4.2 Satellite

4.2.1 Description

Satellite is perhaps the single most important source of weather data world wide, particularly over data sparse regions such as countries without organized weather data collection and the oceans.

GOES satellite imagery can be found on the NWS Aviation Digital Data Service (ADDS) website at: http://adds.aviationweather.noaa.gov/satellite/. Additional satellite imagery for Alaska can be found on the Alaska Aviation Weather Unit (AAWU) website at: http://aawu.arh.noaa.gov/sat.php

4.2.2 Imagery Types

Three types of satellite imagery are commonly used: Visible, infrared (IR), and water vapor. Visible imagery is available only during daylight hours. IR and water vapor imagery are available day or night.

4.2.2.1 Visible Imagery

Visible imagery (Figures 4-16 and 4-17) displays reflected sunlight from the Earth's surface, clouds, and particulate matter in the atmosphere. These images are simply black and white pictures of the Earth from space. During daylight hours, visible imagery is the most widely used image type because it has the highest resolution and approximates what is seen with the human eye.

Gray shades displayed on visible imagery can be correlated with particular features. Assuming a high sun angle, thick clouds and snow will appear white, thin clouds will appear translucent gray, land appears gray, and deep bodies of water such as lakes and oceans will appear black.

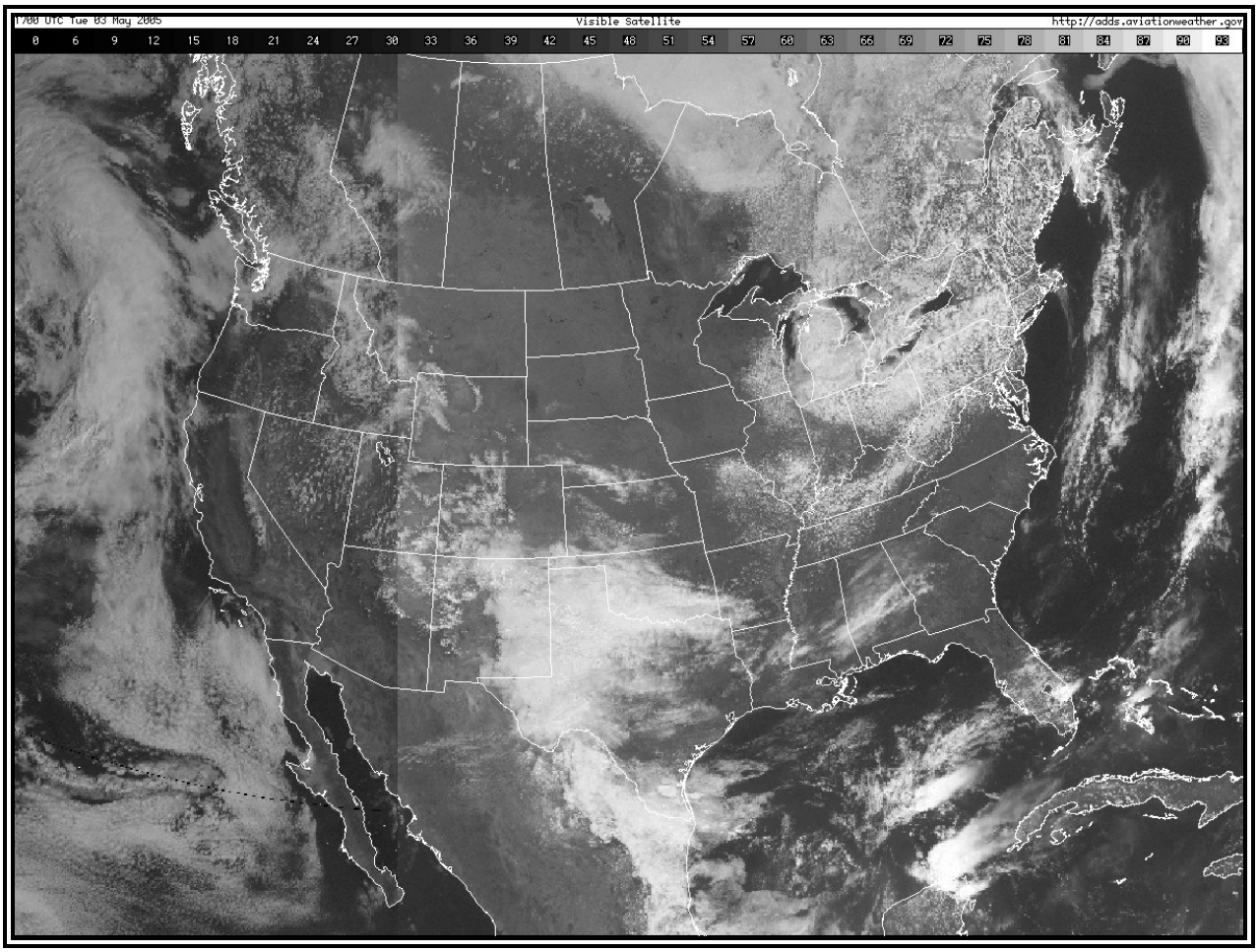


Figure 4-18. Visible Satellite Image – U.S. Example

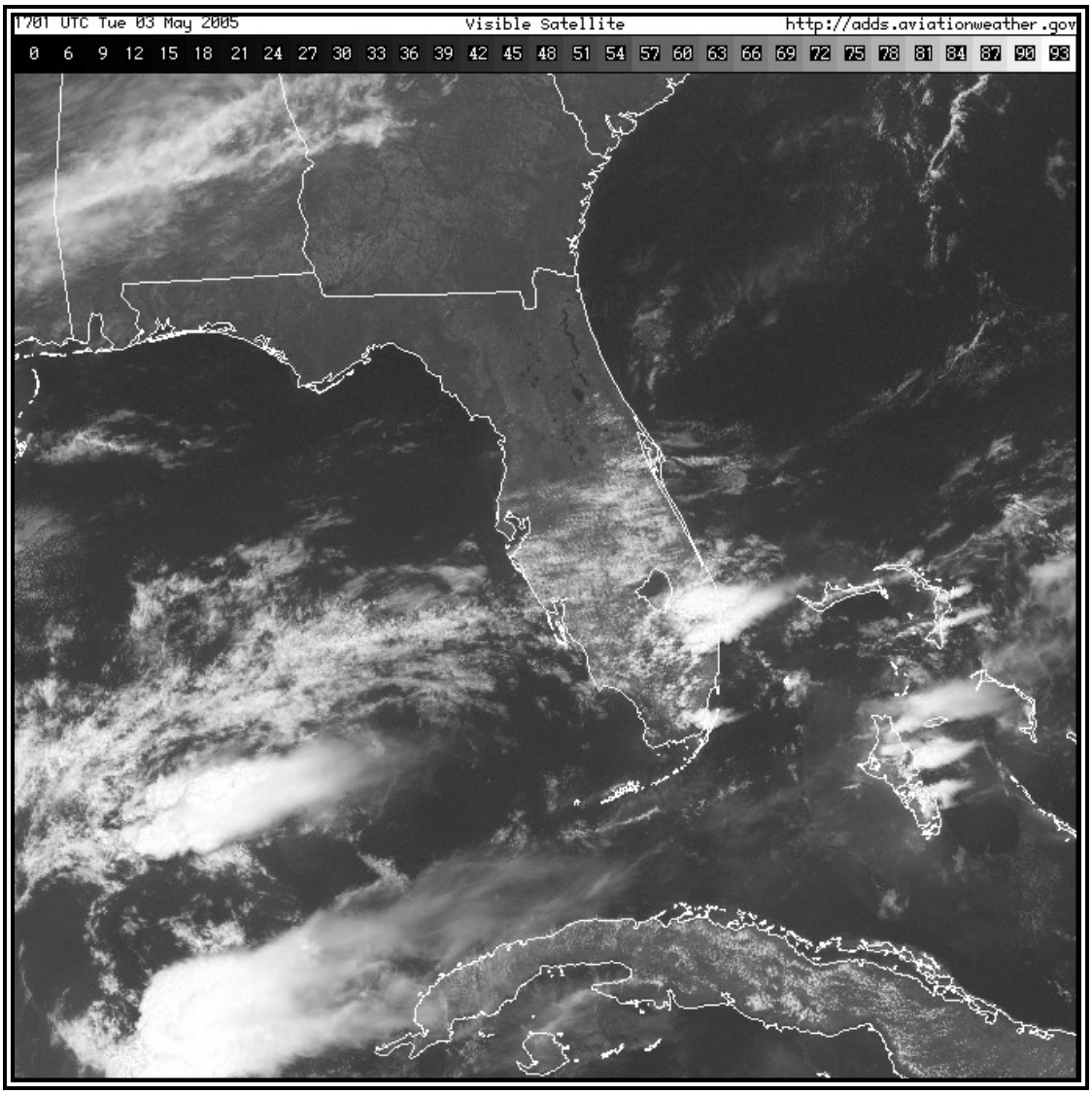


Figure 4-19. Visible Satellite Image – Regional-Scale Example

4.2.2.1.1 Visible Image Data Legend

The data legend (Figure 4-18) on a visible image displays albedo, or reflectance, expressed as a percentage. For example, an albedo of 72 means 72 percent of the sunlight which struck a feature was reflected back to space.

Figure 4-20. Visible Satellite Data Legend.
The gray shades (values) represent albedo or reflectance expressed as a percentage.

4.2.2.2 Infrared (IR) Imagery

Infrared (IR) images (Figure 4-19 through 4-22) display temperatures of the Earth's surface, clouds, and particulate matter. Generally speaking, the warmer an object, the more infrared energy it emits. The satellite sensor measures this energy and calibrates it to temperature using a very simple physical relationship.

Clouds that are very high in the atmosphere are generally quite cold (perhaps -50°C) whereas clouds very near the earth's surface are generally quite warm (perhaps +5°C). Likewise, land may be even warmer than the lower clouds (perhaps +20°C). Those colder clouds emit much less infrared energy than the warmer clouds and the land emits more than those warm clouds.

The data measured by satellite is calibrated and colorized according to the temperature. If the temperature of the atmosphere decreases with height (which is typical), cloud-top temperature can be used to roughly determine which clouds are high-level and which are low-level.

When clouds are present, the temperature displayed on the infrared images is that of the tops of clouds. When clouds are not present, the temperature is that of the ground or the ocean.

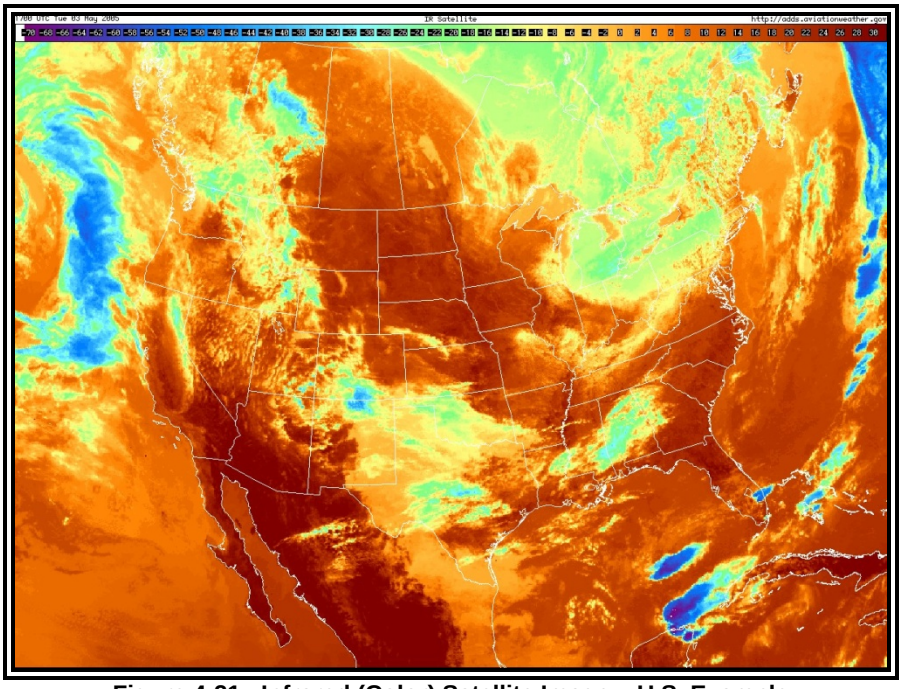


Figure 4-21. Infrared (Color) Satellite Image – U.S. Example
The scale is in degrees Celsius. Blue/purple colors indicate colder temperatures, while orange/red colors indicate warmer temperatures.

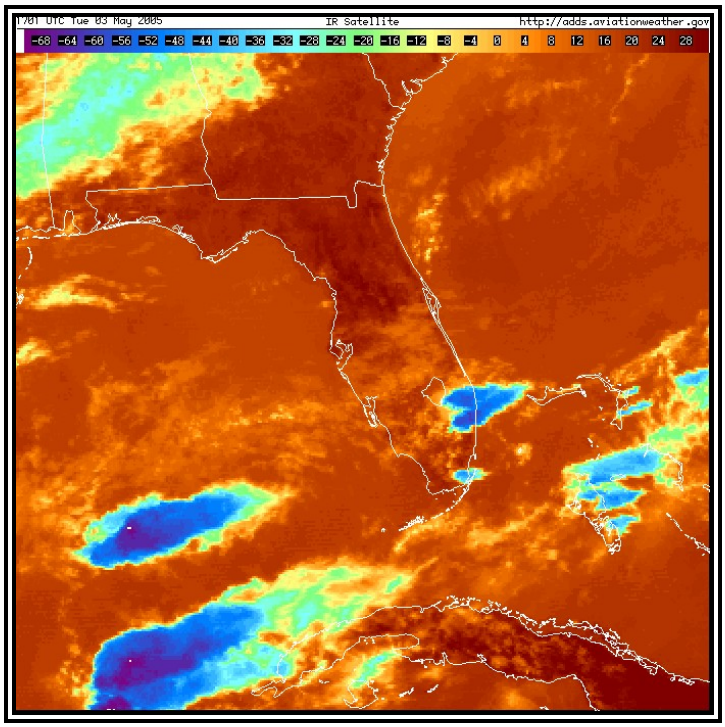


Figure 4-22. Infrared (Color) Satellite Image – Regional-Scale Example
The scale is in degrees Celsius. Blue/purple colors indicate colder temperatures, while orange/red colors indicate warmer temperatures.

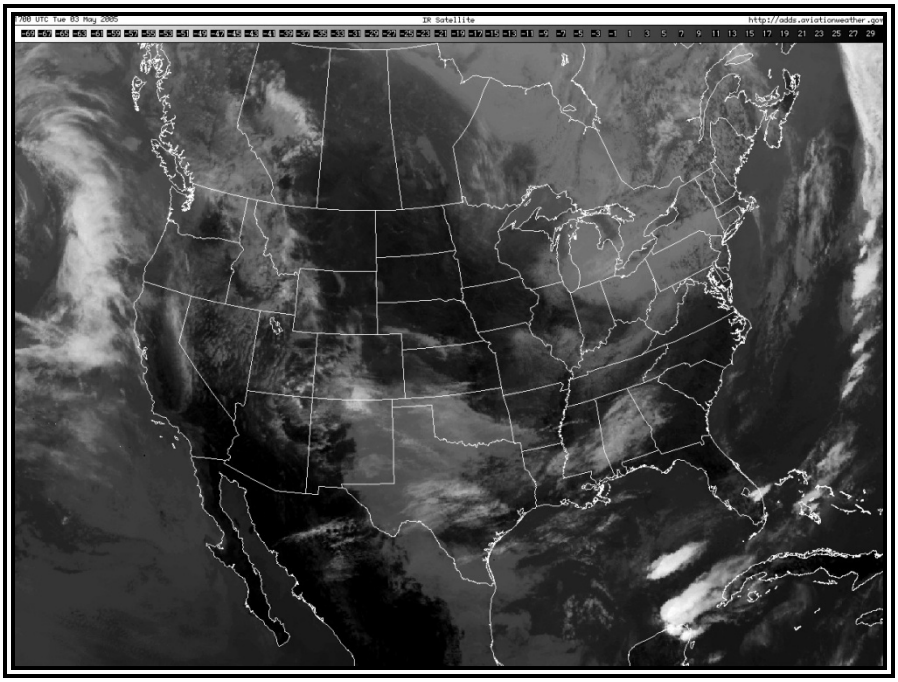


Figure 4-23. Unenhanced Infrared (black and white) Satellite Image – U.S. Example
The scale is in degrees Celsius. Lighter gray shades indicate colder temperatures, while darker gray shades indicate warmer temperatures.

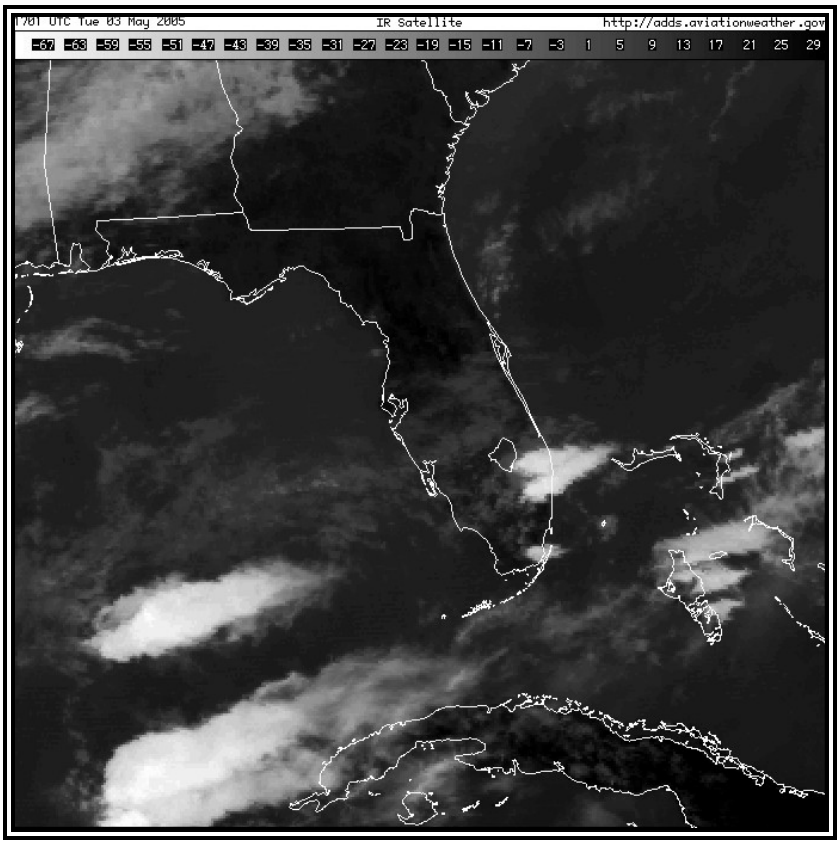


Figure 4-24. Unenhanced Infrared (black and white) Satellite Image – Regional- Scale Example
The scale is in degrees Celsius. Lighter gray shades indicate colder temperatures, while darker gray shades indicate warmer temperatures.

4.2.2.2.1 Infrared Image Data Legends

The data legend (Figure 4-23 and Figure 4-24) on an infrared image is calibrated to temperature expressed in degrees Celsius. The legend may vary based on the satellite image provider.

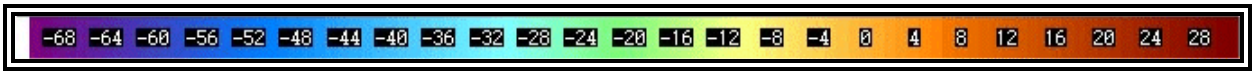


Figure 4-25. Infrared (Color) Satellite Image Data Legend.
The colors (values) represent temperature in degrees Celsius.

Figure 4-26. Unenhanced Infrared (black and while) Satellite Image Data Legend.
The gray shades (values) represent temperature in degrees Celsius.

4.2.3.3 Water Vapor Imagery

The water vapor imagery (Figure 4-25 and Figure 4-26) displays the quantity of water vapor generally located in the middle and upper troposphere within the layer between 700 millibars (FL100) to 200 millibars (FL390). The actual numbers displayed on the water vapor images correspond to temperature in degrees Celsius. No direct relationship exists between these values and the temperatures of clouds, unlike IR imagery. Water Vapor imagery does not really "see" clouds but "sees" high-level water vapor instead.

The most useful information to be gained from the water vapor images is the locations and movements of weather systems, jet streams, and thunderstorms. Another useful tidbit is aided

by the color scale used on the images. In general, regions displayed in shades of red are VERY dry in the upper atmosphere and MAY correlate to crisp blue skies from a ground perspective. On the contrary, regions displayed in shades of blue or green are indicative of lots of high-level moisture and may also indicate cloudiness. This cloudiness could simply be high-level cirrus types or thunderstorms. That determination cannot be gained from this image by itself but could easily be determined when used in conjunction with corresponding visible and infrared satellite images.

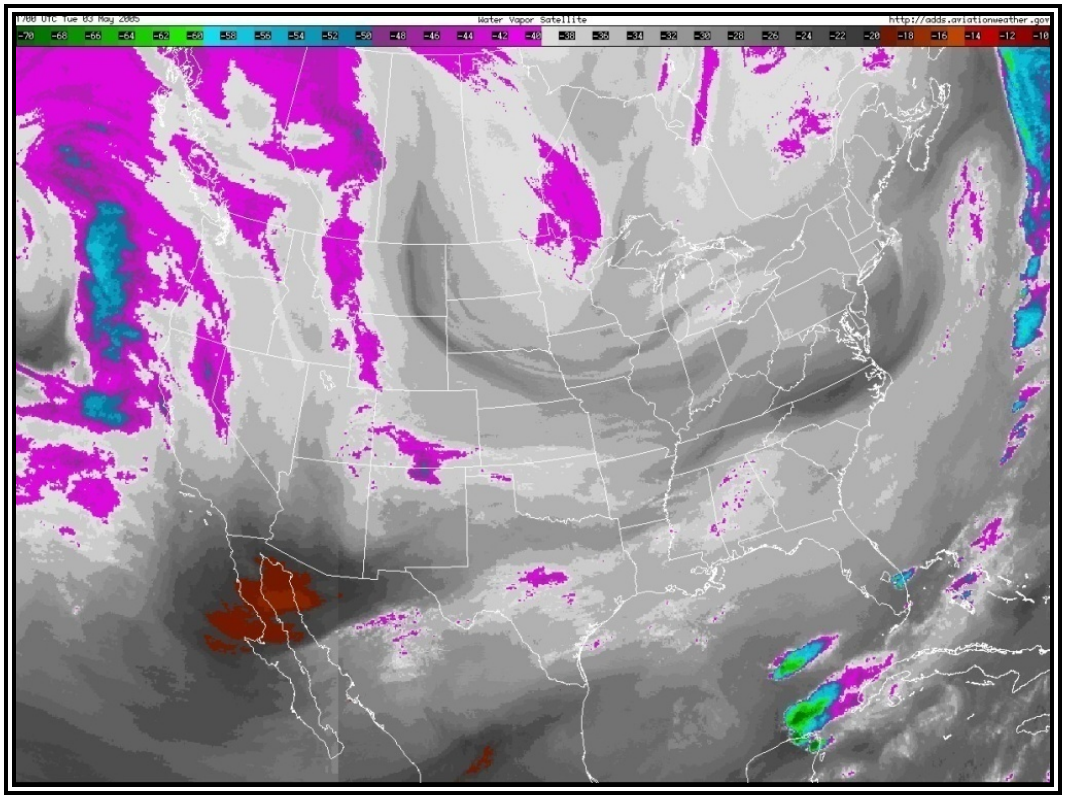


Figure 4-27. Water Vapor Satellite Image – U.S. Example
The scale is in degrees Celsius. Blue/green colors indicate moisture and/or clouds in the mid/upper troposphere, while dark gray/orange/red colors indicate dry air in the mid/upper troposphere.

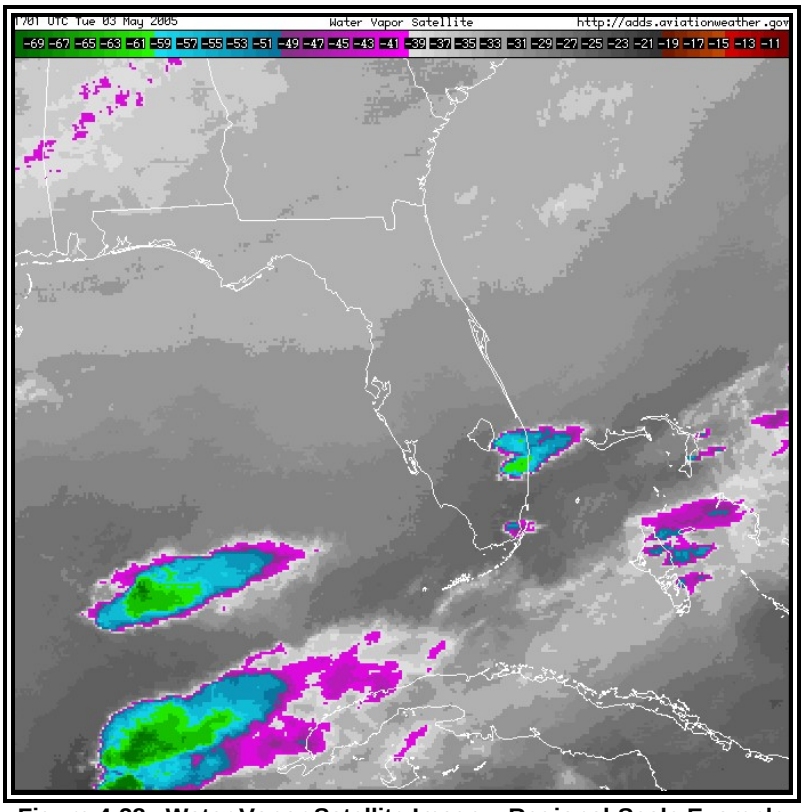


Figure 4-28. Water Vapor Satellite Image – Regional-Scale Example
The scale is in degrees Celsius. Blue/green colors indicate moisture and/or clouds in the mid/upper troposphere, while dark gray/orange/red colors indicate dry air in the mid/upper troposphere.

4.2.3.3.1 Water Vapor Image Data Legend

The data legend (Figure 4-27) on a water vapor images is calibrated to temperature expressed in degrees Celsius. The actual data values on the water vapor images are not particularly useful. Interpretation of the patterns and how they change over time is more important. The legend may vary depending on the satellite image provider.

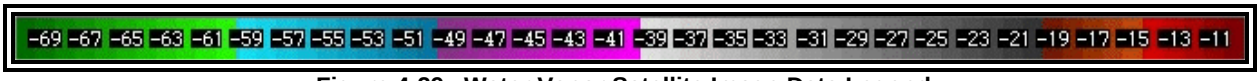


Figure 4-29. Water Vapor Satellite Image Data Legend.
The colors (values) represent temperature in degrees Celsius

5 GRAPHICAL OBSERVATIONS AND DERIVED PRODUCTS

5.1 Surface Analysis Charts

Surface Analysis charts are analyzed charts of surface weather observations. The chart depicts the distribution of several items including sea level pressure, the positions of highs, lows, ridges, and troughs, the location and character of fronts, and the various boundaries such as drylines, outflow boundaries, sea-breeze fronts, and convergence lines. Other symbols are often added depending upon the intended use of the chart. Pressure is referred to in mean sea level (MSL) on the surface analysis chart while all other elements are presented as they occur at the surface point of observation. A chart in this general form is commonly referred to as the weather map.

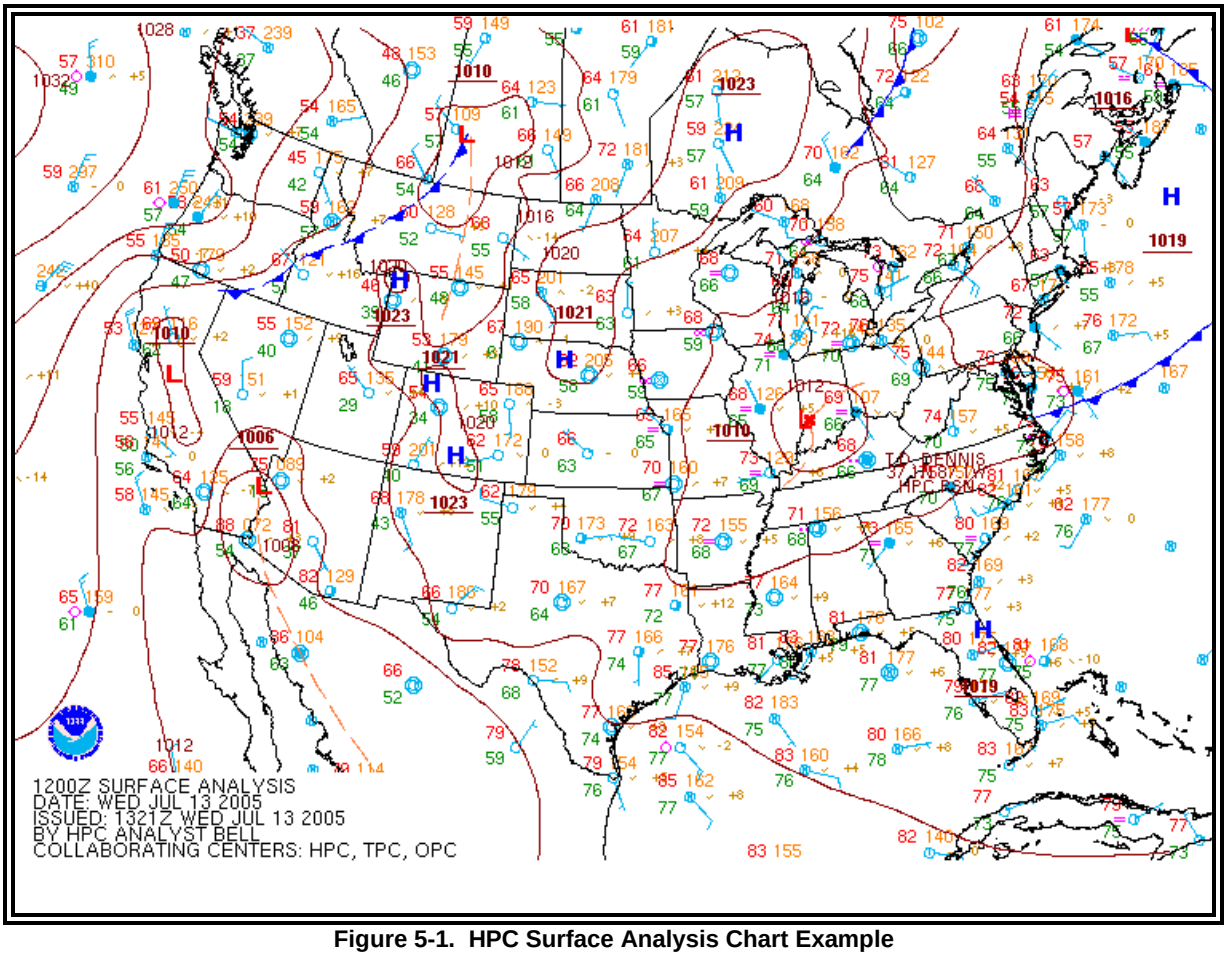


Figure 5-1. HPC Surface Analysis Chart Example

5.1.1 Issuance

Five National Weather Service (NWS) offices issue surface analysis charts:

- The Hydrometeorological Prediction Center (HPC) in Camp Springs, Maryland is responsible for land areas of North America. The charts are available at
  - http://www.hpc.ncep.noaa.gov/html/sfc2.shtml
  - http://www.hpc.ncep.noaa.gov/html/avnsfc.shtml

- The Ocean Prediction Center (OPC) in Camp Spring, Maryland is responsible for the Atlantic and Pacific Oceans north of 30°N latitude. The charts are available at:
  - http://www.opc.ncep.noaa.gov/

- The Tropical Prediction Center (TPC) in Miami, Florida is responsible for the tropical regions of the western hemisphere south of 30°N latitude and east of 160°E longitude. The surface analysis charts are available at:
  - http://www.nhc.noaa.gov/marine_forecasts.shtml

- The Alaskan Aviation Weather Unit (AAWU) in Anchorage, Alaska is responsible for the state of Alaska. The surface analysis chart is available at:
  - http://aawu.arh.noaa.gov/surface.php

- The Weather Forecast Office in Honolulu, Hawaii (WFO HNL) is responsible for the tropical Pacific Ocean, south of 30°N latitude and west of 160°E longitude. The charts are available at:
  - http://www.prh.noaa.gov/hnl/pages/analyses.php

Each office produces multiple versions of the surface analysis chart with varying formats.

5.1.2 HPC Surface Analysis Charts

- The Hydrometeorological Prediction Center (HPC) in Camp Springs, Maryland is responsible for land areas of North America. The charts are available at
  - http://www.hpc.ncep.noaa.gov/html/sfc2.shtml
  - http://www.hpc.ncep.noaa.gov/html/avnsfc.shtml

5.1.2.1 Issuance

The Hydrometeorological Prediction Center (HPC) issues Surface Analysis Charts for North America eight times daily (Table 5-1).

Table 5-1. HPC Surface Analysis Charts Issuance Schedule

Valid Time (UTC)	00	03	06	09	12	15	18	21

5.1.2.2 Analysis Symbols

Figure 5-2 shows analysis symbols used on HPC surface analysis charts:

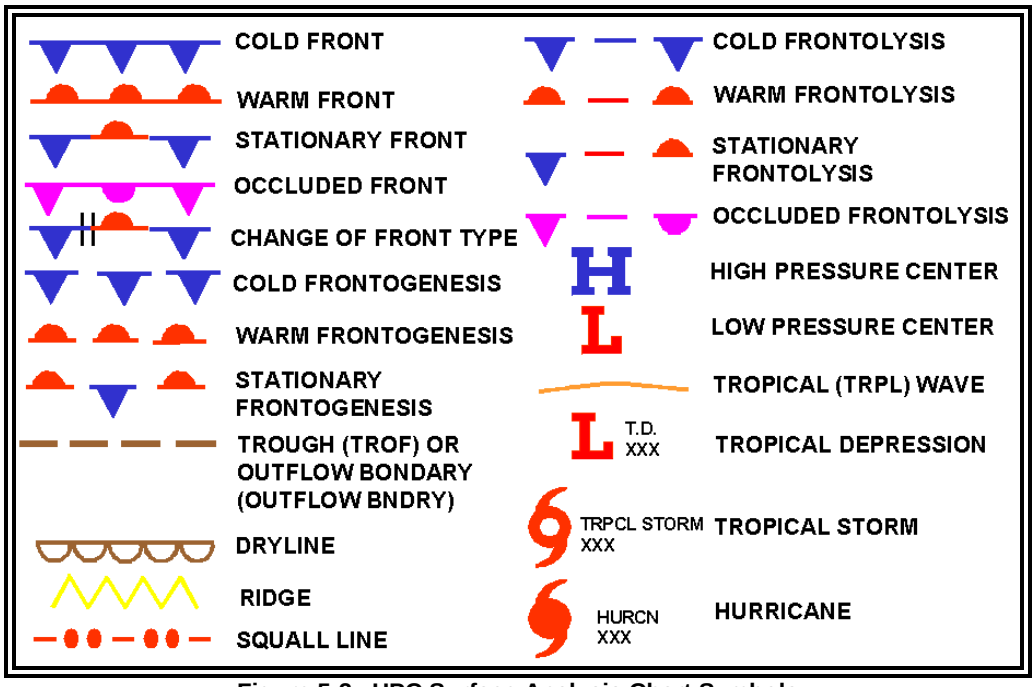


Figure 5-2. HPC Surface Analysis Chart Symbols

5.1.2.3 Station Plot Models

Land, ship, buoy, and C-MAN stations are plotted on the chart to aid in analyzing and interpreting the surface weather features. These plotted observations are referred to as station models. Some stations may not be plotted due to space limitations. However, all reporting stations are used in the analysis.

