precipitation (clear)**
4	**Moderate icing (mixed)**
5	**Moderate icing in cloud (RIME)**
6	**Moderate icing in precipitation (clear)**
7	**Severe icing (mixed)**
8	**Severe icing in cloud (RIME)**
9	**Severe icing in precipitation (clear)**

3.2.10. Turbulence Conditions. The turbulence group is for surface up to 10,000 ft, non-thunderstorm associated, CAT II aircraft, and is prefixed with a **5**. To decode (**Figure 3.4.**):

1. The turbulence designator "**5**" that follows the cloud or icing group (**5** 2 0 0 0 4).

2. Next digit determines the intensity (5 **2** 0 0 0 4).

3. Next three digits determine the base limit of the layer in hundreds of feet (5 2 **0 0 0** 4).

4. The last digit will determine the thickness in thousands of feet (5 2 0 0 0 **4**), add this value to the base height to determine the top limit of the turbulence conditions. Below, the turbulence forecast is occasional moderate turbulence in clear air from surface to 4,000 feet.

TAF
KBLV 051212 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 **520004** QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

Figure 3.4. Turbulence Codes.

	Turbulence Intensity
Code	**Decode**
0	**Trace**
1	**Light turbulence**
2	**Moderate turbulence in clear air occasional**
3	**Moderate turbulence in clear air frequent**
4	**Moderate turbulence in cloud occasional**
5	**Moderate turbulence in cloud frequent**
6	**Severe turbulence in clear air occasional**
7	**Severe turbulence in clear air frequent**
8	**Severe turbulence in cloud occasional**
9	**Severe turbulence in cloud frequent**
X	**Extreme turbulence**

3.2.11. Lowest Altimeter Setting. 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 **Attachment 4** for conversions.

TAF
KBLV 051212 14005KT 8000 BR FEW030 **QNH2958INS** WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 **QNH2958INS**
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 **QNH2952INS**
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 **QNH2952INS**
BECMG 2021 30008KT 9999 SKC **QNH2950IN**S TM01/11Z 08/18Z

3.2.12. Forecast Wind Shear. Wind shear is included if non-convective low level winds (up to 2,000 feet above ground level (AGL)) will change in speed and/or direction and result in shear. Wind shear is encoded with the contraction, **WS,** followed by a 3-digit height, slant character "/," and winds at the height indicated. The remark WSCONDS is used to indicate potential wind shear when there is not enough information available to reliably predict the exact height, direction and speed of the wind shear.

Example: **WS010/18040KT** is **wind shear** at **010** (1,000 feet above the ground), **180** degrees true direction at **040KT** (40 knots).

TAF
KBLV 051212 14005KT 8000 BR FEW030 QNH2960INS **WS010/18040KT**
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS TM01/11Z 08/18Z

3.2.13. Temperatures. Forecast temperatures are routinely found only in military TAFs. Forecast temperatures are found on the first or last line (depending on MAJCOM requirements) following the minimum altimeter and begin with the designator "**T**."

Example: Minimum temperature for this period of time (12Z to 12Z) is **minus 1** or **-1 °C** and will occur at **11Z**. The maximum temperature is **8°C** and will occur at **18Z.**

TAF
KBLV 051212 14005KT 8000 BR FEW030 QNH2960INS WS010/18040KT
BECMG 1314 16010KT 3200 -SHRA OVC020 QNH2959INS
TEMPO 1416 VRB15G30KT 1600 TSRA BKN008CB OVC020
BECMG 1617 29008KT 3200 -RA OVC030 620304 QNH2958INS
BECMG 1819 31012G22KT 9999 NSW SCT040 520004 QNH2952INS
BECMG 2021 30008KT 9999 SKC QNH2950INS **TM01/11Z 08/18Z**

3.3. Pilot Reports. A Pilot Report (PIREP) is an aircrew report of weather conditions at altitude. The Flight Information Handbook has the format for transmittal by aircrews. PIREPs are extremely important to operations. Airborne crews can see a broader horizon and experience phenomena, which may be hidden from the ground observer's view. For example, cloud bases and tops, turbulence and icing may only be evident to airborne crew. While ground observations contain valuable information, they may not meet the need for information on weather conditions at altitude. Weather technicians use PIREPs to service other aircrews and to aid forecasting. PIREPs are transmitted over selected navigational aids and weather data nets. Air traffic controllers will relay PIREPs to other affected aircrews and weather technicians.

3.3.1. PIREP Text. The format includes a "message type" (**UUA: urgent; UA: routine**) and text element indicators preceding data groups. Indicators consist of a slash **(/)**, two letters, and a space (except for "**FL**" which is not followed by a space. Aircraft position is relative to an ICAO, omnirange transmitter TACAN, VORTAC, or VOR, with a six digit group giving the relative bearing (first three digits) and distance (last three digits) from the omnirange. "**DURGC**" (during climb) or "**DURGD**" (during descent) indicates PIREPS received by aircraft taking-off or landing. Full code details can be found in AFMAN 15-124, Meteorological Codes.

Indicators:

/OV Indicates **aircraft position**, time of observation, and altitude

/TM Time of observation (Z)

/FL Altitude (flight level)

/TP Type of aircraft

/SK Sky cover

/WX Visibility and weather (visibility to nearest mile)

/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

UUA's are issued for:

A. Hail (GR or GS)

B. Low-Level Wind Shear (LLWS)

C. Severe icing

D. Severe or extreme turbulence, including Clear Air Turbulence (CAT)

E. Tornado, funnel cloud, or waterspout (FC).

F. Volcanic Eruption and/or Ash (VA), in the air or on the ground.

G. Any condition that, in the judgment of the person entering the PIREP into the system, would present an extreme hazard to flight.

Example: Regular PIREP from 315 degrees and 45 miles from Scott AFB, 2224Z, at an unknown flight level. Aircraft is a C-9, 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 ft.

BLV UA/OV BLV 315045/TM 2224/FL UNKN/TP C9/RM BKN LN TSTMS N-S OCNL LTGCCCG 030 UNKN 345.

3.4. AFWA Text Products. AFWA generates a variety of mission support alphanumeric text products. Any required code break-down is readily available. AFWA has text products (e.g., observations, TAFs, discussions) from other weather sources available on its web page. AFWA text products are on JAAWIN (See Para **2.3.** for address).

3.5. OWS Text Products. OWS created text products to support AOR operations will be displayed on its web page (See Para **2.4.** or FIH for addresses). Any required code break-down is readily available. Some OWSs may convert text bulletins into graphic depictions.

3.6. Civil Weather Advisories. Civil weather advisories may be available via CWT, OWS, or AFWA web pages. These are issued at very high frequency omni-directional range (VOR) facilities. Contact the CWT, OWS, or nearest civilian Flight Service Station (FSS) to determine whether the advisory is pertinent to your flight. Advisories include: Severe Weather Forecast Alert (AWW), Significant Meteorological Reports (SIGMET) and Airman's Meteorological Information (AIRMET).

3.6.1. Severe Weather Forecast Alert (AWW). AWW is a preliminary message used to alert airmen that a Severe Weather Bulletin (WW) is being issued. AWW defines an area of possible severe thunderstorms or tornado activity.

Example: MKC AWW 655 WW 279 SEVERE TSTM NY PA NJ 1630Z-1700Z. 70 STATUTE MILES EITHER SIDE OF LINE 10W KMSS TO 20E KABE. AVIATION COORDS 60 NM EITHER SIDE 16O NW KSLK - 35 W KEWR. HAIL SURFACE AND ALOFT. SURFACE WIND GUSTS 65 KNOTS. MAX TOPS TO 540. MEAN WIND VECTOR 19020. REPLACES WW 278. OH PA NY

3.6.2. Significant Meteorological Event (SIGMET). SIGMETs are issued for observed or forecast non-thunderstorm related hazards:

1. Severe or extreme turbulence and CAT not associated with thunderstorms.
2. Severe icing not associated with thunderstorms
3. Dust storms, sandstorms or volcanic ash lowering visibilities to less than three miles
4. Volcanic eruption

3.6.2.1. Convective SIGMET. Convective SIGMETs (WST) are issued by time and region, and are associated with thunderstorms. WSTs are issued hourly as required. They are valid for two hours or until superseded. Bulletins consist of an observation and/or a forecast. WSTs cover one of three areas: Eastern (E), Central (C), and Western (W), defined by longitudinal boundaries of 87 and 107 degrees West. Hourly, an Outlook is issued for each region. The Outlook is a 2-6 hour projected thunderstorm activity discussion listed at the end of the WST and is updated as required. WSTs are issued for:

1. Severe thunderstorm with surface winds greater than or equal to 50 knots
2. Hail greater than or equal to3/4 inches in diameter
3. Tornados
4. Embedded thunderstorms
5. A line of thunderstorms
6. Thunderstorms greater than or equal to VIP 4 (see **Figure 5.4.**) affecting 40% or more of a 3,000 square mile area

Example:

WSUS42 KMKC 201852
WSTW
MKCW WST 201855
CONVECTIVE SIGMET...NONE

OUTLOOK VALID 202055-210055
TS ARE NOT EXPD TO REQUIRE WST ISSUANCES.

3.6.3. Airmen's Meteorological Information (AIRMET). AIRMETs amend area forecasts concerning weather phenomena which are of operational interest and potentially hazardous to aircraft having limited capability. AIRMETs concern weather of less severity than that covered by SIGMETs. AIRMETS affect at least a 3,000 square mile area. Large regions mean only a small part of the area could be affected at any given time. AIRMETs are designated:

Sierra Bulletin (reserved for IFR and mountain obscuration)

1. Ceilings less than 1000 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

Zulu Bulletin (reserved for icing and freezing level data)

1. Moderate icing
2. Freezing levels

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

3.7. Aircraft Reports (AIREP). An AIREP is an automatic in-flight report generated at routine intervals along a route. This report relays information on flight level, winds, and any flight hazards encountered. Usually, these reports are generated during international, over-the-water flights.

Example:

UANT11 KAWN 201800 RTD02

UAL97 3230N 09010W 1840 F350 M// ////// TB LGT-MOD CHOP;

(Flight Number, Lat/Long, Time (Zulu), Flight Level, Temperature, Remarks)

Chapter 4

METEOROLOGICAL SATELLITES AND IMAGERY

4.1. Meteorological Satellites (METSAT). The types of meteorological satellites are the polar orbiter and the geostationary (equator) orbiter. Polar orbiters circle the earth crossing each pole with an orbit height near 1,000 NM. Each completes passes over same point every 12-hours. As the earth rotates below, the satellite completes one photo strip, which can be stitched together to form a composite photo. Thus, the user often sees a zig-zag pattern in the photo. Geostationary satellites are located approximately 22,300 NM above the Earth with an orbit timed with the rotation of the Earth keeping it fixed over the same point. This characteristic allows imagery sequencing by time to provide an animation of the imagery (or loop). METSAT imagery analysis may reveal many atmospheric phenomena: cloud top heights, thunderstorms, turbulence, jet stream, fog, and terrain features. Although satellite imagery is a common resource used for preflight planning, many variables can cause misinterpretation of photo features. An in depth interpretation instruction is beyond this handbook's scope. You must consult trained technicians to receive a reliable analysis.

4.2. Imagery Types. The types of satellite imagery used are visible, infrared, multi-spectral, microwave imagery, and water vapor.

4.2.1. Visible Satellite Imagery. Visible satellite sensors scan visible light within the same range as the human eye. Thus, visible imagery is the same as a photograph (**Figure 4.1.**).

4.2.2. Infrared Satellite Imagery (IR). Infrared sensors detect radiation dependent upon the temperature of the emitting object. Think of infrared satellite data as a picture of contrasting temperatures (**Figure 4.2.**). Standard infrared pictures show coldest temperatures as white (such as cirrus cloud tops) and warmest (such as land and water) as black. Each gray shade is a temperature range. Some imagery may be color enhanced (**Figure 4.5.**). 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).

4.2.3. Multi-spectral Imagery (MSI). MSI combines Visual and IR into a color enhanced 3-dimensional image (**Figure 4.3.**) used to discriminate between low-mid and high-level clouds, and fog.

4.2.4. Microwave Imagery (MI). MI is used to see through cirrus to detect lower clouds, calculate ocean surface winds, rain rates, snow coverage/depth and soil moisture. MI can produce radar-like images of weather systems, such as severe storms and hurricanes (**Figure 4.4.**).

4.2.5. Water Vapor Imagery (WV). WV is sensitive to water vapor and detects radiation dependent upon the temperature of the emitting object (**Figure 4.6.**). WV can detect moisture movement into (or out) of a region well before clouds form, and moderate to heavy turbulence and icing.

Figure 4.1. Visible Imagery. Sunset near Hawaii showing the Terminator (day-night line).

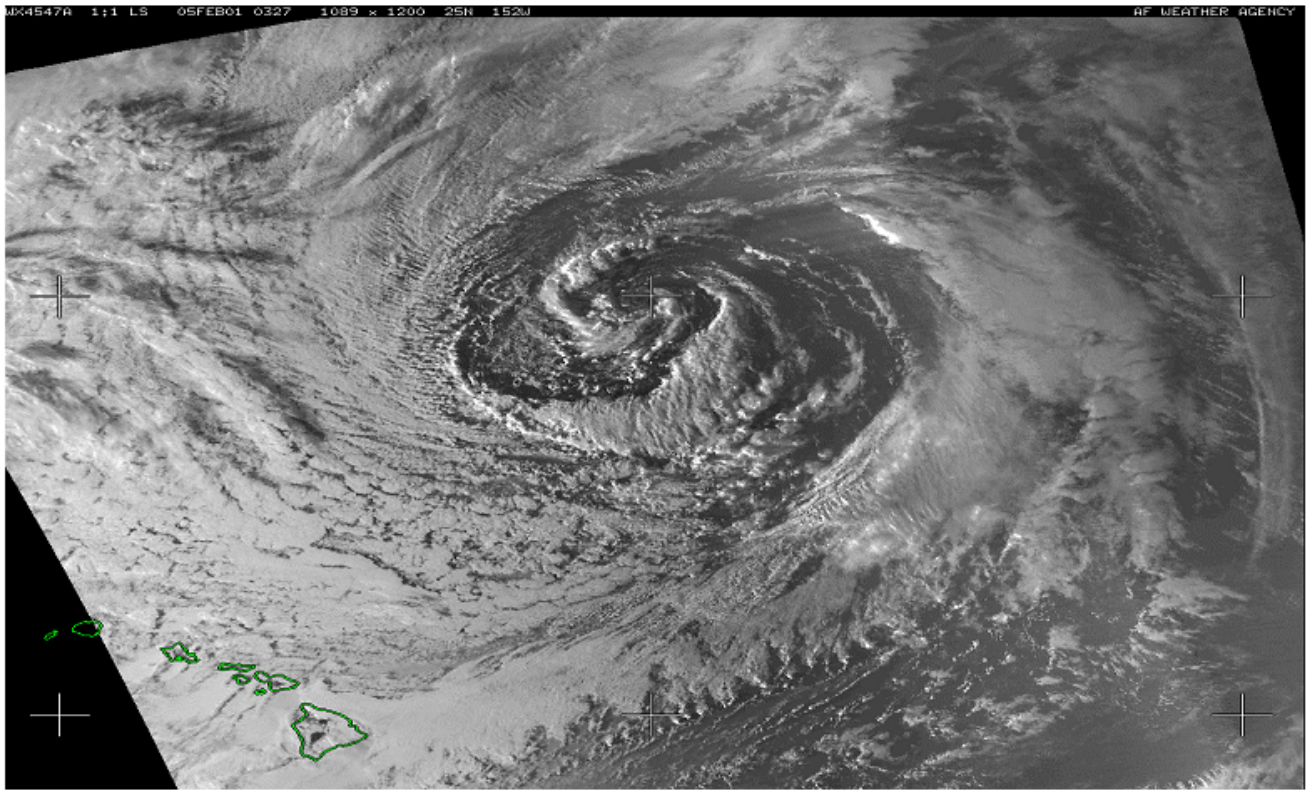


Figure 4.2. IR Imagery. IR is not light dependent (no terminator seen) and low (warmer) clouds are not as bright as visual imagery.