Figure 5-3 and 5-4 contain the most commonly used station plot models used in surface analysis charts:

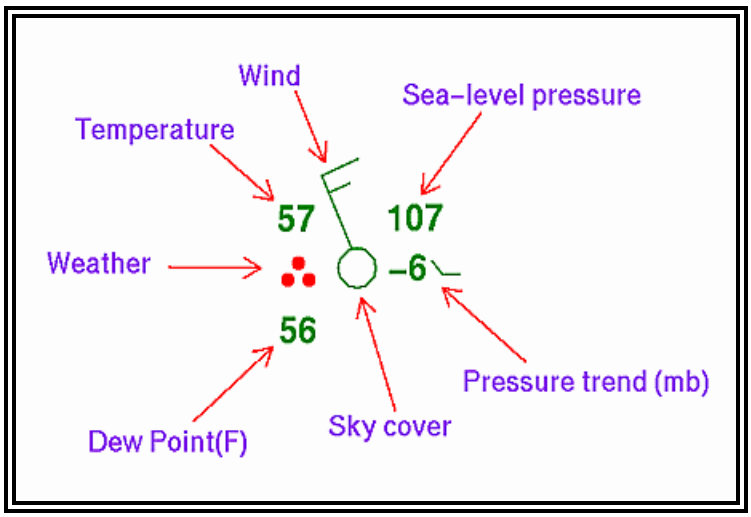


Figure 5-3. HPC Surface Analysis Chart Station Plot Model

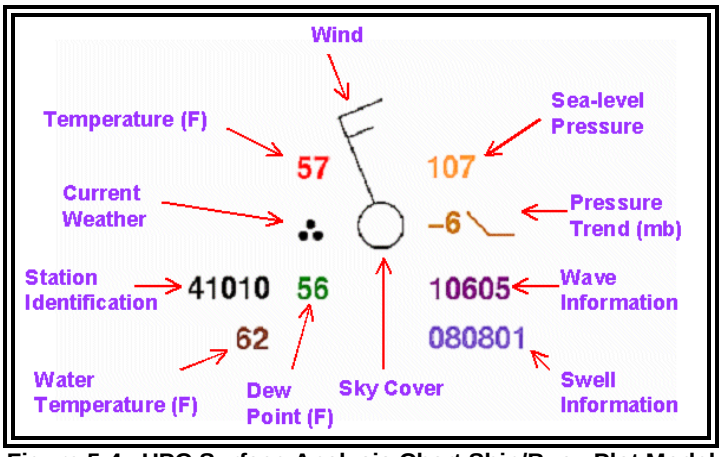


Figure 5-4. HPC Surface Analysis Chart Ship/Buoy Plot Model

HPC also produces surface analysis charts specifically for the aviation community. Figure 5-5 contains the station plot model for these charts:

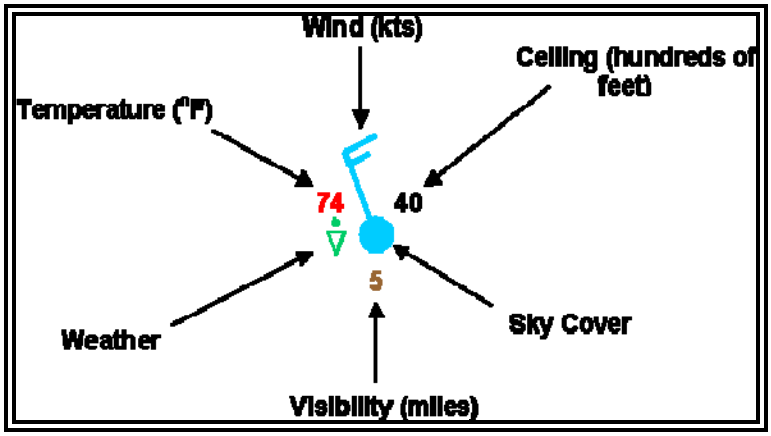


Figure 5-5. HPC Surface Analysis Chart for Aviation Interests Station Plot Model

5.1.2.3.1 Station Identifier

The format of the station identifier depends on the observing platform.

- Ship -- Typically 4 or 5 characters. If 5 characters, then the fifth will usually be a digit.
- Buoy -- Whether drifting or stationary, a buoy will have a 5-digit identifier. The first digit will always be a **4**.
- C-MAN -- Stands for Coastal-Marine Automated Network, and are usually close to coastal areas. Their identifier will appear like a 5-character ship identifier, however the 4th character will identify off which state the platform is located.
- Land -- Land stations will always be 3 characters, making them easily distinguishable from ship, buoy, and C-MAN observations.

5.1.2.3.2 Temperature

The air temperature is plotted in whole degrees Fahrenheit.

5.1.2.3.3 Dew Point

The dew point temperature is plotted in whole degrees Fahrenheit.

5.1.2.3.4 Weather

A weather symbol is plotted if, at the time of observation, precipitation is either occurring or a condition exists causing reduced visibility.

Figure 5-6 contains a list of the most common weather symbols:

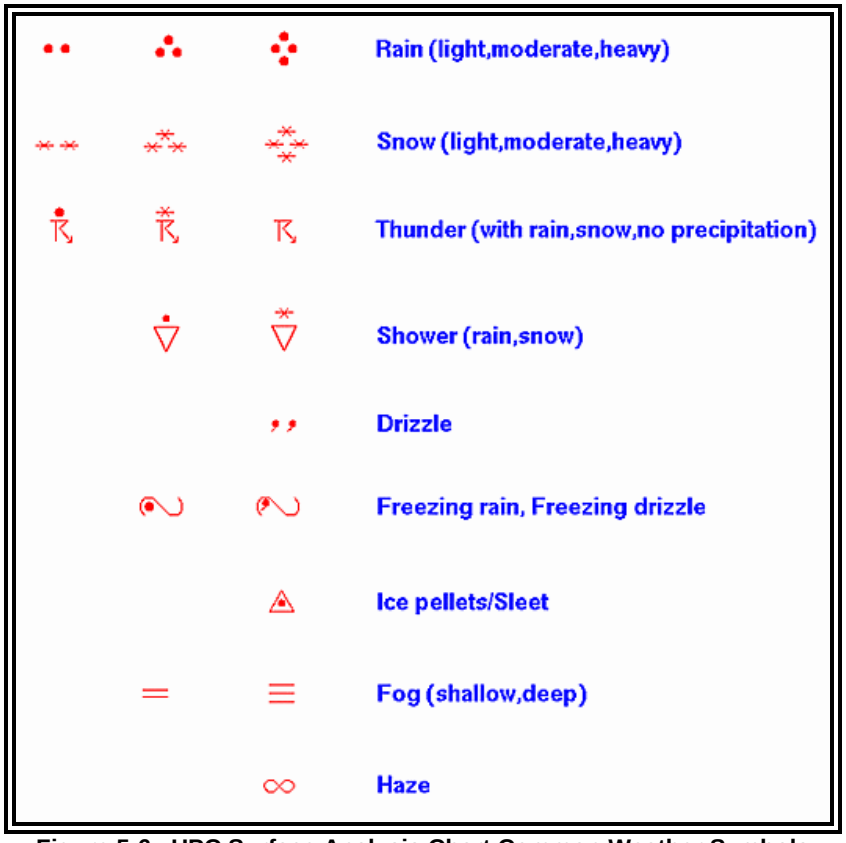


Figure 5-6. HPC Surface Analysis Chart Common Weather Symbols

A complete list of weather symbols can be found at in Appendix I.

5.1.2.3.5 Wind

Wind is plotted in increments of 5 knots (kts). The wind direction is in "true" degrees and is depicted by a stem (line) pointed in the direction from which the wind is blowing. Wind speed is determined by adding the values of the flags (50kts), barbs (10kts), and half-barbs (5kts) found on the stem.

If the wind is calm at the time of observation, only a single circle over the station is depicted.

Figure 5-7 are some sample wind symbols:

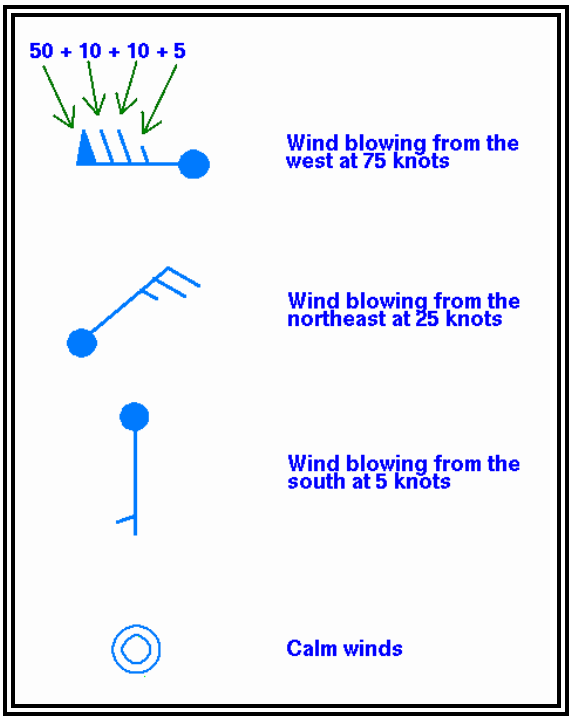


Figure 5-7. HPC Surface Analysis Chart Wind Plotting Model

5.1.2.3.6 Ceiling

Ceiling is plotted in hundreds of feet above ground level.

5.1.2.3.7 Visibility

Surface visibility is plotted in whole statute miles.

5.1.2.3.8 Pressure

Sea-level pressure is plotted in tenths of millibars (mb), with the first two digits (generally 10 or 9) omitted. For reference, 1013 mb is equivalent to 29.92 inches of mercury. Below are some sample conversions between plotted and complete sea-level pressure values:

410: 1041.0 mb
103: 1010.3 mb
987: 998.7 mb
872: 987.2 mb

5.1.2.3.9 Pressure Trend

The pressure trend has two components, a number and a symbol, to indicate how the sea level pressure has changed during the past three hours. The number provides the 3-hour change in tenths of millibars while the symbol provides a graphic illustration of how this change occurred.

Figure 5-8 contains the meanings of the pressure trend symbols:

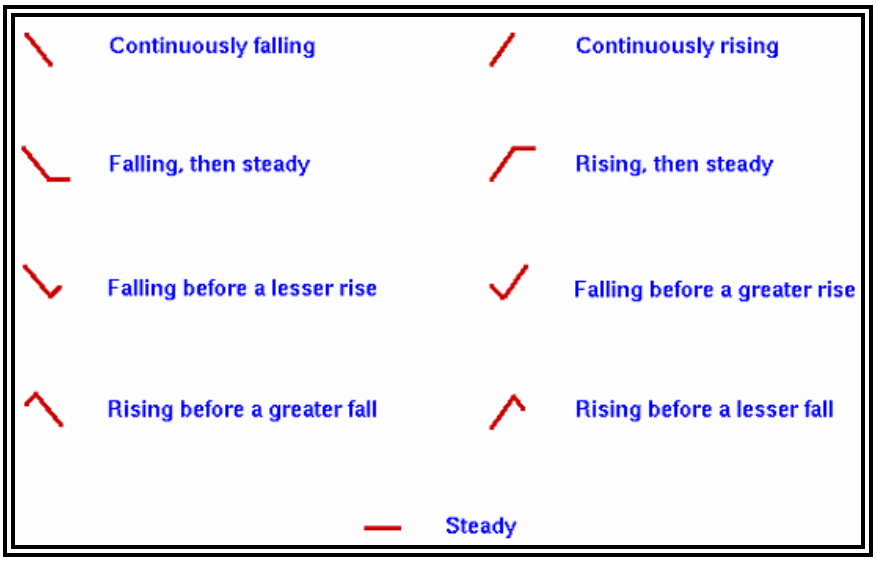


Figure 5-8. HPC Surface Analysis Chart Pressure Trends

5.1.2.3.10 Sky Cover

The approximate amount of sky cover can be determined by the circle at the center of the station plot. The amount the circle is filled reflects the amount of sky covered by clouds. Figure 5-9 contains the common cloud cover depictions:

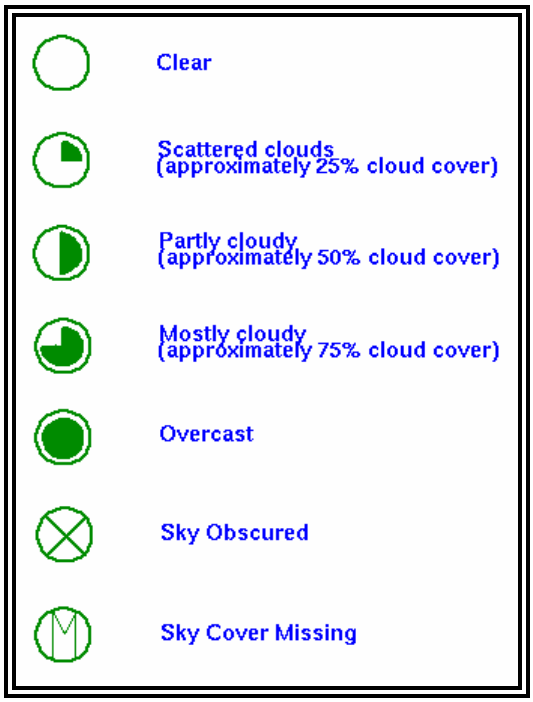


Figure 5-9. HPC Surface Analysis Chart Sky Cover Symbols

5.1.2.3.11 Water Temperature

Water temperature is plotted in whole degrees Fahrenheit.

5.1.2.3.12 Swell Information

Swell direction, period, and height are represented in the surface observations by a 6-digit code. The first two digits represent the swell direction, the middle digits describe the swell period (in seconds), and the last two digits are the swell's height (in half meters).

090703
09 - The swell direction is from 90 degrees (i.e. it is coming from due east).
07 - The period of the swell is 7 seconds.
03 - The height of the swell is 3 half meters.

271006
27 - The swell direction is from 270 degrees (due west).
10 - The period is 10 seconds.
06 - The height of the swell is 6 half meters.

5.1.2.3.13 Wave Information

Period and height of waves are represented by a 5-digit code. The first digit is always **1**. The second and third digits describe the wave period (in seconds), and the final two digits give the wave height (in half meters).

10603
1 - A group identifier. The first digit will always be **1**.
06 - The wave period is 6 seconds.
03 - The wave height is 3 half meters.

10515
1 - The group identifier again.
05 - The wave period is 5 seconds.
15 - Wave height is 15 half meters.

In some charts by the OPC, only the wave height (in feet) is plotted.

5.1.2.4 Analyses

Isobars, pressure systems, and fronts are the most common analyses depicted on surface analysis charts.

5.1.2.4.1 Isobars

An isobar is a line of equal or constant pressure commonly used in the analysis of pressure patterns.

On a Surface Analysis Chart, isobars are solid lines usually spaced at intervals of 4 millibars (mb). Each isobar is labeled. For example, **1032** signifies 1,032.0 mb and **992** signify 992.0 mb.

METAR/SPECI (Section 2.1) reports pressure in hectopascals. However, one millibar is equivalent to one hectopascal, so no conversion is required.

5.1.2.4.2 Pressure Systems

On a Surface Analysis Chart, a High (**H**) is a maximum of atmospheric pressure, while a Low (**L**) is a minimum of atmospheric pressure. Central pressure is the atmospheric pressure located at the center of a High or Low. In general, the central pressure is the highest pressure in the center of a High and the lowest pressure at the center of a Low. The central pressure is denoted near each pressure center.

A trough or an elongated area of low atmospheric pressure is denoted by dashed lines and identified with the word **TROF.** A ridge or an elongated area of high atmospheric pressure is denoted by saw-toothed symbols. Ridges are rarely denoted on charts produced by the HPC.

Tropical storms, hurricanes, and typhoons (See Figure 5-2) are low-pressure systems with their names and central pressures denoted.

5.1.2.4.3 Fronts

The analysis shows positions and types of fronts by the symbols in Figure 5-2. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. Two short lines across a front indicate a change in front type.

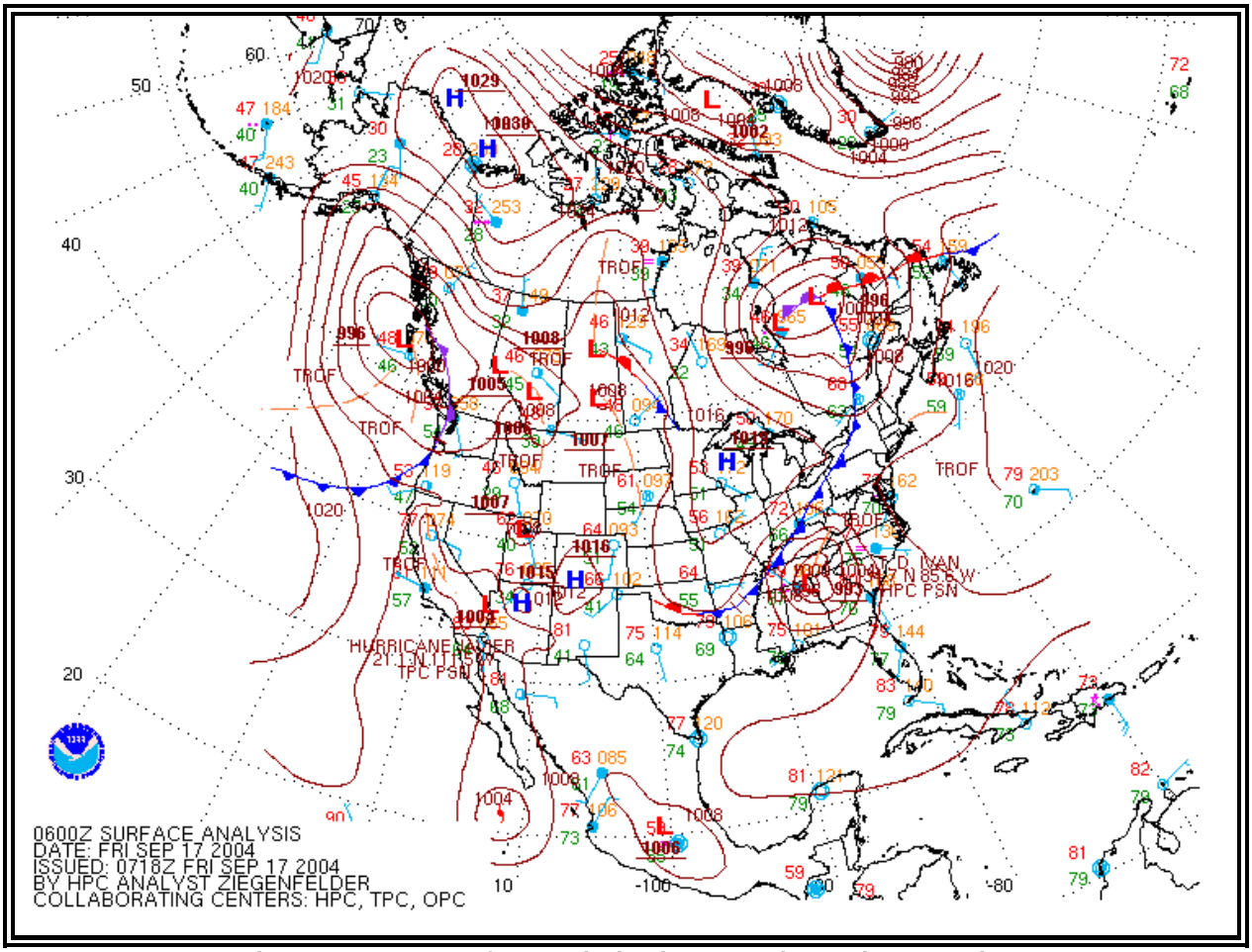


Figure 5-10. HPC Surface Analysis Chart – North America Example

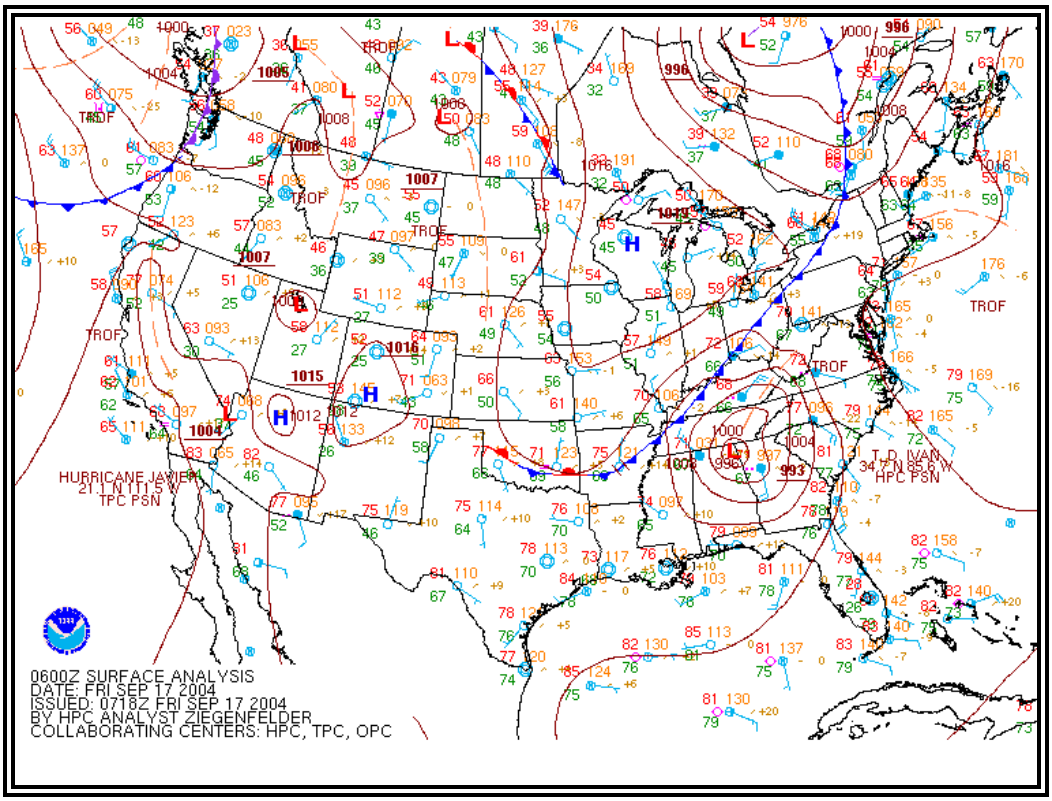


Figure 5-11. HPC Surface Analysis Chart - Contiguous U.S. Example

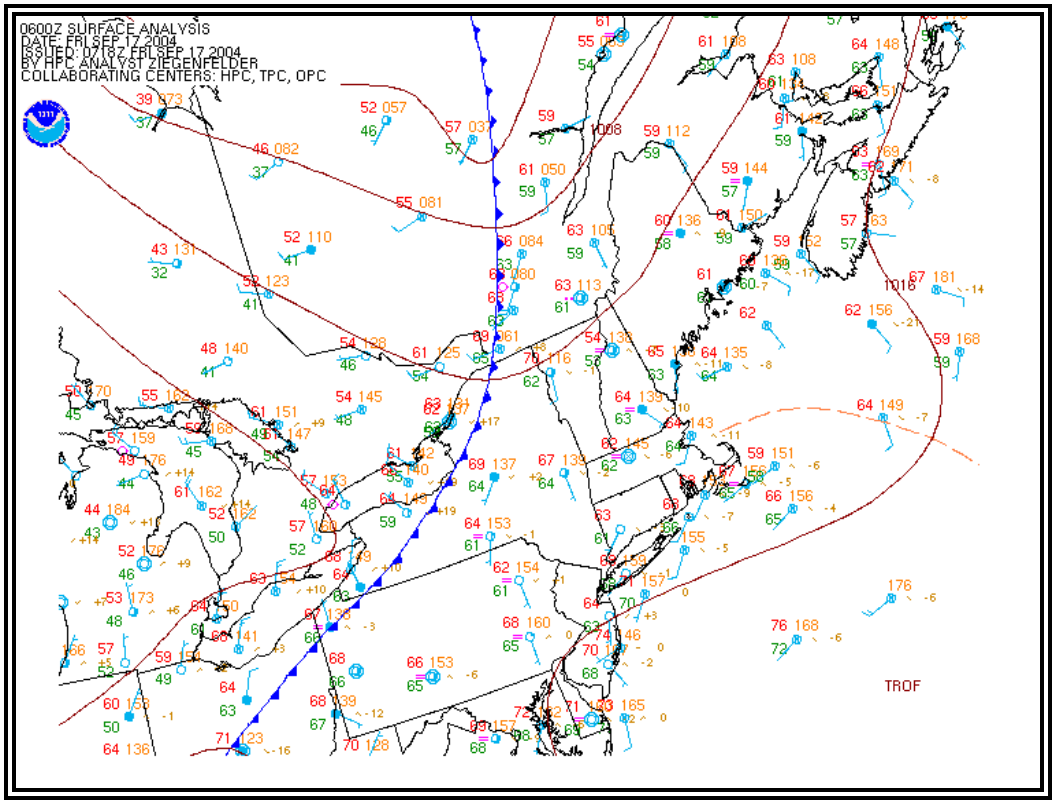


Figure 5-12. HPC Surface Analysis Chart - Northeast U.S. Example

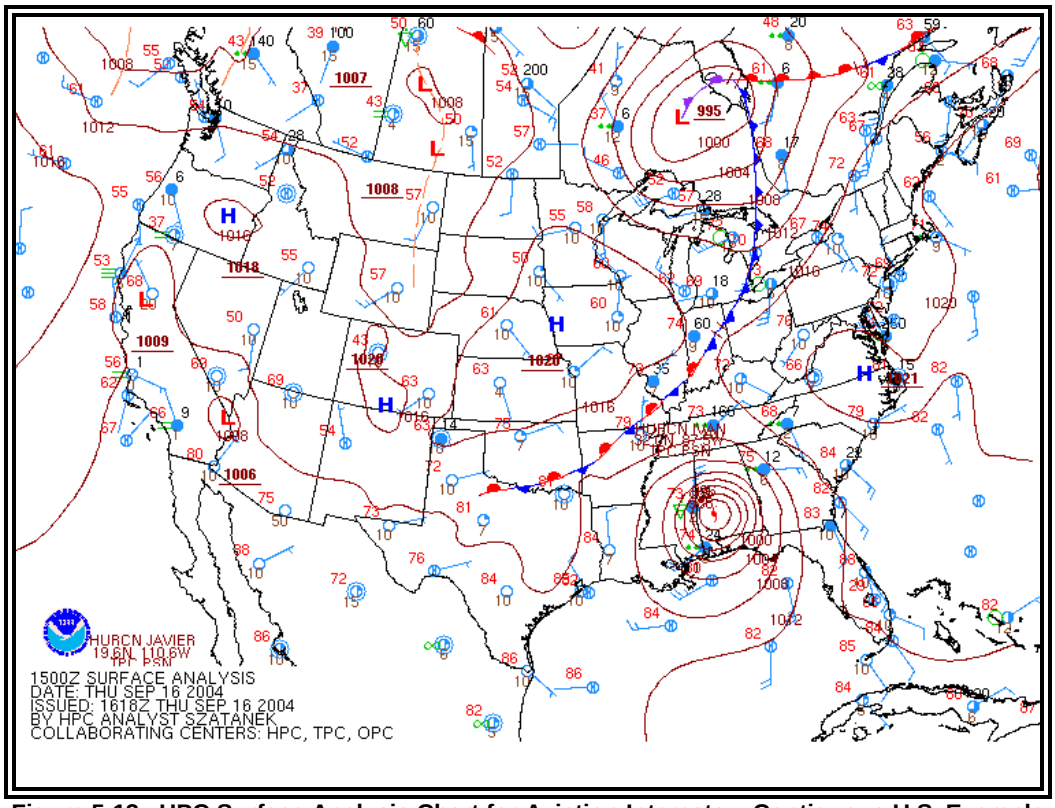


Figure 5-13. HPC Surface Analysis Chart for Aviation Interests – Contiguous U.S. Example

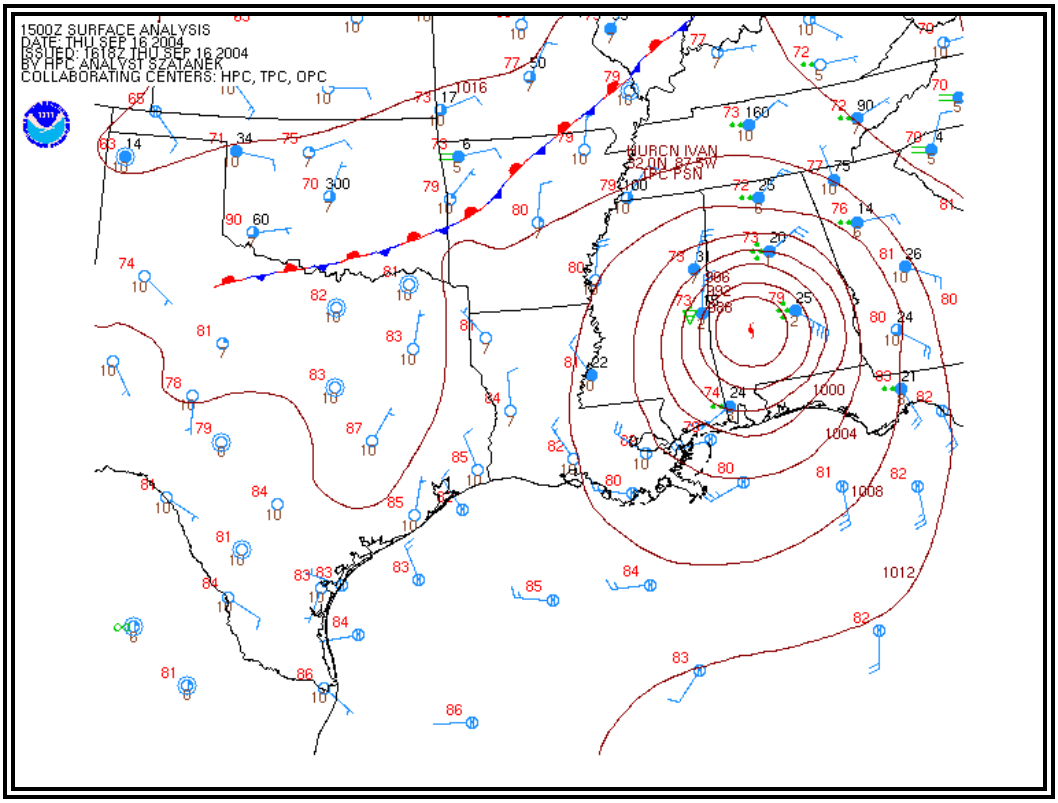


Figure 5-14. HPC Surface Analysis Chart for Aviation Interests – South central U.S. Example

5.1.3 OPC and WFO Honolulu Surface Analysis Charts

The Ocean Prediction Center (OPC) in Camp Spring, Maryland is responsible for the Atlantic and Pacific Oceans north of 30°N latitude. The charts are found at:

- http://www.opc.ncep.noaa.gov/

The Weather Forecast Office in Honolulu, Hawaii (WFO HNL) is responsible for the tropical Pacific Ocean, south of 30°N latitude and west of 160°E longitude. The charts are found at:

- http://www.prh.noaa.gov/hnl/pages/analyses.php

5.1.3.1 Issuance

The Ocean Prediction Center (OPC) produces surface analysis charts for the Atlantic and Pacific Oceans north of 30°N latitude four times daily (Table 5-2). The Weather Forecast Office in Honolulu, Hawaii (WFO HNL) issues surface analysis charts for the tropical Pacific Ocean, south of 30°N latitude and west of 160°E longitude four times daily. Surface analysis charts for the North Pacific are jointly issued by both offices.

Table 5-2. OPC and WFO Honolulu Surface Analysis Charts Issuance Schedule

UTC	00	06	12	18

5.1.3.2 Analysis Symbols

Figure 5-15 shows analysis symbols used on OPC and WFO HNL surface analysis charts.

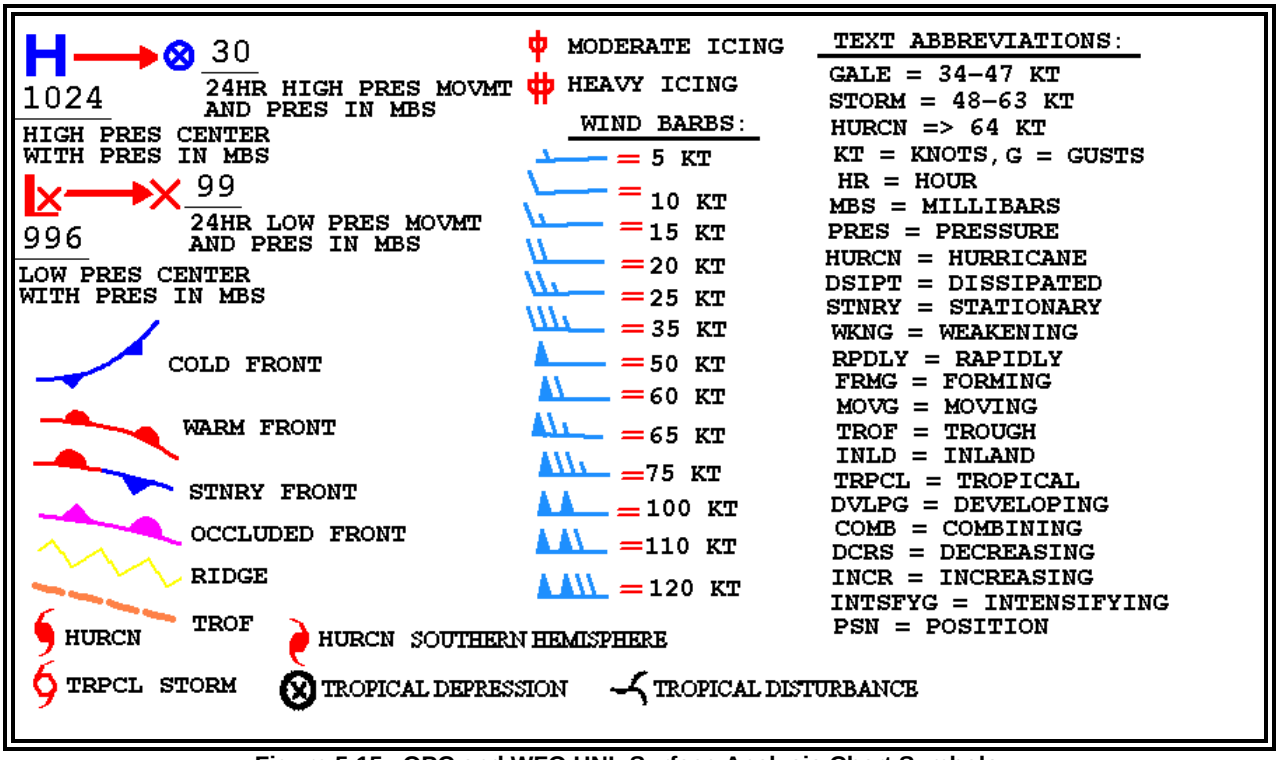


Figure 5-15. OPC and WFO HNL Surface Analysis Chart Symbols

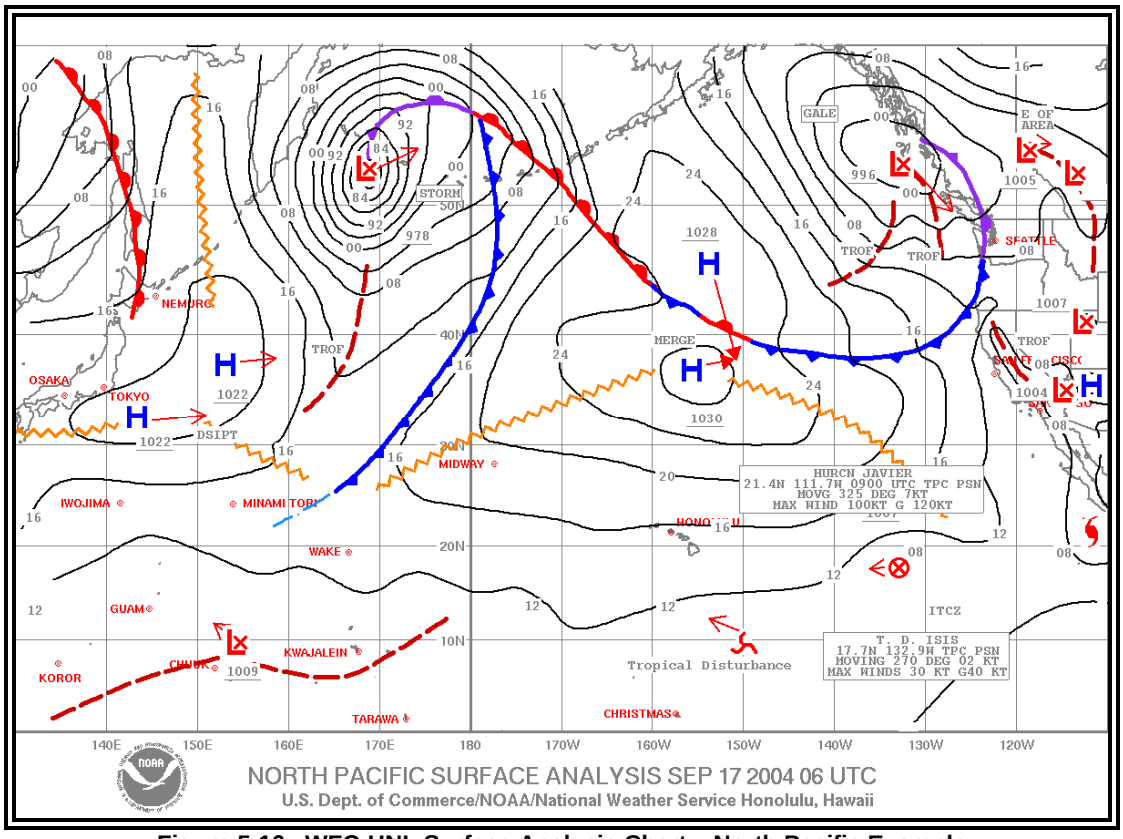


Figure 5-16. WFO HNL Surface Analysis Chart – North Pacific Example

5.1.3.3 Wave Information

Period and height of waves are represented by a 5-digit code. The first digit is always **1**. The second and third digits describe the wave period (in seconds), and the final two digits give the wave height (in half meters). Below are two examples:

10603

1 - A group identifier. The first digit will always be **1**.
06 - The wave period is 6 seconds.
03 - The wave height is 3 half meters.

10515

1 - The group identifier again.
05 - The wave period is 5 seconds.
15 - Wave height is 15 half meters.

In certain charts by the OPC, only the wave height (in feet) is plotted.

5.1.3.4 Analyses

Isobars, pressure systems, and fronts are the most common analyses depicted on the surface analysis charts.

5.1.3.4.1 Isobars

An isobar is a line of equal or constant pressure commonly used to analyze pressure patterns.

On a Surface Analysis Chart, isobars are solid lines usually spaced at intervals of 4 millibars (mb). Each isobar is labeled. For example, **1032** signifies 1,032.0 mb and **992** signify 992.0 mb.

METAR/SPECI (Section 2.1) reports pressure in hectopascals. However, one millibar is equivalent to one hectopascal, so no conversion is required.

5.1.3.4.2 Pressure Systems

On a Surface Analysis Chart, a High (**H**) is a maximum of atmospheric pressure, while a Low (**L**) is a minimum of atmospheric pressure. Central pressure is the atmospheric pressure at the center of a High or Low -- the highest pressure in a High and the lowest pressure in a Low. The central pressure is denoted near each pressure center. Tropical storms, hurricanes, and typhoons (See Figure 5-15) are low-pressure systems with their names and central pressures denoted.

A trough or an elongated area of low atmospheric pressure is denoted by dashed lines and identified with the word **TROF**. A ridge or an elongated area of high atmospheric pressure is denoted with saw-toothed symbols. Ridges are rarely denoted on charts produced by the HPC.

5.1.3.4.3 Fronts

The analysis shows positions and types of fronts by the symbols in Figure 5-15. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. Two short lines across a front indicate a change in front type.

5.1.4 TPC Surface Analysis Charts

The Tropical Prediction Center (TPC) in Miami, Florida is responsible for the tropical regions of the western hemisphere south of 30°N latitude and east of 160°E longitude. The surface analysis chart is located at:

- http://www.nhc.noaa.gov/marine_forecasts.shtml

5.1.4.1 Issuance

The Tropical Prediction Center (TPC) issues Surface Analysis Charts for tropical regions of the western hemisphere south of 30°N latitude and east of 160°E longitude four times a day (Table 5-3).

Table 5-3. TPC Surface Analysis Charts Issuance Schedule

Valid Time (UTC)	00	06	12	18

5.1.4.2 Analysis Symbols

Figure 5-17 shows analysis symbols used on TPC surface analysis charts.

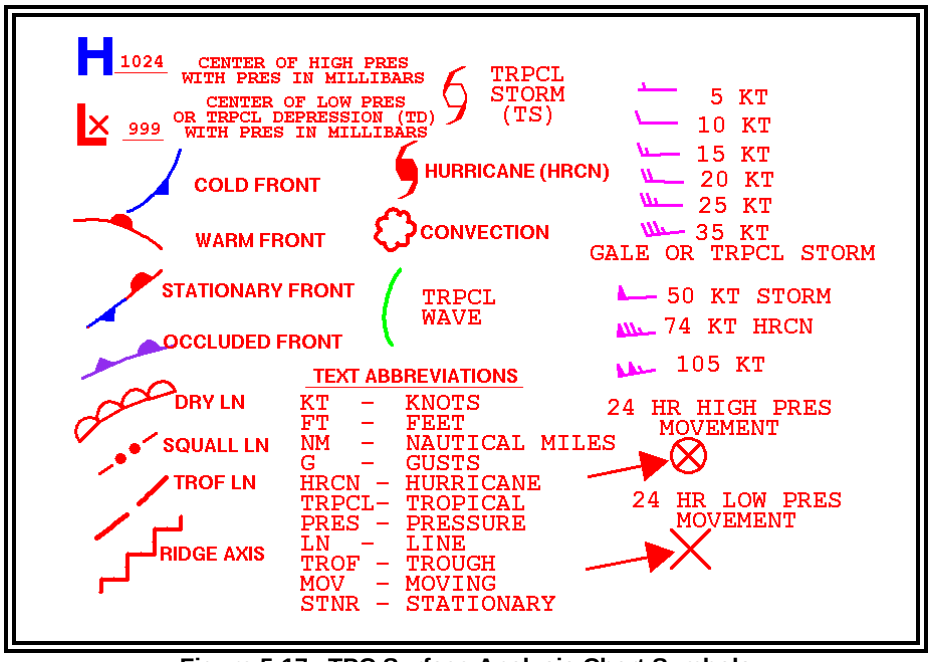


Figure 5-17. TPC Surface Analysis Chart Symbols

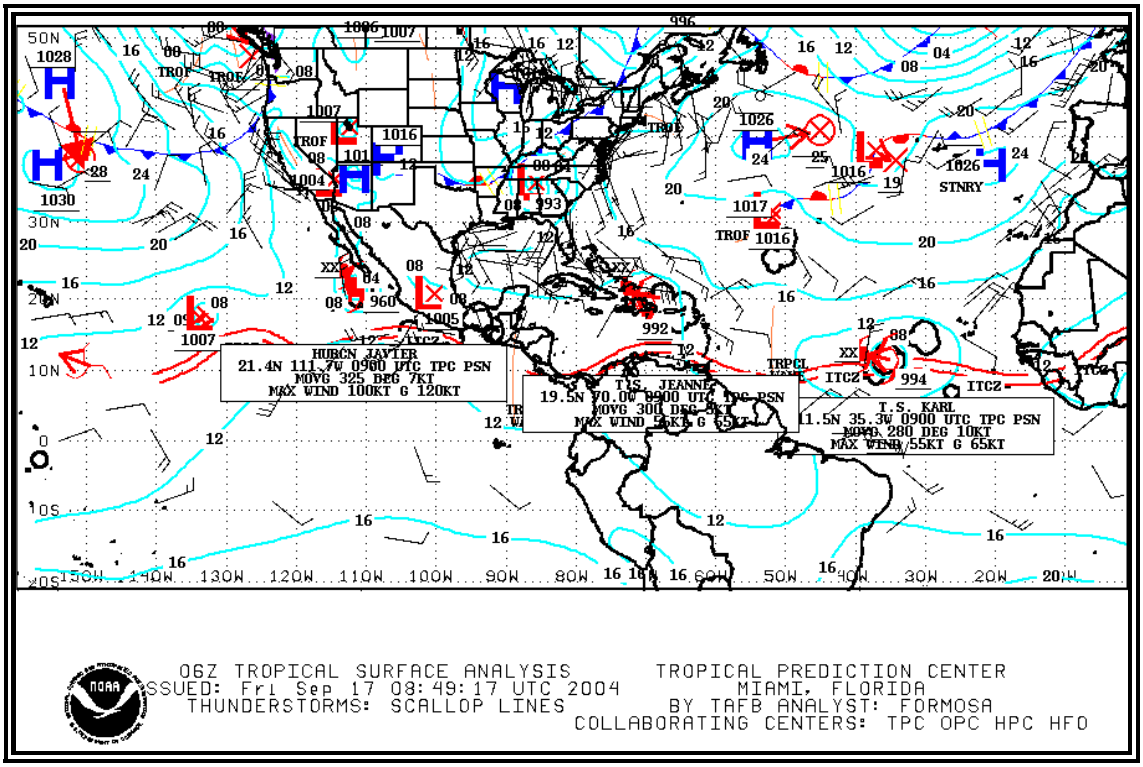


Figure 5-18. TPC Tropical Surface Analysis Chart Example

5.1.4.2.1 Wind

Wind is plotted in increments of 5 knots (kts). The wind direction is in "true" degrees and is depicted by a stem (line) pointed in the direction from which the wind is blowing. The wind speed is determined by adding up the value of the flags (50 kts), lines (10 kts), and half-lines (5 kts), each of which has the following individual values:

A single circle over the station with no wind symbol indicates a calm wind.

Figure 5-19 shows some sample wind symbols:

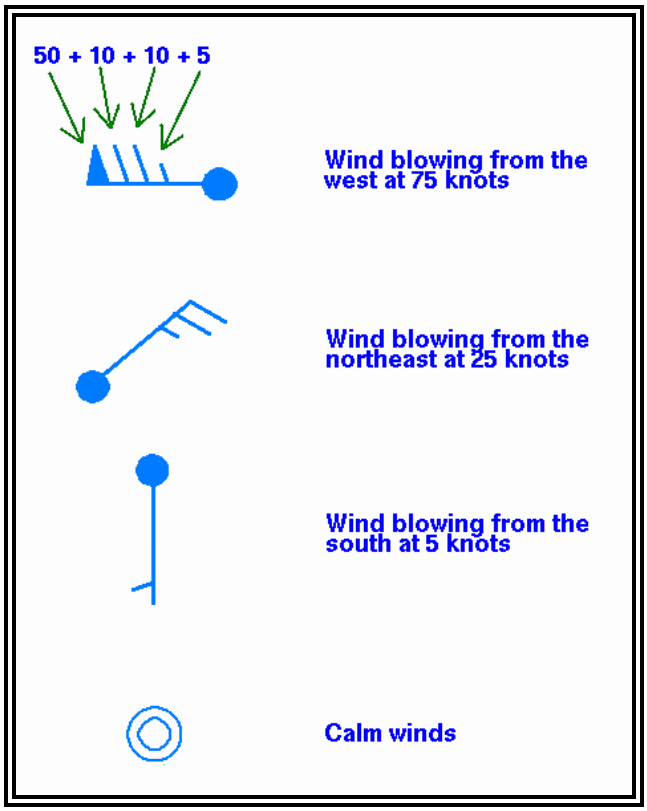


Figure 5-19: TPC Surface Analysis Chart Wind Plotting Model

5.1.4.3 Analyses

Isobars, pressure systems, and fronts are the most common analyses depicted on the surface analysis charts.

5.1.4.3.1 Isobars

An isobar is a line of equal or constant pressure commonly used to analyze pressure patterns.

On a Surface Analysis Chart, isobars are solid lines usually spaced at intervals of 4 millibars (mb). Each isobar is labeled. For example, **1032** signifies 1,032.0 mb and **992** signify 992.0 mb.

METAR/SPECI (Section 2.1) reports pressure in hectopascals. However, one millibar is equivalent to one hectopascal, so no conversion is required.

5.1.4.3.2 Pressure Systems

On a Surface Analysis Chart, a High (**H**) is a maximum of atmospheric pressure, while a Low (**L**) is a minimum of atmospheric pressure. Central pressure is the atmospheric pressure at the center of a High or Low -- the highest pressure in a High and the lowest pressure in a Low. The central pressure is denoted near each pressure center. Tropical storms, hurricanes, and

typhoons (See Figure 5-17) are low-pressure systems with their names and central pressures denoted.

A trough or an elongated area of low atmospheric pressure is denoted by dashed lines and identified with the word **TROF**. A ridge or an elongated area of high atmospheric pressure is denoted by saw-toothed symbols. Ridges are rarely denoted on charts produced by the TPC.

5.1.4.3.3 Fronts

The analysis shows positions and types of fronts by the symbols in Figure 5-17. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. Two short lines across a front indicate a change in front type.

5.1.5 Unified Surface Analysis Chart

The Unified Surface Analysis Chart is a composite of all the surface analysis charts produced by HPC, OPC, TPC and WFO Honolulu. It contains an analysis of isobars, pressure systems and fronts.

5.1.5.1 Issuance

The chart is issued four times daily by the OPC (see Table 5-4).

Table 5-4. Unified Surface Analysis Chart Issuance Schedule

Valid Time (UTC)	00	06	12	18

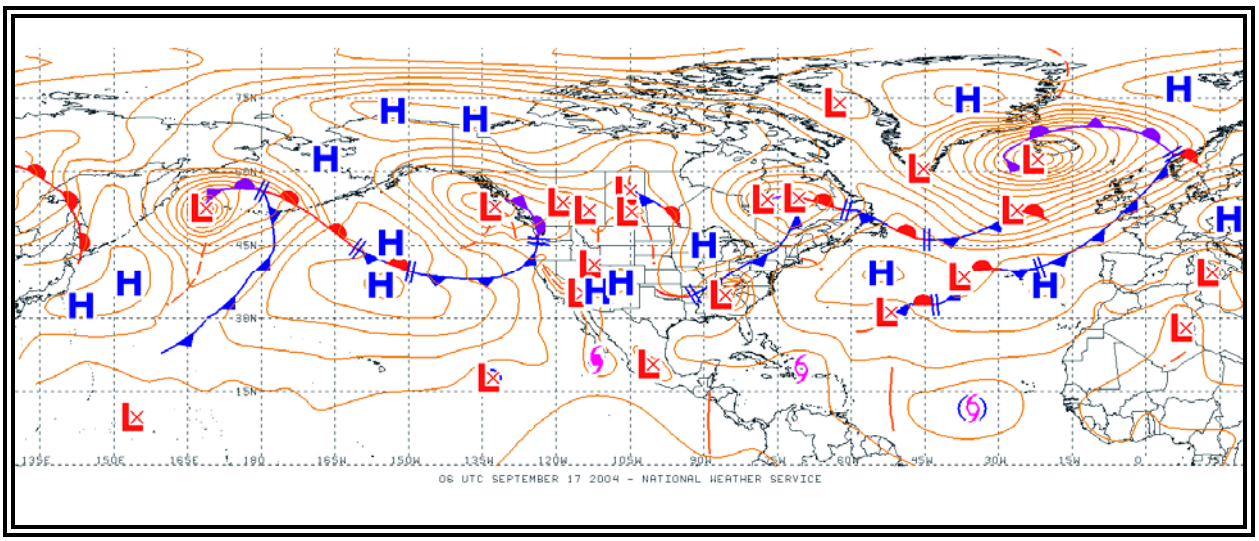


Figure 5-20. Unified Surface Analysis Chart Example

5.1.5.2 Analysis Symbols

Figure 5-21 shows analysis symbols used on the Unified Surface Analysis charts.

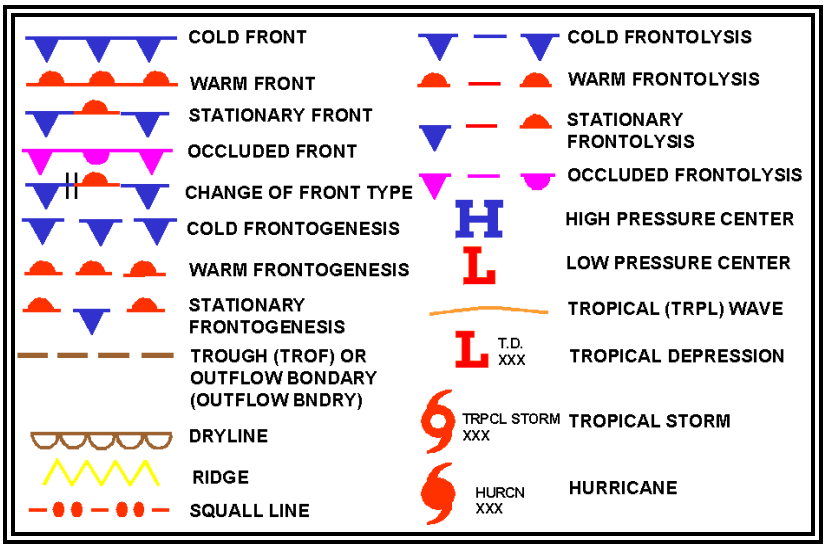


Figure 5-21. Unified Surface Analysis Chart Symbols

5.1.5.3 Analyses

Isobars, pressure systems, and fronts are the most common analyses depicted on the surface analysis charts.

5.1.5.3.1 Isobars

An isobar is a line of equal or constant pressure commonly used to analyze pressure patterns.

On a Surface Analysis Chart, isobars are solid lines usually spaced at intervals of 4 millibars (mb). Each isobar is labeled. For example, **1032** signifies 1032.0 mb and **992** signify 992.0 mb.

METAR/SPECI (Section 2.1) reports pressure in hectopascals. However, one millibar is equivalent to one hectopascal, so no conversion is required.

5.1.5.3.2 Pressure Systems

On a Surface Analysis Chart, a High (**H**) is a maximum of atmospheric pressure while a Low (**L**) is a minimum of atmospheric pressure. Central pressure is the atmospheric pressure at the center of a High or Low -- the highest pressure in a High and the lowest pressure in a Low. The central pressure is denoted near each pressure center. Tropical storms, hurricanes, and typhoons (See Figure 5-21) are low-pressure systems with their names and central pressures denoted.

On a Surface Analysis Chart, a trough is an elongated area of relatively low atmospheric pressure, while a ridge is an elongated area of relatively high atmospheric pressure. Troughs are denoted by dashed lines and identified with the word **TROF**. Ridges are denoted by saw-toothed symbols. Ridges are rarely denoted on charts produced by the HPC.

5.1.5.3.3 Fronts

The analysis shows positions and types of fronts by the symbols in Figure 5-21. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. Two short lines across a front indicate a change in front type.

5.1.6 AAWU Surface Charts

The Alaskan Aviation Weather Unit (AAWU) in Anchorage, Alaska is responsible for the state of Alaska. The surface analysis chart is located at:

- http://aawu.arh.noaa.gov/surface.php

5.1.6.1 Issuance

The AAWU issues Surface Analysis Charts 4 times daily for the state of Alaska. The valid times are shown in Table 5-5.

Table 5-5. AAWU Surface Analysis Issuance Schedule

Valid Time (UTC)	00	06	12	18

5.1.6.2 Analysis Symbols

The symbols (Figure 5-22) used on the Alaskan Surface Analysis Chart are similar to those found on the HPC Surface Analysis chart. However, since the Alaskan Surface Analysis chart is in black and white all of the symbols are black and white as well.

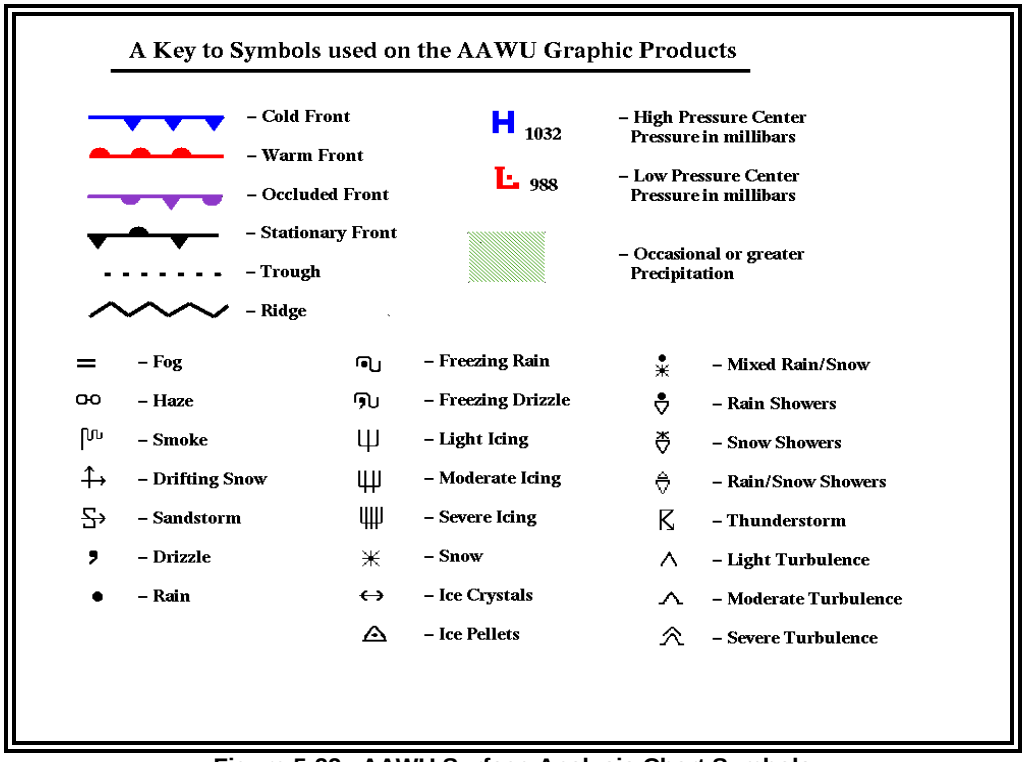


Figure 5-22. AAWU Surface Analysis Chart Symbols

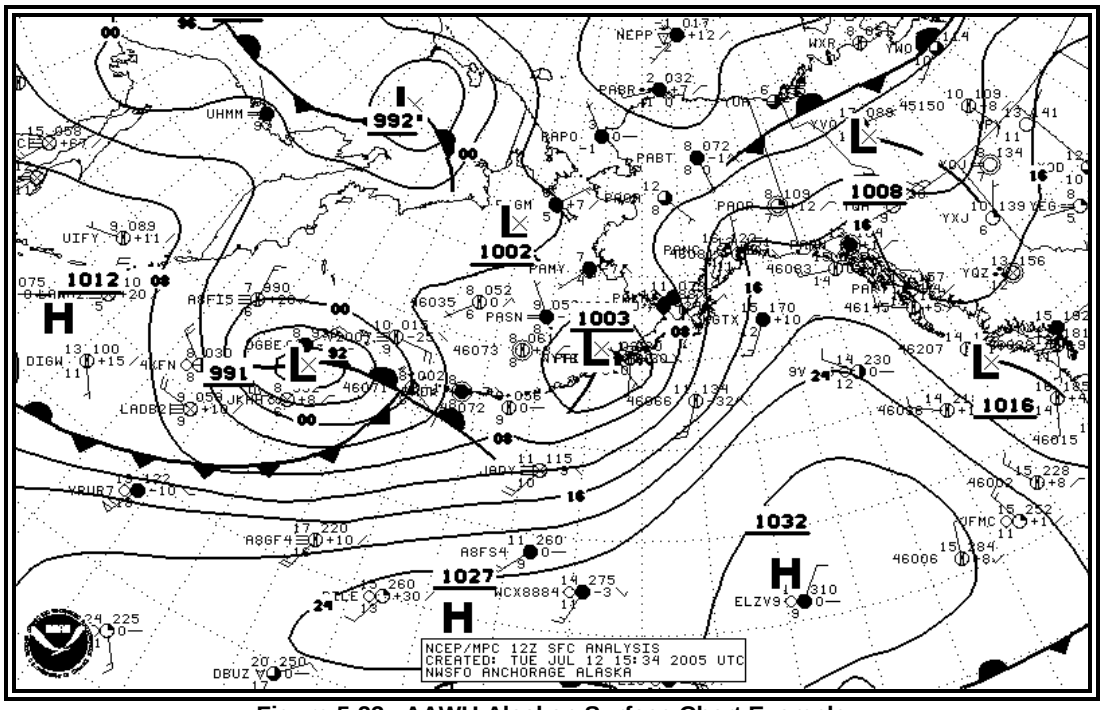


Figure 5-23. AAWU Alaskan Surface Chart Example

5.1.6.3 Station Plot Models

Land, ship, buoy, and C-MAN stations are plotted on the chart to aid in analyzing and interpreting the surface weather features. These plotted observations are referred to as station models. Some stations may not be plotted due to space limitations. However, all reporting stations are used in the analysis.

Figures 5-24 and 5-25 show the most commonly used station plot models used in surface analysis charts.

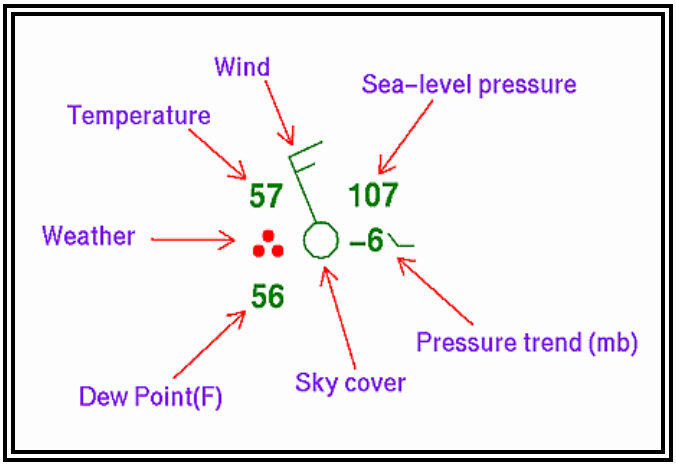


Figure 5-24. AAWU Surface Analysis Chart Station Plot Model

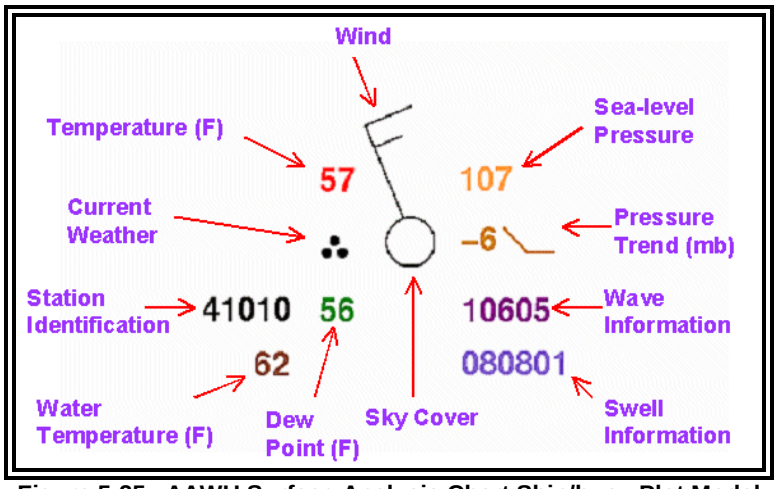


Figure 5-25. AAWU Surface Analysis Chart Ship/buoy Plot Model

5.1.6.3.1 Station Identifier

The format of the station identifier depends on the observing platform.

- Ship -- Typically 4 or 5 characters. If 5 characters, then the fifth will usually be a digit.
- Buoy -- Whether drifting or stationary, a buoy will have a 5-digit identifier. The first digit will always be a **4**.
- C-MAN -- Stands for Coastal-Marine Automated Network, and are usually close to coastal areas. Their identifier will appear like a 5-character ship identifier, however the 4th character will identify off which state the platform is located.
- Land -- Land stations will always be 3 characters, making them easily distinguishable from ship, buoy, and C-MAN observations.

5.1.6.3.2 Temperature

Air temperature is plotted in whole degrees Celsius on large-scale charts. Hourly surface charts may have temperatures using whole degrees Fahrenheit.

5.1.6.3.3 Dew Point

Dew point temperature is plotted in whole degrees Celsius on large-scale charts. Hourly surface charts may have dew point temperatures using whole degrees Fahrenheit.

5.1.6.3.4 Wind

Wind is plotted in increments of 5 knots (kts). The wind direction is in “true” degrees and is depicted by a stem (line) pointed in the direction from which the wind is blowing. Wind speed is determined by adding the values of the flags (50 kts), barbs (10kts), and half barbs (5 kts) found on the stem.

A single circle over the station with no wind symbol indicates a calm wind.

Figure 5-26 shows some sample wind symbols.

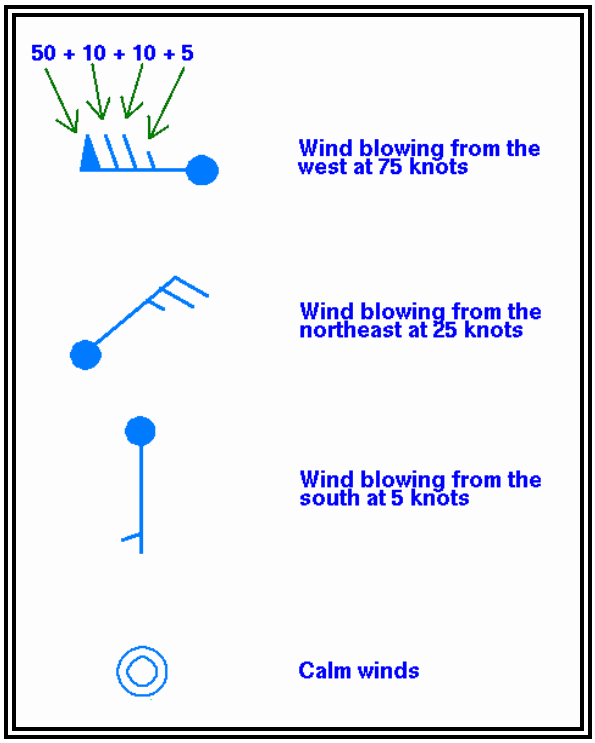


Figure 5-26: AAWU Surface Analysis Chart Wind Plotting Model

5.1.6.3.5 Ceiling

Ceiling is plotted in hundreds of feet above ground level.

5.1.6.3.6 Visibility

Surface visibility is plotted in whole statute miles.

5.1.6.3.7 Pressure

Sea-level pressure is plotted in tenths of millibars (mb), with the first two digits omitted (generally a 10 or 9). For reference, 1013 mb is equivalent to 29.92 inches of mercury. Below are some sample conversions between plotted and complete sea-level pressure values:

410: 1041.0 mb
103: 1010.3 mb
987: 998.7 mb
872: 987.2 mb

5.1.6.3.8 Pressure Trend

The pressure trend has two components, a number and symbol, to indicate how the sea-level pressure has changed during the past three hours. The number provides the 3-hour change in tenths of millibars, while the symbol provides a graphic illustration of how this change occurred.

Figure 5-27 shows the meanings of the pressure trend symbols.