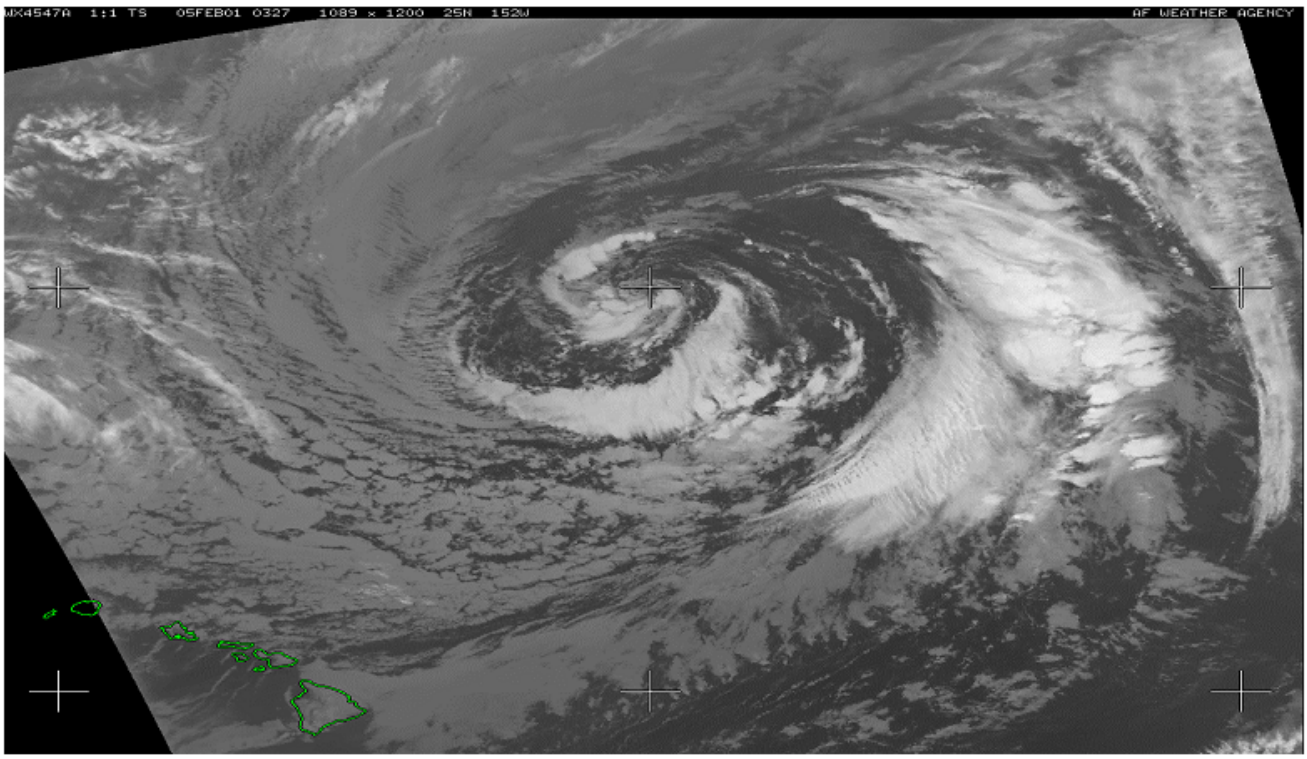


Figure 4.3. MSI. Shows low clouds as yellow and high clouds as blue.

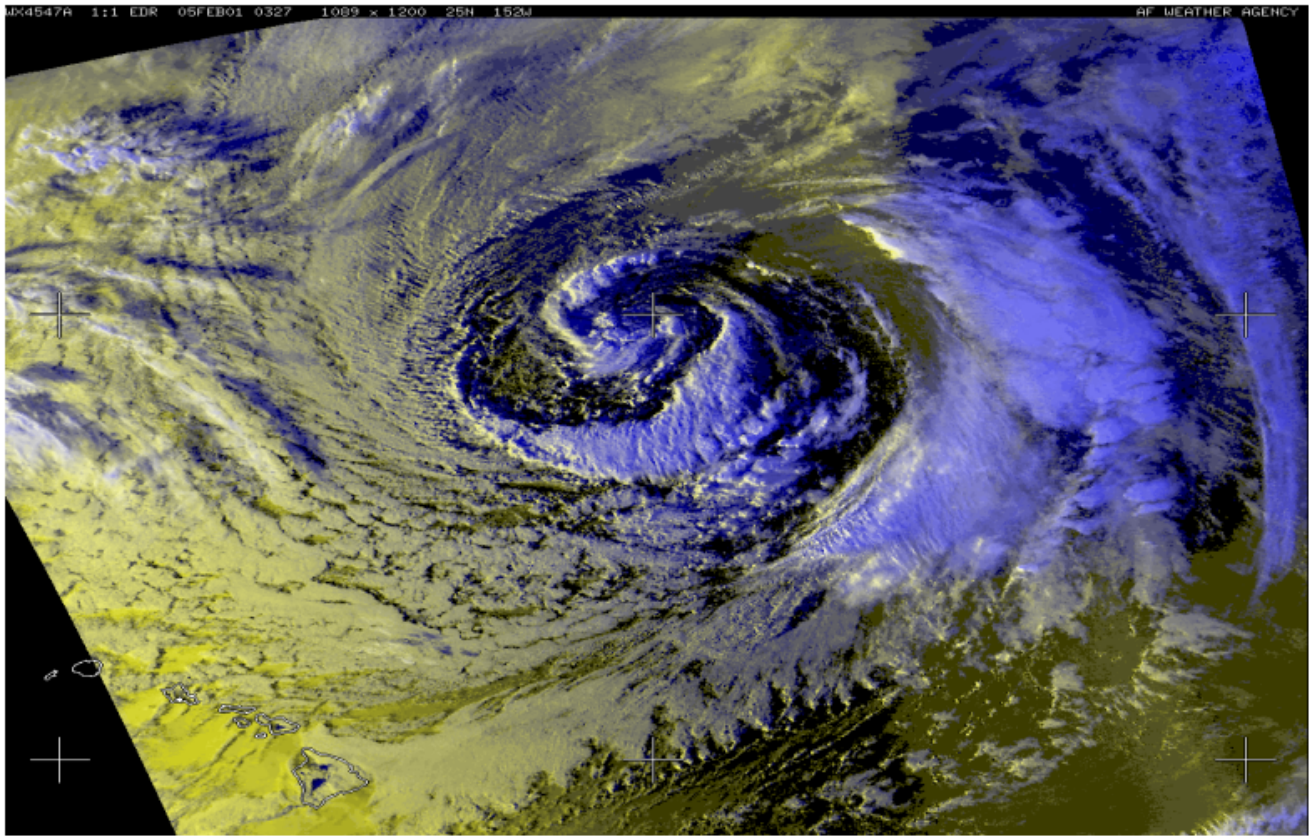


Figure 4.4. Microwave Imagery. Shows low (warmer) clouds as bright white.

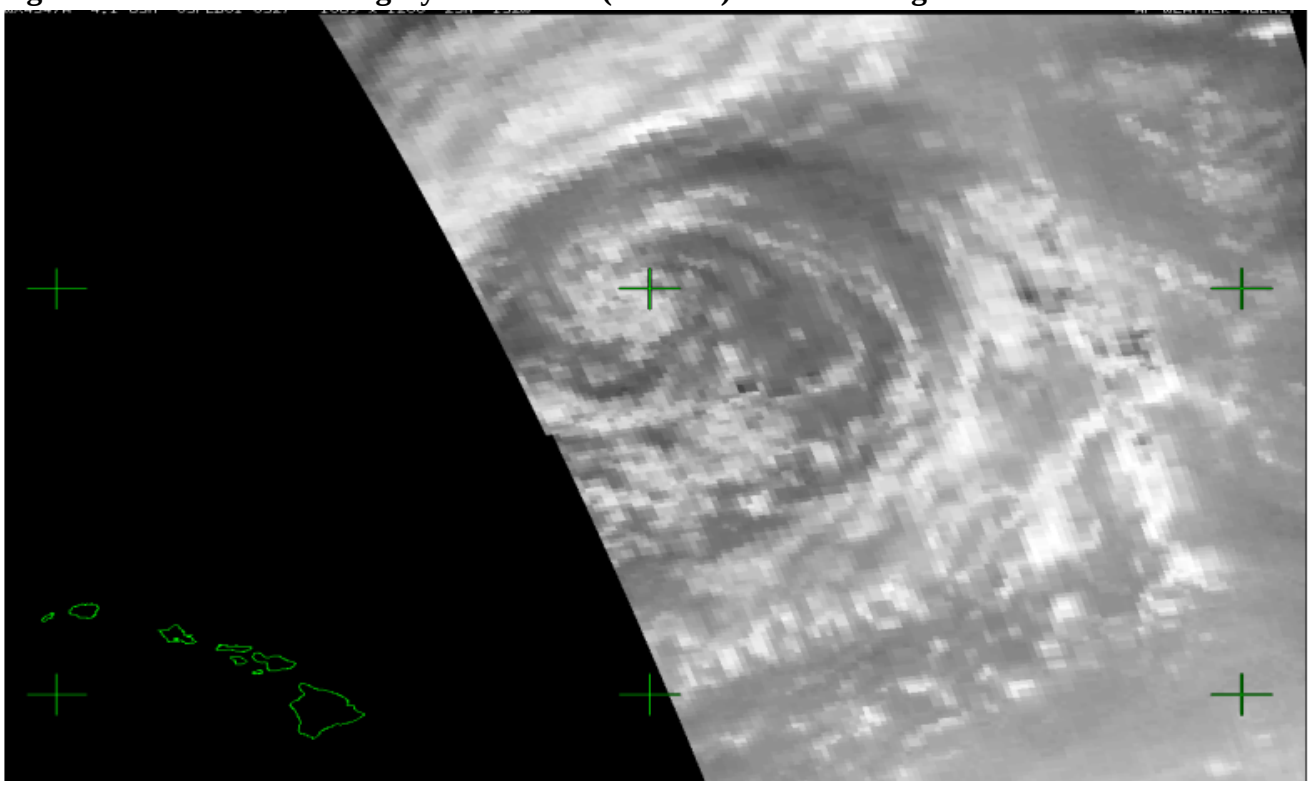


Figure 4.5. Color Enhanced IR.

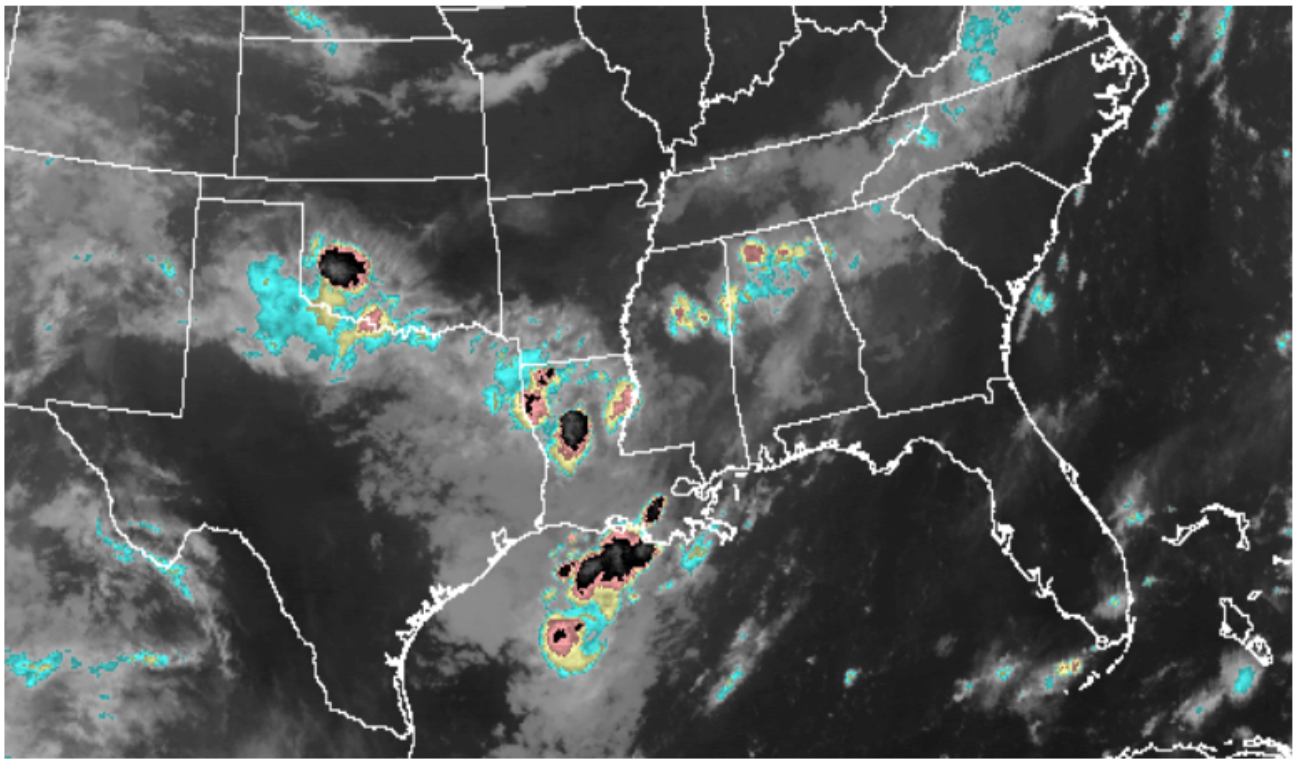
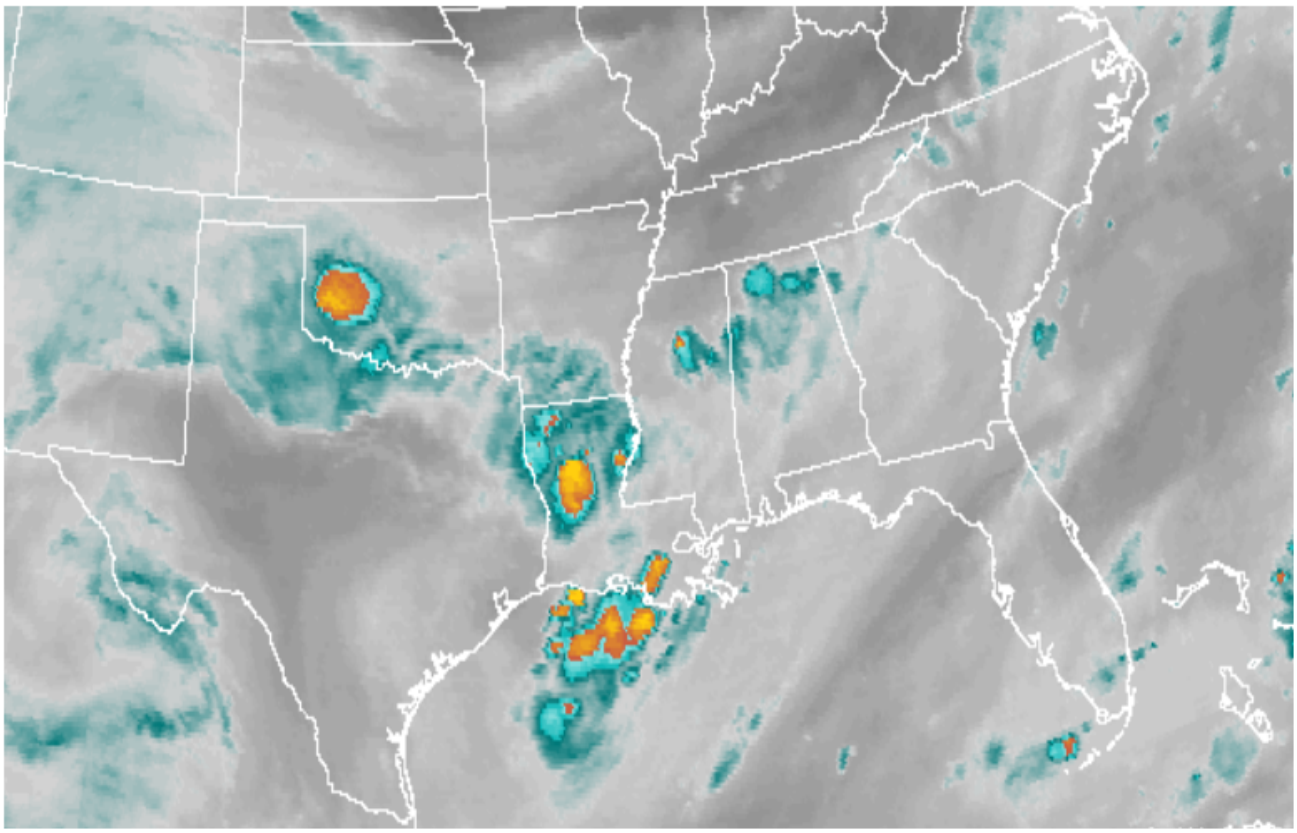


Figure 4.6. Water Vapor.



Chapter 5

GROUND WEATHER RADAR AND PRODUCTS

5.1. Ground Weather Radars. Conventional and Doppler radars are used for weather detection. Conventional radars produce reflectivity products. Doppler radars (a.k.a. Next Generation Radar (NEXRAD)) produce reflectivity and velocity products. Multiple web sources provide radar data, but your primary source should be your CWT or OWS for data and interpretation.

5.1.1. Availability. Radar coverage is very limited OCONUS. Contact your CWT to find radar availability for operations. NEXRAD provides near blanket coverage in CONUS. Only a few OCONUS NEXRADs exist. NEXRAD capable stations are listed in the en route supplements. Stations with a Pilot to Metro Service Voice (PMSV) and radar collocated can provide real time reports to aircrews. Technicians can advise you of location, movement, and intensity but cannot vector aircraft.