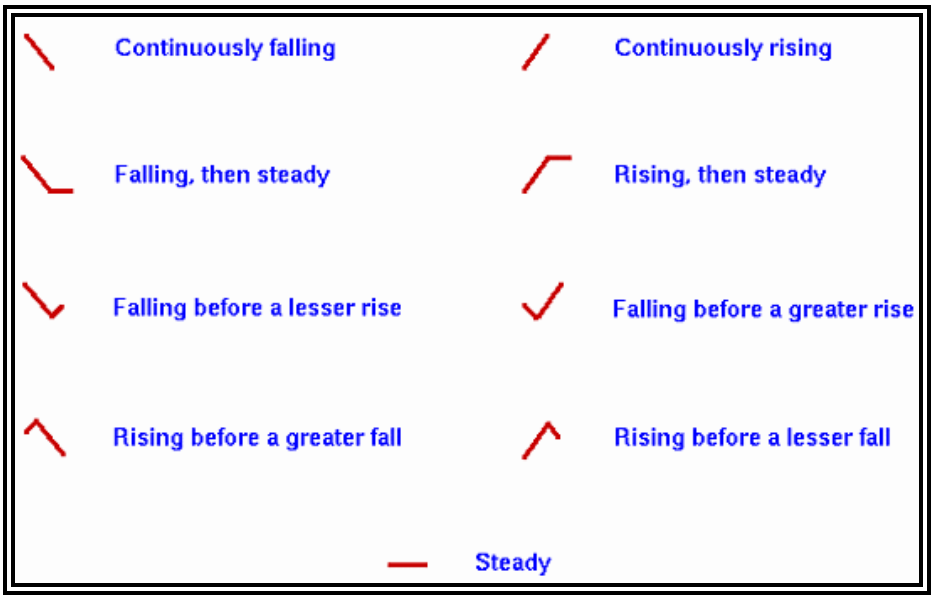


Figure 5-27. AAWU Surface Analysis Chart Pressure Trends

5.1.6.3.9 Sky Cover

The approximate amount of sky cover can be determined by the circle at the center of the station plot. The amount the circle is filled reflects the amount of sky covered by clouds. Figure 5-28 shows the common cloud cover depictions:

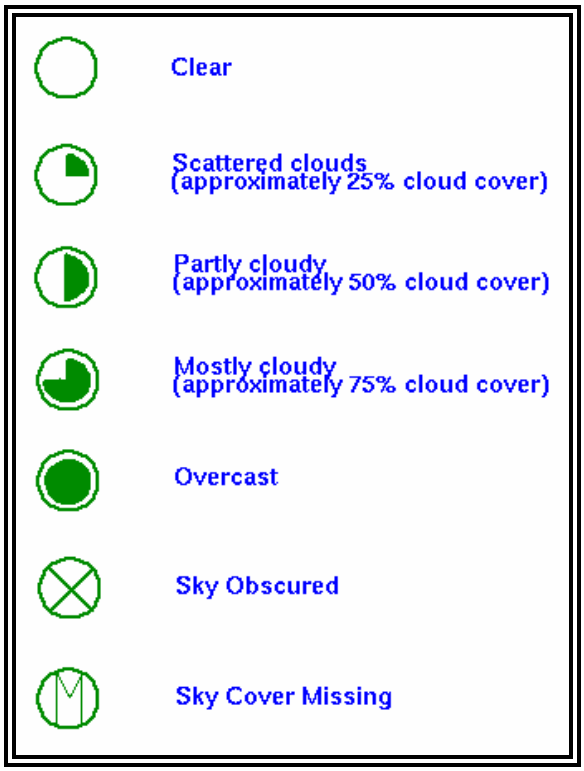


Figure 5-28. AAWU Surface Analysis Chart Sky Cover Symbols

5.1.6.3.10 Water Temperature

Water temperature is plotted in whole degrees Fahrenheit.

5.1.6.3.11 Swell Information

Swell direction, period, and height are represented in the surface observations by a 6-digit code. The first two digits represent the swell direction, the middle digits describe the swell period (in seconds), and the last two digits are the swell's height (in half meters).

090703
09 - The swell direction is from 90 degrees (i.e. it is coming from due east).
07 - The period of the swell is 7 seconds.
03 - The height of the swell is 3 half meters.

271006
27 - The swell direction is from 270 degrees (due west).
10 - The period is 10 seconds.
06 - The height of the swell is 6 half meters.

5.1.6.3.12 Wave Information

The period and height of waves are represented by a 5-digit code. The first digit is always **1**. The second and third digits describe the wave period (in seconds), and the final two digits give the wave height (in half meters). Below are two examples:

10603
1 - A group identifier. The first digit will always be **1**.
06 - The wave period is 6 seconds.
03 - The wave height is 3 half meters.

10515
1 - The group identifier again.
05 - The wave period is 5 seconds.
15 - Wave height is 15 half meters.

5.1.6.4 Analyses

Isobars, pressure systems, and fronts are the most common analyses depicted on surface analysis charts.

5.1.6.4.1 Isobars

An isobar is a line of equal or constant pressure commonly used to analyze pressure patterns.

On a Surface Analysis Chart, isobars are solid lines usually spaced at intervals of 4 millibars (mb). Each isobar is labeled. For example, **1032** signifies 1032.0 mb and **992** signify 992.0 mb.

METAR/SPECI (Section 2.1) reports pressure in hectopascals. However, one millibar is equivalent to one hectopascal, so no conversion is required.

5.1.6.4.2 Pressure Systems

On a Surface Analysis Chart, a High (**H**) is a maximum of atmosphere pressure, while a Low (**L**) is a minimum of atmospheric pressure. Central pressure is the atmospheric pressure at the center of a High or Low – the highest pressure in a High and the lowest pressure in a Low. The central pressure is denoted near each pressure center.

A trough or an elongated area of relatively low atmospheric pressure is denoted by dashed lines and identified with the word **TROF**. A ridge or an elongated area of relatively high atmospheric pressure is denoted by saw-toothed symbols. Ridges are rarely denoted on charts produced by the AAWU.

5.1.6.4.3 Fronts

The analysis shows positions and types of fronts by the symbols in Figure 5-22. The symbols on the front indicate the type of front and point in the direction toward which the front is moving. Two short lines across a front indicate a change in front type.

5.2 Constant Pressure Charts

Constant pressure charts are maps of selected conditions along specified constant pressure surfaces (pressure altitudes) and depict observed weather.

Constant pressure charts help to determine the three-dimensional aspect of depicted pressure systems. Each chart provides a plan-projection view at a specified pressure altitude.

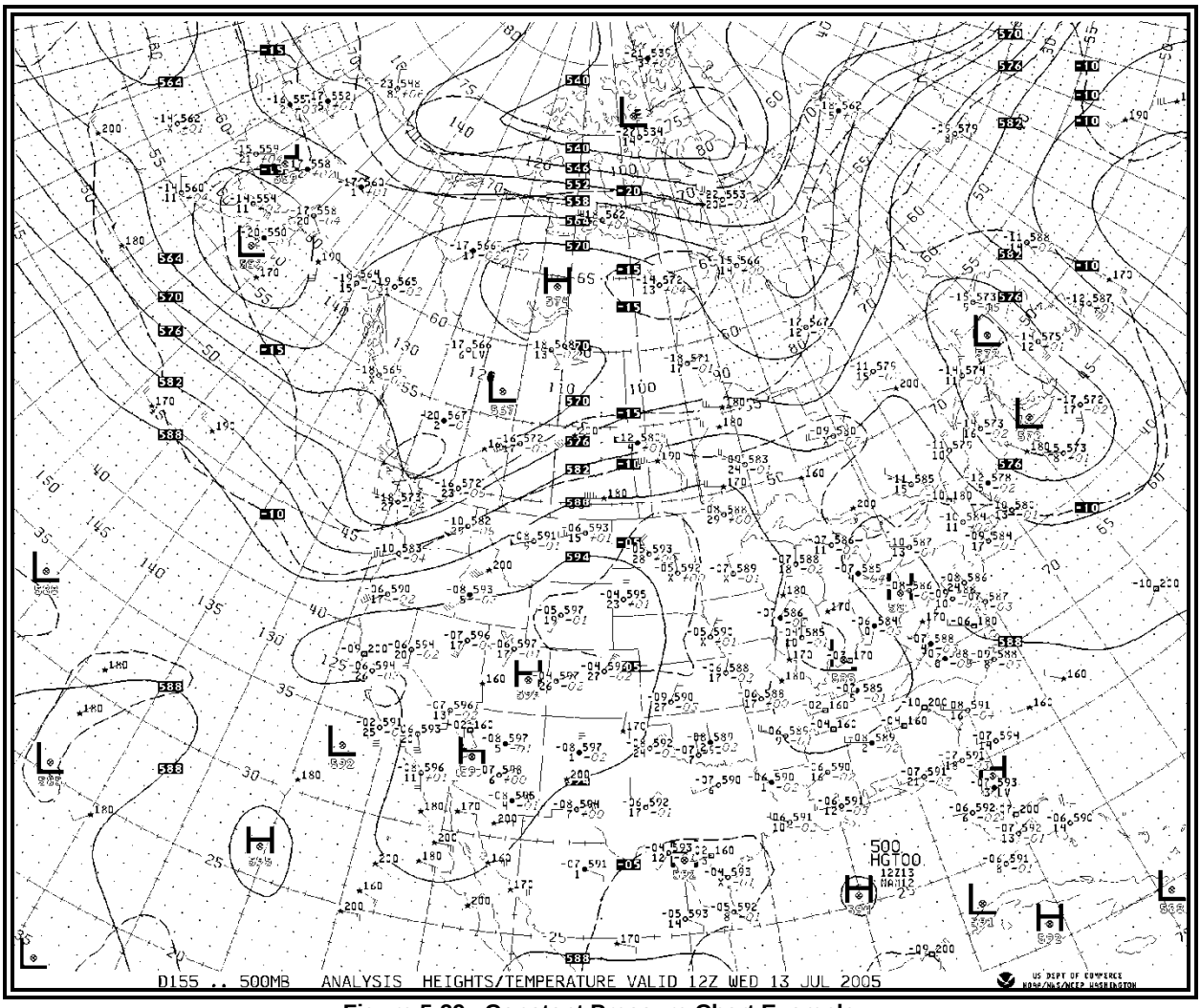


Figure 5-29. Constant Pressure Chart Example

5.2.1 Issuance

Constant pressure charts are issued twice per day from observed data obtained at 00Z and 12Z. Charts are available at the NWS Fax Chart web site at: http://weather.noaa.gov/fax/barotrop.shtml.

5.2.2 Observational Data

Observational data is plotted according to priority with some data deleted to prevent overlap. The retention priority is:

- Radiosonde observations (see Figure 5-30)
- Weather reconnaissance aircraft observations
- Aircraft observations on-time and on-level
- Aircraft observations off-time or off-level
- Satellite wind estimates

Many other data sources are used in the analysis but are not plotted. These include:

- Ships
- Buoys
- Tide gauges
- Wind profilers
- WSR-88D weather radar VAD wind profiles
- Satellite sounder

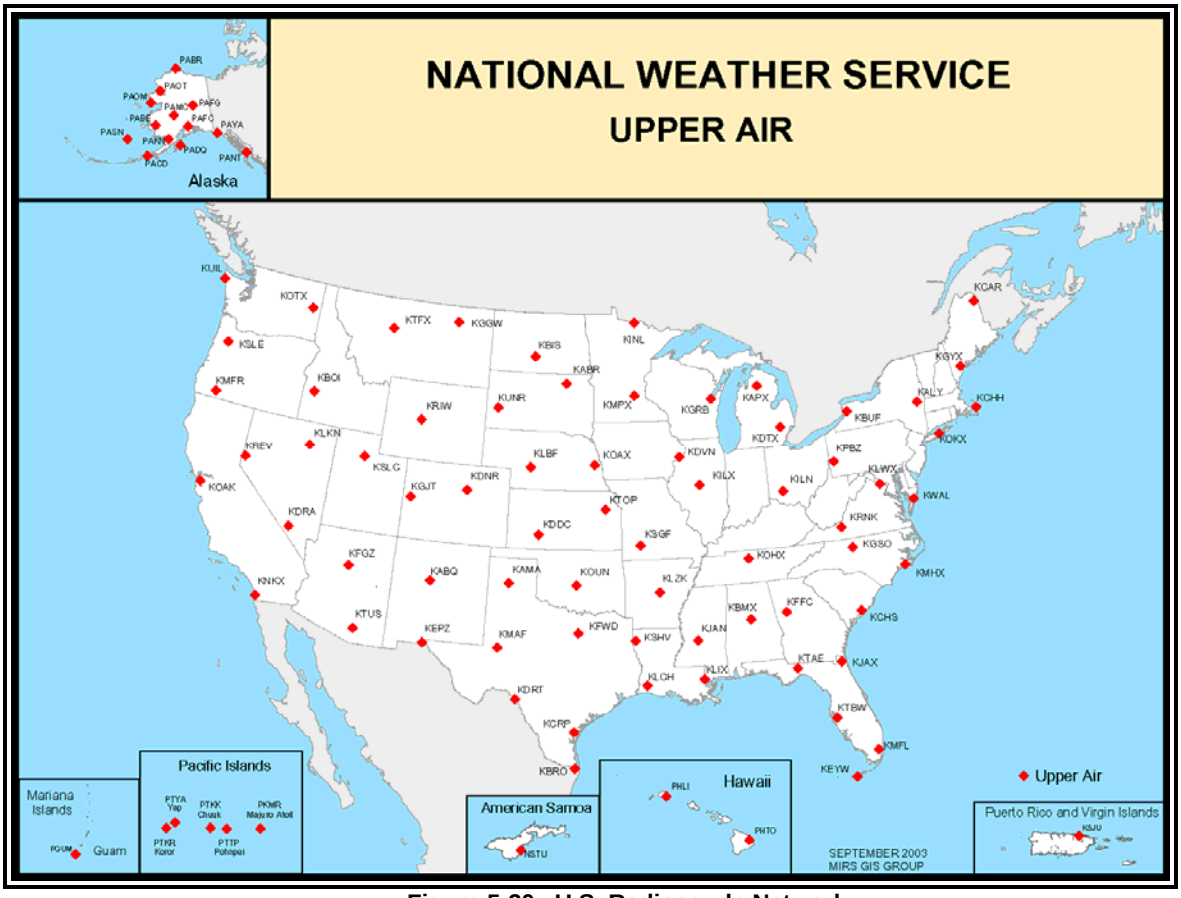


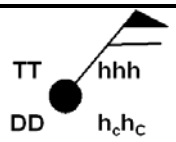
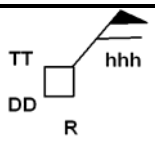
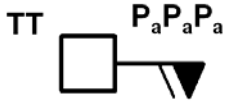
Figure 5-30. U.S. Radiosonde Network

Table 5-6 Features of Constant Pressure Charts

					Height Plot Decoding		Examples of Height Plotting	
Constant Pressure Chart	**Pressure Altitude (MSL)**		**Isotachs**	**Contour Interval (meters)**	**Prefix**	**Suffix**	**Plotted**	**Height (meters, MSL)**
850MB	5,000 ft	1,500 m	No	30 m	1	-	530	1,530 m
700MB	10,000 ft	3,000 m	No	30 m	2 or 3*	-	180	3,180 m
500MB	18,000 ft	5,500 m	No	60 m	-	0	582	5,820 m
300MB	30,000 ft	9,000 m	Yes	120 m	-	0	948	9,480 m
200MB	39,000 ft	12,000 m	Yes	120 m	1	0	164	11,640 m

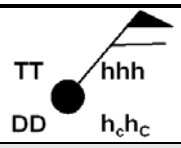
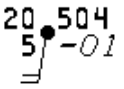
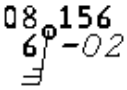
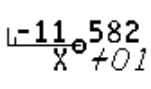
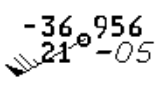
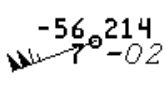
Note: Pressure altitudes are rounded to the nearest 1,000 for feet and 500 for meters.
* Prefix a "2" or "3," whichever brings the height closer to 3,000 meters.

Table 5-7. Constant Pressure Chart Plotting Models

Radiosonde	Reconnaissance Aircraft (RECCO)	Aircraft Report (AIREP)	Satellite Wind Estimate
			

SYMBOL	MEANING
	Wind plotted in standard notation. The stem points in the direction from which the wind is blowing plotted to 36 compass points, relative to true north. Wind speed is denoted by a combination of flags (50 knots), barbs (10 knots), and half barbs (5 knots).
TT	Temperature rounded to the nearest whole degree Celsius, with minus sign prefixed if negative.
hhh	Height of the constant pressure surface in meters MSL. See the Table 5-8 to see how each chart abbreviates height.
$P_aP_aP_a$	Pressure altitude in hundreds of feet MSL.
DD	Temperature-dew point spread (depression of the dew point temperature) rounded to the nearest whole degree Celsius. When **DD** is less than or equal to 5 degrees Celsius, the station circle is darkened so a region of high moisture content will stand out. If **DD** is greater than 5 degrees Celsius, the station circle is not shaded. If the **DD** is too large to measure, an **X** is plotted. For RECCO reports, **DD** will be missing when the temperature is colder than -41°C.
R	Reconnaissance aircraft type.

Table 5-8. Radiosonde Plotting Model Examples

						
Plotting Model		**850MB**	**700MB**	**500MB**	**300MB**	**200MB**
	Wind*	190°/20 kt	190°/25 kt	270°/15 kt	240°/70 kt	250°/115 kt
TT	**Temperature**	20°C	8°C	-11°C	-36°C	-56°C
hhh	**Height**	1,504 m	3,156 m	5,820 m	9,560 m	12,140 m
DD	**Temperature -Dew Point Spread**	5°C	6°C	Too dry to measure	21°C	7°C
h_ch_c	**Height Change**	-10 m	-20 m	+10 m	-50 m	-20 m

***** Wind direction assumes that north is at the top of the page. Latitude and longitude lines, as well as other geographical references, must be used to determine actual compass direction.

5.2.3 Analyses

All constant pressure charts contain analyses of height and temperature. Selected charts have an analysis of wind speed as well.

5.2.3.1 Height

Heights are analyzed with contours. Contours are lines of constant height in MSL and are used to map height variations of constant pressure surfaces. They identify and characterize pressure systems on constant pressure charts.

Contours are drawn as solid lines labeled with 3-digit numbers in decameters. Intervals at which the contours are drawn at: 30 meters for the 850 mb and 700 mb charts, 60 meters for the 500-mb chart, and 120 meters for the 300-mb and 200-mb charts. The location of a High or Low is marked with a ⊗ symbol together with a larger **H** or **L**, and the central value in decameters printed under the center location.

Contour gradient is the amount of height change over a specified horizontal distance. Gradients identify slopes of constant pressure surfaces that fluctuate in altitude. Strong gradients are denoted by closely-spaced contours which identify steep slopes. Weak gradients are denoted by widely-spaced contours which identify shallow slopes.

Wind speeds are directly proportional to contour gradients. Faster wind speeds are associated with strong contour gradients and slower wind speeds are associated with weak contour gradients. In mountainous areas, winds are often variable on constant pressure charts with altitudes near terrain elevation due to friction.

5.2.3.2 Temperature

Temperature is analyzed with isotherms which are lines of constant temperature. They are drawn as long dashed lines at intervals of 5° Celsius. They are given a two-digit label in whole degrees Celsius and are preceded with a **+** (positive) or **–** (negative) sign. The zero degree isotherm denotes the freezing level.

Temperature gradient is the amount of temperature change over a specified distance. Isotherm gradients identify the magnitude of temperature variations. Strong gradients are denoted by closely spaced isotherms and identify large temperature variations. Weak gradients are denoted by loosely spaced isotherms and identify small temperature variations.

5.2.3.3 Wind Speed

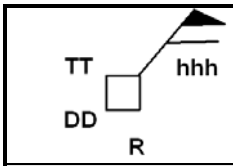
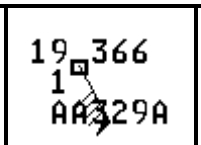
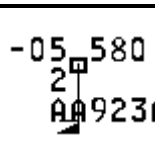
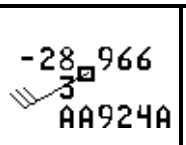
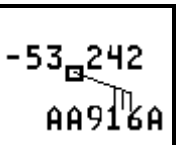
Wind speed is analyzed with isotachs which are lines of constant wind speed. They are drawn on the 300-mb and 200-mb charts with short-dashed lines at 20-knot intervals beginning with10 knots. They are labeled with a two- or three-digit number followed by a **K** for knots. Regions of high wind speeds are highlighted by alternate bands of shading and no-shading at 40-knot intervals beginning at 70 knots. A jet stream axis is the axis of maximum wind speed in a jet stream. Jet axes are not explicitly indicated, but their positions can be inferred from the isotach pattern and plotted winds.

5.2.3.4 Use

Constant pressure charts are used to provide an overview of selected observed weather conditions at specified pressure altitudes.

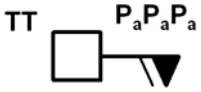
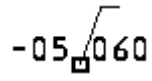
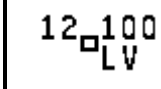
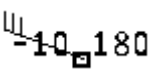
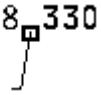
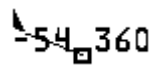
Pressure patterns cause and characterize much of the weather. Typically, lows and troughs are associated with bad weather, clouds and precipitation, while highs and ridges are associated with good weather.

Table 5-9. Reconnaissance Aircraft (RECCO) Plotting Model Examples

						
Plotting Model		**850MB**	**700MB**	**500MB**	**300MB**	**200MB**
	**Wind***	150°/90 kt	130°/35 kt	180° /60 kt	240°/30 kt	110°/30 kt
TT	**Temperature**	19°C	9°C	-5°C	-28°C	-53°C
hhh	**Height**	1,366 m	3,146 m	5,800 m	9,660 m	12,420 m
DD	**Temperature -Dew Point Spread**	1°C	1°C	2°C	3°C	Missing
R	**RECCO Type**	AA329A	AA921A	AA923A	AA924A	AA916A

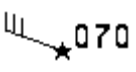
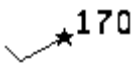
***** Wind direction assumes that north is at the top of the page. Latitude and longitude lines, as well as other geographical references, must be used to determine actual compass direction.

Table 5-10. Aircraft Report (AIREP) Plotting Model Examples

						
Plotting Model		**850MB**	**700MB**	**500MB**	**300MB**	**200MB**
	**Wind***	20°/10 kt	Light and Variable	300°/30 kt	190°/5 kt	290°/50 kt
TT	**Temperature**	-5°C	12°C	-10°C	-38°C	-54°C
$P_aP_aP_a$	**Pressure Altitude (MSL)**	6,000 ft	10,000 ft	18,000 ft	33,000 ft	36,000 ft

***** Wind direction assumes that north is at the top of the page. Latitude and longitude lines, as well as other geographical references, must be used to determine actual compass direction.

Table 5-11. Satellite Wind Estimate Plotting Model Examples

						
Plotting Model		**850MB**	**700MB**	**500MB**	**300MB**	**200MB**
	**Wind***	290°/30 kt	360°/20 kt	240°/10 kt	140°/165 kt	310°/60 kt
$P_aP_aP_a$	**Pressure Altitude (MSL)**	7,000 ft	11,000 ft	17,000 ft	33,000 ft	36,000 ft

***** Wind direction assumes that north is at the top of the page. Latitude and longitude lines, as well as other geographical references, must be used to determine actual compass direction.

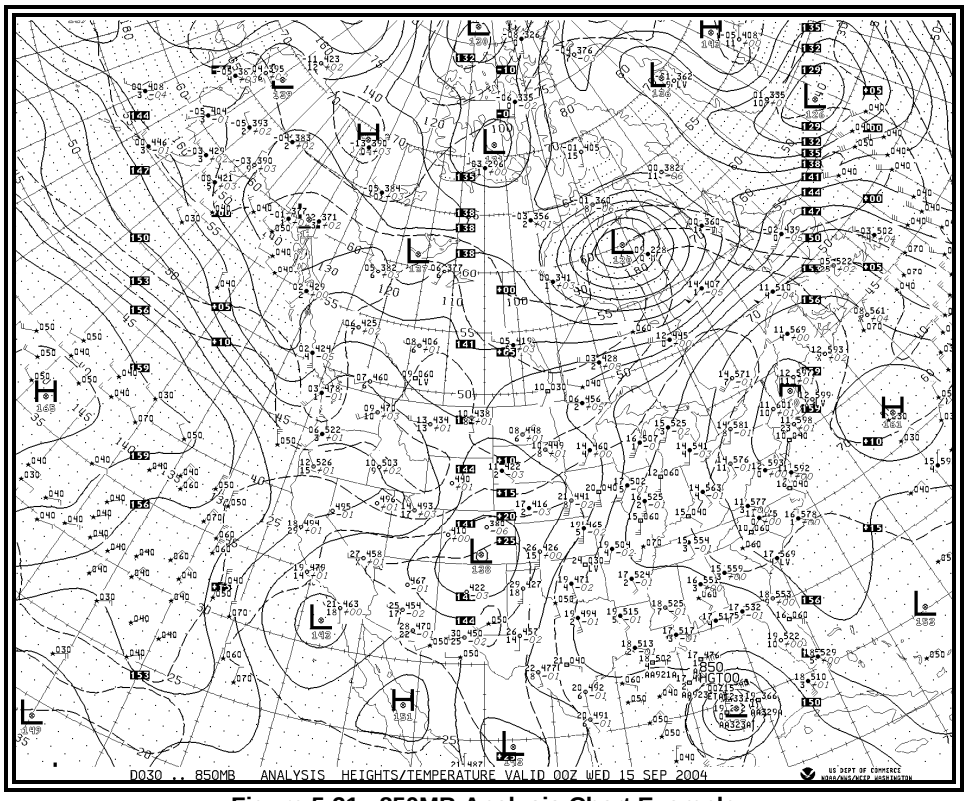


Figure 5-31. 850MB Analysis Chart Example

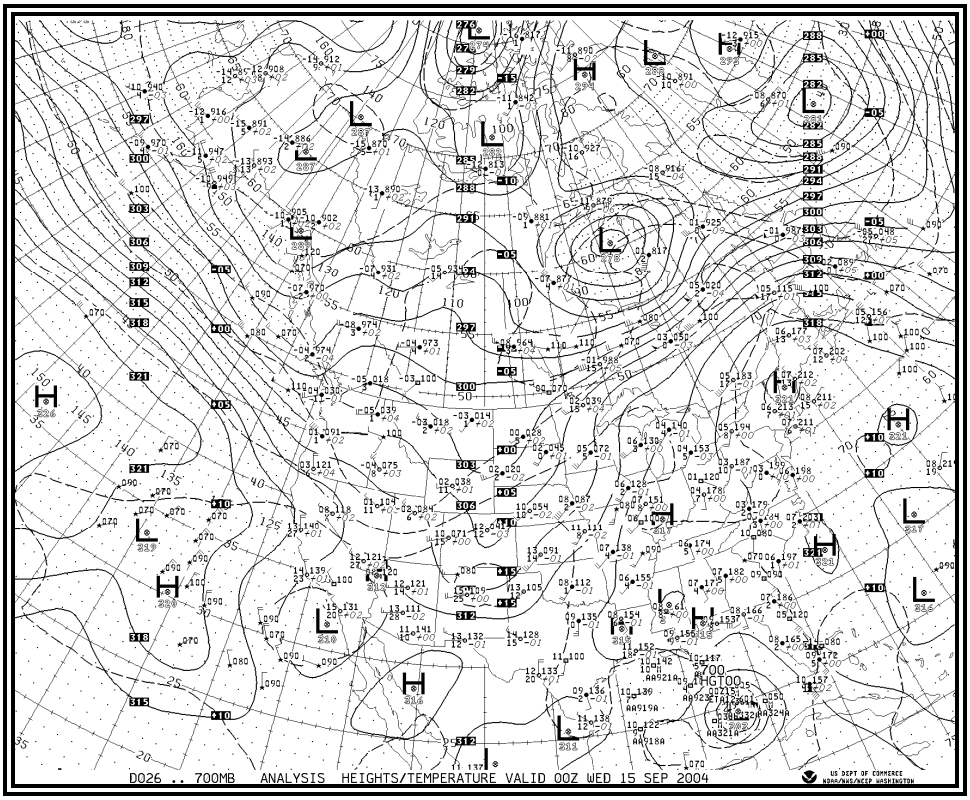


Figure 5-32. 700MB Analysis Chart Example

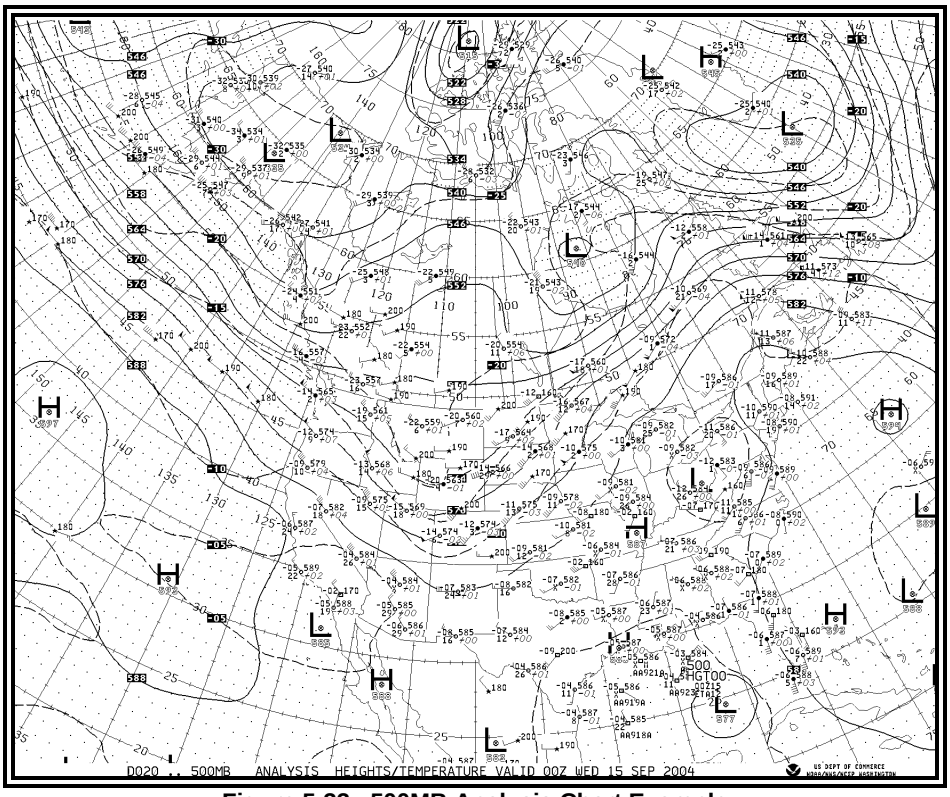


Figure 5-33. 500MB Analysis Chart Example

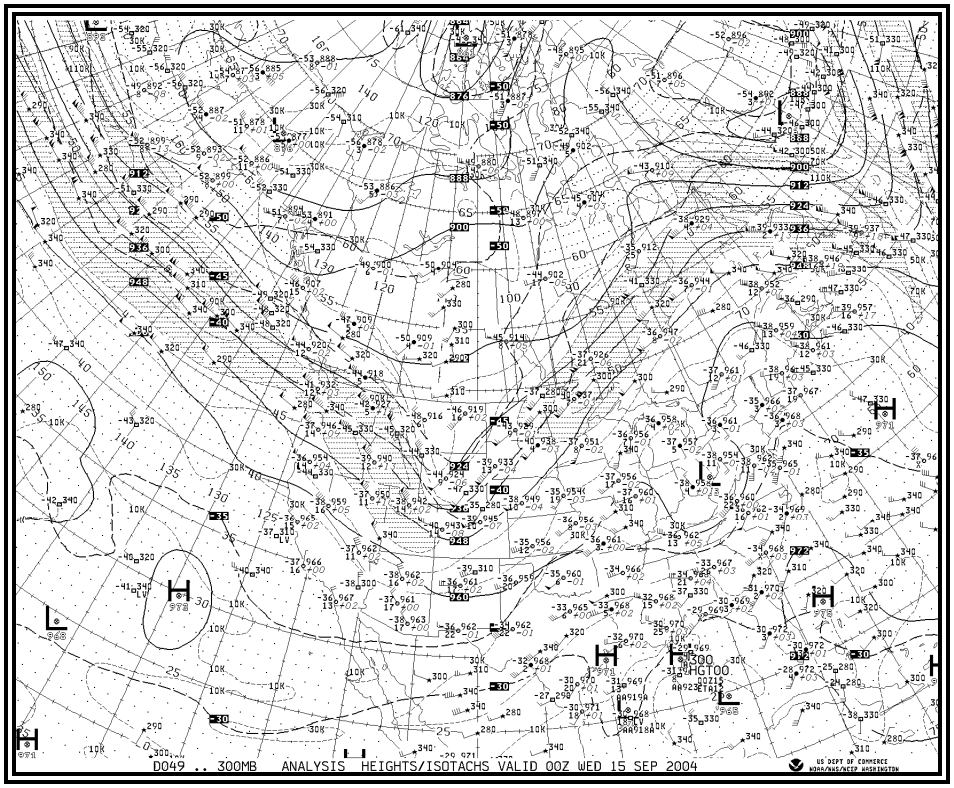


Figure 5-34. 300MB Analysis Chart Example

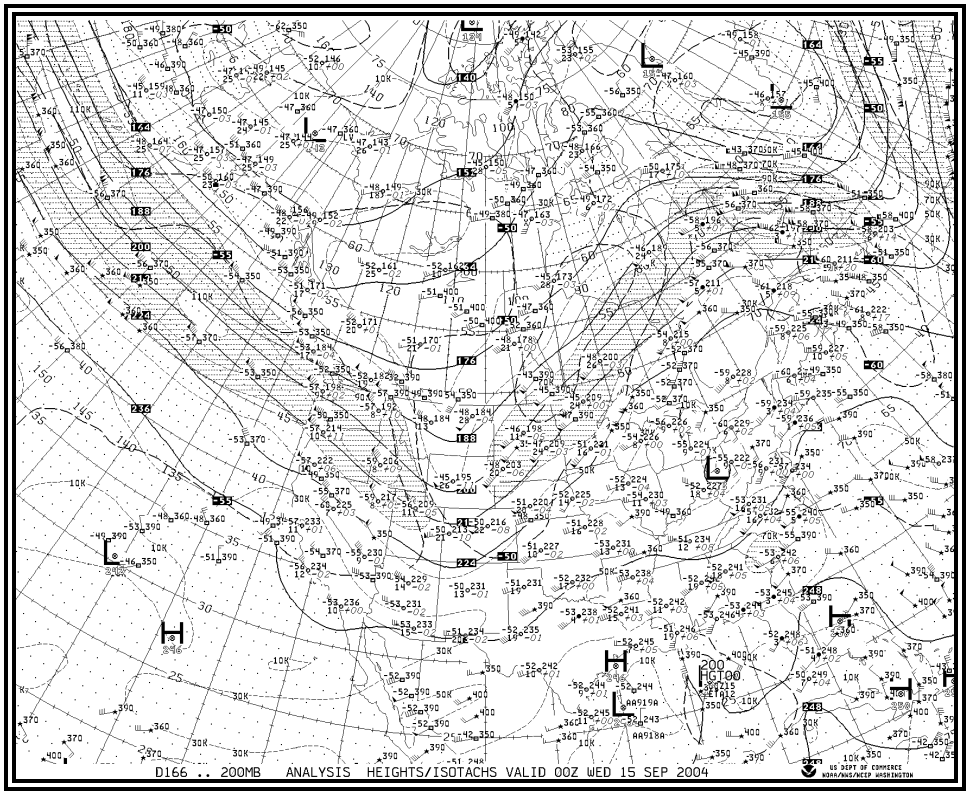


Figure 5-35. 200MB Analysis Chart Example

5.3 Freezing-level Graphics

The freezing level is the lowest altitude in the atmosphere over a given location at which the air temperature reaches 0°C. This altitude is also known as the height of the 0°C constant-temperature surface. A freezing level chart shows the height of the 0°C constant-temperature surface.

The concept of freezing level becomes slightly more complicated when more than one altitude is determined to be at a temperature of 0°C. These "multiple freezing layers" occur when a temperature inversion at altitudes above the defined freezing level are present. For example, if the first freezing level is at 3000 ft MSL and the second is at 7000 ft MSL, a temperature inversion is between these two altitudes. This would indicate temperatures rising above freezing above 3000 ft MSL and then back below freezing at 7000 ft MSL.

The Aviation Weather Center (AWC) provides freezing level graphics available on the Aviation Digital Data Service (ADDS) web site at:
http://adds.aviationweather.noaa.gov/icing/frzg_nav.php

The ADDS Freezing Level graphics provide an initial analysis and forecasts at 3-, 6-, 9-, and 12-hours into the future. The forecasts are based on output from the National Weather Service's (NWS) Rapid Update Cycle (RUC) numerical forecast model.

5.3.1 Issuance

The initial analysis and 3-hour forecast graphics are updated hourly. The 6-, 9-, and 12-hour forecast graphics are updated every three hours.

5.3.2 Observational Data

The RUC forecast model incorporates all of the latest weather observations in order to produce the best available analysis and forecast. These observations include:

- Commercial aircraft
- Profiler related:
    - Wind profilers (404 and boundary layer 915 MHz)
    - VAD (Velocity Azimuth Display) winds from WSR-88D radars
    - RASS (Radio Acoustic Sounding System)
- Rawinsondes and special dropwinsondes
- Surface:
    - GPS total precipitable water estimates
    - GOES cloud-top data (pressure and temperature)
    - GOES total precipitable water estimates

  - SSM/I total precipitable water estimates
  - GOES high-density visible and infrared (IR) cloud drift winds

- Experimental:
  - Radar reflectivity (3-d)
  - Lightning
  - Regional aircraft data with moisture (TAMDAR)

5.3.3 Format

The colors represent the height in hundreds of feet above mean sea level (MSL) of the lowest freezing level.

- Regions with white indicate the surface and the entire depth of the atmosphere are below freezing.
- Hatched regions represent areas where the surface temperature is below freezing with multiple freezing levels aloft.

- Areas where the surface temperature is above freezing with multiple freezing levels aloft are in regions where adjacent pixels change by more than one color when compared against the color scale (e.g., orange to dark blue).

The following cases illustrate the interpretation of the graphic.

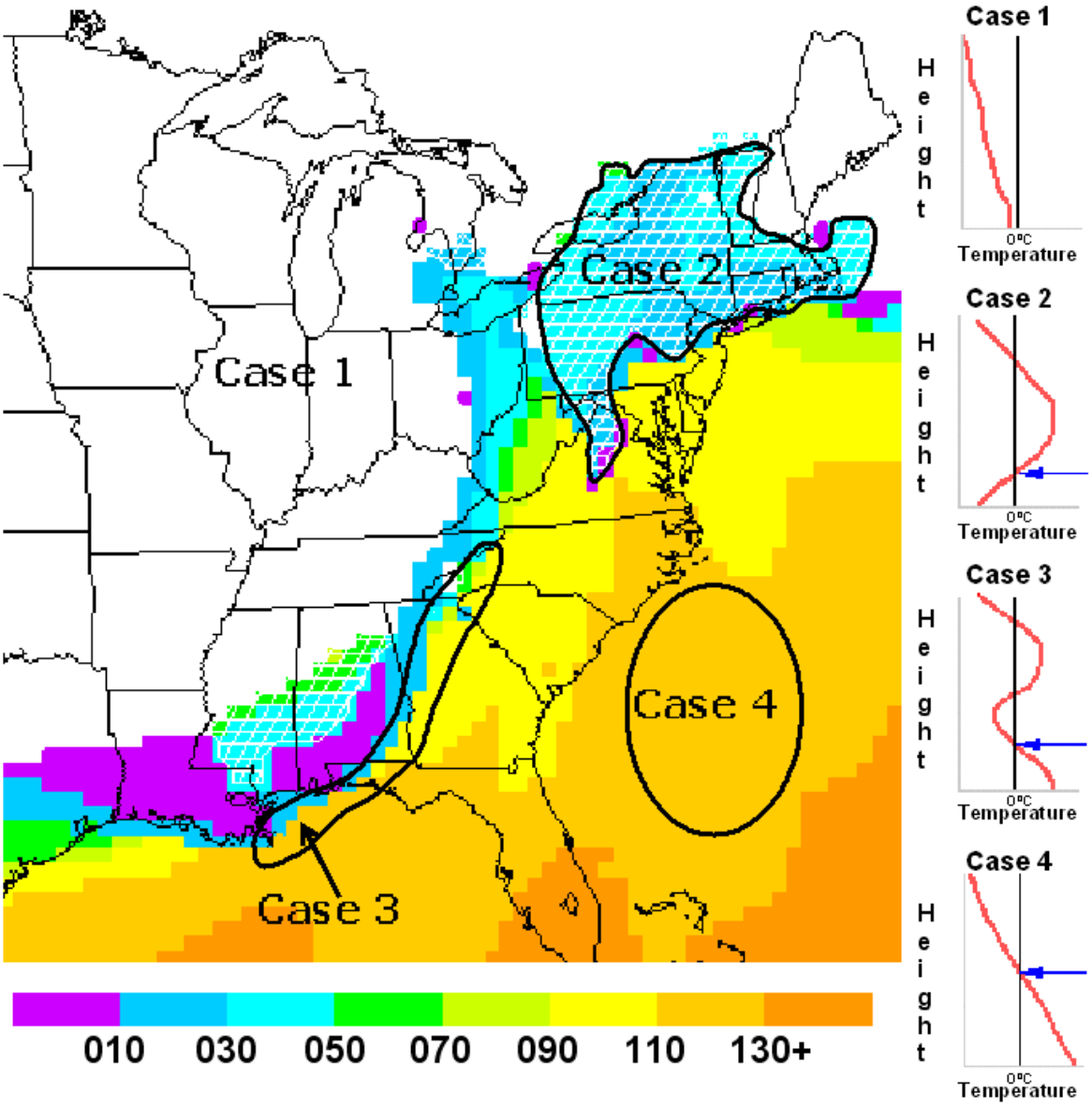


Figure 5-36. RUC 00-hour Freezing Level Graphic Example

Case 1 (Figure 5-36, Case 1) represents the condition where temperature is below freezing at the surface and all levels above the surface (represented in the graphic above by white-colored pixels).

Case 2 (Figure 5-36, Case 2) represents the condition where the temperature goes above and below freezing two or more times vertically through the atmosphere while the surface temperature is less than 0°C. These regions are hatched with white. The underlying color represents the lowest height where the temperature crosses the 0°C line as shown by the blue arrow on the vertical temperature graphic.

Case 3 (Figure 5-36, Case 3) represents the condition where the temperature goes above and below freezing three or more times vertically through the atmosphere while the surface

temperature is higher than 0°C. These regions are located in areas where adjacent pixels change by more than one color when compared against the color scale.

Case 4 (Figure 5-36, Case 4) is relatively simple and represents the condition where the temperature at the surface is above freezing and the air generally cools with height crossing the 0°C line once.

5.3.4 Use

Freezing level graphics are used to assess the lowest freezing level heights and their values relative to flight paths. Clear, rime and mixed icing are found in layers with below-freezing (negative) temperatures and super-cooled water droplets. Users should be aware that official forecast freezing level information is specified within the AIRMET Zulu Bulletins (Contiguous U.S. and Hawaii) and the AIRMET "ICE AND FZLVL" information embedded within the Area Forecasts (Alaska only)

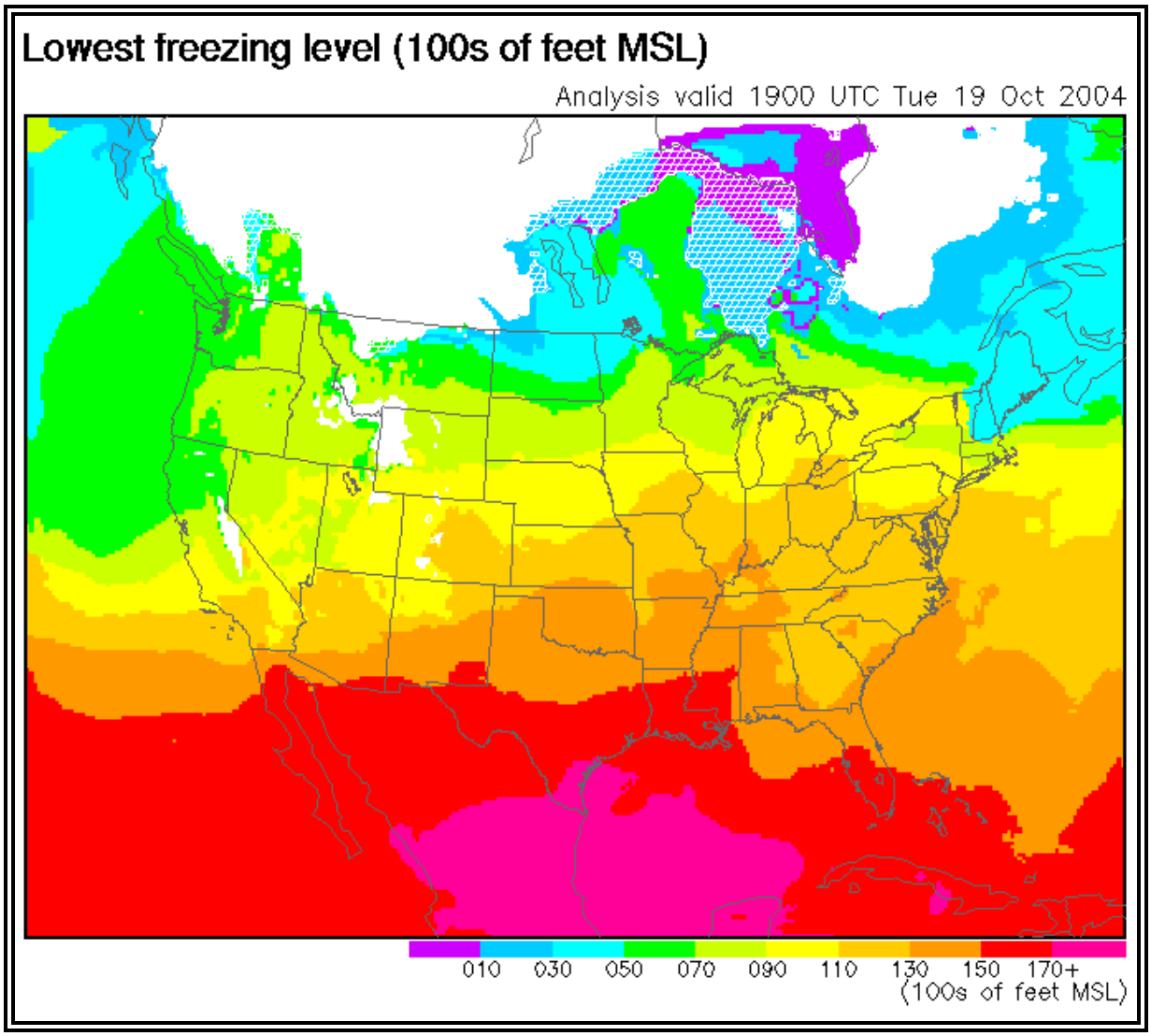


Figure 5-37. ADDS Freezing Level Graphic Example

5.4 Lifted Index Analysis Chart

The Lifted Index Analysis Chart (Figure 5-38) provides a data plot of observed lifted index (LI) and K index values for radiosonde sites and an analysis of LI for the contiguous U.S., southern Canada and northern Mexico.

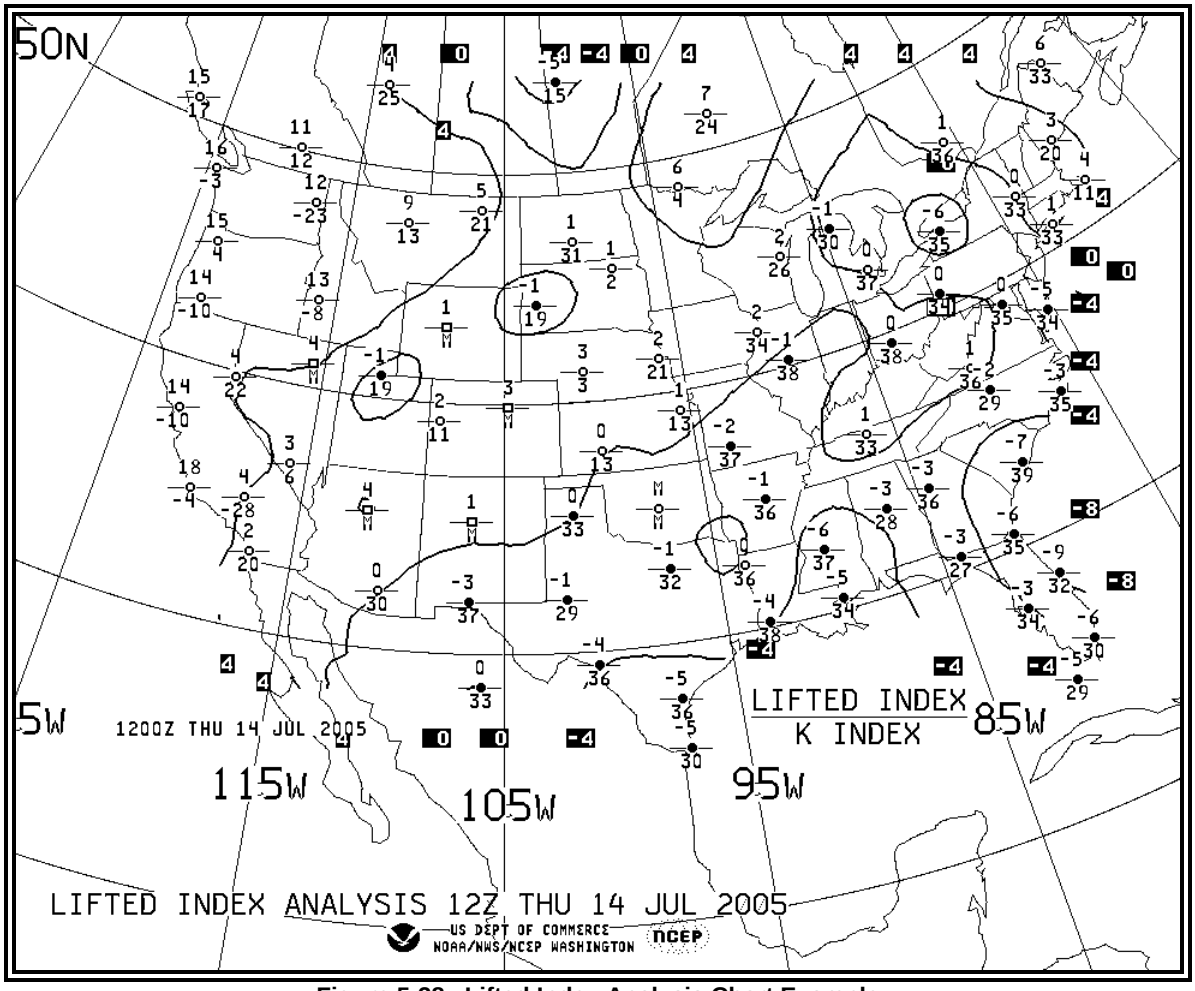


Figure 5-38. Lifted Index Analysis Chart Example

5.4.1 Issuance

The Lifted Index Analysis Chart is issued twice daily by the NWS and based solely on radiosonde observations from 00Z and 12Z. It is available at the NWS Fax Chart web site at: http://weather.noaa.gov/pub/fax/QXUA00.TIF.

5.4.2 Lifted Index (LI)

The lifted index (LI) is a common measure of atmospheric stability. The Lifted Index Analysis Chart depicts a number associated with the stability of a surface parcel of air lifted to 500 mb. For more complete information on the computation, refer to the Aviation Weather manual (AC 00-6A).

Lifted index values range from positive to negative. A positive lifted index indicates stable air. Larger positive numbers imply greater stability. A negative lifted index indicates unstable air.

Larger negative numbers imply greater instability. A zero lifted index indicates neutrally stable air.

5.4.2.1 Data Plot
Values of lifted index are plotted above the station circle for each available radiosonde station. Missing values are denoted with **M**. Station circles are blackened for LI values of zero or less.

5.4.2.2 Analysis
Isopleths, or lines of equal value, of lifted index are drawn for intervals of 4 units for index values of +4 and lower.

5.4.2.3 Use of Lifted Index
LI values on the Lifted Index Analysis Chart must be used with caution. The chart is only issued twice per day and significant changes can occur between chart times. LI values are typically lowest (least stable) during the afternoon due to daytime heating and highest (most stable) at sunrise due to nighttime cooling.

LI values can change rapidly due to moving fronts, drylines, outflow boundaries, and other boundaries which change surface airmass characteristics. LI (and thus stability) is particularly sensitive to changes of surface dew point. Temperature changes at 500 mb also affect LI, but these changes are usually much less dramatic than those which occur with temperature and dew point near the surface.

The Lifted Index Analysis chart only uses radiosonde data in its LI analysis. This means only large synoptic-scale stability patterns can be determined. Smaller, mesoscale LI variations will be missed.

An unstable airmass (denoted by negative LI values) only implies the potential for thunderstorms. A lifting mechanism such as a front, dryline, upslope flow, outflow boundary from prior storms, or frictional convergence around lows and troughs is still necessary to initiate a thunderstorm.

5.4.3 K Index
The K index (Figure 5-38) is a measure of thunderstorm potential based on vertical temperature lapse rate, moisture content of the lower atmosphere, and vertical extent of the moist layer. For more complete information on the computation, refer to the Aviation Weather (AC 00-6A).

5.4.3.1 Data Plot
Values of K will be plotted below the station circle for each available radiosonde station. Missing values are denoted with **M**. No analysis of the K-index is made on the Lifted Index Chart.

5.4.3.2 Use of K Index
With the K index, the higher the positive number, the likelihood of thunderstorm development is greater. The computation of the K-Index biases it in favor of general thunderstorms and it works better for non-severe convection. The K-index is also an index for forecasting heavy rain.

Although K-index values can be correlated to a probability of thunderstorm occurrence, these values will vary with seasons, locations, and synoptic settings. The values listed in Table 5-12 were empirically-derived and should be used with caution.

Table 5-12. K Index and Coverage of General Thunderstorms

K INDEX West of the Rockies	K INDEX East of the Rockies	Coverage of General Thunderstorms
less than 15	less than 20	None
15 to 20	20 to 25	Isolated thunderstorms
21 to 25	26 to 30	Widely scattered thunderstorms
26 to 30	31 to 35	Scattered thunderstorms
Above 30	Above 35	Numerous thunderstorms
Note: K value may not be representative of airmass if 850 mb level is near the surface.		

The chart only uses radiosonde data in its K index analysis. This means only large synoptic-scale stability patterns can be determined. Smaller, mesoscale K index variations will be missed.

5.5 Weather Depiction Chart

The Weather Depiction Chart (Figure 5-39) contains a plot of weather conditions at selected METAR stations and an analysis of weather flying category. It is designed primarily as a briefing tool to alert aviation interests to the location of critical or near-critical operational minimums at terminals in the conterminous US and surrounding land areas. The chart can be found at: http://weather.noaa.gov/pub/fax/QGUA00.TIF

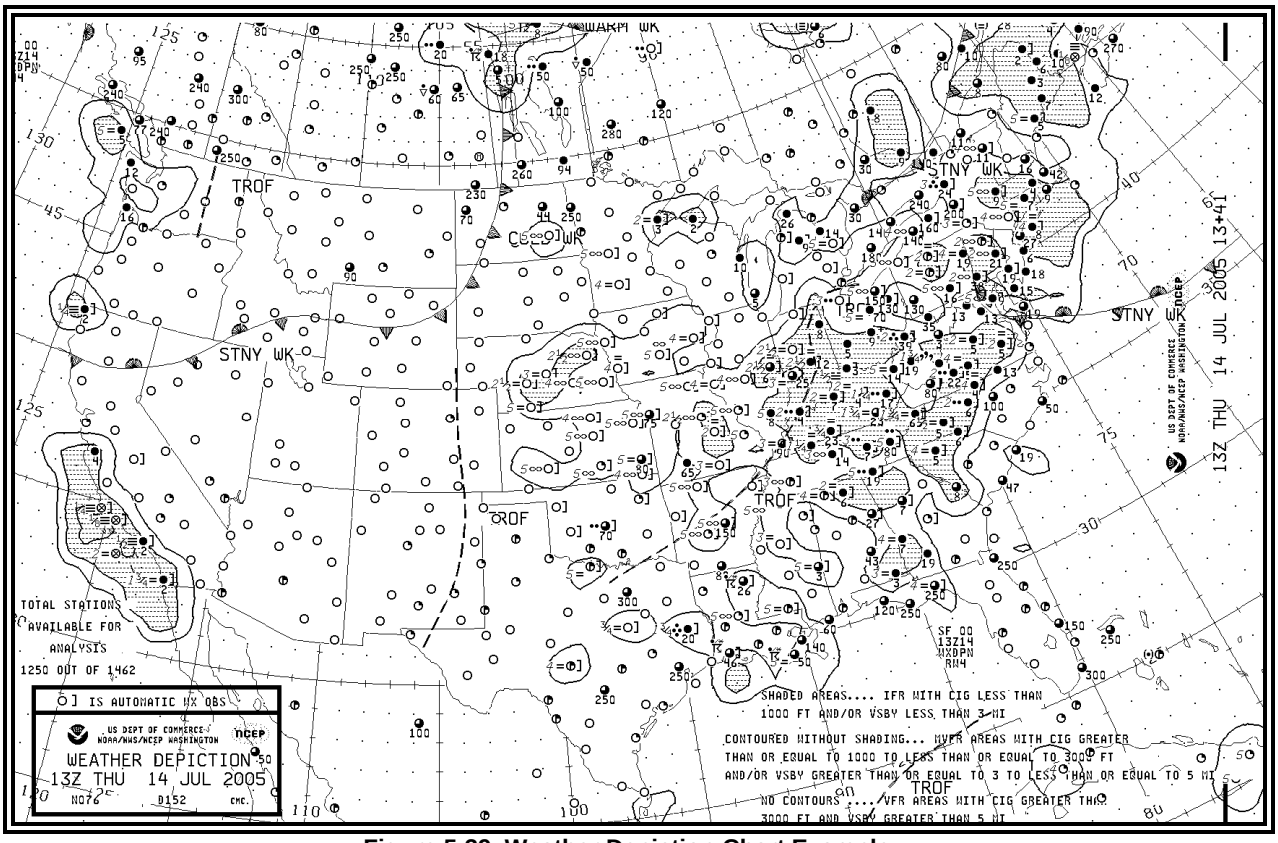


Figure 5-39. Weather Depiction Chart Example

5.5.1 Issuance

The Weather Depiction chart is issued eight times daily at the following times:

Table 5-13. Weather Depiction Charts Issuance Schedule

Valid Time (UTC)	01	04	07	10	13	16	19	22

5.5.2 Station Plot Model

METAR elements (Section 2.1) associated with weather flying category (visibility, present weather, sky cover, and ceiling) are plotted for each station on the chart (Figure 5-41). The station is located at the center of the sky cover symbol. Most stations are not plotted due to space limitations. However, all reporting stations are used in the weather flying category analysis.

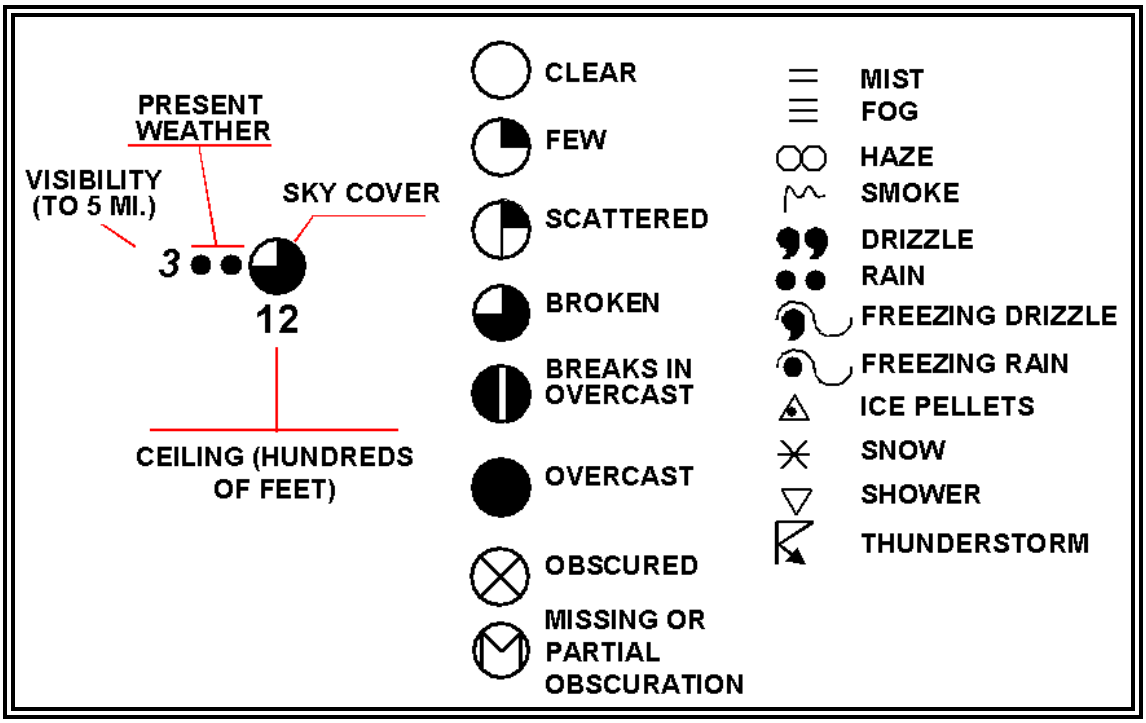


Figure 5-40. Weather Depiction Chart Station Plot Model

5.5.2.1 Visibility

When visibility is 5 miles or less, it is entered to the left of the station. Visibility is entered in statute miles and fractions of a mile.

5.5.2.2 Present Weather

Present weather symbols are entered to the left of the station. If the present weather information is obtained by an automated system, the right bracket symbol (**]**) is plotted to the right of the station.

When several types of weather and/or obstructions to visibility are reported, the most significant weather element is plotted. This is the first weather element coded in the METAR report (Section 2.1) and is usually the highest coded number in the Present Weather Symbols guide (Appendix I).

5.5.2.3 Sky Cover

Sky cover represents the summation total of the sky condition element from the METAR report. For example, if the METAR sky condition element was **SCT030 BKN060 OVC090**, the sky cover would be overcast. Sky cover symbols are listed in Figure 5-41.

5.5.2.4 Ceiling

Ceiling is the height from the base of the lowest layer aloft covering more than one-half the sky to the ground. Additionally, vertical visibility into a total surface-based obscuration is defined as a ceiling. For a METAR report, the first broken (BKN) or overcast (OVC) layer is the ceiling. For example, if the METAR sky condition element is **SCT030 BKN060 OVC090**, the ceiling is 6,000 feet.

For stations with broken to overcast layers, the ceiling height is plotted below the station. Ceilings are reported as hundreds of feet above ground level (AGL).

For a total surface-based obscuration, no ceiling is plotted and the METAR must be consulted.

Partial obscurations are not identified.

- For a partial obscuration with no layer above, the sky cover symbol will be plotted as missing (Figure 5-41).
- For a partial obscuration with a layer above, the sky cover and ceiling height will be plotted for the cloud layer only.

The METAR report should be consulted to identify the partial obscuration.

If the sky cover is clear, few, or scattered, no ceiling is plotted.

5.5.3 Weather Flying Category Analysis

Instrument Flight Rules (IFR) indicated on the Weather Depiction Chart represents ceilings less than 1,000 feet and/or visibility less than 3 statute miles and IFR operations must be in place. IFR areas are outlined on the chart with a solid line and are shaded. IFR areas are typically shaded red in colorized versions of the chart.

Marginal Visual Flight Rules (MVFR) indicated on the Weather Depiction Chart represents ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 statute miles and VFR operations can take place. MVFR areas are outlined with a solid line, but the area is not shaded. MVFR areas are typically shaded blue in colorized versions of the chart.

Visual Flight Rules (VFR) indicated on the Weather Depiction Chart represents a ceiling greater than 3,000 feet or clear skies and visibility greater than 5 statute miles and VFR operations can take place. VFR conditions are not analyzed. This does not necessarily imply that the sky is clear.

5.5.4 Use

The Weather Depiction Chart is an ideal place to begin flight planning or to prepare for a weather briefing. This chart provides an overview of weather flying categories and other adverse weather conditions for the chart valid time. The chart, though, may not completely represent the en route conditions because of terrain variations and the possibility of weather occurring between reporting stations. This chart should be used in addition to the current METAR reports, pilot weather reports, and radar and satellite imagery for a complete look at the latest flying conditions.

5.6 Alaska Weather Depiction Charts

The Alaska Weather Depiction Charts (Figure 5-43) display color coded station plots which show: temperature, dew point, ceiling, visibility and wind direction/speed. A key to the station plots is found on each map.

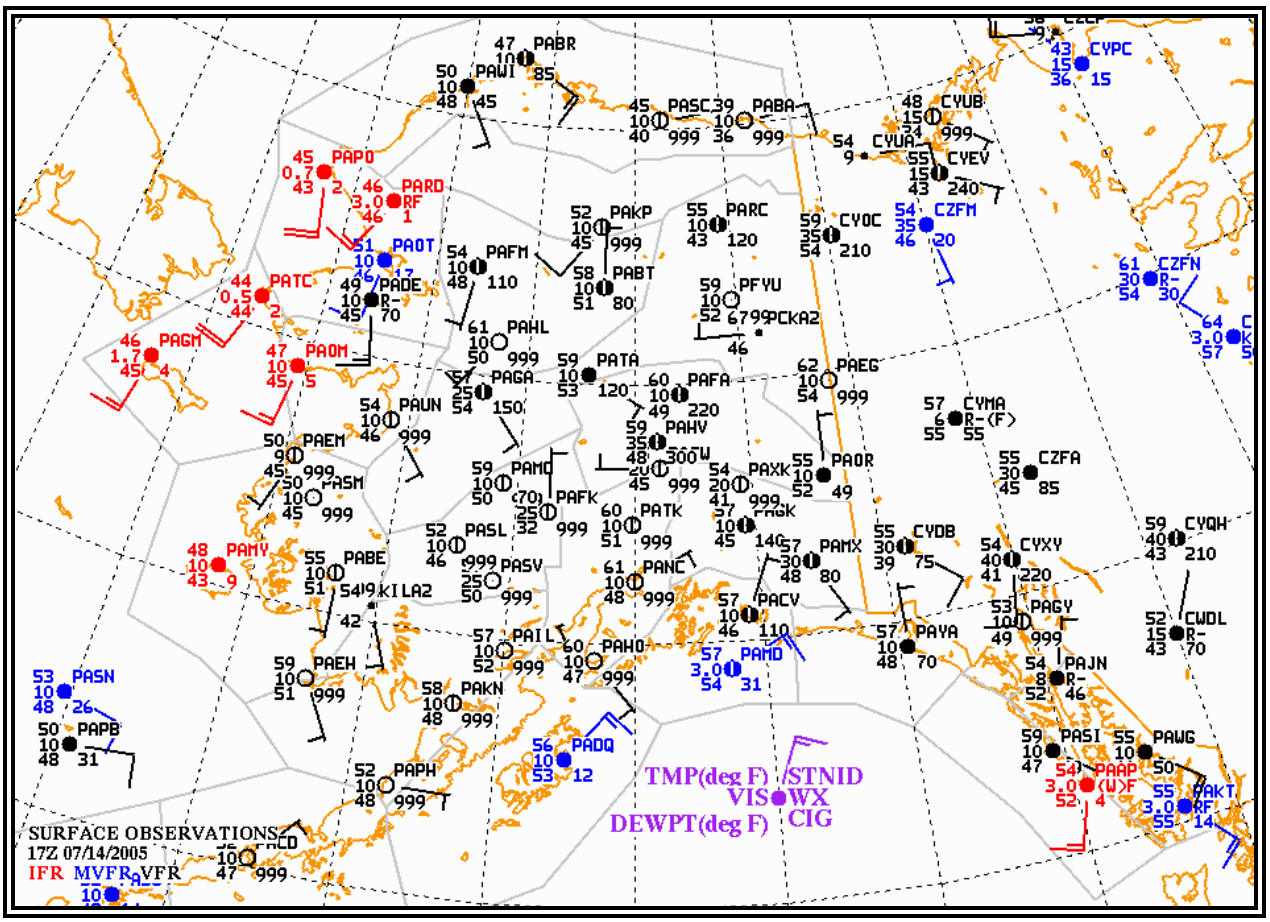


Figure 5-41. AAWU Alaska Weather Depiction Chart Example

Thirteen charts cover Alaska (except for the Aleutians) and adjacent areas of Canada.

Table 5-14. AAWU Alaska Weather Depiction Charts Coverage

Chart Coverage	Scale
Entire State of Alaska	(1:12 million)
All of Southeast Alaska	(1:5 million)
Southern Southeast Alaska	(1:3 million)
Northern Southeast Alaska	(1:3 million)
North Gulf Coast	(1:5 million)
South Central Alaska	(1:5 million)
Cook Inlet/Susitna Valley	(1:2 million)
Southwest Alaska	(1:6 million)
Western Interior	(1:5 million)
Central Interior	(1:5 million)
Northern Alaska	(1:6 million)
Southwest British Columbia	(1:7 million)
Yukon Territory/Northern British Columbia	(1:8 million)

5.6.1 Issuance

The charts are issued hourly and can be found on the Alaska Aviation Weather Unit (AAWU) web site at: http://aawu.arh.noaa.gov/Sigwx.php. The charts will first appear at about 10 minutes past the hour, with a second update at about 25 minutes past the hour.

5.6.2 Legends

The Alaska Weather Depiction Charts depict numerous parameters including the flying category, sky cover and wind.