5.2. Product Display. Product displays will vary depending on radar type and data processing source. Individual radars use an azimuthal color display, usually with a small area map (248 nm maximum radius). The center is usually the radar location. Displays will differ for 32, 128, or 248 nm ranges as the range markers and relative echo location will be closer or further from the center. Multiple radar composite displays combine data from large area to provide a big picture look. These combine data onto large area maps (i.e. CONUS). Single and multiple radar products will use the same background to display a variety of information. It is crucial to read the Product Legend to identify data displayed.

5.3. Reflectivity Products. Reflectivity products from both radars types are analogous. The two main categories of reflectivity products are the base and the composite product.

5.3.1. Base Reflectivity. Base Reflectivity depicts echoes (objects illuminated by the radar beam) from a single scan (**Figure 5.1.**). Echo strength is measured in decibels (DBZ). Products may group DBZs into 1-6 VIP levels or even converted to rainfall rates. The Product Legend color bar indicates the associated strength levels. Stronger levels farther down the scale should be avoided. Radars can display an image using different elevation angles, which effects presentation. Each elevation angle provides a different view of the echo. Greater angles give higher views but have decreased horizontal sensing range. Reflectivity time-lapse loops are excellent tools for determining storm movement and intensity changes.

5.3.2. Composite Reflectivity. A single radar Composite Reflectivity product (**Figure 5.2.**) is produced from data collected from all elevation scans and depicts the maximum reflectivity (highest DBZ) over any given point. The Base and Composite Reflectivity imagery have similar appearances (See **Figure 5.1.** and **Figure 5.2.**, from the same radar during the same time). Multiple radar displays use single radar composite reflectivity information to build large-scale area images. The largest value over a point scanned by at least two radars is displayed. **Figure 5.3.** shows multiple radar composite displays from conventional (data is converted to rainfall rates) and Doppler (radar composite reflectivity data is converted and grouped into 1-6 VIP levels) radars.

Figure 5.1. Doppler Base Reflectivity.

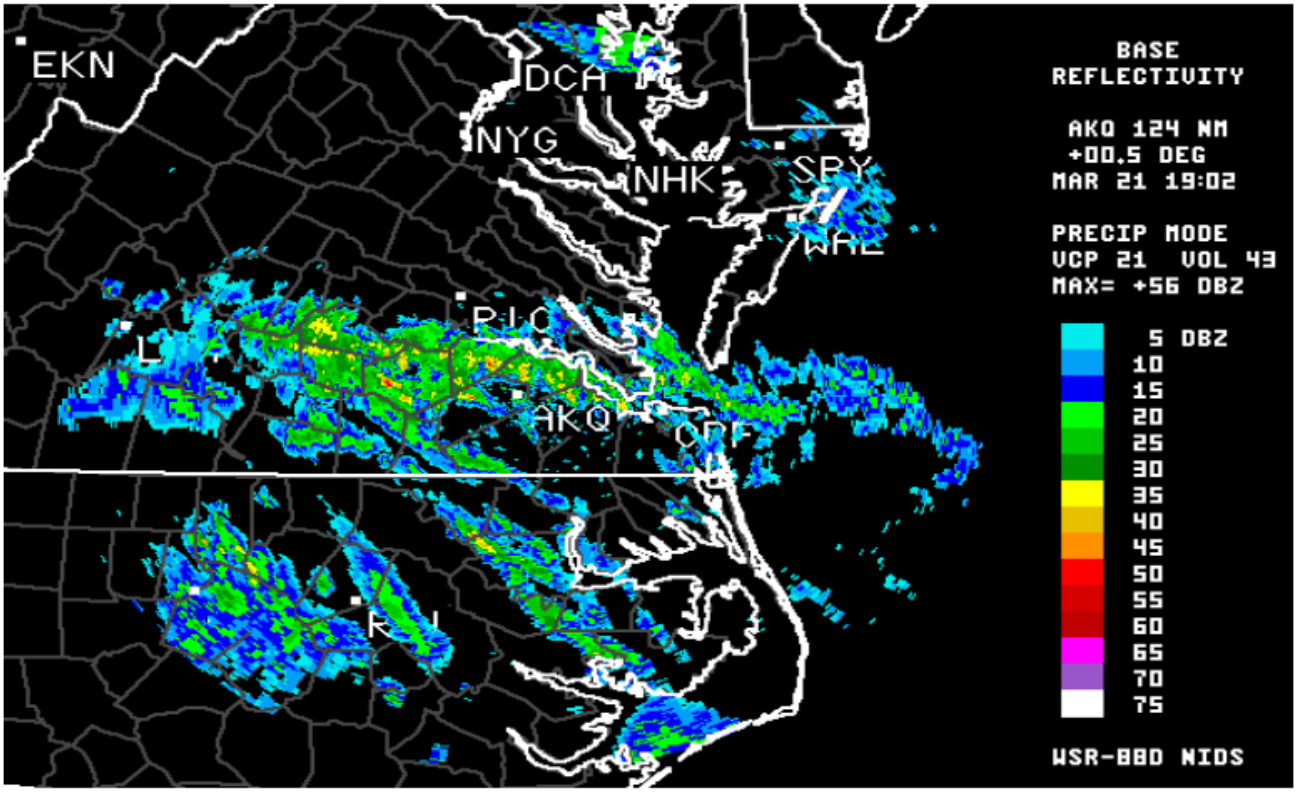


Figure 5.2. Doppler Composite Reflectivity (Same Time and Location as Figure 5.1.).

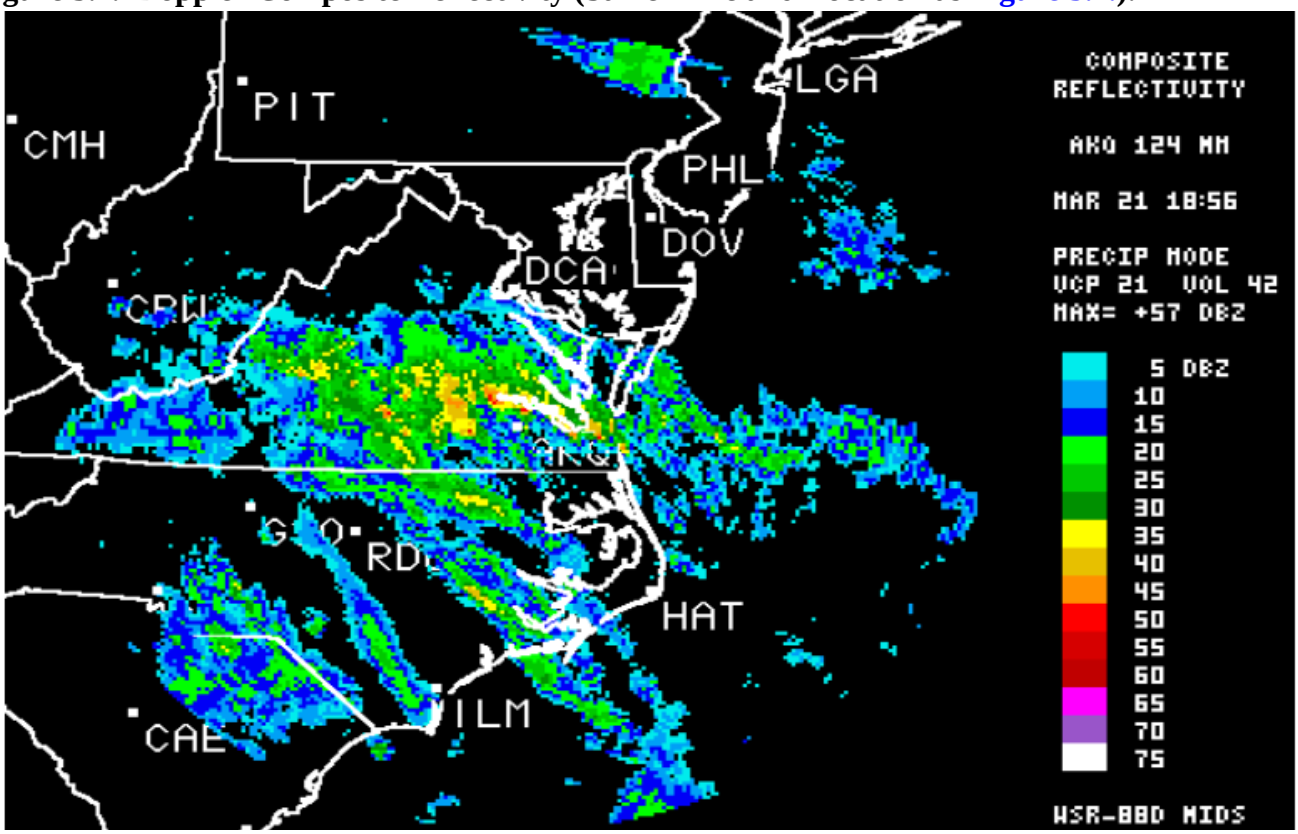
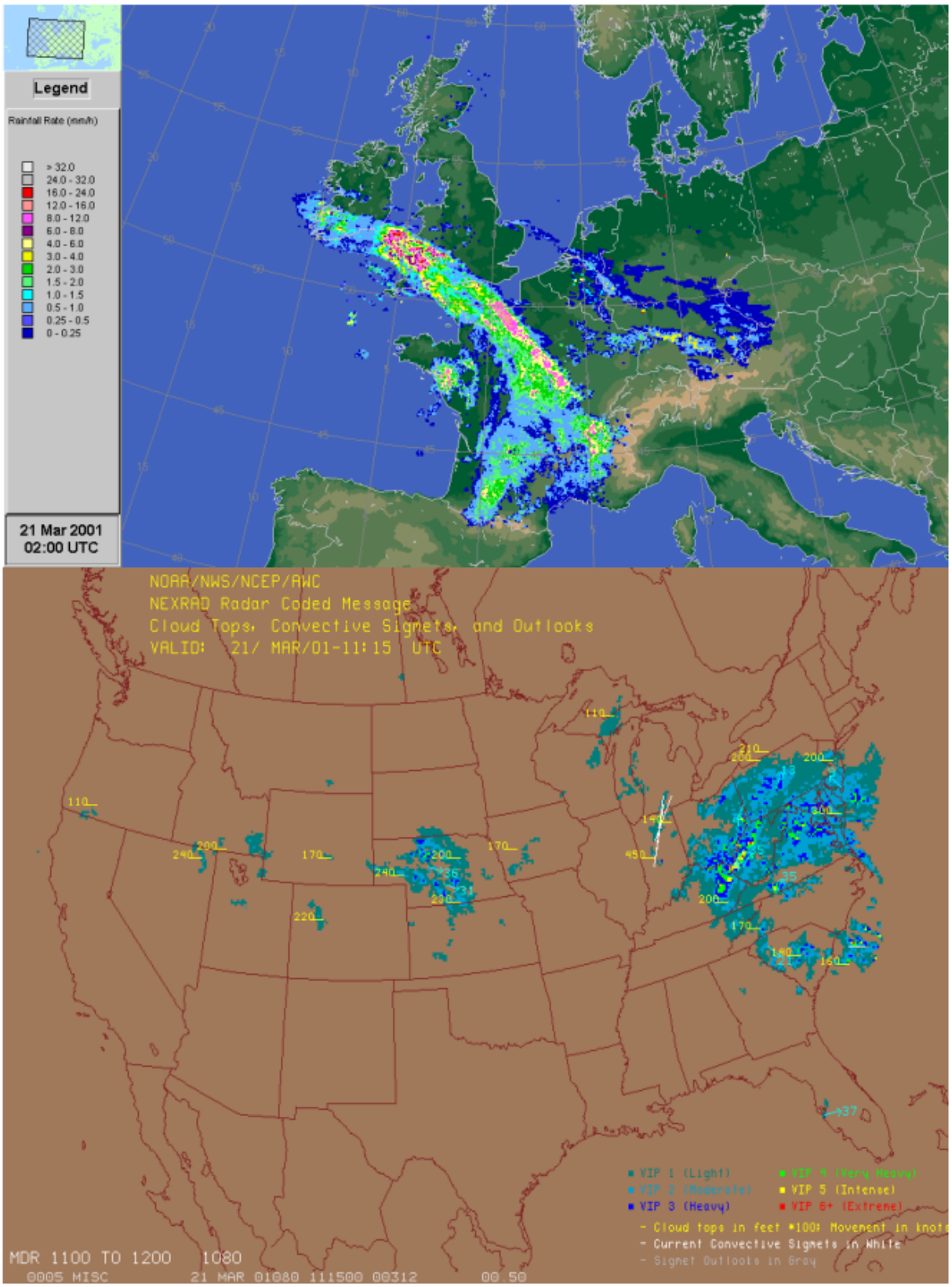


Figure 5.3. Multiple Radar Composites, European Conventional From NAMIS (Top), CONUS Doppler (Bottom).



5.3.3. Radar Summary Data . Radar data may be displayed with composite images or as a graphic chart (**Figure 5.3.**). Data may include movement, intensity, tops of echoes (precipitation), or other significant data. Arrows depict movement with associated speed in knots. DBZs or VIPs depict intensity. For some graphics, contour shaded areas depict intensity (See **Figure 5.4.** for interpretation). Radar determined echo tops and bases are included when available, but actual cloud tops may be higher. Other significant data includes precipitation type, severe weather data, and descriptive symbols (**Figure 5.5.**).

Figure 5.4. Radar Data Contours.

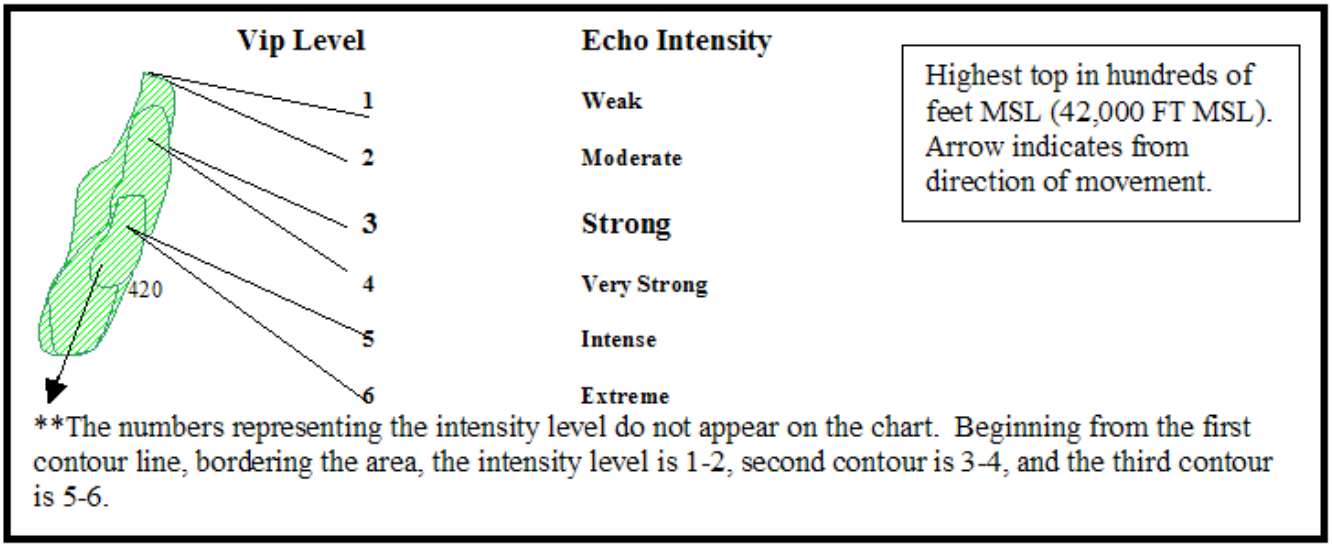


Figure 5.5. Radar Summary Data Symbols.

Key to Radar Summary Data

Precipitation:

FZ	Freezing	RW	Rain showers
IP	Ice pellets	S	Snow
NA	Not available	SW	Snow showers
NE	No echoes observed	TRW	Thunderstorms
R	Rain	ZRW	Freezing

Severe Weather:

LEWP	Line Echo Wave Pattern	SLD	8/10 or greater coverage in a line
HOOK	Hook Echo	WSD999	Severe Thunderstorm Watch
HAIL	Hail	WT999	Tornado Watch

Descriptive symbols:

LM	Little Movement
MA	Echoes Mostly Aloft
PA	Echoes Partly Aloft
-	Intensity Decreasing
+	Intensity Increasing or New Echo
No Symbol	No change in Intensity
OM	Out for Maintenance
ROBEPS	Radar Operating Below Performance Standard
RHINO	Range Height Indicator Not Operating
STC	STC ON-All precipitation may not be seen

5.4. Velocity Products. Velocity products are only available from a Doppler radar, thus, these are limited OCONUS. Base Velocity (**Figure 5.6.**) can provide wind location and speed, windshear, and microburst activity. These depict negative values as inbound winds and positive values as outbound winds relative to the radar. Match Product Legend colors and associated numerical value to find speed. Velocity Azimuth Display (VAD) Wind Profile (**Figure 5.7.**) depicts a time-lapse image of the vertical wind profile at the radar site. Winds are shown in 1,000 ft MSL increments. Wind speed and direction at any given level are depicted by the standard arrow and barb format (See **Figure 2.5.**). The color of the wind barb is a measure of data reliability based on the Route Mean Square (RMS) derived during data processing. The lower the RMS, the more reliable the data. RMS values greater than 16 are not displayed and depicted by a ND. Note: ND does not mean winds are not present at a given level.