5.6.2.1 Flying Category

Each station plot is color-coded according to the weather flying category reported (Table 5-16). Red indicates instrument flight rules (IFR), blue indicates marginal visual flight rules (MVFR), and black is plotted for stations reporting visual flight rules (VFR).

Table 5-15 AAWU Alaska Weather Flying Categories and Criteria

FLYING CATEGORY	CEILING (feet)	VISIBILITY (miles)
VFR (black)	Greater than 3,000 feet	Greater than 5 miles
MVFR (blue)	1,000 to 3,000 feet	3 to 5 miles
IFR (red)	Less than 1,000 feet	Less than 3 miles

5.6.2.2 Station Plot

METAR elements are plotted for each station on the chart (Figure 5-45). Some stations are not plotted due to space limitations, notably on the chart which covers the entire state of Alaska.

Figure 5-42. AAWU Alaska Weather Depiction Chart Station Plot Legend

5.6.2.3 Sky Cover

The sky cover symbol is plotted at the station location and is filled according to the summation total of the sky condition element from the METAR report. For example, if the METAR sky condition element was **SCT030 BKN060 OVC090**, the sky cover would be overcast. Sky cover symbols are listed in Figure 5-41.

5.6.2.4 Station Identifier (STNID)

The four-letter ICAO station identifier is entered to the upper right of the station.

5.6.2.5 Wind

Wind is plotted in increments of 5 knots (kts). The wind direction is referenced to "true" north and is depicted by a stem (line) pointed in the direction from which the wind is blowing. Wind speed is determined by adding the values of the flags (50 kts), barbs (10kts), and half barbs (5 kts) found on the stem.

A single circle over the station with no wind symbol indicates a calm wind.

Some sample wind symbols are shown on Figure 5-46.

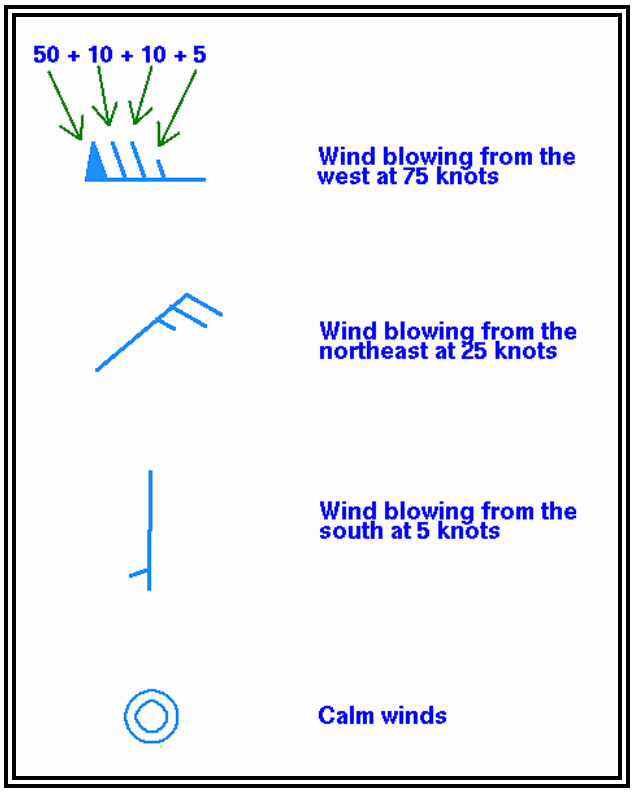


Figure 5-43. AAWU Alaska Weather Depiction Chart Wind Symbols

5.6.2.6 Temperature (TMP deg F)

Temperature in degrees Fahrenheit is plotted to the upper left of the sky cover symbol.

5.6.2.7 Visibility (VIS)

Visibility in statute miles is plotted to the left of the sky cover symbol. Decimals are used to represent tenths of miles when necessary.

5.6.2.8 Dew Point Temperature (DEWPT deg F)

Dew point temperature in degrees Fahrenheit is plotted to the lower left of the sky cover symbol.

5.6.2.9 Ceiling (CIG)

Ceiling is the height from the base of the lowest layer aloft covering more than one-half the sky. Additionally, vertical visibility into a total surface-based obscuration is defined as a ceiling. For a METAR report, the first broken (BKN) or overcast (OVC) layer is the ceiling. For example, if the METAR sky condition element is **SCT030 BKN060 OVC090**, the ceiling is 6,000 feet.

For a total surface-based obscuration, no ceiling is plotted and the METAR must be consulted.

If the sky cover is clear, few, or scattered, no ceiling is plotted.

The ceiling is plotted to the lower right of the station circle. Ceilings are reported as hundreds of feet above ground level (AGL). If no ceiling is present, the code **999** will be plotted.

5.6.2.10 Present Weather (WX)

Present weather symbols are entered to the left of the station. Note that the older Surface Aviation Observation (SAO) code is used instead Surface Analysis Chart symbols or the modern METAR code.

Table 5-16 Alaska Weather Depiction Charts Precipitation Symbols

Symbol	Meaning
T	Thunderstorm
R	Rain
RW	Rain Shower
L	Drizzle
ZR	Freezing Rain
ZL	Freezing Drizzle
A	Hail
IP	Ice Pellets
IPW	Ice Pellet Showers
S	Snow
SW	Snow Showers
SP	Snow Pellets
SG	Snow Grains
IC	Ice Crystals

Table 5-17 Alaska Weather Depiction Charts Obstruction to Visibility Symbols

Symbol	Meaning
BD	Blowing Dust
BN	Blowing Sand
BS	Blowing Snow
BY	Blowing Spray
D	Dust
F	Fog
GF	Ground Fog
H	Haze
IF	Ice Fog
K	Smoke

Table 5-18 Alaska Weather Depiction Charts Precipitation Intensity Symbols

Symbol	Meaning
-	Light
(No symbol)	Moderate
+	Heavy

5.6.3 Use

The Alaska Weather Depiction Charts provide an overview of weather flying categories and other adverse weather conditions for the chart valid time. The chart often does not completely represent the en route conditions because of terrain variations and the possibility of weather occurring between reporting stations. These charts should be used in addition to the latest METAR/SPECIs, pilot weather reports, and radar and satellite imagery for a complete look at the latest flying conditions.

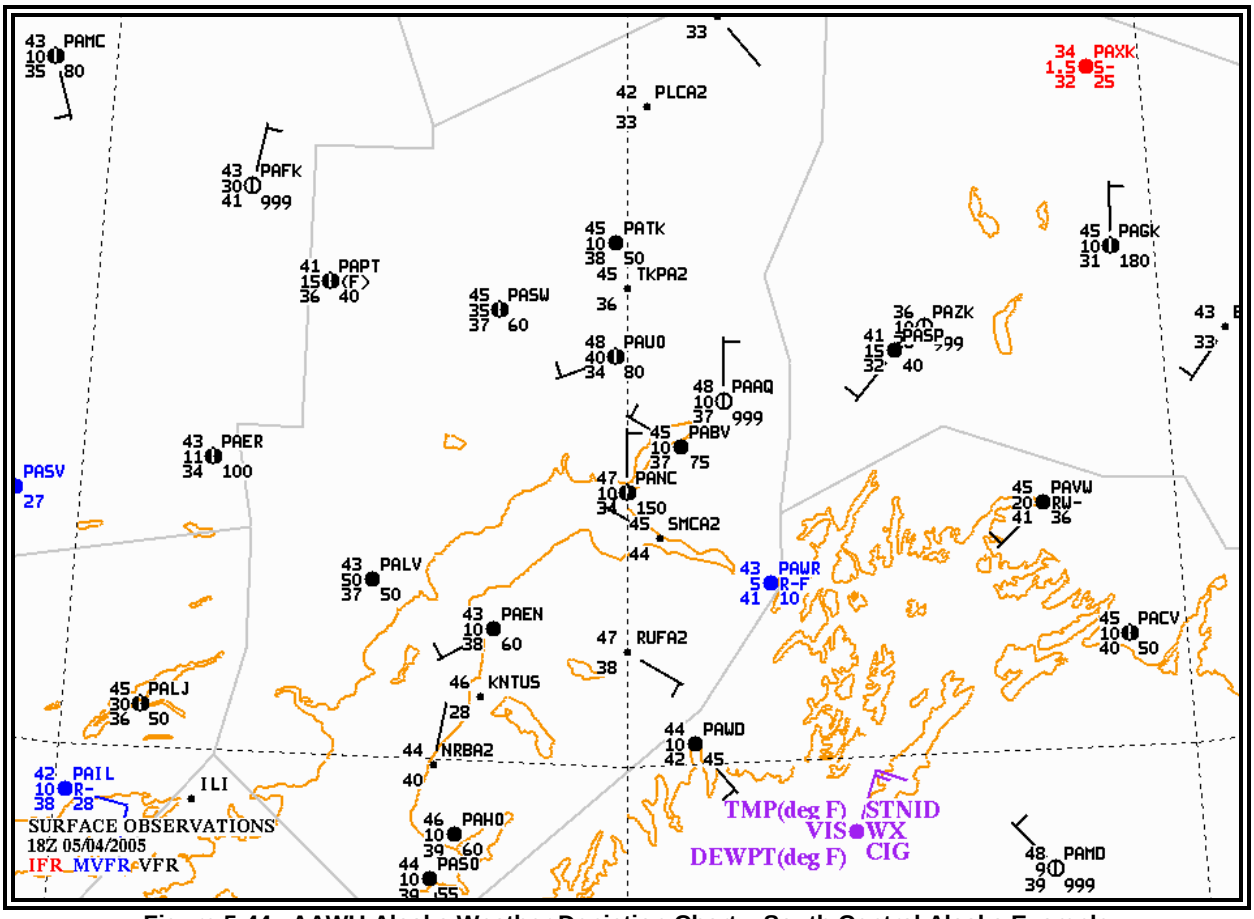


Figure 5-44. AAWU Alaska Weather Depiction Chart – South Central Alaska Example

5.7 Radar Summary Chart

The Radar Summary Chart (Figure 5-49) is a computer-generated mosaic of radar echo intensity contours based on Radar Weather Reports (Section 2.3) over the contiguous U.S. Possible precipitation types, cell movements, maximum tops, locations of line echoes, and remarks are plotted on this chart. Much of this information is often truncated due to space limitations. Severe thunderstorm and tornado watches are plotted if they are in effect when the chart is valid. The Radar Summary Chart is available on the National Weather Service (NWS) Fax Charts web site at: http://weather.noaa.gov/pub/fax/QAUA00.TIF

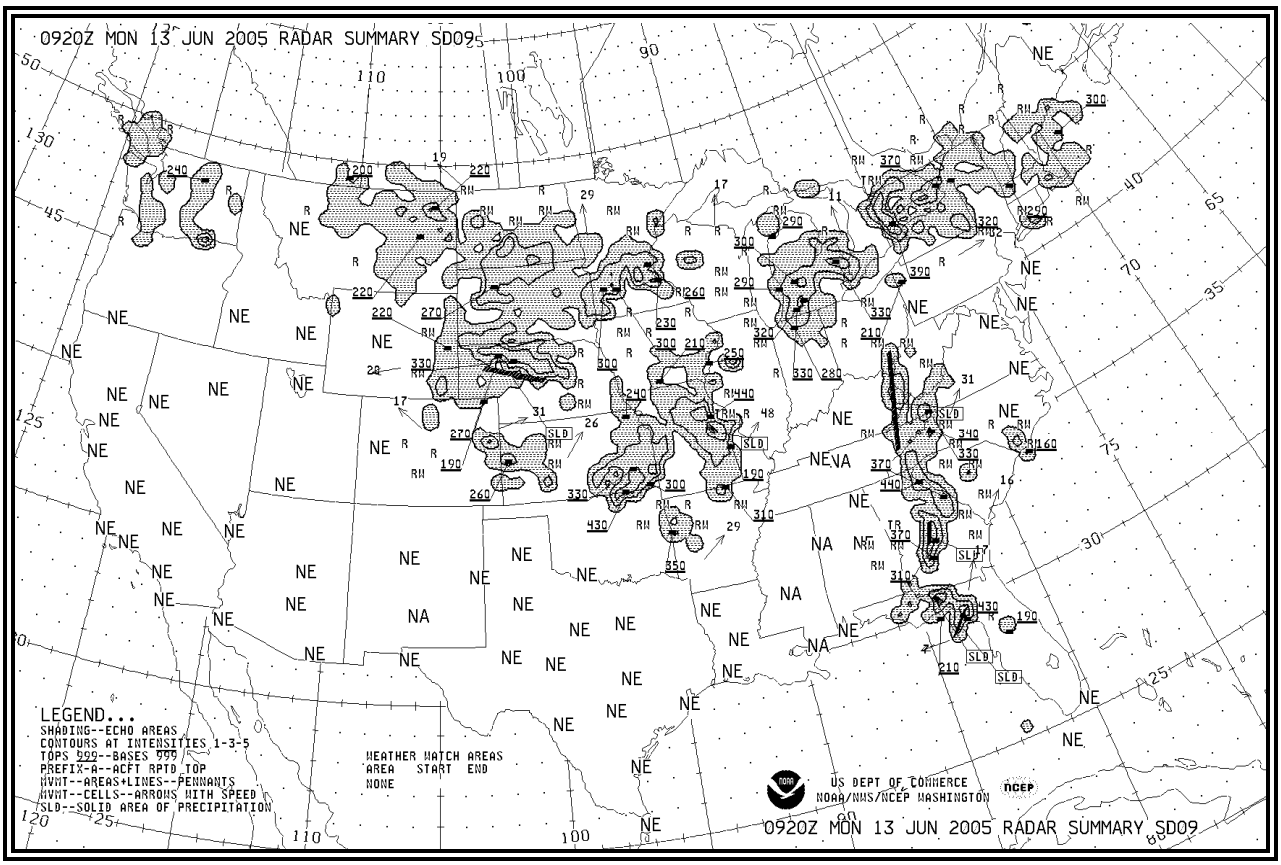


Figure 5-45. Radar Summary Chart Example

5.7.1 Issuance

The chart is issued hourly. Figure 5-50 depicts the WSR-88D weather radar network from which the chart is produced.

5.7.2 Format

The Radar Summary Chart depicts precipitation type, intensity, coverage, movement, echoes, and maximum tops.

5.7.2.1 Precipitation Type

The precipitation type, determined by a computer model, is indicated on the chart by symbols located adjacent to the precipitation areas. These symbols (Table 5-20) are not in METAR

format. Freezing precipitation is not reported in Radar Weather Reports and, thus, not plotted on the Radar Summary Chart.

Table 5-19. Radar Summary Chart Precipitation Type Symbols

SYMBOL	MEANING
R	Rain
RW	Rain shower
S	Snow
SW	Snow shower
T	Thunderstorms

5.7.2.2 Precipitation Intensity

The six precipitation intensity levels coded in the Radar Weather Report are consolidated into three contour intervals for the Radar Summary Chart (Figure 5-52). Precipitation intensity is correlated only for liquid precipitation, not solid precipitation (e.g., snow).

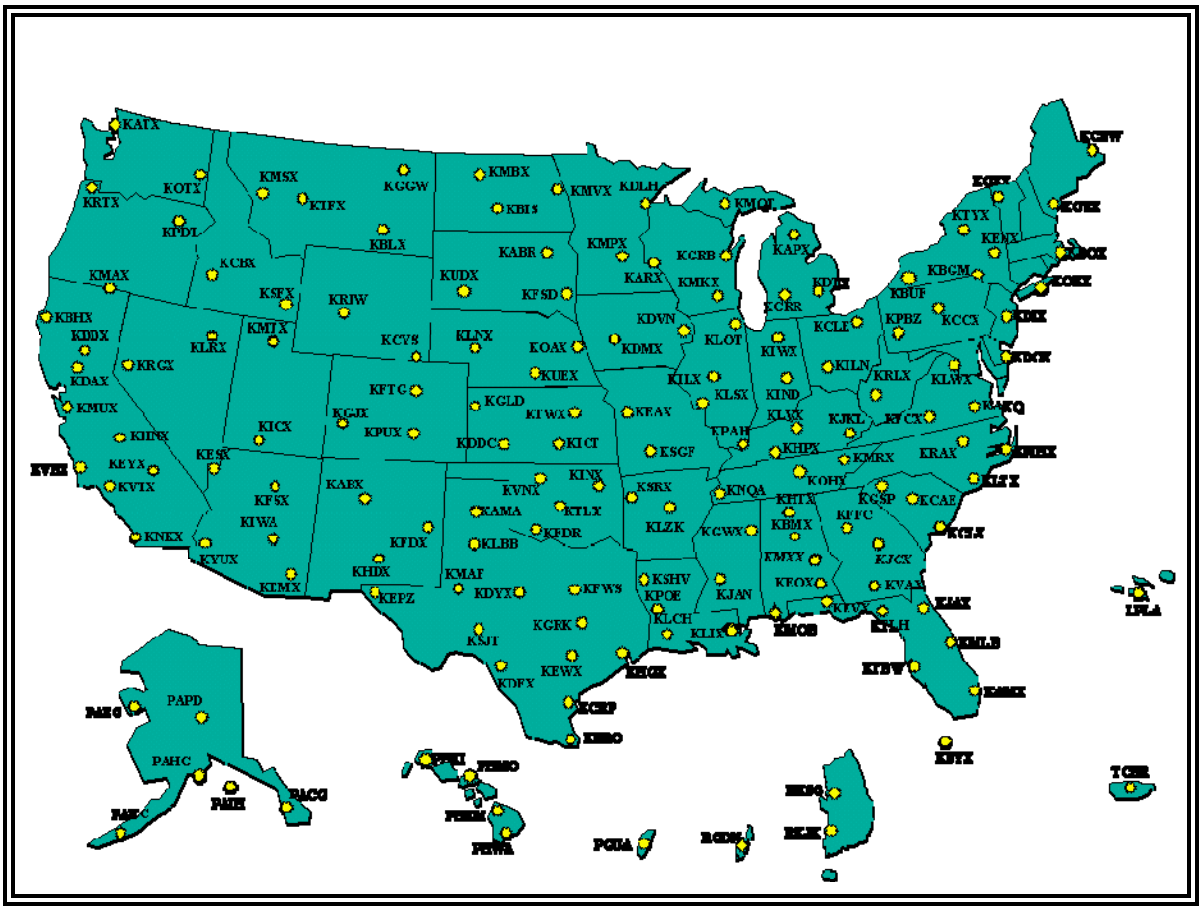


Figure 5-46. WSR-88D Weather Radar Network

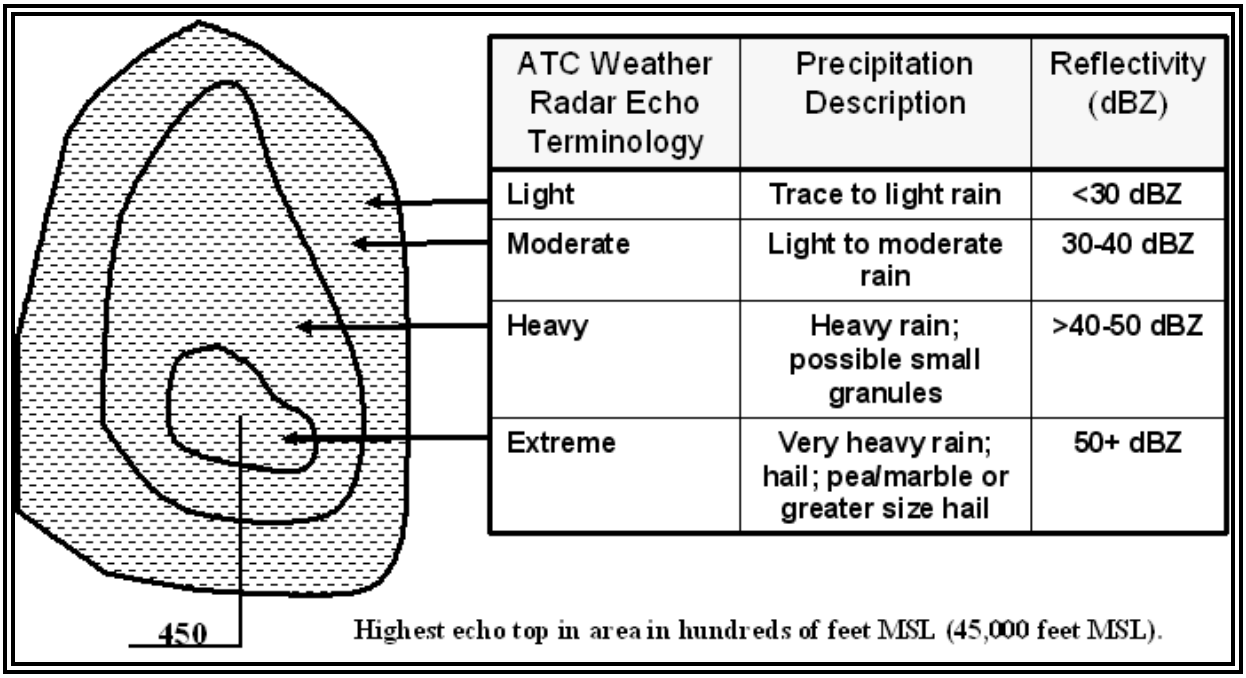


Figure 5-47. Radar Summary Chart Precipitation Intensity

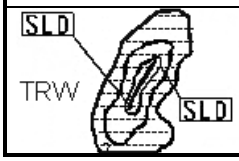
5.7.2.3 Echo Coverage

All of the shaded areas within the contours are assumed to contain precipitation. However, actual precipitation coverage is less. This is because only a fraction of a grid box needs to be covered with echoes for the entire grid box to be plotted as precipitation on the chart.

5.7.2.4 Line Echoes

When precipitation echoes are reported as a **LINE**, a line will be drawn through them on the chart (see Table 5-21). Where there is 8/10ths or more coverage, the line is labeled as solid (**SLD**) at both ends.

Table 5-20. Radar Summary Chart Echo Configuration Symbols

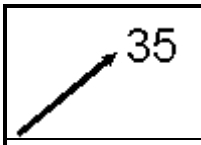
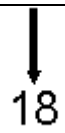
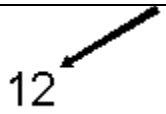
SYMBOL	MEANING
SLD	8/10ths or greater coverage in a line.
	Line of echoes.
	Solid line of thunderstorms with intense to extreme precipitation.

5.7.2.5 Cell Movement

Cell movement is the average motion of all cells within a configuration. An arrow indicates direction of cell movement. Speed in knots is entered near the arrowhead. **LM** identifies little

movement. Movement of areas and lines can be significantly different from the motion of the individual cells that comprise these configurations.

Table 5-21. Radar Summary Chart Cell Movement Examples

SYMBOL	MEANING
	Cell movement to the northeast at 35 knots
	Cell movement to the east at 24 knots
	Cell movement to the south at 18 knots
	Cell movement to the southwest at 12 knots
LM	Little cell movement

5.7.2.6 Maximum Top

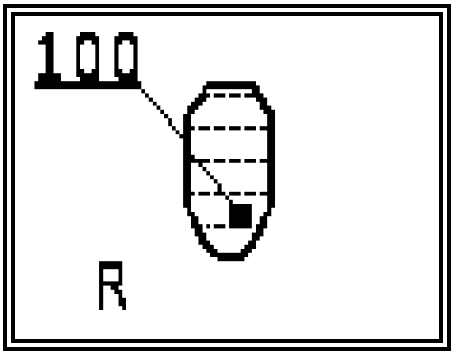


Figure 5-48. Radar Summary Chart Maximum Top Example

A maximum top is the altitude of the highest precipitation echo as coded on a Weather Radar Report (Section 2.3). Altitudes are sometimes augmented by satellite data. Individual Radar Weather Reports should be used to determine if satellite data was used for precipitation echo tops.

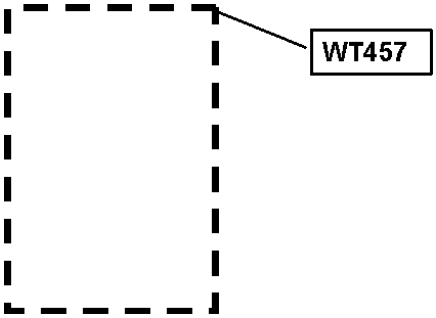
Tops are plotted in 3-digit groups representing height in hundreds of feet MSL and are underlined. Where it is necessary to offset a top for reasons of insufficient space, a line is drawn from one end of the underline to a small black square which represents the location of the top.

Maximum echo top does not equal maximum cloud top. The maximum echo top is the altitude of the highest light precipitation echo, not highest cloud top. Also, all radar heights are approximations due to radar wave propagation variations depending on atmosphere conditions.

5.7.2.7 Weather Watch Areas

Heavy dashed lines outline Tornado (**WT**) (Section 5.5.2) and Severe Thunderstorm (**WS**) Watch (Section 5.4.2) areas. The type of watch and the watch number are enclosed in a rectangle and positioned as closely as possible to the northeast corner of the watch. If there is no room at the northeast corner of the watch, the watch information is offset and connected to the watch by a thin line. The watch number is also printed at the bottom of the chart (in Mexico) together with the issuance time and expiration time under a label reading "**WEATHER WATCH AREAS**". In case no weather watch is in effect, "**NONE**" is printed at the bottom of the chart.

Table 5-22. Radar Summary Chart Weather Watch Area Examples

SYMBOL	MEANING
	Severe Thunderstorm Watch number 210
	Tornado Thunderstorm Watch number 457

5.7.2.8 Operational Contractions

Radar sites which report **PPINA**, **PPINE**, and **PPIOM** in their Weather Radar Reports (Section 2.3.1.10) are abbreviated to **NA**, **NE**, and **OM** respectively and plotted over the radar sites on the chart.

Table 5-23. Radar Summary Chart Operational Contractions

SYMBOL	MEANING
NA	Not available
NE	No echoes
OM	Out for maintenance

5.7.3 Use

The Radar Summary Chart aids in preflight planning by identifying areas of precipitation and highlighting its characteristics. This chart displays precipitation only; it does not display clouds, fog, fronts, or other boundaries. Therefore, the absence of echoes does not equal clear

weather. Cloud tops will be somewhat higher than precipitation tops detected by radar. The chart must be used in conjunction with other charts, reports, and forecasts.

The radar summary chart is for preflight planning only and should always be cross-checked and updated by current WSR-88D images. Once airborne, the pilot must evade individual storms by in-flight observations. This can be done by using visual sighting or airborne radar as well as by requesting weather radar information from En route Flight Advisory Service "Flight Watch" briefers at Automated Flight Service Station (AFSS). AFSS Flight Watch briefers have access to current weather radar imagery.

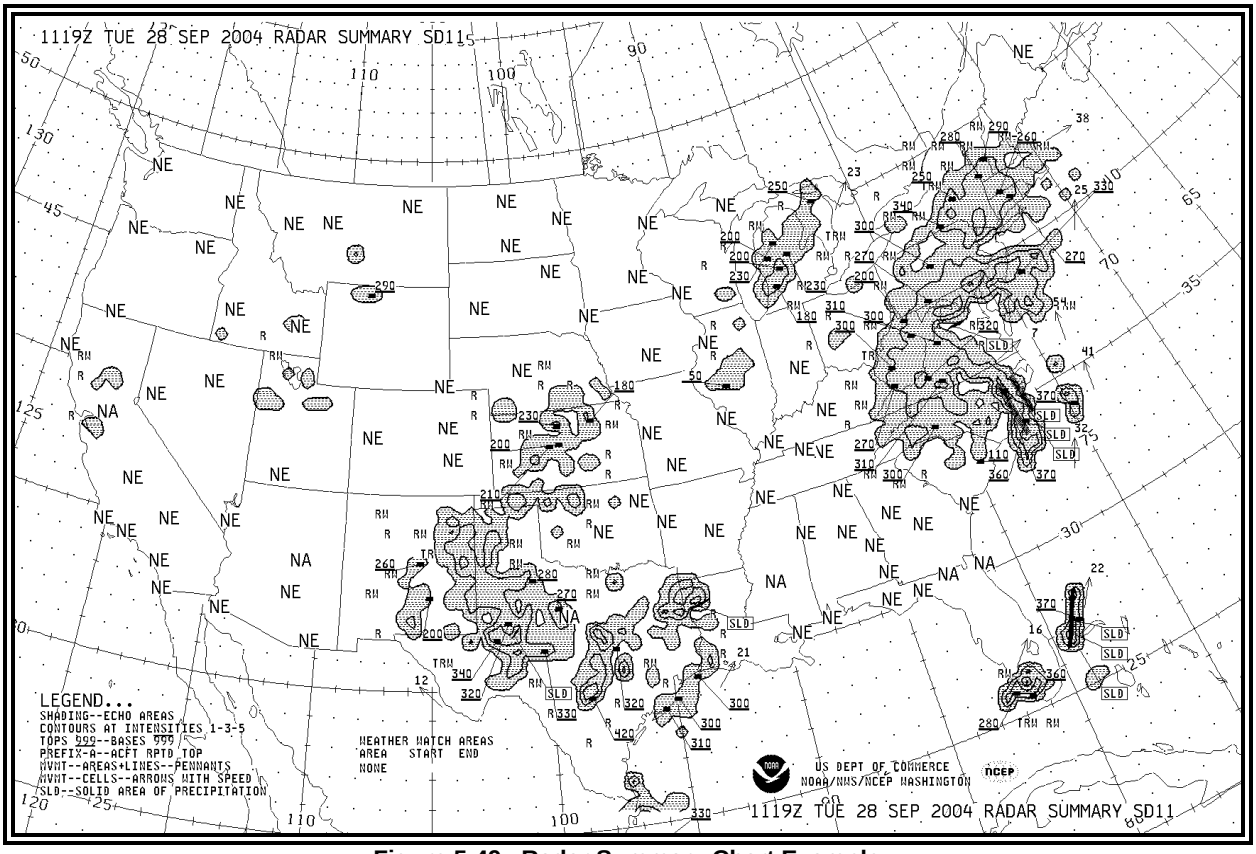


Figure 5-49. Radar Summary Chart Example

5.8 Alaska Initial Geopotential Heights and Winds Charts

The Alaska Initial Geopotential Heights and Winds Charts (Figure 5-54) display an analysis of the observed height contours and winds at selected constant pressure surfaces (flight levels).

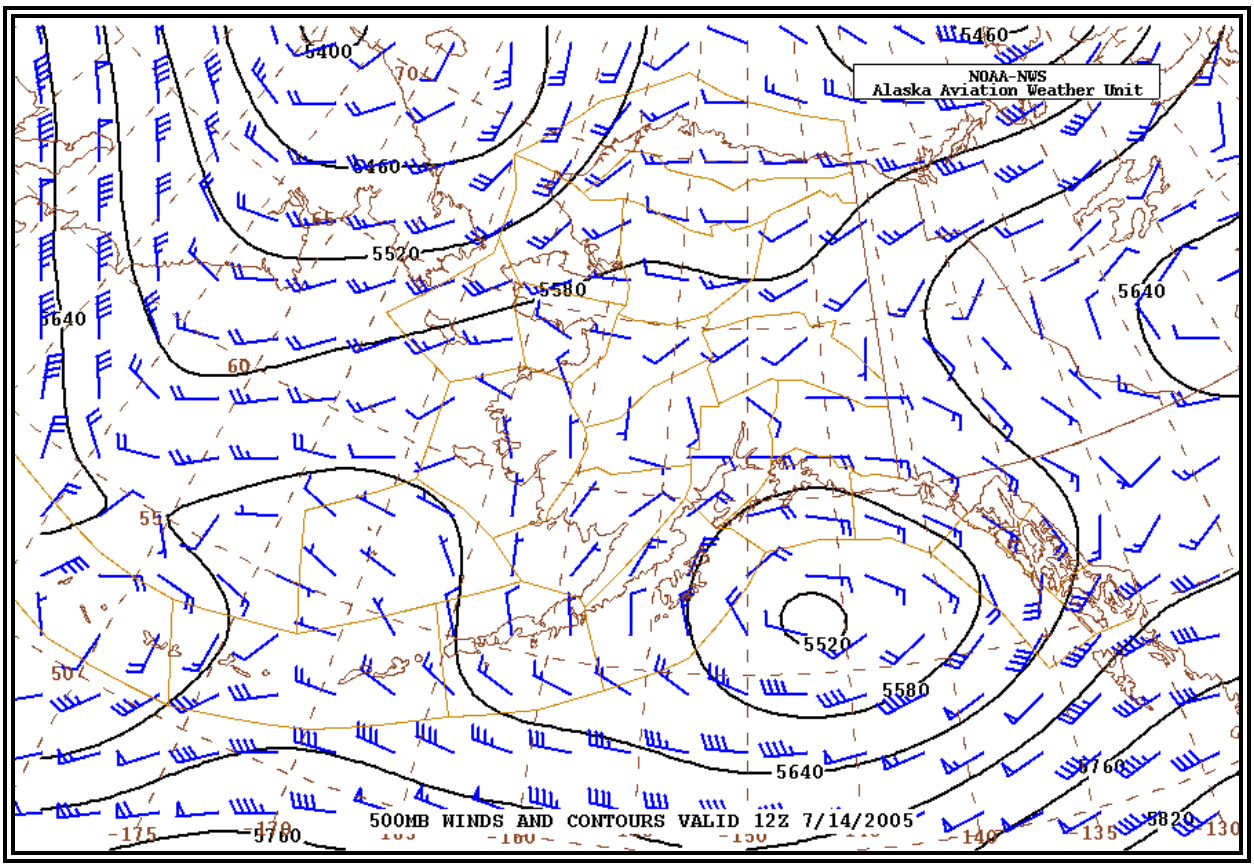


Figure 5-50. Alaskan Initial Geopotential Heights and Winds Chart Example

Table 5-24. Pressure Altitudes of Alaska Initial Geopotential Heights and Winds Charts

CHART	PRESSURE ALTITUDE (Feet, MSL)	PRESSURE ALTITUDE (Meters, MSL)
200 MB	39,000 ft	12,000 m
300 MB	30,000 ft	9,000 m
500 MB	18,000 ft	5,500 m
700 MB	10,000 ft	3,000 m
850 MB	5,000 ft	1,500 m

5.8.1 Issuance

The charts are issued twice daily with valid times of 00z and 12z and can be found on the Alaska Aviation Weather Unit (AAWU) web site at: http://aawu.arh.noaa.gov/upperwinds.php.

5.8.2 Analysis

The analysis of both height contours and winds are based on output from the North American Mesoscale (NAM) computer forecast model.

5.8.2.1 Height Contours

Height contours are lines of constant height referenced to MSL and are used to map the height variations of constant pressure surfaces. They identify and characterize pressure systems on constant pressure charts.

Contours are drawn as solid lines and labeled in meters. The intervals at which the contours are drawn are 60 meters on all of the charts.

5.8.2.2 Winds

Wind is plotted in increments of 5 knots (kts). The wind direction is referenced to “true” north and is depicted by a stem (line) pointed in the direction from which the wind is blowing. Wind speed is determined by adding the values of the flags (50 kts), barbs (10kts), and half barbs (5 kts) found on the stem.

A single circle over the station with no wind symbol indicates a calm wind.

Figure 5-55 contains some examples wind symbols.

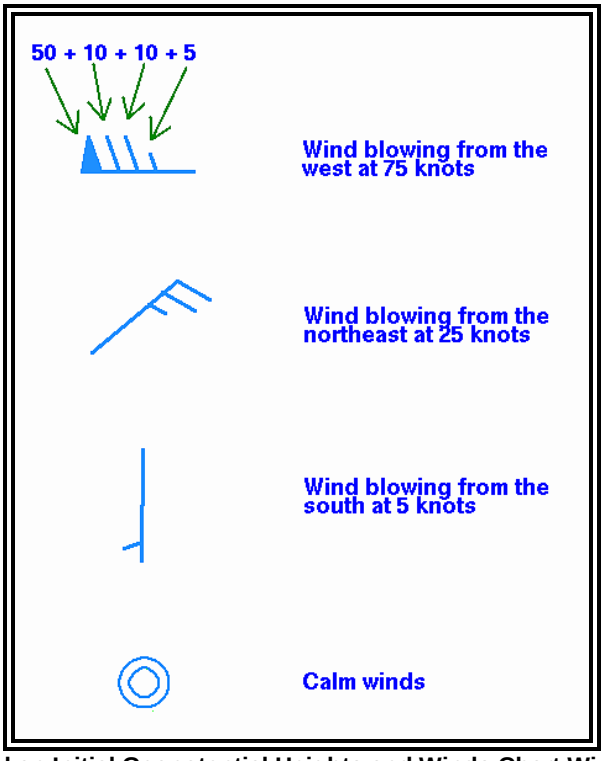


Figure 5-51. Alaskan Initial Geopotential Heights and Winds Chart Wind Plotting Model

5.8.3 Use

The Alaska Initial Geopotential Heights and Winds Charts are used to provide an overview of heights, pressure patterns and winds at specified pressure altitudes. Pressure patterns cause

and characterize much of the weather. Typically, lows and troughs are associated with bad weather, clouds and precipitation, while highs and ridges are associated with good weather.

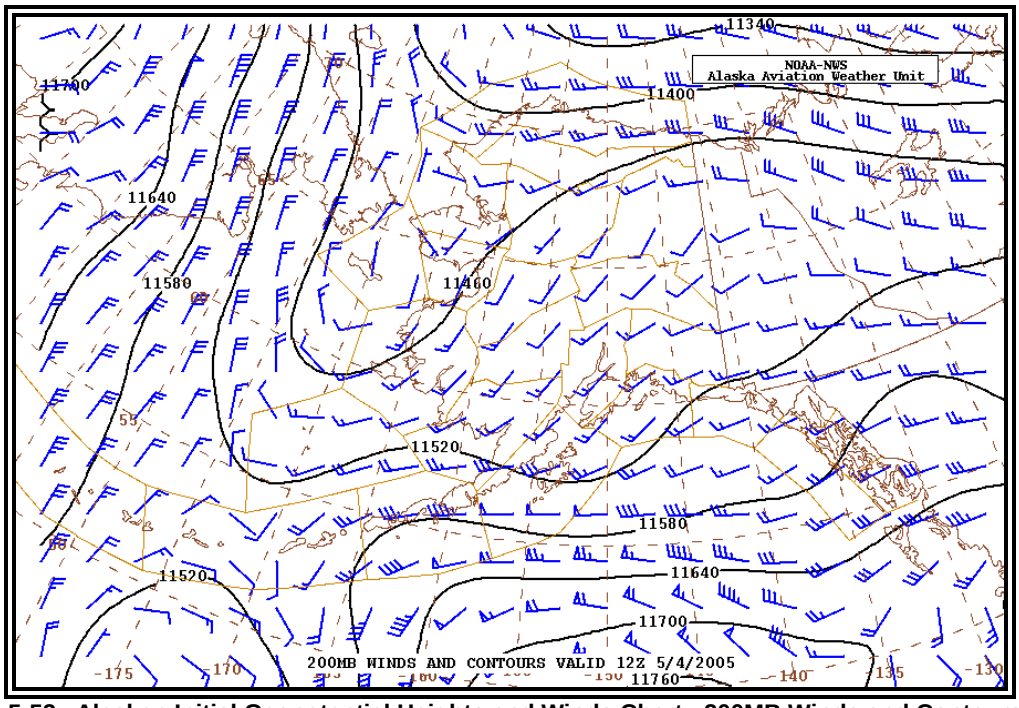


Figure 5-52. Alaskan Initial Geopotential Heights and Winds Chart - 200MB Winds and Contours Chart Example

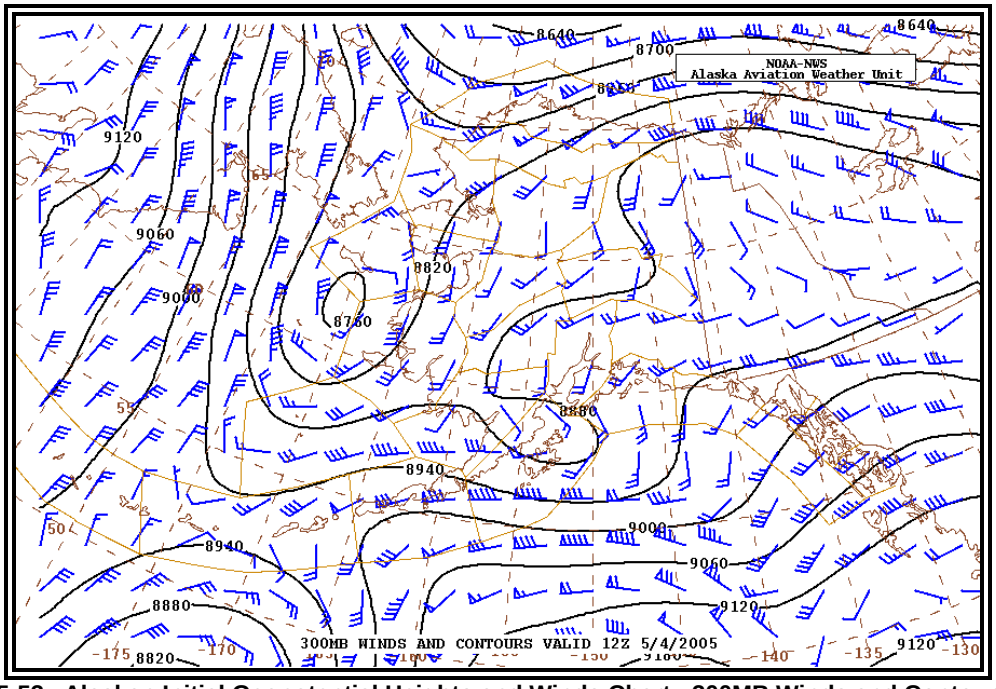


Figure 5-53. Alaskan Initial Geopotential Heights and Winds Chart - 300MB Winds and Contours Chart Example

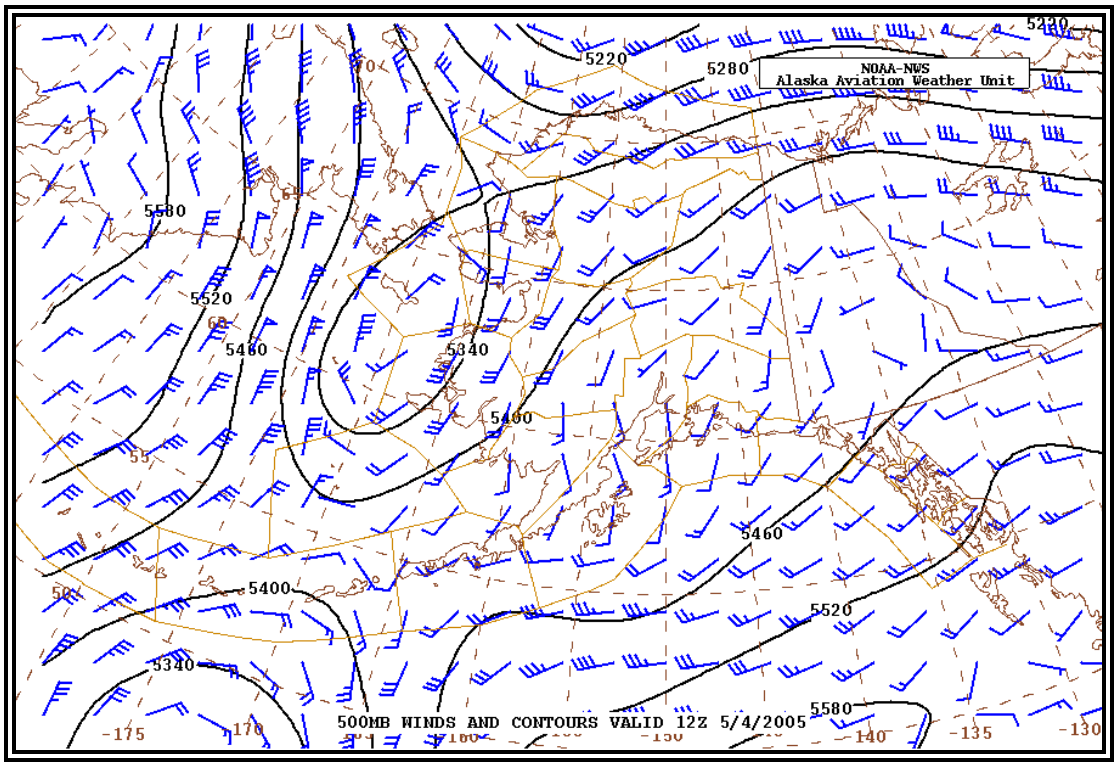


Figure 5-54. Alaskan Initial Geopotential Heights and Winds Chart - 500MB Winds and Contours Chart Example

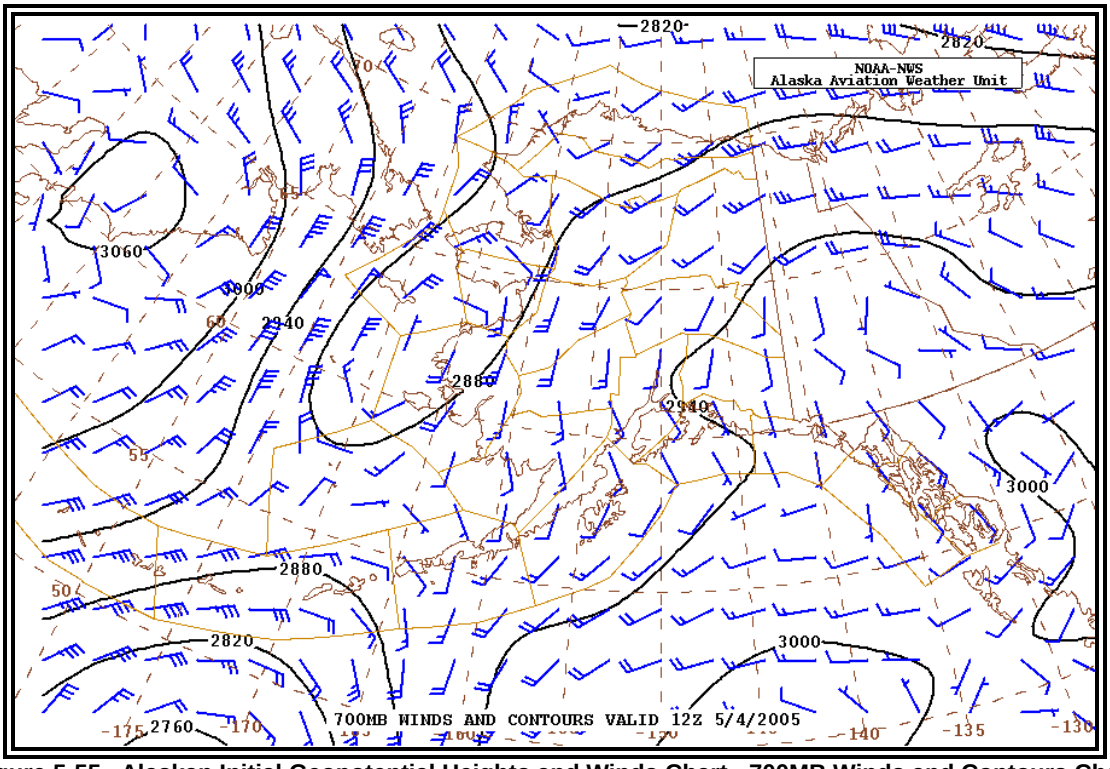


Figure 5-55. Alaskan Initial Geopotential Heights and Winds Chart - 700MB Winds and Contours Chart Example

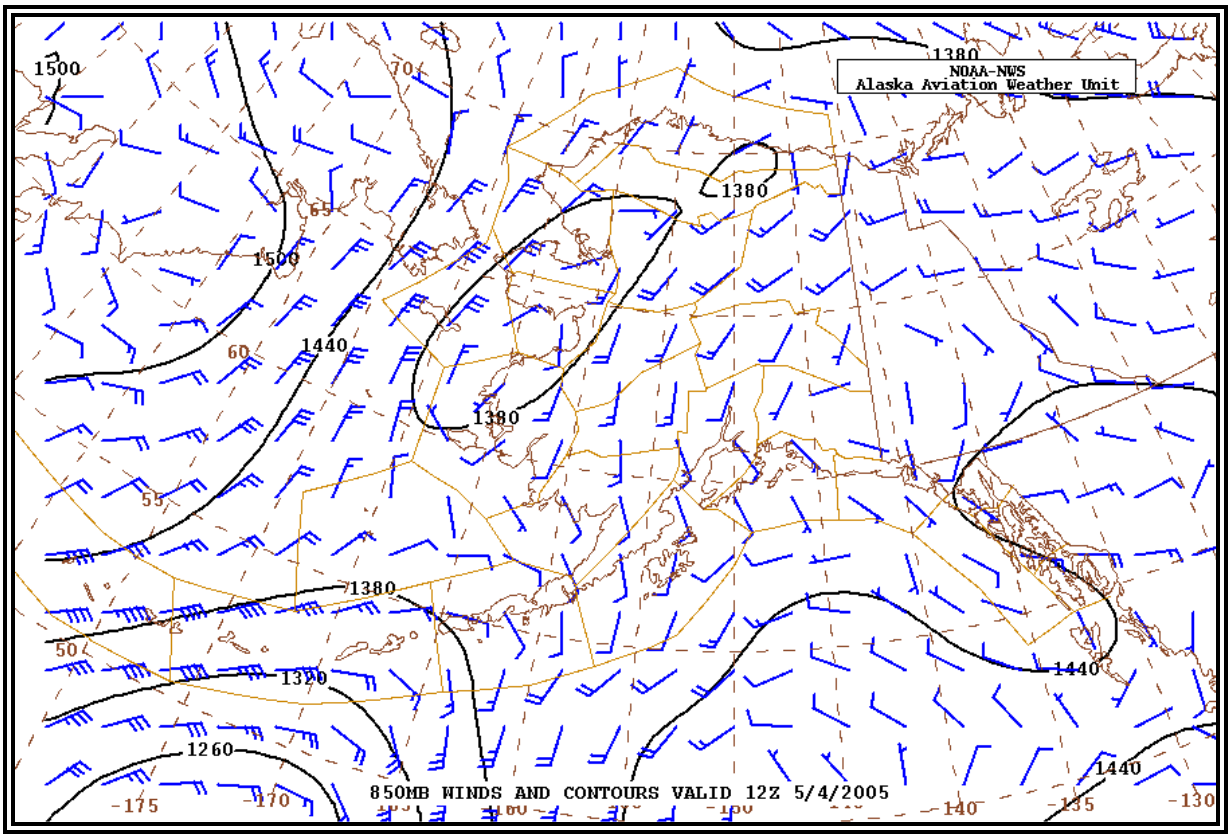


Figure 5-56. Alaskan Initial Geopotential Heights and Winds Chart - 850MB Winds and Contours Chart Example

6 PRODUCTS FOR AVIATION HAZARDS

6.1 Significant Meteorological Information (SIGMET)

Significant Meteorological Information (SIGMETs) provides aircraft operators and aircrews notice of potentially hazardous en route phenomena such as thunderstorms and hail, turbulence, icing, sand and dust storms, tropical cyclones, and volcanic ash.

- Domestic SIGMETs for the conterminous U.S. (CONUS) are available on the Aviation Digital Data Service (ADDS) web site at: http://adds.aviationweather.noaa.gov/airmet/

- International SIGMETs (including Alaska and Hawaii) are available on the Aviation Weather Center (AWC) website at: http://aviationweather.gov/products/sigmets/intl/

    - Alaska SIGMETs are also available on the Alaska Aviation Weather Unit (AAWU) web site at: http://aawu.arh.noaa.gov/

    - Hawaii SIGMETs are also available on the NWS WFO Honolulu web site at: http://www.prh.noaa.gov/hnl/pages/aviation.php

6.1.1 SIGMET Criteria (Non-Convective)

A SIGMET may be issued when any of the following conditions occur or is expected to occur in an area affecting at least 3,000 square miles or an area deemed to have a significant effect on the safety of aircraft operations.

- Thunderstorm* of the following type *except for the contiguous U.S.* (see Section 6.1.8)

    - Obscured (OBSCN TS)

    - Embedded (EMBD TS)

    - Widespread (WDSPR TS)

    - Squall line (SQL TS)

    - Isolated severe (ISOL SEV TS)

- Severe or greater Turbulence (SEV TURB)

- Severe Icing (SEV ICE)

- Widespread Duststorm (WDSPR DS)

- Widespread Sandstorm (WDSPR SS)

- Volcanic Ash (VA)

- Tropical Cyclone (TC)

NOTE: Obscured, embedded, or squall line thunderstorms, or mountain waves do not have to reach 3,000 square miles.

* Tornado (TDO), Funnel Cloud (FC), Waterspout (WTSPT), and Heavy Hail (HVYGR) may be used as a further description of the thunderstorm as necessary.

6.1.2 Standardization

SIGMETs follow these standards:

- All heights or altitudes are referenced to Mean Sea Level (MSL) and consist of three (3) digits depicting height in hundreds of feet. Flight Level (**FL**) is used for heights at or above 18,000 feet above. Examples: 100, FL190.

- References to latitude and longitude are in whole degrees and minutes following the model: Nnn[nn] or Snn[nn], Wnnn[nn] or Ennn[nn] with a space between latitude and longitude and a hyphen between successive points. Products issued by AWC have the N, S, W, or E behind the latitude/longitude numbers. Example: N3106 W07118

- Messages are prepared using approved ICAO contractions, abbreviations and numerical values of self-explanatory nature.

- Weather and obstructions to visibility are the same as weather abbreviations used for surface observations (METAR or SPECI) (Section 2.1).

- All amended (AMD) or corrected (COR) en route forecasts or advisory products follow the same format procedures. An AMD or COR is identified as a change in the first line after the time and date, and where appropriate, a comment - the reason for the change, etc. - is added as the last line of the product.

6.1.3 SIGMET Format

The WMO SIGMET header for non-convective SIGMETs is **WS**.

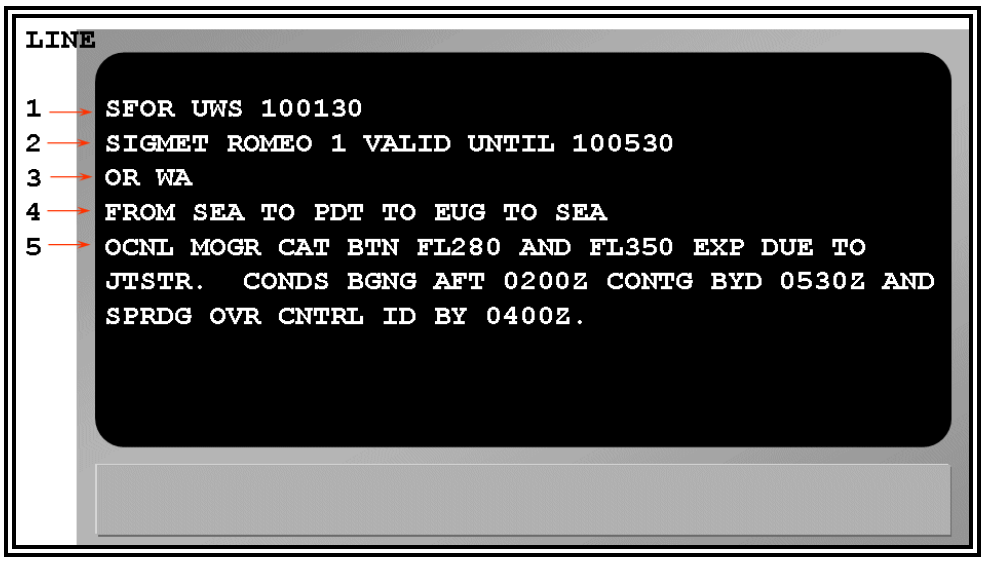


Figure 6-1. SIGMET for the Conterminous U.S. Decoding Example

Table 6-1. Decoding a Domestic SIGMET for the Conterminous U.S.

Line	Content	Description
1	SFO R WS 100130	SIGMET area identifier SIGMET series letter Product type Issuance UTC date/time
2	SIGMET ROMEO 1 VALID UNTIL 100530	Product type SIGMET series name Issuance number Ending valid UTC date/time
3	OR WA	Phenomenon location (states)
4	FROM SEA TO PDT TO EUG TO SEA	Phenomenon location (VOR coordinates)
5	OCNL MOGR CAT BTN FL280 AND FL350 EXP DUE TO JTSTR. CONDS BGNG AFT 0200Z CONTG BYD 0530Z AND SPRDG OVR CNTRL ID BY 0400Z.	Phenomenon description

The SIGMET in Figure 6-1 can be decoded as the following:

(Line 1) *SIGMET ROMEO series issued for the San Francisco Area at 0130 UTC on the 10th day of the month.*

(Line 2) *This is the first issuance of the SIGMET ROMEO series and is valid until the 10th day of the month at 0530 UTC.*

(Line 3) *The affected states within the SFO area are Oregon and Washington.*

(Line 4) *From Seattle, WA; to Pendleton, OR; to Eugene, OR; to Seattle, WA;*

(Line 5) *Occasional moderate or greater clear air turbulence between Flight Level 280 and Flight Level 350, expected due to jet stream. Conditions beginning after 0200Z continuing beyond 0530Z and spreading over central Idaho by 0400Z.*

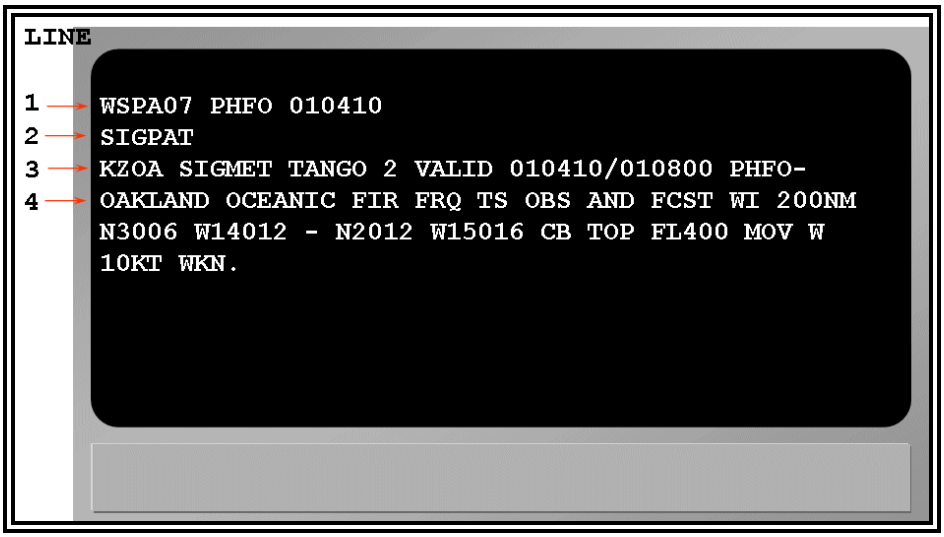


Figure 6-2. SIGMET Outside the Conterminous U.S. Decoding Example

Table 6-2. Decoding a SIGMET Outside of the Conterminous U.S.

Line	Content	Description
1	WSPA07 PHFO 010410	ICAO communication header Issuance MWO Issuance UTC date/time
2	SIGPAT	NWS AWIPS communication header
3	KZOA SIGMET TANGO 2 VALID 010410/010800 PHFO	Area Control Center Product type SIGMET series Issuance number Valid period UTC date/time Issuance office
4	OAKLAND OCEANIC FIR FRQ TS OBS AND FCST WI 200NM N3006 W14012 - N2012 W15016 CB TOP FL400 MOV W 10KT WKN.	Flight Information Region (FIR) Phenomenon description

The SIGMET in Figure 6-2 can be decoded as the following:

(*Line 1) The WMO product header is WSPA07. Issued by the PHFO on the 1st day of the month at 0410 UTC.*

(Line 2) The NWS AWIPS communication header is SIGPAT.

(Line 3) For the Oakland (KZOA) Area Control Center. This is the 2nd issuance of SIGMET Tango series, valid from the 1st day of the month at 0410 UTC until the 1st day of the month at 0800 UTC, issued by the Honolulu Meteorological Watch Office.

(Line 4) Concerning the Oakland Oceanic Flight Information Region (FIR), frequent thunderstorms observed and forecast within 200 nautical miles of 30 degrees and 6 minutes north; 140 degrees and 12 minutes west; to 20 degrees and 12 minutes north, 150 degrees and 16 minutes west, cumulonimbus tops to flight level 400 moving west at 10 knots, weakening.

6.1.3.1 SIGMET Phenomena Information

A SIGMET contains the following information related to the specific phenomena and in the order indicated:

- Phenomena and its description; e.g., **SEV TURB.**
- An indication whether the information is observed, using **OBS** or **FCST** with the time of observation will be given in UTC.
- Location (referring, when possible, to latitude and longitude and/or locations or geographic features which are well known internationally) and flight level (altitude).
- Movement towards or expected movement using sixteen points of the compass, with speed in knots, or stationary, if appropriate.
- Thunderstorm maximum height as FL
- Changes in intensity; using as appropriate, the abbreviations Intensifying (**INTSF**), Weakening (**WKN**), or No Change (**NC**).
- On the last line, an outlook beyond the valid period for forecast trajectory of a volcanic ash cloud or tropical cyclone.

6.1.4 Issuance

SIGMETs are issued from Meteorological Watch Offices (MWO). The U.S. has three MWOs: the Aviation Weather Center (AWC), the Alaska Aviation Weather Unit (AAWU), and the Weather Forecast Office (WFO) in Honolulu. Their areas of responsibility are as follows:

- The AWC:
    - Forecast areas for the conterminous U.S. (CONUS) out to the domestic Flight Information Region (FIR) boundary (Figure 6-3).
    - The New York, Houston, Miami, and San Juan Oceanic FIRs (Figure 6-4).
    - The Oakland Oceanic FIR north of 30 north latitude, and the portion east of 140 west longitude which is between the equator and 30 north latitude (Figure 6-5).
- The AAWU is responsible for the Anchorage FIR (Figures 6-5 and 6-6).
- WFO Honolulu is responsible for the Oakland Oceanic FIR south of 30 north latitude to the equator and between 140 west and 160 east longitude (Figure 6-5).

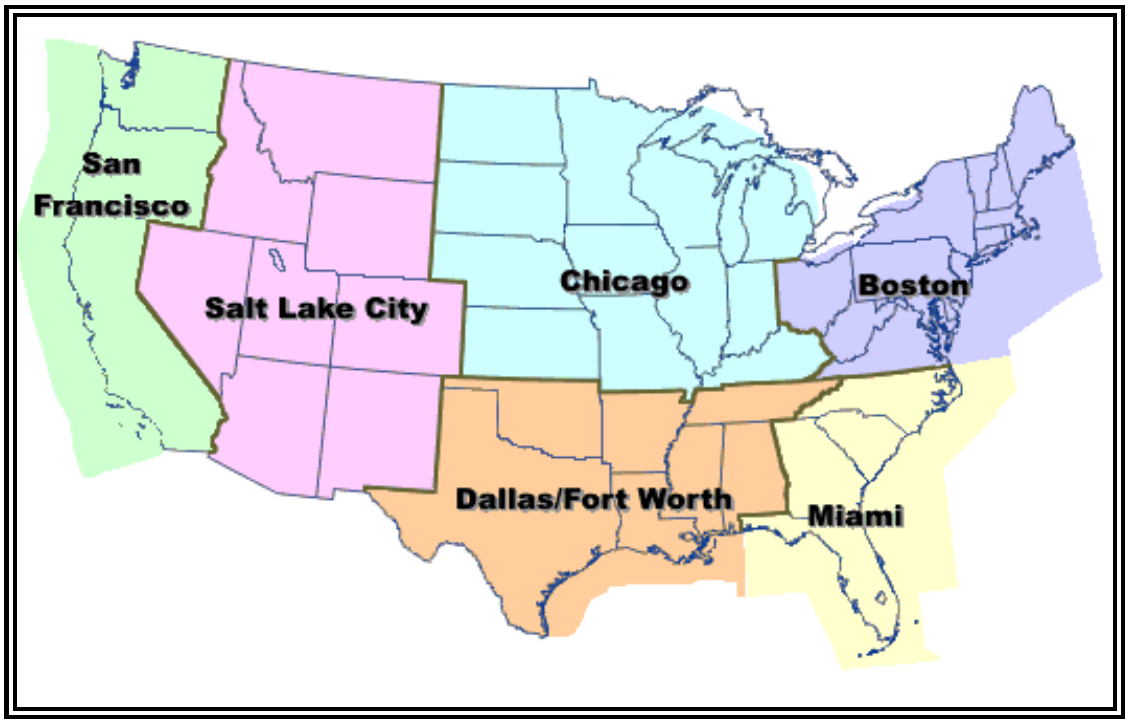


Figure 6-3. AWC SIGMET Areas of Responsibility - Conterminous U.S.