Figure 5.6. Base Velocity With Speed In kts.

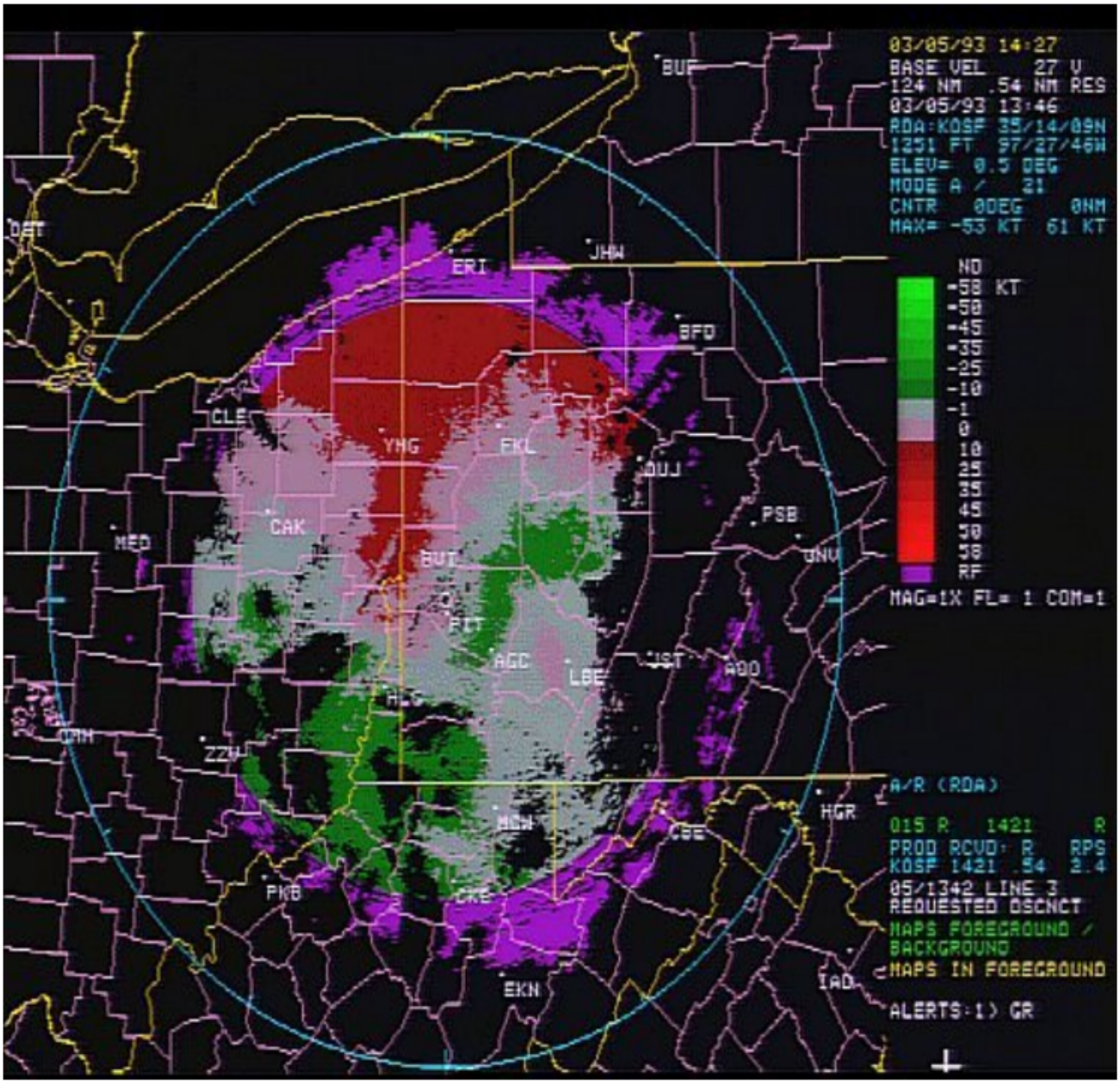
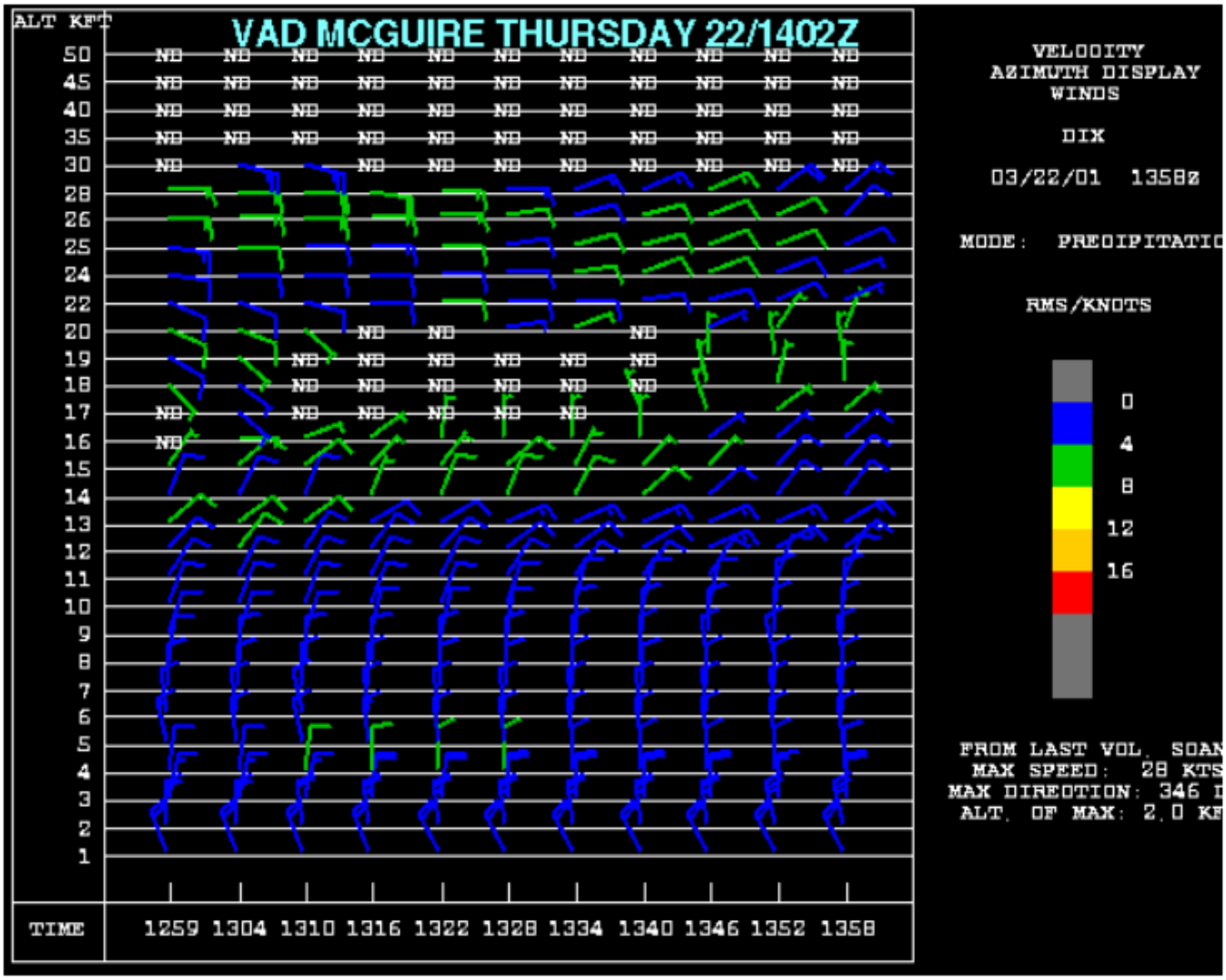


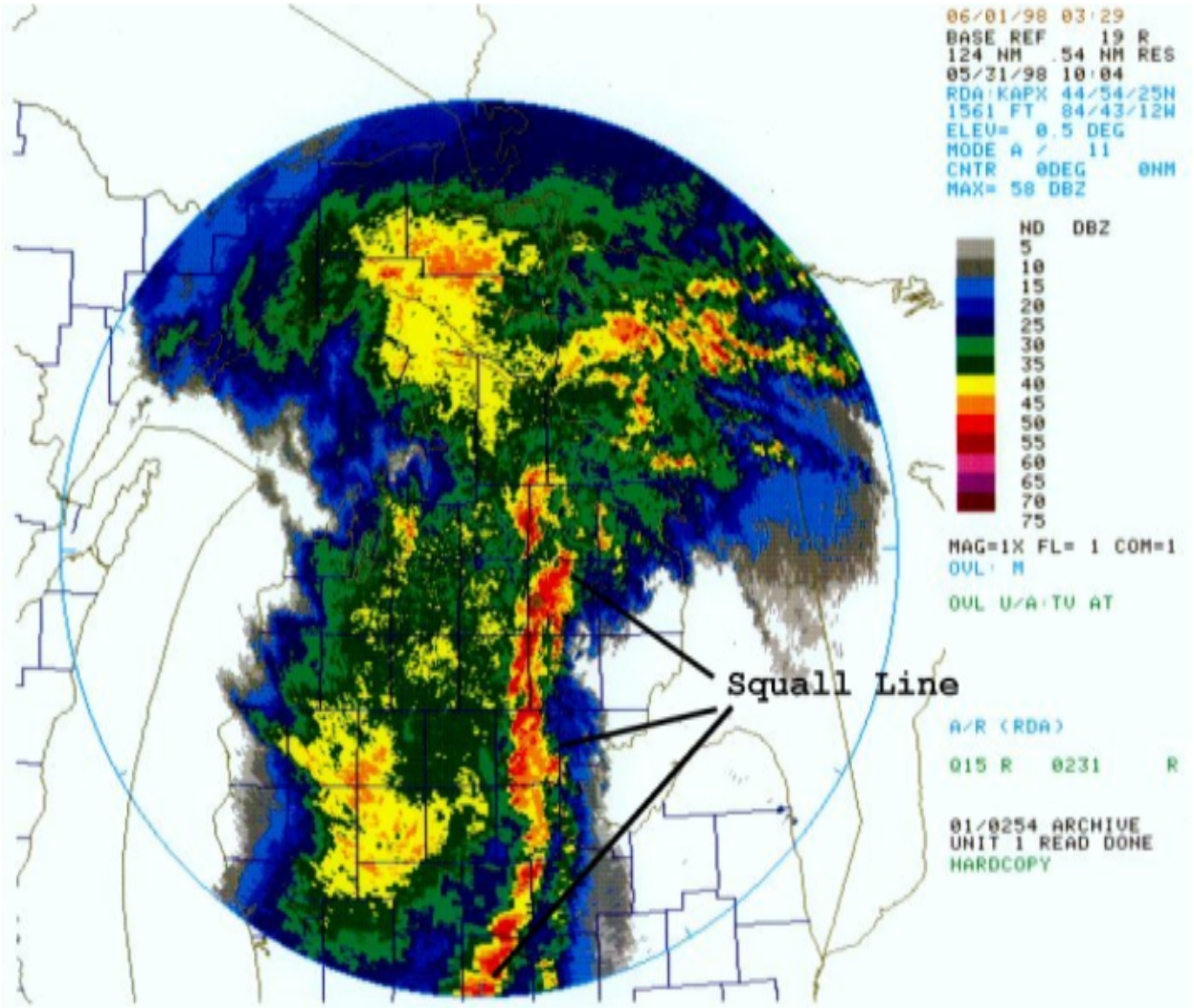
Figure 5.7. VAD Wind Profile.



5.5. Severe Weather Signatures. Radars can identify several severe weather signatures. Some examples are: hail (reflectivity values over 55 DBZ), squall lines, or microbursts.

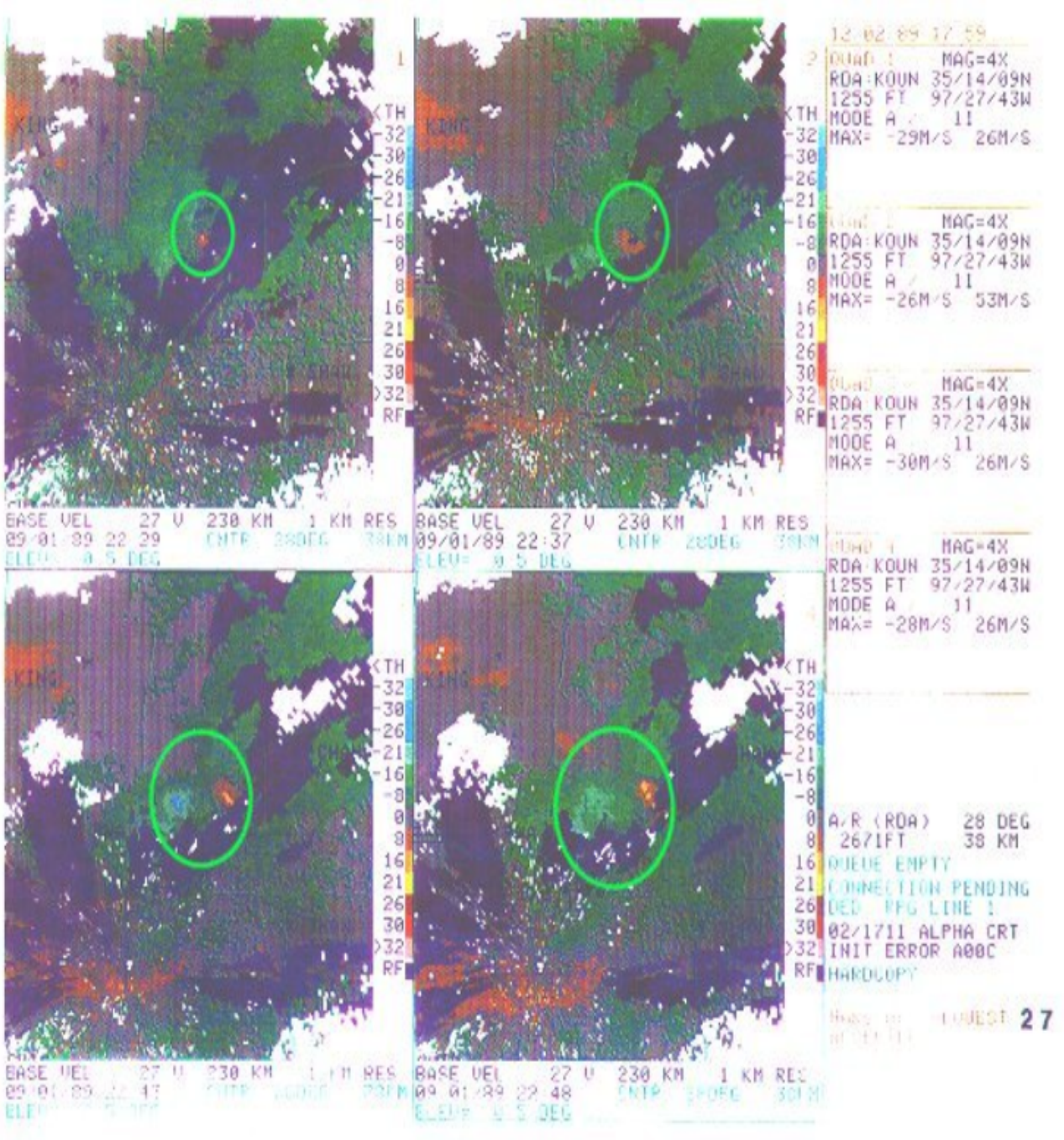
5.5.1. Squall Line. Squall lines (**Figure 5.8.**) are identified by a line of high reflectivities.

Figure 5.8. Squall Line.



5.5.2. Microbursts. Microbursts are short in duration and small in size relative to thunderstorm complexes, but they may have 100 kts of wind and severe downdrafts which can greatly impact takeoffs and landings. Microbursts are best detected by velocity products (**Figure 5.9.**). Due to the shallow vertical extent, microbursts are seen at low levels and usually not detected beyond 20 nm from the radar. Microbursts are seen as a matched strong flow to and from the radar.

Figure 5.9. Time-Lapse Sequence of a Microburst.



5.6. Non-Precipitation Phenomenon. Radar sensitivity allows technicians to see non-precipitation echoes such as birds and insects, solar effects, and smoke plumes. Always verify the data viewed with a certified weather technician.

Chapter 6

LIGHTNING DETECTION PRODUCTS

6.1. Lightning Detection Products . Lightning detection products are available for CONUS (**Figure 6.1.**), but may be limited for OCONUS (**Figure 6.3.**) operations. These products provide an indication of thunderstorms that have recently discharged lightning, but are not the only data to identify thunderstorms. They should be used in conjunction with other data.

6.1.1. Display Animations And Colors. Lightning product animations present a movie of lighting strikes over a region. Always double-check the legend for increment of time used. Some use color-codes vice animation. For example, NWS (**Figure 6.1.**) presents 30-minutes of strike data grouped into 6-minute groups, for five groupings from oldest to newest. Colors range from green (oldest strike occurrence) to red (latest strike occurrence). It also differentiates ground-to-cloud strikes using colored circles and cloud-to-ground strikes using hatches (**Figure 6.2.**). Technology is not yet available for cloud-to-cloud discharges. **Figure 6.3.** uses Red to Gray color codes for time, but does not distinguish strike type.

Figure 6.1. Lightning Display. DTG: 21 Jun 2000/1723Z.

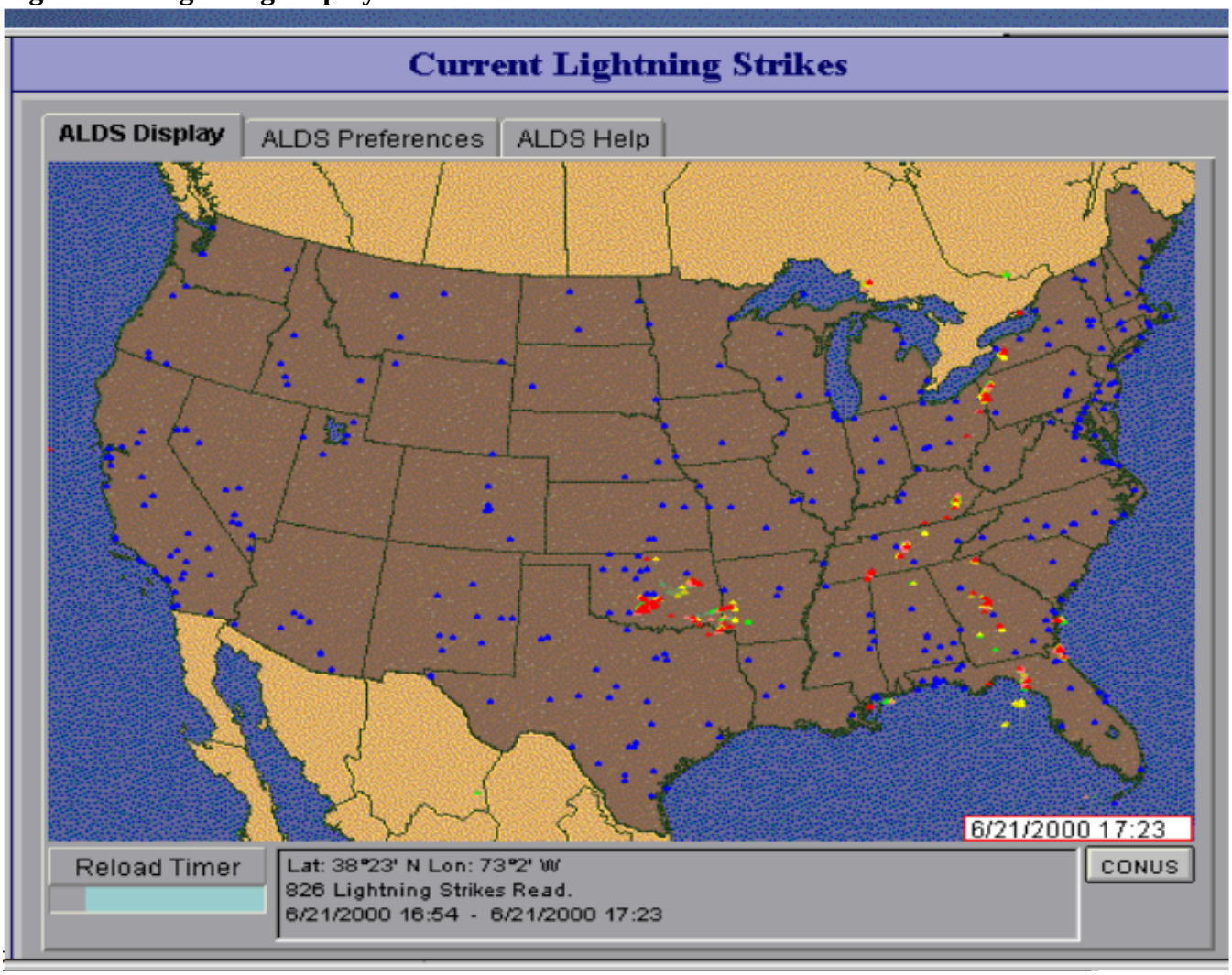


Figure 6.2. NWS Color Code And Strike Type Legend For Figure 6.1.

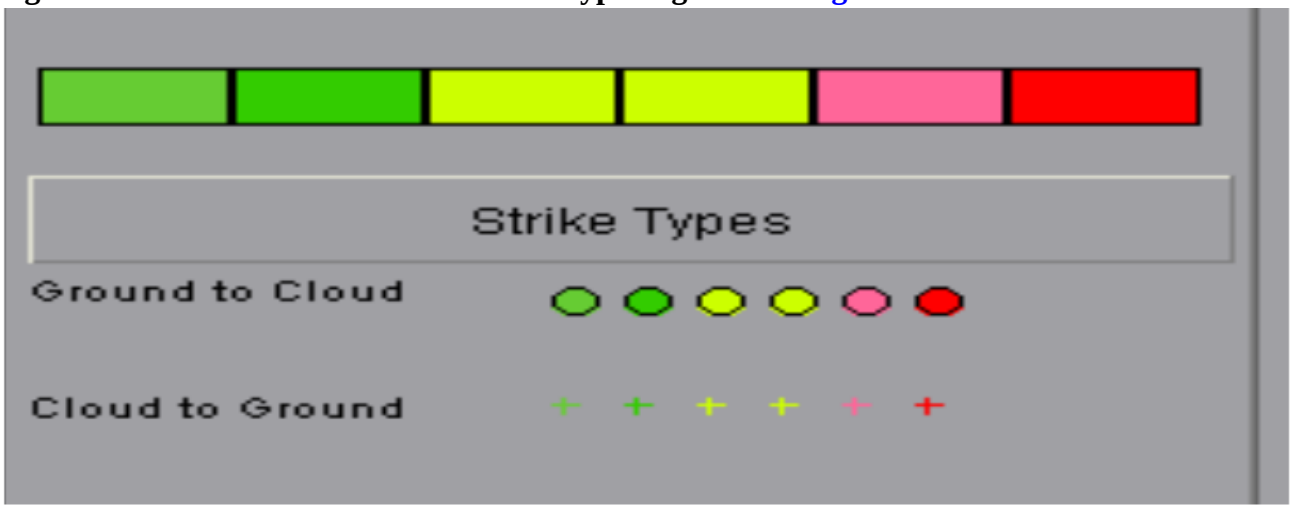
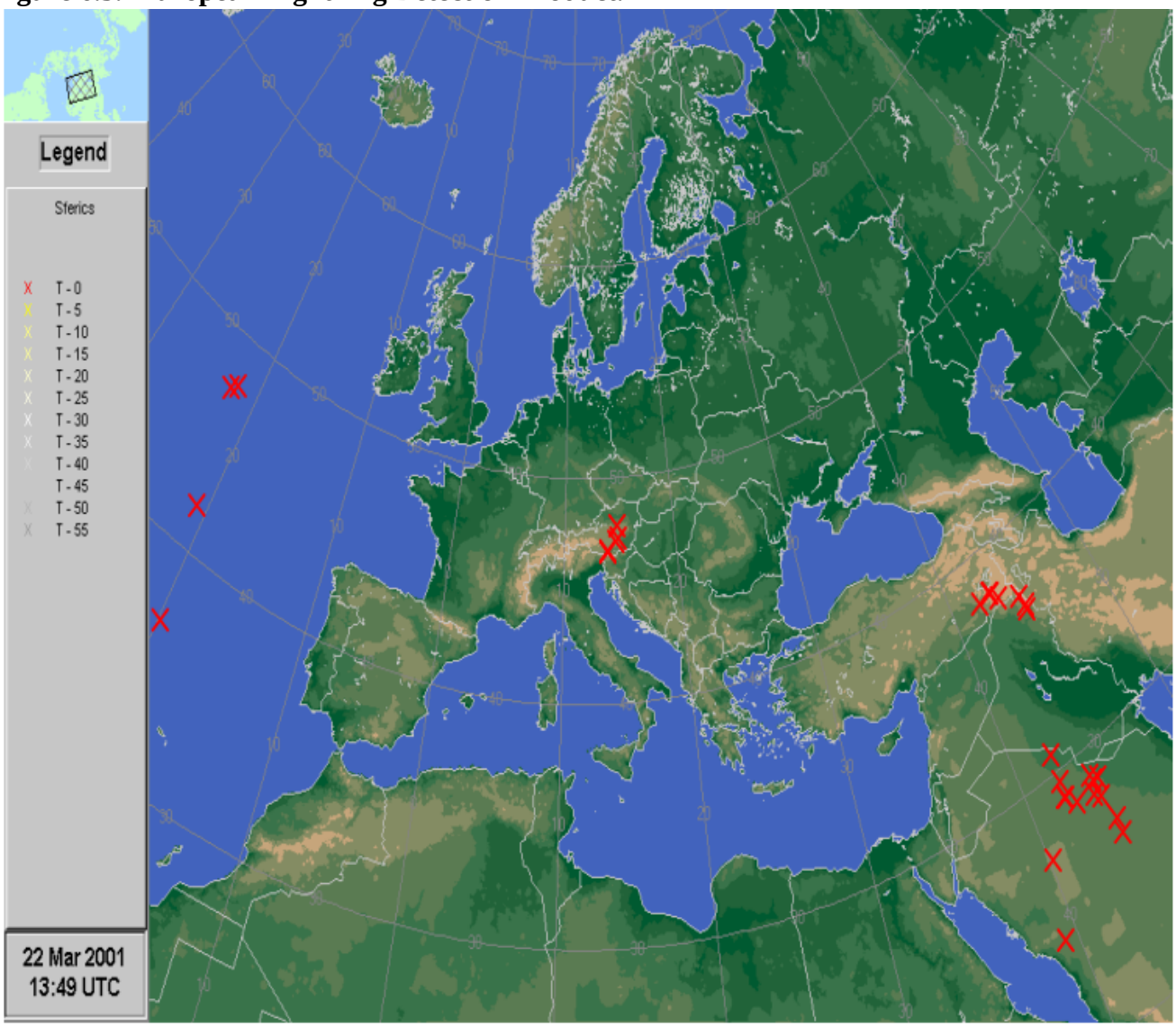


Figure 6.3. European Lightning Detection Product.



Chapter 7

SPECIAL SUPPORT PRODUCTS

7.1. 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 fighter missions using precision-guided munitions (PGMs) to strike a target. Examples of special support products are: Space Support, Tactical Decision Aids (TDAs), Volcano eruptions, Computer Flight Plans (CFPs), blowing dust imagery, and snow coverage/depth. Space Support (including Solar and Lunar data) and Volcano products can be found on OWS or AFWA web pages. CFPs can be requested by following your MAJCOM's directives. TDAs are usually classified and may be available over the secure web. CWTs can provide an in-depth orientation to the specific special support products used for your wing's mission and how to acquire them.

7.2. Space Support. AFWA produces multiple text and graphic Space Support products. A complete list is available on the AFWA web page. AFMAN 15-135, Combat Weather Team Operations, includes detailed information on space weather effects. Space Support products are for the region from the upper atmosphere to the Sun. Most important to the aircrew will be the space effects on the Ionosphere. These can impact radio, Global Positioning Satellite (GPS), and missile warning operations (**Figure 7.1.**).

Figure 7.1. Space Weather Effects on Magnetosphere and Ionosphere.

Region	Timescales of Features Important to AFW	Examples of Space Weather Features	Importance to Military Operations
Magnetosphere Measured along earth-sun line: 10 times radius of earth (10 Re) towards the sun & 1000 Re behind the earth	- Minutes to months.	Radiation Belts, Electrical Currents, Earth's Magnetic Field (geomagnetic field), Geomagnetic storms.	Region of most satellite orbits, effects radio propagation.
Ionosphere 50 km - 1000 km +	- Seasonal & daily variations - Minutes to days. - Dramatic variations resulting from increased solar activity.	Ionized Layer (D- E- F1, & F-2 Regions), Aurora, Ionospheric Disturbances.	Region effects radio propagation, satellite com, GPS receivers, missile warning, space surveillance and space track radars.

7.2.1. Space Weather Warnings. AFWA Space Operations Center prepares many alerts, warnings and advisories (**Figure 7.2.**) that are used to provide resource protection for valuable satellite assets. OWSs or CWTs do not have the capability to produce these products, but can assist with product interpretation.

Figure 7.2. Sample of Space Weather Warning Types.

Warning/Advisory	Criteria	Desired Lead-Time
Short Wave Fade	- Expect HF radio blackouts up to specified frequency and duration on sunlight side of the Earth.	- None. Issued when observed.
X-Ray Flare Event	- Issued when solar radio bursts exceed 5000 solar flux units.	- None. Issued when observed.

7.2.2. Space Text Products. AFWA currently produces over 40 space text bulletins. Also readily available on AFWA and OWS web pages is solar and lunar data (**Figure 7.3.**) which can be used for a variety of missions including Night Vision Goggle (NVG) operations.

Figure 7.3. Sample Solar and Lunar Data.

Scotia, Schenectady County, New York (longitude W74.0, latitude N42.8):

Friday 23 March 2001 Eastern Standard Time

SUN

Begin civil twilight	5:26 a.m.
Sunrise	5:54 a.m.
Sun transit	12:03 p.m.
Sunset	6:12 p.m.
End civil twilight	6:41 p.m.

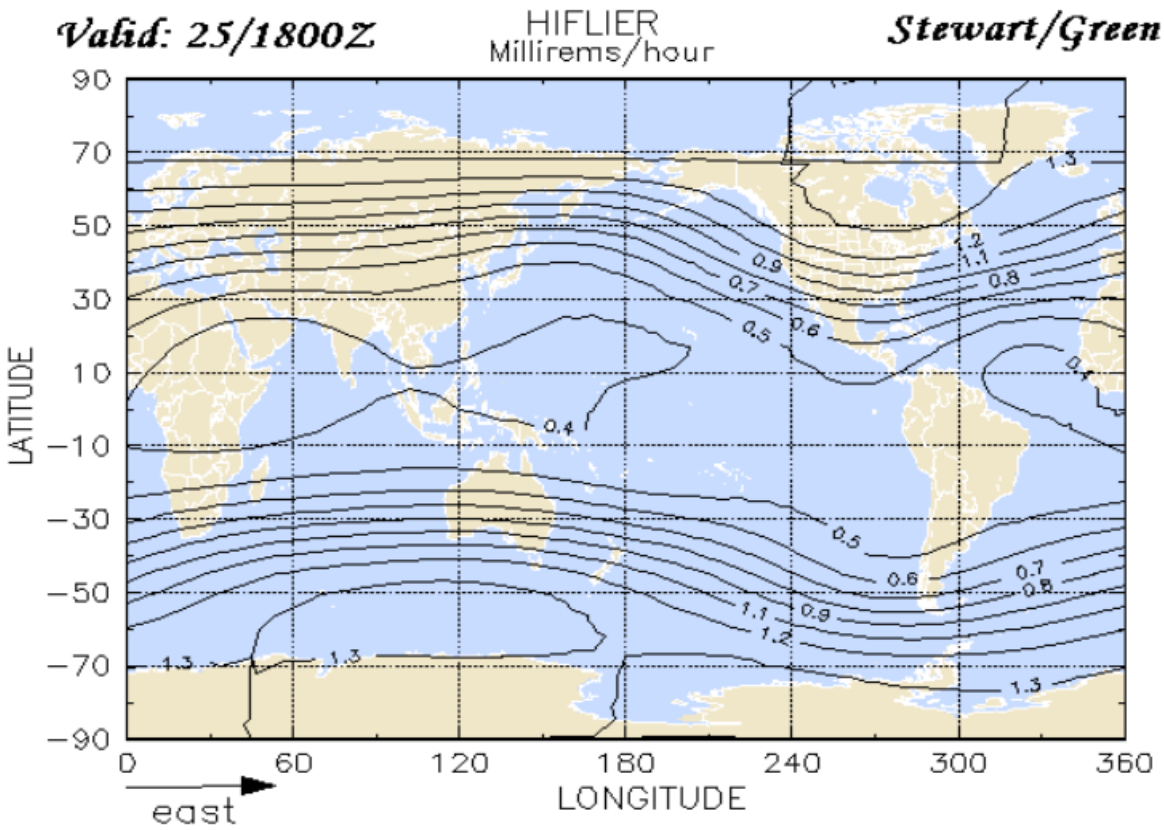
MOON

Moonset	3:50 p.m. preceding day
Moonrise	5:41 a.m.
Moon transit	11:12 a.m.
Moonset	4:51 p.m.
Moonrise	6:06 a.m. on following day

Moon Phase: waning crescent with 2% of the Moon's visible disk illuminated.

7.2.3. Space Graphic Products. Space graphic products provide global visual depictions of the space impacts on operations. Graphics include analysis and forecast of the effects on UHF (**Figure 1.2.**), HF, and high altitude operations (**Figure 7.4.**). Space products can be used to make aircrews aware of potential impacts to communications or GPS. Furthermore, space products can be tailored to a specific operation.

Figure 7.4. Space Impacts.



7.3. Tactical Decision Aids (TDAs). CWTs and occasionally OWSs use TDAs to translate weather parameters into mission impact descriptions (e.g., stoplight charts or go/no go charts), or compute weapon system acquisition and lock on ranges, illumination levels, and temperature contrasts between the target and background. TDAs range from simple look-up tables and graphs to complex software programs. Aircrews and Intelligence interface with the CWT is essential to obtain the necessary mission and target data required to generate TDAs. 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 (IPB) process to gain situational awareness of the battlefield. TDA output is often classified because it discloses details of the mission or performance of the weapon system. TDAs used by CWTs and other weather units are discussed in paragraphs **7.3.1.** - **7.3.4.**

7.3.1. Night Vision Goggle (NVG) Operations Weather Software (NOWS). NOWS calculates sunrise/set, moonrise/set, and illumination levels for NVG operations. NOWS includes atmosphere-induced effects on illumination. It offers decision aids tailored for routes and areas.

7.3.2. Target Acquisition Weather Software (TAWS). TAWS computes detection and lock-on ranges for various PGMs and temperature contrasts between the target and background. TAWS is used to provide target acquisition information for operations employing infrared and television (IR/TV) weapons systems.

7.3.3. Infrared Target/Scene Simulation Software (IRTSS). This is the full-physics TDA capability, including scene rendering and fly-throughs. Weather strategic centers and OWSs will provide IRTSS support to CWTs for mission planning and execution purposes upon request.

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

7.4. Volcanic Eruption Alerts. The effects from a volcanic eruption can greatly impact operations and damage aircraft. Volcano eruption data is available on AFWA and OWS web pages. The data may be text (**Figure 7.5.**), animated graphics (**Figure 7.6.**) or 8-panel (**Figure 7.7.**).

Figure 7.5. Sample Text Volcano Alert.

VOLCANIC ASH ERUPTION ALERT

1. MT ETNA,ITALY 3744N 1500E
DETAILS OF ERUPTION: ETNA POSEIDON WEBCAM HAS SHOWN WEAK ACTIVITY OVER ETNA AT THE VERY BEGINNING OF THE DAY. NOW BOTH SATELLITE IMAGERY AND WEBCAM SHOW THAT ACTIVITY HAS STOPPED.
DETAILS OF ASH CLOUD: NO CONFIRMATION OF ASH CLOUD.
TRAJECTORY FOR ASH CLOUD: ANY ASH CLOUD SHOULD MOVE SOUTH-EASTWARD 50KT.

2. FOR METSAT ANALYSIS AND PUFF MODEL FORCAST BASED ON AVN DATA. SEE:**HTTP://WWW.AFWIN.AFWA.AF.MIL/CGI-BIN/NFGWC.CGI?WCVOLC.TXT** (ALL LOWER CASE). NO ASH PLUME VISIBLE ON CURRENT METSAT IMAGE.

3. FOR MORE INFORMATION SEE FVAF01 LFPW 230827.

4. THIS BULLETIN WILL BE UPDATED EVERY SIX HOURS FOR ERUPTIONS ABOVE FL400.

7.5. Computer Flight Plans (CFP). The Tanker Airlift Control Center provides CFPs for operations. Given the departure time, altitude and true airspeed, the computer "flies" the route and provides winds, temperatures and pressures encountered. It also determines the ground speed, heading, wind factor, and fuel load. Follow MAJCOM directives to obtain a CFP.

Figure 7.6. Volcano Ash Alert At One (Top) and Six (Bottom) Hours After Eruption

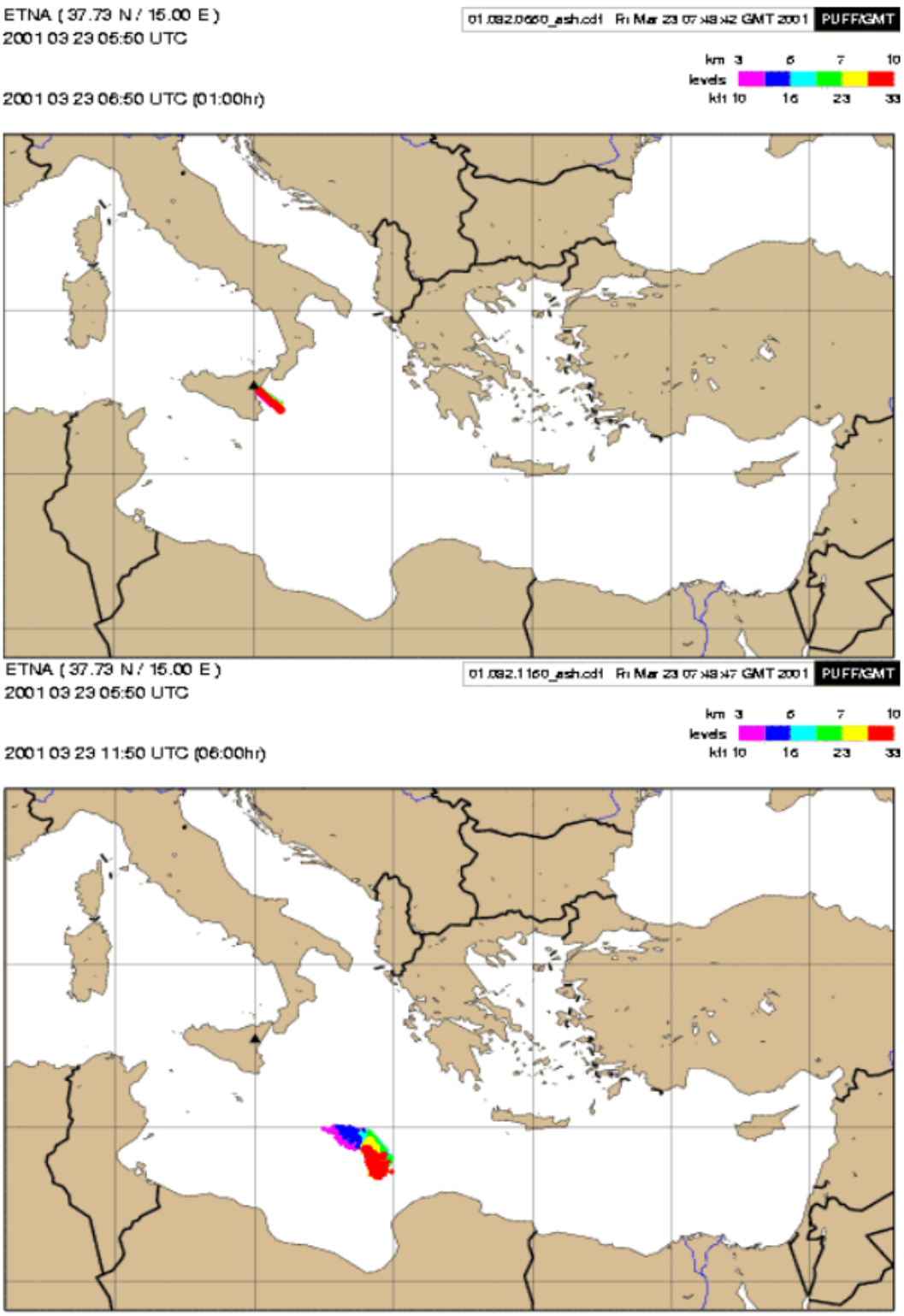
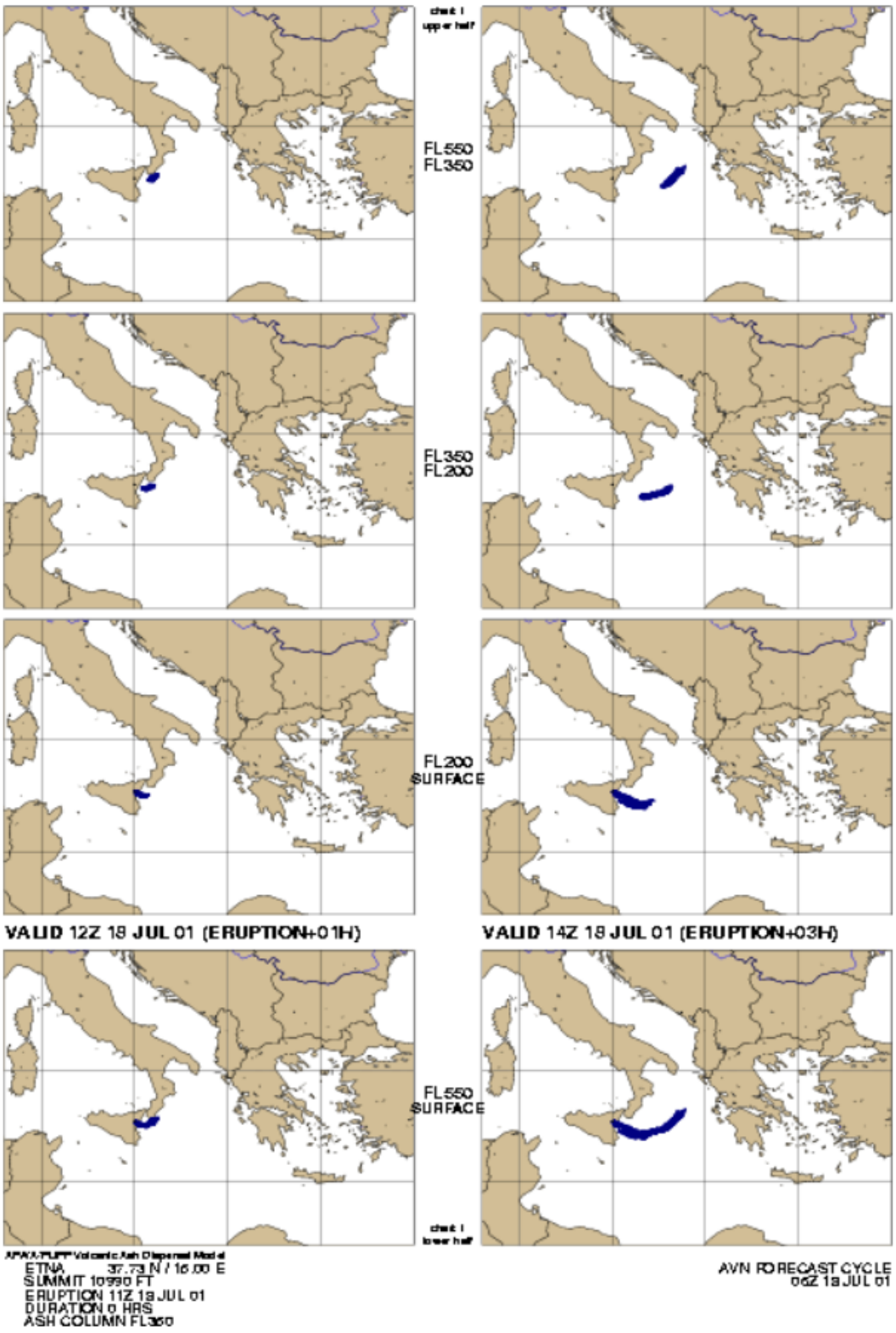
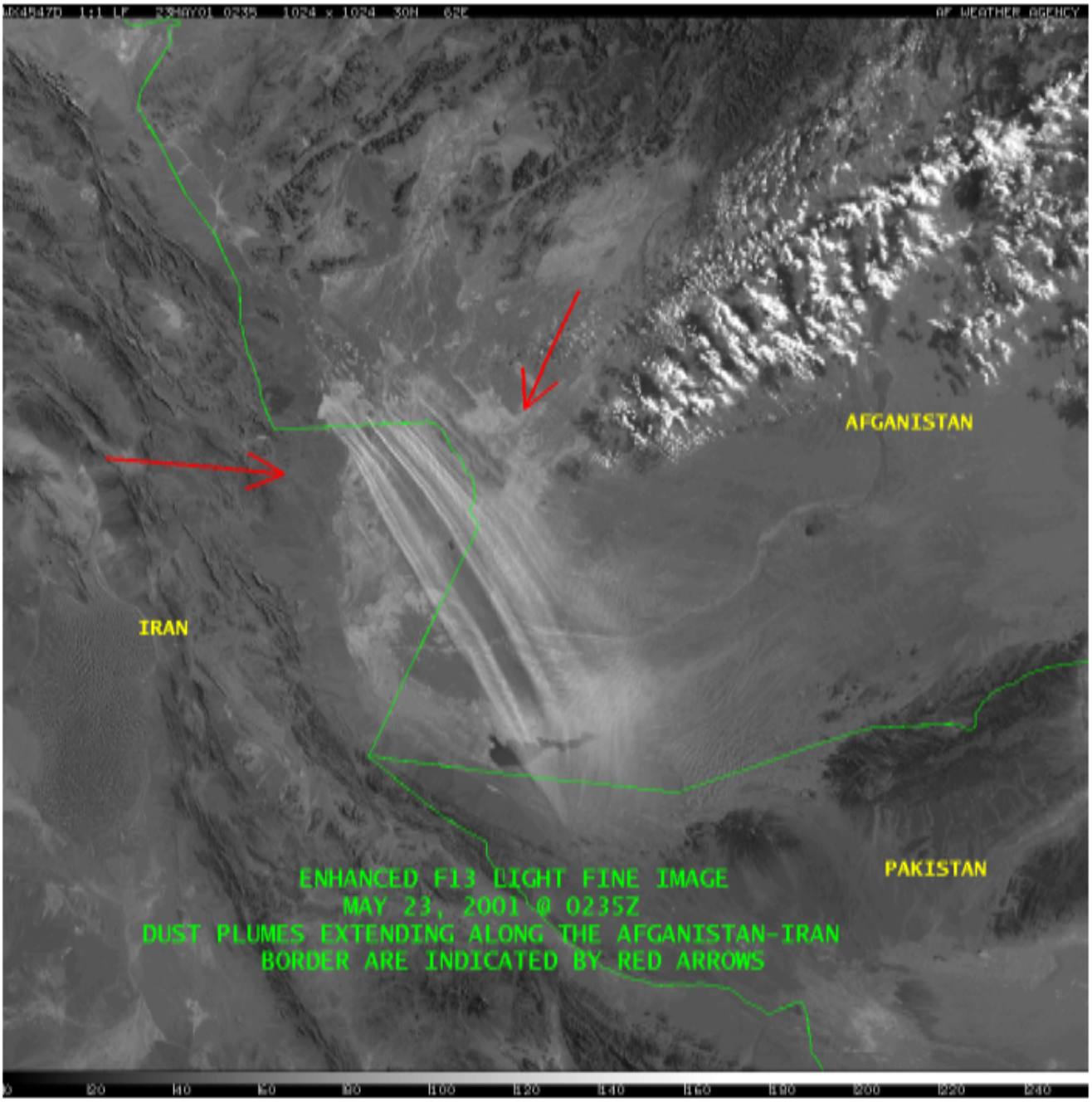


Figure 7.7. Volcano Ash Alert 8-Panel Forecast



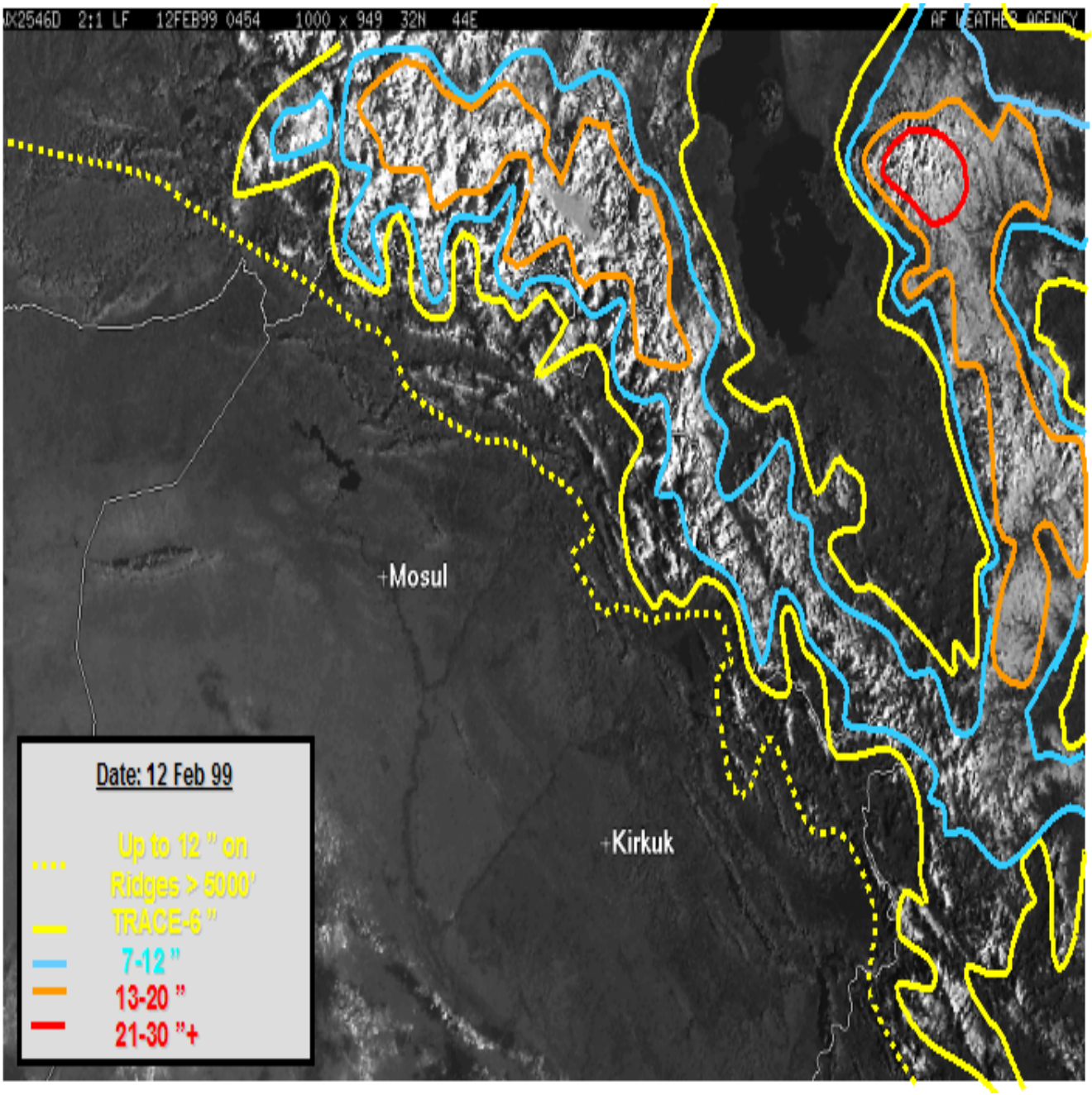
7.6. Blowing Dust Imagery. Blowing dust can impact operations. Imagery (**Figure 7.8.**) is updated as events occur. Regions available are Africa, Mid East, and E, SW, & Central Asia.

Figure 7.8. Sample Dust Event Imagery



7.7. Snow Coverage/Depth Analysis. Imagery (**Figure 7.9.**) is used for trafficability estimates.

Figure 7.9. Snow Analysis Example.



Chapter 8

WEATHER BRIEFINGS

8.1. Weather Briefings. Weather briefings are a three-phase process including the planning, mission execution, and post-mission debrief. Your CWT is the primary point of contact for briefings and all operational weather support. If you are not at home base, your CWT should have arranged support with another CWT or OWS. OWSs will support transient aircrews or aircrews without CWT support. Briefings are obtained in-person, via telephone, or on-line depending on the situation. Always obtain a mental picture of the weather. Ask yourself, How will weather affect my flight? Understanding weather's operational impacts is essential to mission success, especially if emergency actions are required. Spend the time needed to gather data, especially when adverse weather is a factor. Extra time spent with the CWT, the OWS, or MAJCOM-approved web sites, forming a mental picture of the weather could be vital to a successful mission. Never hesitate to ask about any item you believe needs clarification.

8.1.1. Web-based Aircrew Briefing Terminals. Web-based programs utilizing Program Generation Scheduler/Server (PGSS) capabilities provide flight weather data. This program is intended for DoD aviator use. It is not intended to replace the weather person. Aircrews using this program should call a weather facility to obtain additional information, clarify the products, or to ask questions. Briefing terminals provide the standard weather alphanumeric, graphics, satellite, and radar information. This includes airfield observations, forecasts, winds, weather hazards, pilot reports, and current weather warnings. CWTs and OWSs provide access information and procedures to supported units. CWTs include information on how to access and use web-based PGSS systems in the Instrument Refresher Course (IRC) and can provide additional training to local customers upon request.

8.2. Requesting Weather Briefings. A unit flight scheduler will usually notify the CWT of all planned flights. If your flight is not scheduled with the CWT, provide upcoming flight notification by website, phone, or other locally established procedures. Transient or aircrews without CWT support should request OWS support on-line or by phone if web access is not available. OWSs need a minimum of two hours notification to prepare a weather briefing. You should never leave your home base without knowing whom to contact for weather support and updates while in transient status. Military weather briefing facilities and phone numbers are listed in the back of the IFR supplement and are available at the CWT. When requesting a briefing be prepared to provide as much information as possible. At a minimum include:

A. Your name (Always identify yourself as a crew member)

B. Aircraft identification/type

C. Enroute plan (stops, low levels, landing zones, targets, ranges, etc)

D. Proposed altitude

E. Estimated time of departure/return

F. Time enroute to destination

G. Alternates required

8.3. Mission Planning Forecast (MPF). Whenever possible, you should request a Mission Planning Forecast (MPF). Ideally the MPF request is made a minimum of 24 hours in advance. Outline mission parameters to the CWT. This will allow the CWT to select the best weather products to support the mission and allows them to begin monitoring your specific operational areas. Furthermore, this process allows the CWT to efficiently prepare your actual mission briefing, the Mission Execution Forecast (MEF). The MPF will contain a general synopsis of take-off, enroute profile (targets, landing zones, etc.) and recovery phases. MPF results may directly effect your final mission profile decisions (types of PGMs, refueling altitudes, etc.) including the go/no-go decision. Once your final mission parameters are set based on the MPF, you will order a MEF.

8.4. Mission Execution Forecast (MEF). CWTs prepare and brief MEFs to aircrews and the Supervisor of Flying (SOF). DD Form 175-1, Flight Weather Briefing, is the standard MEF tool, but the MEF may take other forms. MEFs can be stand-alone flimsies for local flying, a customized weather depiction for a specific mission (e.g., ARs, DZs, Low-levels), customer-specific visualizations, etc. CWTs use TAFs as general guidance for MEF takeoff, landing, and alternate airfield information. The MEF takes into account takeoff and landing weather thresholds for specific aircraft, pilot category or mission. CWTs use OWS-generated Military Operating Area Forecasts (MOAFs) to help create mission-specific (refueling, drop/landing zone, etc.) MEFs coordinate MEF production times, delivery method, etc., with your local CWT.

8.4.1. MEF Content. Mission parameters, the weather situation, and published Air Force guidance drive MEF content. **Figure 8.1.** and **Figure 8.2.** show typical items covered in a MEF.

Figure 8.1. Take-off and Arrival Weather.

Weather Element	Additional Information
Clouds	Bases and tops of layers
Visibility	Obstructions to visibility, if any
Precipitation	Type and Intensity
Freezing Level	
Surface Temperature	
Surface Winds	Departure and recovery
Climb Winds	
Hazards	Thunderstorms, icing, turbulence, freezing precipitation, crosswinds, low-level wind shear, and any other factor producing a negative impact based upon your experience level and aircraft type.
Condition of Runway	As determined by Base/Post Operations

Figure 8.2. Enroute Weather.

Weather Element	Additional Information
CloudsIncludes bases, tops, type and amount of each cloud layer	
Enroute WindsClimb-out and descent	
Temperature	
Visibility at altitude	Includes in and out of cloud
Freezing level	Departure and recovery
Temperature and Winds	
HazardsThunderstorms, icing, turbulence, freezing precipitation, crosswinds and any other factor producing a negative impact based upon your experience level and aircraft type.	

8.5. DD Form 175-1, Flight Weather Briefing . The DD Form 175-1 (**Figure 8.3.**)**, Flight Weather Briefing** is the standard briefing form. Whether you receive a verbal or written briefing, it will contain this form's data. Some blocks may not be completed or extra data may be included. The following discusses the form. All time entries are in Zulu (Z). All heights are in hundreds of feet AGL/MSL. All winds are entered in tens of degrees and speed in knots.

Section I: Mission Takeoff Data:

1. Date

2. Aircraft 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. Runway temperature and dew point (°C, unless otherwise requested)

5. Temperature deviation (°C, unless other requested)

6. Pressure altitude/density altitude

7. Surface wind (Magnetic direction for local and true direction for remote locations)

8. Climb winds (Entered in true direction)

9. Local weather advisory (Weather warnings or advisories valid for ETD +/- 1 hour)

10. RCR (Latest reported Runway Conditions Reading (RCR) for departure)

11. Remarks/Takeoff Alt. Forecast (Any remark on weather affecting take-off and climb (i.e., inversions, icing and turbulence))

Section II: En Route Data (25 miles of either side and 5000 Ft vertically of flight path)

1. **Flight Level** (entered in three digits)
2. **Flight level winds and temperature**
3. **Clouds at flight level** (Appropriate block will be checked)
4. **Minimum visibility at flight level outside of clouds** (statute miles and will include the phenomenon that will lower the visibility)
5. **Minimum ceiling and location** (hundreds of feet and geographical location)
6. **Maximum cloud tops and location** (location and excluding of thunderstorm tops)
7. **Minimum freezing level and location**
8. **Thunderstorms** (height of thunderstorm tops, coverage percentage, and applicable weather watches/ weather warnings , or other data source)
9. **Turbulence** (geographic location, levels, intensity)
10. **Icing** (geographic location, area, levels, intensity, advisory identification number (usually date time group))
11. **Precipitation** (geographic location, levels, intensity, identification number of bulletin (usually date/ time group))

Section III: Destination Data

1. **Terminal forecasts** (Destination and alternate)
2. **Cloud layers**
3. **Visibility/Weather**
4. **Surface Wind** (True direction provided for off-station and magnetic for local)
5. **Altimeter** (The lowest altimeter setting expected during the valid period)
6. **Valid Time** (Forecast will be valid through +/- 1 hour of ETA)

Section IV: Comments Remarks

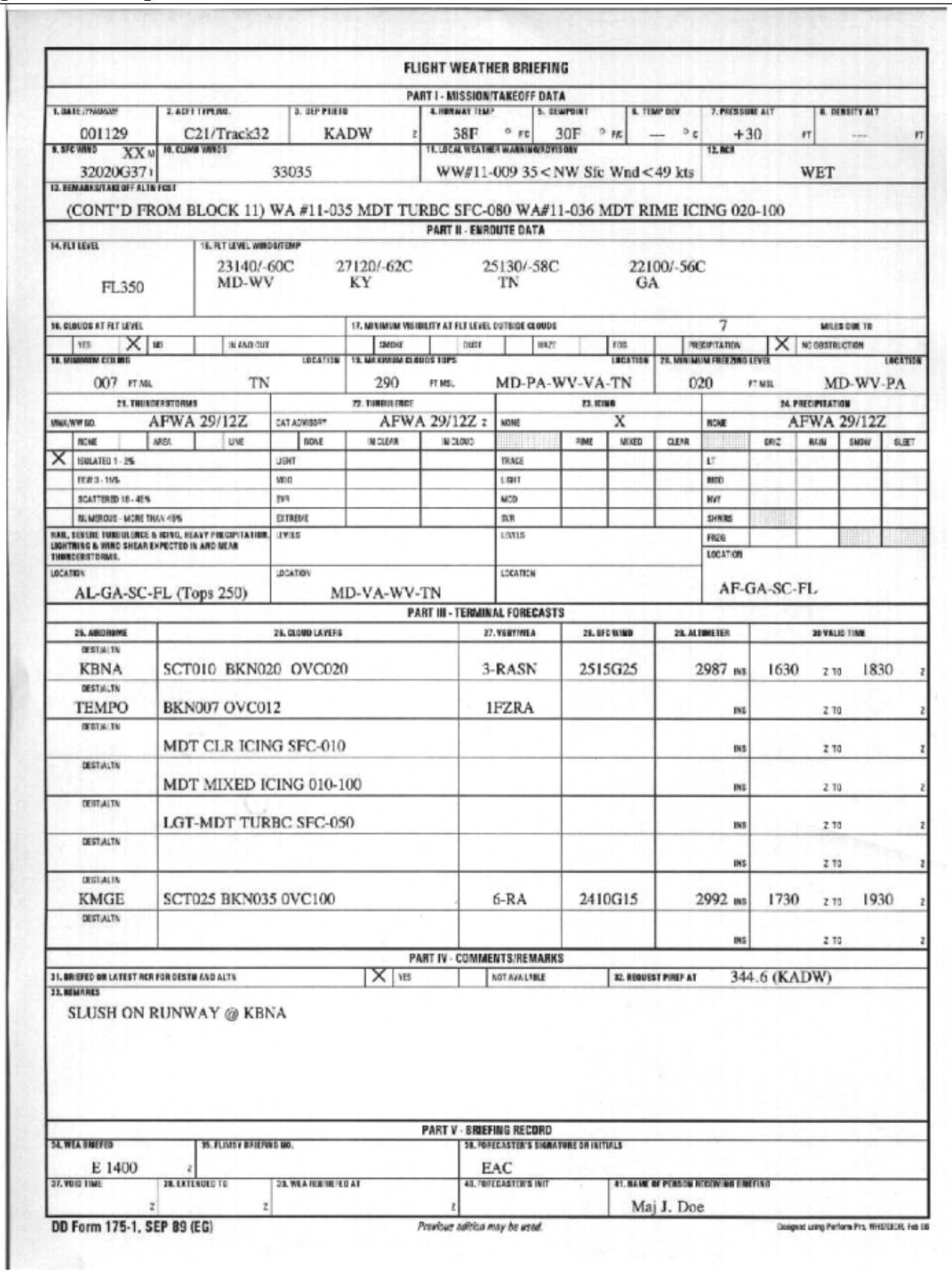
1. **Briefed on latest RCR for Destination and Alternate**
2. **PIREP** (PMSV frequency annotated)
3. **Remarks** (May include any other significant data)
4. **Data for which there was insufficient space in other blocks**
5. **Comments and remarks** (on terminal forecasts)
6. **Icing and turbulence** (destination descent (enter location, type, intensity and level))
7. **Specialized remarks** (for low level areas, air refueling or gunnery/bombing ranges)
8. **Transient aircrew weather support contact information**

Section V: Briefing Record

1. **Weather briefed at** (Time briefing was completed)
2. **Flimsy/briefing number** (Briefing package, flimsy or CFP identification)
3. **Forecaster's signature or initials** (Name of the forecaster providing the briefing)
4. **Void Time** (Army and Navy use only)
5. **Extended to weather** (Army and Navy use only)
6. **Weather re-briefed time**
7. **Forecasters initials**
8. **Name and grade of person receiving briefing**

8.6. Post-Mission Debrief. Beyond pre-mission interface with the CWT, the post-mission debrief is the best way an aircrew can influence and improve weather support. Aircrew provided feedback of actual weather encountered vice the MEF, helps the CWT evaluate the MEF process and improve support and product accuracy. Debriefings can be made in person, via telephone, by locally established procedures, or on-line (where available).

Figure 8.3. Sample DD Form 175-1.



FLIGHT WEATHER BRIEFING

PART I - MISSION/TAKEOFF DATA

1. DATE/TIME/MSN NO	2. ACFT TYPE/NO.	3. DEP FIELD	4. OUTSIDE AIR TEMP	5. DEWPOINT	6. TEMP DEV	7. PRESSURE ALT	8. DENSITY ALT
001129	C21/Track32	KADW Z	38F °F/°C	30F °F/°C	— °C	+30 FT	--- FT

9. SFC WIND	10. CLIMB WINDS	11. LOCAL WEATHER WARNING/ADVISORY	12. RCR
XX M 32020G37 I	33035	WW#11-009 35<NW Sfc Wnd<49 kts	WET

13. REMARKS/TAKE OFF ALTN FCST

(CONT'D FROM BLOCK 11) WA #11-035 MDT TURBC SFC-080 WA#11-036 MDT RIME ICING 020-100

PART II - ENROUTE DATA

14. FLT LEVEL	15. FLT LEVEL WINDS/TEMP			
FL350	23140/-60C MD-WV	27120/-62C KY	25130/-58C TN	22100/-56C GA

16. CLOUDS AT FLT LEVEL: YES X NO ___ IN AND OUT ___

17. MINIMUM VISIBILITY AT FLT LEVEL OUTSIDE CLOUDS: 7 MILES DUE TO: SMOKE ___ DUST ___ HAZE ___ FOG ___ PRECIPITATION ___ X NO OBSTRUCTION

18. MINIMUM CEILING	LOCATION	19. MAXIMUM CLOUD TOPS	LOCATION	20. MINIMUM FREEZING LEVEL	LOCATION
007 FT MSL	TN	290 FT MSL	MD-PA-WV-VA-TN	020 FT MSL	MD-WV-PA

21. THUNDERSTORMS		22. TURBULENCE		23. ICING		24. PRECIPITATION	
WA/WW NO.	AFWA 29/12Z	CAT ADVISORY	AFWA 29/12Z Z	NONE	X	NONE	AFWA 29/12Z

	NONE	AREA	LINE		NONE	IN CLEAR	IN CLOUD		RIME	MIXED	CLEAR		DRIZ	RAIN	SNOW	SLEET
X	ISOLATED 1 - 2%				LIGHT			TRACE				LT				
	FEW 3 - 11%				MOD			LIGHT				MOD				
	SCATTERED 16 - 40%				SVR			MOD				MVT				
	NUMEROUS - MORE THAN 45%				EXTREME			SVR				SHWRS				

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

LEVELS	LEVELS	FRZG	
		LOCATION	

LOCATION	LOCATION	LOCATION
AL-GA-SC-FL (Tops 250)	MD-VA-WV-TN	AF-GA-SC-FL

PART III - TERMINAL FORECASTS

26. AIRDROME	28. CLOUD LAYERS	27. VSBY/WEA	29. SFC WIND	25. ALTIMETER	30. VALID TIME
DEST/ALTN KBNA	SCT010 BKN020 OVC020	3-RASN	2515G25	2987 INS	1630 Z TO 1830 Z
DEST/ALTN TEMPO	BKN007 OVC012	1FZRA		INS	Z TO Z
DEST/ALTN	MDT CLR ICING SFC-010			INS	Z TO Z
DEST/ALTN	MDT MIXED ICING 010-100			INS	Z TO Z
DEST/ALTN	LGT-MDT TURBC SFC-050			INS	Z TO Z
DEST/ALTN				INS	Z TO Z
DEST/ALTN KMGE	SCT025 BKN035 OVC100	6-RA	2410G15	2992 INS	1730 Z TO 1930 Z
DEST/ALTN				INS	Z TO Z

PART IV - COMMENTS/REMARKS

31. BRIEFED ON LATEST RCR FOR DEST/W AND ALTN: X YES ___ NOT AVAILABLE

32. REQUEST PIREP AT: 344.6 (KADW)

33. REMARKS

SLUSH ON RUNWAY @ KBNA

PART V - BRIEFING RECORD

34. WEA BRIEFED	35. FLIMSY BRIEFING NO.	36. FORECASTER'S SIGNATURE OR INITIALS
E 1400 Z		EAC

37. VOID TIME	38. EXTENDED TO	39. WEA REBRIEFED AT	40. FORECASTER'S INIT	41. NAME OF PERSON RECEIVING BRIEFING
Z	Z	Z		Maj J. Doe

DD Form 175-1, SEP 89 (EG) *Previous editions may be used.*

Chapter 9

AVIATION WEATHER SERVICES

9.1. Automatic Terminal Information Service (ATIS). Most high-density military and civil airfields broadcast recorded weather for takeoff, approach, and landing on ATIS. Terminal IAPs, enroute charts and the Enroute Supplement list radio frequencies.

9.2. Pilot-to-Metro Service Voice (PMSV). Use PMSV to update latest weather. The FIH has PMSV facility locations, frequencies, and instructions. CWTs will support all PMSV contacts. CWTs monitoring common frequencies may respond if an aircrew is not answered by their CWT or OWS after two calls. OWSs provide support when a CWT is off-duty or unable to respond. OWS will support aircrews unable to contact their home station CWT or another OWS. Only qualified personnel will respond. Trainees may respond with proper supervision. Individuals not qualified to make forecasts will identify themselves as a weather apprentice, and may *only* relay data. If a forecast or forecast interpretation is required and a qualified technician is unavailable, the apprentice will refer you to the nearest forecasting service facillity. Weather personnel will not vector aircraft.

9.3. Flight Service Station (FSS). The FSS functions as a weather service and ATC facility. FSS facilities are found in the IFR supplement or on navigation charts. The FSS provides briefings, observations and broadcasts weather. FSS technicians can translate weather codes and graphics, but can’t make forecasts. At selected locations, Enroute Flight Advisory Service (EFAS or Flight Watch) is available for non-routine weather data. FSS provide Standard, Abbreviated and Outlook Briefings. Standard Briefings are complete and include winds aloft, departure, enroute, and destination weather. Abbreviated Briefings are updates to a previous briefing. For an Abbreviated Briefing, be specific about the previous information received to include the source, date and time group, so the FSS can limit the information to what you have not received. Outlook Briefings are used for planning when departure is over six hours away.

9.4. FAA Telephone Services. The FAA maintains sources for telphone information:

1. 1-800-WX-BRIEF. Available 24 hours a day by FSS. Local numbers are found in the Airport/ Facility Directory (A/FD) under "FAA and NWS Telephone Numbers." Also check under U.S. government, Department of Transportation, FAA, or NWS.
2. Telephone Information Briefing Service (TIBS) provides continuous, updated recordings for local flights.
3. Direct User Access System (DUATS) provides data and VFR/IFR file plan capability.

9.5. VHF Omnidirectional Range (VOR). Certain VORs transmit weather data, PIREPs, and NOTAMs. Radio code "AB" indicates FAA operated VORs providing continuous recorded broadcasts. Request weather on VHF frequency 122.1, and FSS personnel will broadcast data over the VOR.

9.6. Non-Directional Beacon (NDB). NDBs with radio code SABH or HSAW transmit transcribed continuous data (route forecasts and observations) for selected civilian airports.

WALTER E. BUCHANAN III, Maj Gen, USAF
DCS/Air and Space Operations

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Abbreviations and Acronyms

ADIZ—Air Defense Identification Zone

AEF —Aerospace Expeditionary Force

AFCCC—Air Force Combat Climatology Center

AFW—Air Force Weather

AFWA—Air Force Weather Agency

AGL—Above Ground Level

AIREP—Air Report

AIRMET—Airman's Meteorological Information **(**A NWS In-Flight Weather Advisory)

AMC—Air Mobility Command

AMD—Amendment

ANG—Air National Guard

AOG—Air Operations Group

AOR—Area of Responsibility

AR—Air Refueling

ARC—Air Reserve Component

ASOG—Air Support Operations Group

ASOS—Automated Surface Observation System

ATC—Air Traffic Control

ATIS—Automated Terminal Information System

CAT—Clear Air Turbulence

CENTCOM—Central Command

CFP—Computer Flight Plan

CINC—Commander in Chief

CONUS—Continental United States

CWT—Combat Weather Team

DBZ—Decibels

DET—Detachment

DoD—Department of Defense

DTG—Date-Time Group

DZ—Drop Zone

FAA—Federal Aviation Administration

FDC—Flight Data Center

FIH—Flight Information Handbook

FLIP—Flight Information Publication

FSS—Flight Service Station

GPS—Global Positioning System

ICAO—International Civil Aviation Organization

IFR—Instrument Flight Rules

IPB—Intelligence Preparation of the Battlefield

IR—Infared

IRC—Instrument Refresher Course

IRTSS—Infrared Target Scene Simulation System Software

IWEDA—Integrated Weather Environmental Aid

JAAWIN—Joint Air Force and Army Weather Information Network

LLWS—Low Level Wind Shear

MACOM—Major Command (Army)

MAJCOM—Major Command (Air Force)

MEF—Mission Execution Forecast

METSAT—Meteorological Satellite

METAR—Aviation Routine Weather Report

METWATCH—Meteorological Watch

MISSIONWATCH—Mission Meteorological Watch

MOAF—Military Operation Area Forecast

MPF—Mission Planning Forecast

MSL—Mean Sea Level

MWA—Military Weather Advisory

NAF—Numbered Air Force

NDB—Non-Directional Beam

NEXRAD—Next Generation Radar

NOAA—National Oceanic and Atmospheric Administration

NOTAM—Notice to Airmen

NOWS —NVG Operations Weather Software

NVG—Night Vision Goggles

NWS—National Weather Service

OCONUS—Outside Continental United States

OSS—Operations Support Squadron

OWS—Operational Weather Squadron

PACAF—Pacific Air Forces

PGM—Precision Guided Munitions

PGSS—Program Generation Scheduler/Server

PIREP—Pilot Weather Report

PMSV—Pilot-to-Metro Service Voice

RCR—Runway Condition Reading

RMS—Route Mean Square

RSC—Runway Surface Condition

RVR—Runway Visual Range

SAR—Support Assistance Request

SATCOM—Satellite Communications

SIGMET—Significant Meteorological Information **(**NWS In-flight Weather Advisory)

SOF—Supervisor of Flying

SOUTHCOM—Southern Command

SPECI—Aviation Selected Special Weather Report

SW—Space Weather

SWO—Staff Weather Officer

TACC—Tanker Airlift Control Center

TAF—Aerodrome Forecast

TAWS—Target Acquisition Weather Software

TDA—Tactical Decision Aid

UHF—Ultra High Frequency

UTC—Universal Time Coordinate

VAD—Velocity Azimuth Display

VFR—Visual Flight Rules

VHF—Very High Frequency

VOR—VHF Omni-directional Range

WA—Weather Advisory

WF—Weather Flight

WW—Weather Warning

XOW—DCS, Air and Space Operations, Director of Weather

Terms

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

AIRMET—NWS in-flight weather advisories issued only to amend the area forecast concerning weather phenomena which 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.

Air Report—A pilot report made over areas where weather information is limited or nonexistent (e.g., over an ocean).

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

Combat Weather Team (**CWT**)**—**An umbrella term covering any military weather organization providing direct operational support at the tactical level. In addition to designated weather units, (OSS weather flights, Weather Detachments and Squadrons, ANG Weather Flights) specialized sections in an OWS (flight briefing or contingency cell) and AFWA (Special Support Operations Branch) also operate as CWTs.

Contour—Line drawn on a weather map connecting points of equal height.

ICAO Identifier—A specifically authorized 4-letter identifier assigned to a location and documented in ICAO Document 7910.ICAO (used by NTFS).

Intelligence Preparation of the Battlefield (IPB)—An analytical methodology employed to reduce uncertainties concerning the enemy, environment, and terrain for all types of operations. IPB builds an extensive database for each potential area in which a unit may be required to operate. The database is then analyzed in detail to determine the impact of the enemy, environment, and terrain on operations and presents it in graphic form.

Infrared Target Scene Simulation System Software (IRTSS)—A UNIX-server, (hosted by AFWA and the OWSs) full-physics, tactical decision aid capability that illustrates the weapons-eye (sensor's spectral response) view of the target area.

Isobar—Line drawn on a weather map connecting points of equal barometric pressure.

Isodrosotherm—Line drawn on a weather map connecting points of equal dew point.

Isotach—Lines drawn on a weather map connecting points of equal wind speed.

Isotherm —Line drawn on a weather map connecting points of equal temperature.

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

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

Mission Execution Forecast (MEF) — MEF is a customized weather product providing terrestrial and space weather data and forecasts for a specific mission, or set of missions. It fully integrates aerospace weather with the customer's tactics, weapon systems, environmental sensitivities of equipment, and other operational requirements.

MISSIONWATCH—The monitoring of aerospace weather for a specific mission (i.e., ground, air or space) and informing supported agencies when unforecasted mission-limiting phenomena could effect 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 management, technician, and training personnel responsible for providing regional weather support. Their mission is to produce fine-scale tailored weather forecast products and services to customers within their area of responsibility (AOR).

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

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

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

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

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

Weather Warning—A special notice provided to a supported agency when an established weather condition of such intensity as to effect operations, 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 customers that alerts them of a potential for weather conditions of such intensity as to pose a hazard to life or property for which the customer must take protective action.

Work Chart/Composite—A representation of meteorological elements or features and their variability in space and time. Work charts/composites supplement or refine centralized products.

Attachment 2

STATUTE MILES TO METERS

Statute Miles to Meters					
STATUTE MILES	**METERS**	**STATUTE MILES**	**METERS**	**STATUTE MILES**	**METERS**
0	**0000**	**1-1/2**	**2400**	**3**	**4800**
1/16	**0100**	**-**	**2500**	**-**	**4900**
1/8	**0200**	**1-5/8**	**2600**	**-**	**5000**
3/16	**0300**	**-**	**2700**	**4**	**6000**
	0400	**1-3/4**	**2800**	**-**	**7000**
5/16	**0500**	**-**	**2900**	**5**	**8000**
3/8	**0600**	**1-7/8**	**3000**	**6**	**9000**
-	**0700**	**-**	**3100**	**7**	**9999**
	0800	**2**	**3200**	**8**	**9999**
-	**0900**	**-**	**3300**	**9**	**9999**
5/8	**1000**	**-**	**3400**	**10**	**9999**
-	**1100**	**-**	**3500**	**11**	**9999**
	1200	**2-1/4**	**3600**	**12**	**9999**
-	**1300**	**-**	**3700**	**13**	**9999**
7/8	**1400**	**-**	**3800**	**14**	**9999**
-	**1500**	**-**	**3900**	**15**	**9999**
1	**1600**	**2-1/2**	**4000**	**20**	**9999**
-	**1700**	**-**	**4100**	**25**	**9999**
1-1/8	**1800**	**-**	**4200**		
-	**1900**	**-**	**4300**		
1-1/4	**2000**	**2-3/4**	**4400**		
-	**2100**	**-**	**4500**		
1-3/8	**2200**	**-**	**4600**		
-	**2300**	**-**	**4700**		

Attachment 3

FAHRENHEIT TO CELSIUS

Fahrenheit to Celsius											
°F		°C	°F		°C	°F		°C	°F		°C
From	To		From	To		From	To		From	To	
128.3	130.0	54	83.3	85.0	29	38.3	40.0	04	-4.8	-3.1	M20
126.5	128.2	53	81.5	83.2	28	36.3	38.2	03	-6.6	-4.9	M21
124.7	126.4	52	79.7	81.4	27	34.7	36.2	02	-8.4	-6.7	M22
122.9	124.6	51	77.9	79.6	26	32.9	34.6	01	-10.2	-8.5	M23
121.1	122.8	50	76.1	77.8	25	32.0	32.8	00	-12.0	-10.3	M24
119.3	121.0	49	74.3	76.0	24	31.2	31.9	M00	-13.8	-12.1	M25
117.5	119.2	48	72.5	74.2	23	29.4	31.1	M01	-15.6	-13.9	M26
115.7	117.4	47	70.7	72.4	22	27.6	29.3	M02	-17.4	-15.7	M27
113.9	115.6	46	68.9	70.6	21	25.8	27.5	M03	-19.2	-17.5	M28
112.1	113.8	45	67.1	68.8	20	24.0	25.7	M04	-21.0	-19.3	M29
110.3	112.0	44	65.3	67.0	19	22.2	23.9	M05	-22.8	-21.1	M30
108.5	110.2	43	63.5	65.2	18	20.4	22.1	M06	-24.6	-22.9	M31
106.7	108.4	42	61.7	63.4	17	18.6	20.3	M07	-26.4	-24.7	M32
104.9	106.6	41	59.9	61.6	16	16.8	18.5	M08	-28.2	-26.5	M33
103.1	104.8	40	58.1	59.8	15	15.0	16.7	M09	-30.0	-28.3	M34
101.3	103.0	39	56.3	58.0	14	13.2	14.9	M10	-31.8	-30.1	M35
99.5	101.2	38	54.5	56.2	13	11.4	13.1	M11	-33.6	-31.9	M36
97.7	99.4	37	52.7	54.4	12	9.6	11.3	M12	-35.4	-33.7	M37
95.9	97.6	36	50.9	52.6	11	7.8	9.5	M13	-37.2	-35.5	M38
94.1	95.8	35	49.1	50.8	10	6.0	7.7	M14	-39.0	-37.3	M39
92.3	94.0	34	47.3	49.0	09	4.2	5.9	M15	-40.8	-39.1	M40
90.5	92.2	33	45.5	47.2	08	2.4	4.1	M16	-42.6	-40.9	M41
88.7	90.4	32	43.7	45.4	07	0.6	2.3	M17	-44.4	-42.7	M42
86.9	88.6	31	41.9	43.6	06	-1.2	+0.5	M18	-46.2	-44.5	M43
85.1	86.8	30	40.1	41.8	05	-3.0	-1.3	M19	-48.0	-46.5	M44

Attachment 4

MILLIBARS TO INCHES

Millibars to Inches										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
MB	**Inches**									
940	27.76	27.79	27.82	27.84	27.88	27.91	27.94	27.96	27.99	28.02
950	28.05	28.08	28.11	28.14	28.17	28.20	28.23	28.26	28.29	28.32
960	28.35	28.38	28.41	28.44	28.47	28.50	28.53	28.56	28.59	28.61
970	28.64	28.67	28.70	28.73	28.76	28.79	28.82	28.85	28.88	28.91
980	28.94	28.97	29.00	29.03	29.06	29.09	29.12	29.15	29.18	29.21
990	29.23	29.26	29.29	29.32	29.35	29.28	29.41	29.44	29.47	29.50
1000	29.53	29.56	29.59	29.62	29.65	29.68	29.71	29.74	29.77	29.80
1010	29.83	29.85	29.88	29.91	29.94	29.97	30.00	30.03	30.06	30.09
1020	31.12	30.15	30.18	30.21	30.24	30.27	30.30	30.33	30.36	30.39
1030	30.42	30.45	30.47	30.50	30.53	30.56	30.59	30.62	30.65	30.68
1040	30.71	30.74	30.77	30.80	30.83	30.86	30.89	30.92	30.95	30.98
1050	31.01	31.04	31.07	31.10	31.12	31.15	31.18	31.12	31.24	31.27