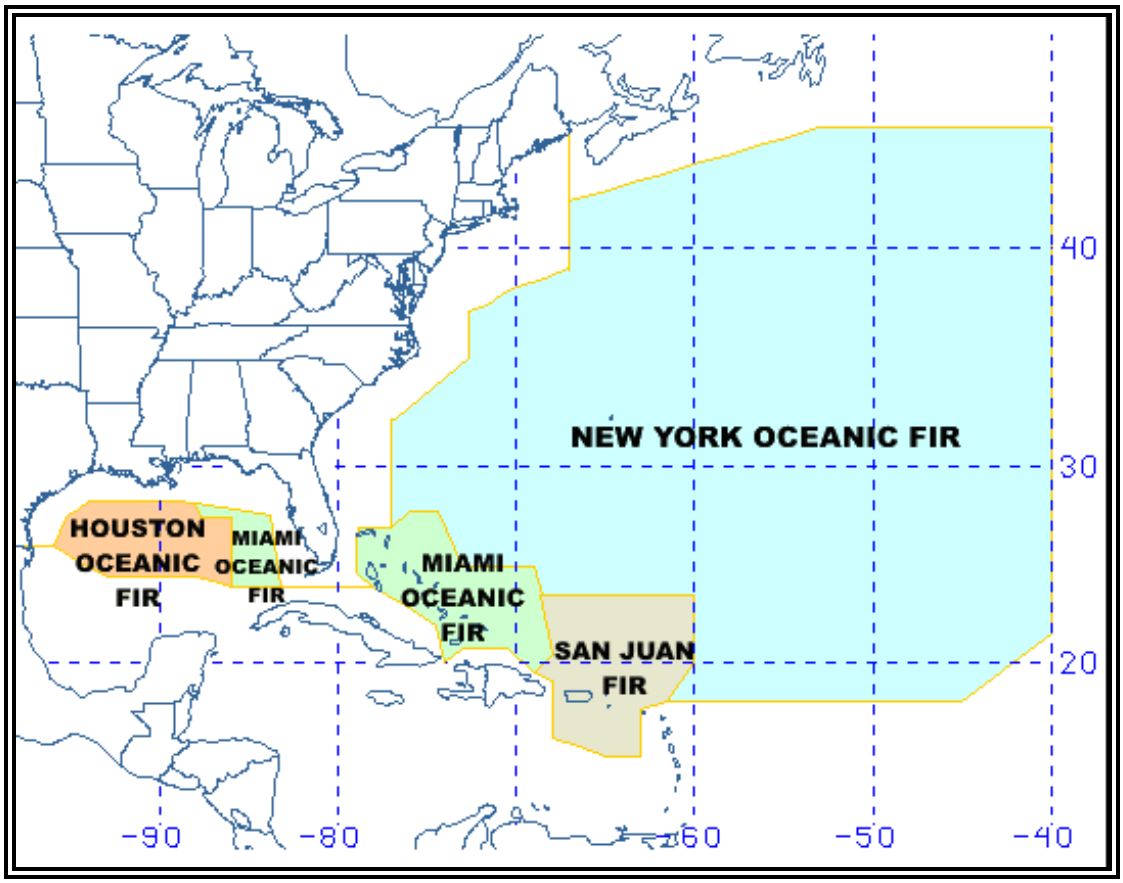


Figure 6-4. AWC SIGMET Areas of Responsibility – Atlantic Basin

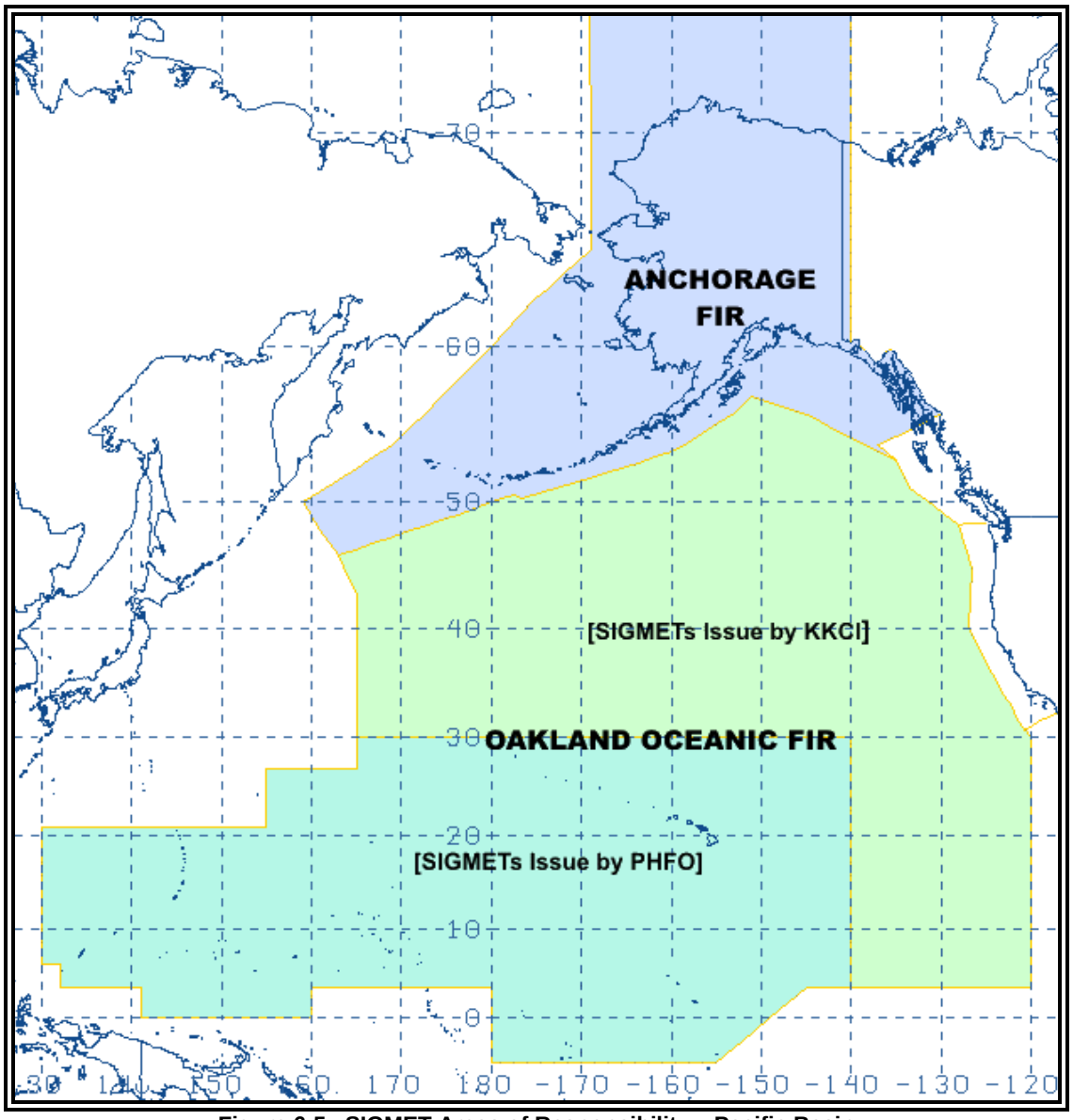


Figure 6-5. SIGMET Areas of Responsibility – Pacific Basin

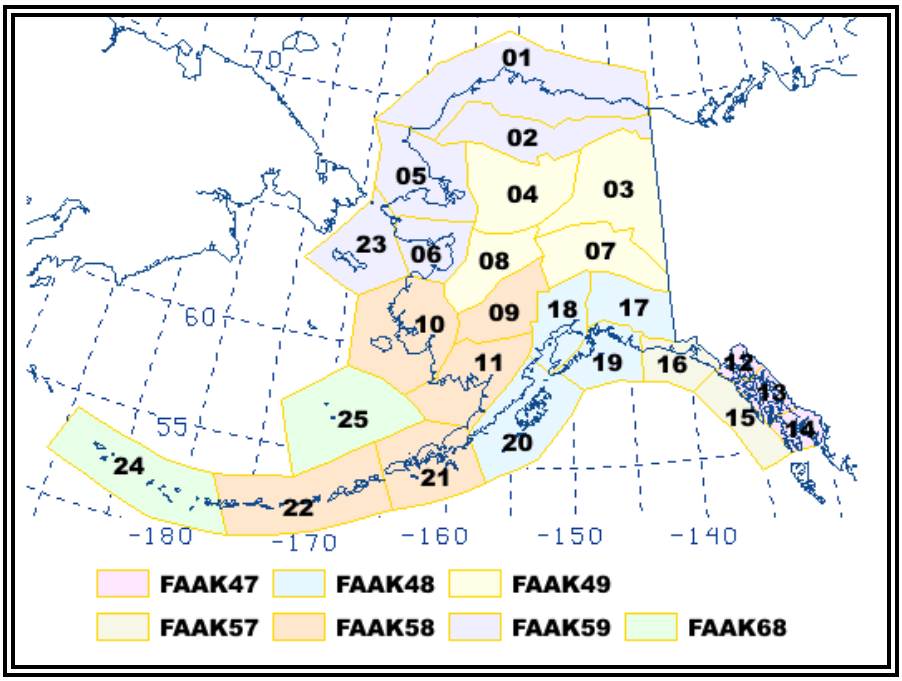


Figure 6-6. AAWU Flight Advisory and Area Forecast Zones – Alaska

Table 6-3. AAWU Flight Advisory and Area Forecast Zones – Alaska

1	Arctic Coast Coastal	**14**	Southern Southeast Alaska
2	North Slopes of the Brooks Range	**15**	Coastal Southeast Alaska
3	Upper Yukon Valley	**16**	Eastern Gulf Coast
4	Koyukuk and Upper Kobuk Valley	**17**	Copper River Basin
5	Northern Seward Peninsula-Lower Kobuk Valley	**18**	Cook Inlet-Susitna Valley
6	Southern Seward Peninsula-Eastern Norton Sound	**19**	Central Gulf Coast
7	Tanana Valley	**20**	Kodiak Island
8	Lower Yukon Valley	**21**	Alaska Peninsula-Port Heiden to Unimak Pass
9	Kuskowim Valley	**22**	Unimak Pass to Adak
10	Yukon-Kuskowim Delta	**23**	St. Lawrence Island-Bering Sea Coast
11	Bristol Bay	**24**	Adak to Attu
12	Lynn Canal and Glacier Bay	**25**	Pribilof Islands and Southeast Bering Sea
13	Central Southeast Alaska		

6.1.4.1 SIGMET Identification

When a SIGMET is issued, it is assigned a unique series identifier:

- AWC for CONUS
  - **NOVEMBER** through **YANKEE**, excluding **SIERRA** and **TANGO**
- AWC for Oakland Oceanic FIR
  - **ALFA** through **HOTEL**
- Honolulu MWO for Oakland Oceanic FIR
  - **NOVEMBER** through **ZULU**
- AAWU for Anchorage FIR
  - **INDIA** through **MIKE**

A number is assigned sequentially with each issuance until the phenomenon ends. At 0000 UTC each day, all continuing SIGMETs are renumbered to one (1) regardless of a continuation of the phenomena.

Examples: YANKEE 1, YANKEE 2, YANKEE 3, etc.

6.1.4.2 SIGMET Valid Period

SIGMETs for volcanic ash or tropical cyclones are valid up to six (6) hours with an outlook of up to twelve (12) hours beyond the valid period. They are reissued at least every six (6) hours while the volcanic ash or tropical cyclone exists or is forecast to exist. SIGMET messages for volcanic ash or tropical cyclones expected to affect a FIR are issued up to 12 hours before the start of the valid period or as soon as practicable if such advance warning of the existence of these phenomena is not available.

SIGMETs for all other phenomena (other than domestic Convective SIGMETs) have a valid period not to exceed four (4) hours. These SIGMETs are issued up to four (4) hours before the initial valid time. SIGMETs for continuing phenomena are reissued at least every four (4) hours as long as SIGMET criteria are met.

6.1.4.3 SIGMET Cancellation

SIGMETs are cancelled when the phenomena is no longer occurring or expected to occur in the area.

6.1.4.4 SIGMET Amendments

Updates to SIGMETs are issued as necessary. This is done by issuing a new SIGMET in the current series, which advances the SIGMET number and replaces the previous SIGMET. The valid time of the new SIGMET is updated to reflect a new four (4) hour period.

6.1.4.5 SIGMET Corrections

Corrections to SIGMETs are issued as necessary. This is done by issuing a new SIGMET in the series, which advances the SIGMET number and cancels the previous SIGMET. The start time of the new, corrected SIGMET is updated, but the end valid time remains the same as the original SIGMET. At the end of the SIGMET, the product states “CORRECTS SIGMET {SERIES} {#}”, where {SERIES} is the SIGMET designator and {#} is the series number.

6.1.5 SIGMET Examples

```
BOSR WS 050600
SIGMET ROMEO 2 VALID UNTIL 051000
ME NH VT
FROM MLT TO YSJ TO CON TO MPV TO MLT
OCNL SEV TURB BLW 080 EXP DUE TO STG NWLY FLOW. CONDS CONTG BYD
1000Z.
```

SIGMET issued for the Boston Area Forecast region on the 5th day of the month at 0600 UTC. This is the second (2nd) issuance of SIGMET series Romeo and is valid until the 5th day of the month at 1000 UTC. The affected states are Maine (ME), New Hampshire (NH) and Vermont (VT). Within an area bounded from Millinocket, Maine; to St. Johns, New Brunswick; to Concord, New Hampshire; to Montpelier, Vermont; to Millinocket, Maine. Occasional severe turbulence below 8,000 feet due to strong northwesterly flow. Conditions are expected to continue beyond 1000 UTC

```
KZOA SIGMET TANGO 1 VALID 010400/010800 PHFO-
OAKLAND OCEANIC FIR ACT TS OBS BY SATELLITE WITHIN 100 NM EITHER SIDE
OF LINE N3006 W14012 - N2012 W15016. CB TO TOPS FL400. MOV W 10 KT.
WKN.
```

SIGMET issued for the Honolulu area of the Oakland Oceanic FIR. This first (1) issuance of SIGMET Series Tango valid from the 1st day of the month at 0400 UTC to the 1st day of the month at 0800 UTC. Issued by the Honolulu Weather Forecast Office. Within the Oakland Oceanic FIR, active thunderstorms observed by satellite within 100 nautical miles either side of a line from 30 degrees, 6 minutes north to 140 degrees, 12 minutes west to 20 degrees 12 minutes north, 150 degrees, 16 minutes west. Cumulonimbus tops to 40,000 feet. The thunderstorms are moving west at 10 knots and weakening.

```
KZOA SIGMET DELTA 2 VALID 081530/081930 KKCI-
OAKLAND OCEANIC FIR FRQ TS WITHIN AREA BOUNDED BY N3935 W16920 – N3414
W17050 – N3010 W17325 TOPS FL470 MOV NNE 10KT NC.
```

SIGMET issued for the Aviation Weather Center's area of the Oakland FIR. This is the second (2) issuance of SIGMET series Delta valid from the 8th day of the month at 1530 UTC to the 8th day of the month at 1930 UTC. Within the Oakland Oceanic FIR, frequent thunderstorms within an area bounded by 39 degrees 35 minutes north, 169 degrees 20 minutes west to 34 degrees 14 minutes north, 170 degrees, 50 minutes west to 30 degrees 10 minutes north, 173 degrees 25 minutes west. Thunderstorm tops to 47,000 feet, thunderstorms are moving to the north-northeast at 10 knots with no change observed.

```
DFWY WS 121450 COR
SIGMET YANKEE 4 VALID UNTIL 121700
MO AR LA MS
FROM STL TO 30 N MEI TO BTR TO MLU TO STL
OCNL SVR MXD ICING 90 TO 130 EXPCD.
FRZLVL 80 E TO 120 W. CONDS CONTG BYD 1700Z
CORRECTS YANKEE 3
```

Corrected SIGMET issued for the Dallas/Fort Worth Area Forecast region on the 12th day of the month at 1450 UTC. This is the fourth (4) issuance of SIGMET series Yankee and is valid until the 12th day of the month at 1700 UTC. The affected states are Missouri (MO), Arkansas (AR), Louisiana (LA) and Mississippi (MS). Bounded within an area from Saint Louis, Missouri; to 30 nautical miles north of Meridian, Mississippi; to Baton Rouge, Louisiana; to Monroe, Louisiana; to Saint Louis, Missouri. Occasional severe mixed icing between 9,000 and 13,000 feet is expected. The freezing level is 8,000 feet over the eastern portion of the Area Forecast region to 12,000 feet over the western portion of the Area Forecast region. Conditions are expected to continue beyond 1700 UTC. This SIGMET corrects SIGMET YANKEE 3.

6.1.6 SIGMET for Volcanic Ash

A SIGMET for volcanic ash (VA) may be issued for all volcanic eruptions, regardless of the eruption's magnitude. Volcanic ash SIGMETs are issued until the ash cloud is no longer a threat to aviation. The forecast position information for the volcanic ash cloud is based on advisories provided by a Volcanic Ash Advisory Center (VAAC). Initial VA SIGMETs may be

issued based on credible pilot or aircraft reports in the absence of a Volcanic Ash Advisory (VAA) but are updated once a VAA is issued.

6.1.6.1 Examples of SIGMETs for Volcanic Ash

```
ANCI UWS 190530

PAZA SIGMET INDIA 1 VALID 190530/190930 PANC-
SATELLITE IMAGERY SHOWS DEVELOPING VA FROM ANOTHER POSSIBLE
ERUPTION OF CHIKURACHKI VOLCANO AT 0500 UTC IN THE NORTHERN KURIL
ISLANDS. HEIGHT IS ESTIMATED AT FL300 MOVEMENT IS E AT 75KTS. FURTHER
UPDATES TO FOLLOW ASAP.
FCSTR APRIL 2003 AAWU

ANCI UWS 190930
PAZA SIGMET INDIA 2 VALID 190930-191330Z PANC-
AT 0830 UTC SATELLITE IMAGERY SHOWED THE PLUME FROM THE 0500 UTC
ERUPTION OF CHIKURACHKI VOLCANO IN THE NORTHERN KURIL ISLANDS BECOMING
VERY DIFFUSE IN AN APPROXIMATELY 60 NM WIDE BAND FROM N48/E167 AND
EXTENDING SE FOR 250 NM. HEIGHT IS ESTIMATED AT FL300. MOVEMENT IS E
AT 90 KTS. THE PLUME IS MOVING SE OF ALASKA AIRSPACE INTO THE
WASHINGTON VAAC AREA OF RESPONSIBILITY. SEE WASHINGTON VAAC VOLCANIC
ASH SIGMETS AND ADVISORIES FOR FURTHER FORECASTS.
RB APRIL 2003
```

6.1.7 SIGMET for Tropical Cyclone

A SIGMET for a tropical cyclone may be issued for non-frontal synoptic-scale cyclones over oceanic FIRs (Figure 6-4 and 6-5) meeting the following criteria:

- Originate over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation; and
- Wind speeds reach 34 knots or more, independent of the wind averaging time used by the Tropical Cyclone Advisory Center (TCAC).

SIGMETs for tropical cyclones do not include references to associated turbulence and icing.

6.1.7.1 Example of a SIGMET for Tropical Cyclone

```
KZNY SIGMET CHARLIE 4 VALID 081500/082100 KKCI-
NEW YORK OCEANIC FIR TC KYLE OBS N3106 W07118 AT 1500Z CB TOPS FL500
WI 80NM OF CENTER MOV SSW 5KT NC FCST 2100Z TC CENTER N2930 W07130
OTLK TC CENTER 090000 N3018 W07142 091200 UTC N2918 W07224
```

SIGMET issued by the Aviation Weather Center (AWC) for the New York Area Control Center. This is the fourth (4th) issuance of SIGMET series Charlie valid from the 8th day of the month at 1500 UTC to the 8th day of the month at 2100 UTC. Within the New York Oceanic FIR. Tropical Cyclone Kyle was observed at 31 degrees 6 minutes north, 71 degrees 18 minutes west at 1500 UTC. Cumulonimbus tops at 50,000 feet within 80 nautical miles of the center, moving south-southwest at 5 knots, with no change observed. At 2100 UTC, the tropical cyclone's center is forecast to be located at 29 degrees, 30 minutes north and 71 degrees, 30 minutes west. The

outlook on the 9th day of the month at 0000 UTC is for the tropical cyclone center to be located at 30 degrees, 18 minutes north and 71 degrees, 42 minutes west. On the 9th day of the month at 1200 UTC, the center is forecast to be at 29 degrees, 18 minutes north and 72 degrees, 24 minutes west.

6.1.8 Convective SIGMET for CONUS

Convective SIGMETs (also known as SIGMETs for Convection) are issued for the contiguous U.S. instead of SIGMETs for convection. Each bulletin includes one or more Convective SIGMETs for a specific region of the CONUS (Figure 6-7). Convective SIGMETs are issued for thunderstorms and related phenomena and do not include references to all weather associated with thunderstorms such as turbulence, icing, low-level wind shear and IFR conditions.

6.1.8.1 Convective SIGMET Criteria

A Convective SIGMET may be issued when any of the following occurs and/or is forecast to occur:

- Severe thunderstorms and embedded thunderstorms occurring for more than 30 minutes of the valid period regardless of the size of the area.
  - A thunderstorm is classified as severe when it is accompanied by tornadoes, hail ¾-inch or greater, or wind gusts of 50 knots or greater
  - A thunderstorm is classified as embedded when it is obscured by haze, non-convective clouds or precipitation.
- A line of thunderstorms
  - A line of thunderstorms must be at least 50 miles long with thunderstorms affecting at least 40 percent of its length.
- An area of active thunderstorms affecting at least 3,000 square miles.
  - Thunderstorms are classified as active when they are heavy (>40 dBZ) or greater and affect at least 40 percent of the area. In the absence of radar, AWC meteorologists may identify active thunderstorms using satellite or lightning information.

Obscured, embedded, or squall line thunderstorms do not have to reach 3000 square miles to be included in Convective SIGMETs.

6.1.8.2 Special Convective SIGMET

A special Convective SIGMET may be issued when either of the following criteria is occurring or expected to occur for more than 30 minutes of the valid period of the current Convective SIGMET:

- Tornado, hail greater than or equal to 3/4 inch, or wind gusts greater than or equal to 50 knots is reported or indicated when the previous Convective SIGMET did not mention severe thunderstorms; and/or

- Indications of rapidly changing conditions, if, in the forecaster's judgment, they are not sufficiently described in existing Convective SIGMETs.

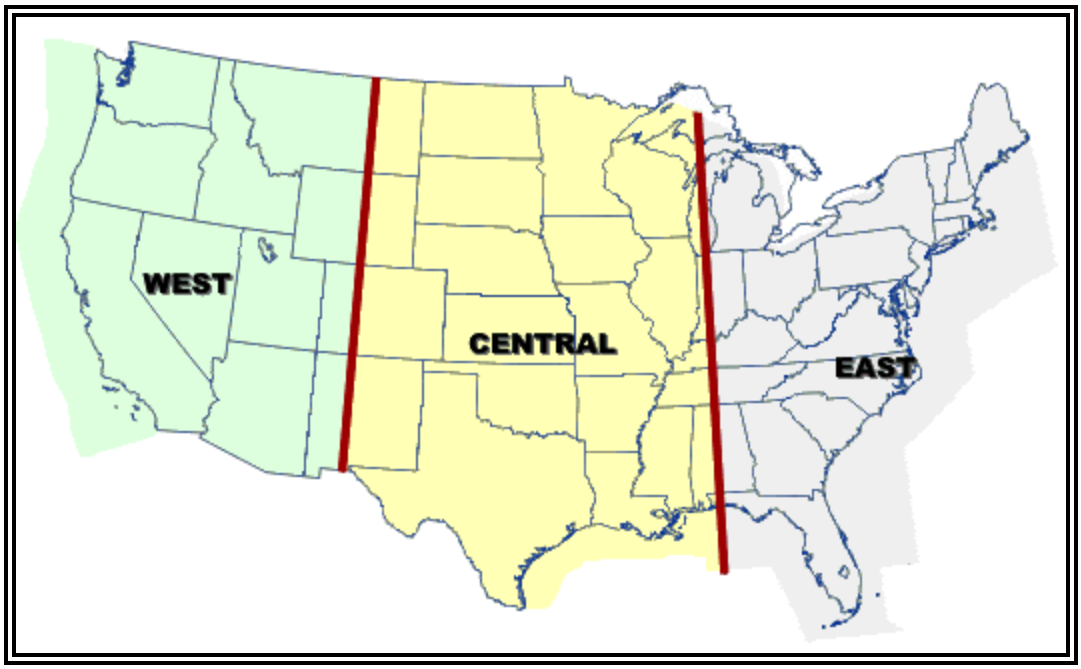


Figure 6-7. AWC Convective SIGMET Areas of Responsibility

6.1.8.3 Convective SIGMET Issuance

Three (3) Convective SIGMET bulletins describing conditions in the eastern, central and western regions of the CONUS are issued hourly at 55 minutes past the hour (Figure 6-7). Special Convective SIGMETs are issued as required. Each Convective SIGMET bulletin is made up of one or more individually numbered Convective SIGMETs for conditions within the region and are valid for up to two (2) hours or until superseded by the next hourly issuance. An outlook message is included which describes areas where Convective SIGMET issuances are expected between two (2) and six (6) hours after issuance time.

Since the Convective SIGMET bulletin is a scheduled product, a message must be transmitted each hour. If no Convective SIGMETs are expected within a region, a bulletin with **CONVECTIVE SIGMET...NONE** is transmitted.

Convective SIGMETs are not cancelled but expire as soon as the next bulletin is issued.

6.1.8.4 Format of a Convective SIGMET

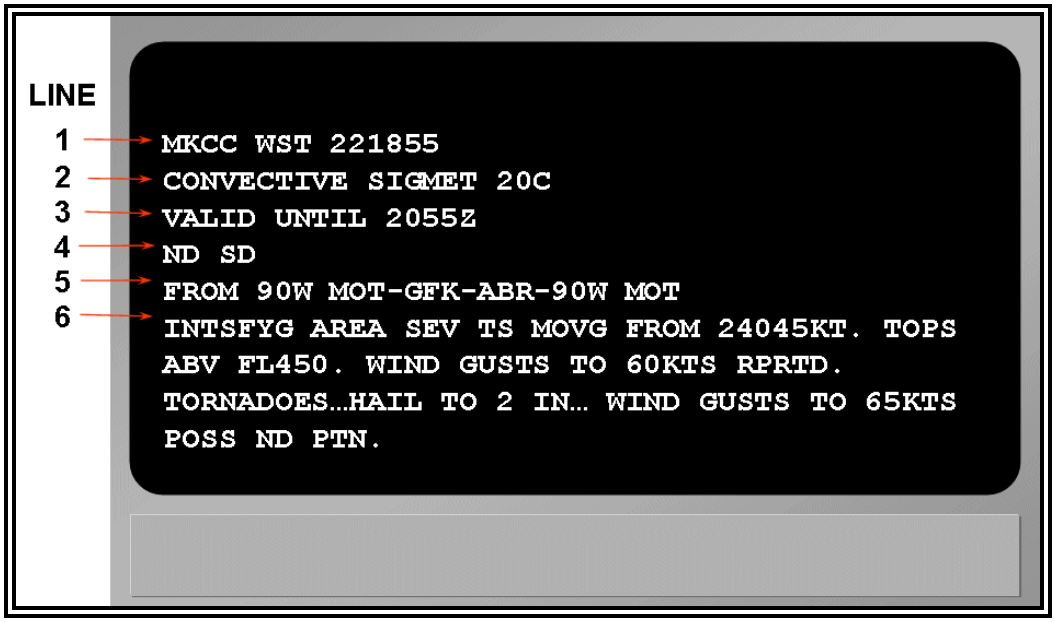


Figure 6-8. Convective SIGMET Decoding Example

Table 6-4. Decoding a Convective SIGMET

Line	Content	Description
1	MKC C WST 221855	Issuing Office W, C, or E Contraction WST Six-digit date/time group (DDHHMM)
2	CONVECTIVE SIGMET 20 C	Product type Issuance number Location (West, Central or East)
3	VALID UNTIL 2055Z	Ending valid UTC date/time
4	ND SD	Phenomenon location (states)
5	FROM 90W MOT-GFK-ABR-90W MOT	Phenomenon location (VOR coordinates)
6	INTSFYG AREA SEV TS MOVG FROM 24045KT. TOPS ABV FL450. WIND GUSTS TO 60KTS RPRTD. TORNADOES…HAIL TO 2 IN… WIND GUSTS TO 65KTS POSS ND PTN	Phenomenon description

The Convective SIGMET in Figure 6-8 is decoded as the following:

(Line 1) *Convective SIGMET issued for the central portion of the United States on the 22nd at 1855Z*.

(Line 2) *This is the 20th Convective SIGMET issued on the 22nd for the central United States as indicated by "20C."*

(Line 3) *Valid until 2055Z*

(Line 4) *The affected states are North and South Dakota.*

(Line 5) *From 90 nautical miles west of Minot, ND; to Grand Forks, ND; to Aberdeen, SD; to 90 nautical miles west of Minot, ND.*

(Line 6) *An intensifying area of severe thunderstorms moving from 240 degrees at 45 knots (to the northeast). Thunderstorm tops above Flight Level 450. Wind gusts to 60 knots reported. Tornadoes, hail to 2 inches in diameter, and wind gusts to 65 knots possible in the North Dakota portion.*

6.1.8.5 Convective SIGMET Bulletin Example

```
CONVECTIVE SIGMET 54C
VALID UNTIL 1855Z
WI IL
FROM 30E MSN-40ESE DBQ
DMSHG LINE TS 15 NM WIDE MOV FROM 30025KT. TOPS TO FL450. WIND GUSTS
TO 50 KT POSS.

CONVECTIVE SIGMET 55C
VALID UNTIL 1855Z
TX OK NM
FROM 70SE TBE-60NW AMA-40NW TCC-30ESE CIM-70SE TBE
AREA SEV TS MOV FROM 33025KT. TOPS TO FL400.
HAIL TO 2 IN...WIND GUSTS TO 70KT POSS.

OUTLOOK VALID 251855-252255
FROM 60NW ISN-INL-TVC-GIJ-UIN-FSD-BIL-60NW ISN
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.
```

Convective SIGMET 54C is the 54th Convective SIGMET issued for the central region of the US on the 25th day of the month. Valid until 1855Z. States affected include Wisconsin and Illinois. Bounded within an area from 30 east of Madison, WI; to 40 miles east-southeast of Dubuque, Iowa. A diminishing line of thunderstorms 15 nautical miles wide moving from 300 degrees (to the southeast) at 25 knots. Thunderstorms tops to FL450 (approximately 45,000 ft MSL). Wind gusts to 50 knots are possible.

Convective SIGMET 55C is the 55th Convective SIGMET issued for the central region of the US on the 25th day of the month. Valid until 1855 UTC. States affected include Texas, Oklahoma and New Mexico. Bounded within an area from 70 miles southeast of Tuba City, Arizona; to 60 miles northwest of Amarillo, Texas; to 40 northwest of Tucumcari, New Mexico; to 30 miles east-southeast of Cimarron, New Mexico; to 70 miles southeast of Tuba City, Arizona. An area of severe thunderstorms is moving from 330 degrees (to the southeast) at 25 knots.

Thunderstorms tops to Flight Level 400 (approximately 40,000 feet MSL). Hail up to 2 inches in diameter and wind gust to 70 knots are possible.

The outlook portion of the Convective SIGMET bulletin is valid from the 25th day of the month at 1855 UTC to the 25th day of the month at 2255 UTC. Within an area bounded by 60 miles northwest of Williston, North Dakota; to International Falls, Minnesota; to Traverse City, Michigan; to Niles, Michigan; to Quincy, Illinois; to Sioux Falls, South Dakota; to Billings, Montana; to 60 miles northwest of Williston, North Dakota. Convective SIGMET issuances are expected for this area. Refer to the most recent Day 1 Convective Outlook (ACUS01 KWNS) from the Storm Prediction Center for a synopsis and meteorological details.

6.2 Airmen's Meteorological Information (AIRMET)

An Airmen's Meteorological Information (AIRMET) is a concise description of the occurrence or expected occurrence in time and space of specified en route weather phenomena. The intensities are lower than those of a SIGMET although the phenomena can still affect the safety of aircraft operations. AIRMETs are intended for dissemination to all pilots in flight to enhance safety and are of particular concern to operators and pilots of aircraft sensitive to the phenomena described and to pilots without instrument ratings. Freezing level information is also included.

An AIRMET provides notice of significant weather phenomena, issued as scheduled products, for icing, turbulence, strong surface winds and low-level wind shear, and Instrument Flight Rules (IFR) and mountain obscuration, all at intensities that DO NOT meet SIGMET criteria.

- AIRMETs are available for the conterminous U.S. (CONUS) on the Aviation Digital Data Service (ADDS) web site at: http://adds.aviationweather.noaa.gov/airmets/

- AIRMETs are available for Alaska on the Alaska Aviation Weather Unit (AAWU) web site at: http://aawu.arh.noaa.gov/

- AIRMETs are available for Hawaii on the NWS WFO Honolulu web site at: http://www.prh.noaa.gov/hnl/pages/aviation.php

6.2.1 AIRMET Criteria

An AIRMET may be issued when any of the following weather phenomena are occurring or expected to occur over an area of at least 3,000 square miles:

- Sustained surface wind greater than 30 knots - **STG SFC WND**
  - Cause and direction will not be given

- Ceiling less than 1,000 feet (**IFR, CIG BLW 010**) or visibility less than 3 statue miles - **IFR, VIS BLW 3 SM BR**
  - The cause of the visibility restriction is included but limited to precipitation (PCPN), smoke (FU), haze (HZ), mist (BR), fog (FG), and blowing snow (BLSN)

- Widespread mountain obscuration - **MTN OBSCN**
  - The cause of the mountain obscuration is included but limited to clouds (CLDS) precipitation (PCPN), smoke (FU), haze (HZ), mist (BR), and fog (FG)

- Moderate turbulence - **MOD TURB**;

- Moderate icing - **MOD ICE**
  - Will not reference the location of the icing with respect to either in clouds or in precipitation
  - The freezing level is defined as the lowest freezing level above ground level or the surface (SFC)
  - Freezing levels above the surface are delineated using high altitude VOR locations at intervals of 4,000 feet above MSL or the surface (SFC)
  - Areas with multiple freezing levels are delineated with high altitude VOR locations

  - The range of freezing levels over the AIRMET area is included

- Non-convective LLWS potential below 2,000 ft - **LLWS POTENTIAL**
  - Will include a list of affected states and be bounded by high altitude VOR locations

6.2.2 Standardization

All in-flight advisories follow these standards:

- All heights or altitudes are referenced to Mean Sea Level (MSL) and consist of three (3) digits depicting height in hundreds of feet. Flight Level (**FL**) is used for heights at or above 18,000 feet above. Examples: 100, FL190.

- References to latitude and longitude are in whole degrees and minutes following the model: Nnn[nn] or Snn[nn], Wnnn[nn] or Ennn[nn] with a space between latitude and longitude and a hyphen between successive points. Products issued by AWC have the N, S, W, or E behind the latitude/longitude numbers.

- Messages are prepared using approved ICAO contractions, abbreviations and numerical values of self-explanatory nature.

- Weather and obstructions to visibility will be limited to clouds, (CLDS), precipitation (PCPN), smoke (FU), haze (HZ), mist (BR), fog, (FG), and blowing snow (BLSN).

- All amended (AMD) or corrected (COR) en route forecasts or advisory products follow the same format procedures. An AMD or COR is identified as a change in the first line after the time and date (Figure 6-9).

6.2.3 AIRMET Format

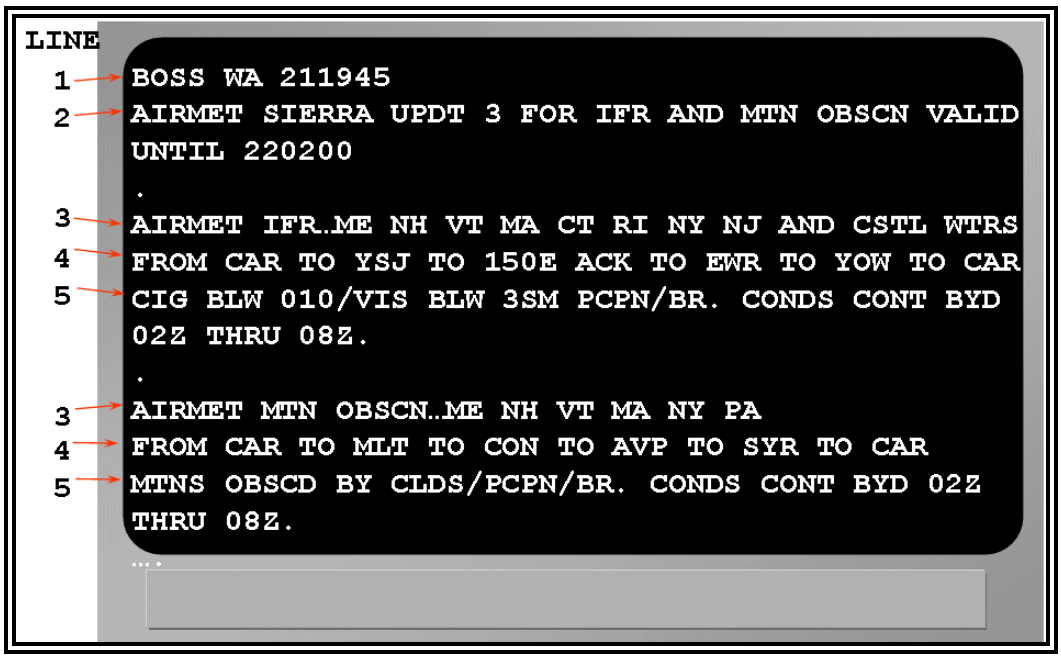


Figure 6-9. AIRMET Bulletin Decoding Example

Table 6-5. Decoding an AIRMET Bulletin

Line	Content	Description
1	BOS S WA 211945	AIRMET area identifier AIRMET series Product type Issuance UTC date/time
2	AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 220200	Product type AIRMET series Update number Product description Ending UTC date/time
3	AIRMET IFR..ME NH VT MA CT RI NY NJ AND CSTL WTRS AIRMET MTN OBSCN..ME NH VT MA NY PA	Product type/series… Phenomenon location (states)
4	FROM CAR TO YSJ TO 150E ACK TO EWR TO YOW TO CAR FROM CAR TO MLT TO CON TO AVP TO SYR TO CAR	Phenomenon location (VOR locations)
5	CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONT BYD 02Z THRU 08Z. MTNS OBSCD BY CLDS/PCPN/BR. CONDS CONT BYD 02Z THRU 08Z.	Phenomenon description

The AIRMET bulletin in Figure 6-9 is decoded as follows:

(Line 1) *AIRMET SIERRA issued for the Boston area at 1945Z on the 21st day of the month. "SIERRA" contains information on Instrument Flight Rules (IFR) and/or mountain obscuration.*

(Line 2) *This is the third updated issuance of this Boston AIRMET series as indicated by "SIERRA UPDT 3" and is valid until 0200Z on the 22nd.*

(Line 3) *The affected states within the BOS area are: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, and coastal waters.*

(Line 4) *From Caribou, ME; to Saint Johns, New Brunswick; to 150 nautical miles east of Nantucket, MA; to Newark, NJ; to Ottawa, Ontario; to Caribou, ME*

(Line 5) Ceiling below 1,000 feet/visibility below 3 statute miles, precipitation/mist. Conditions continuing beyond 0200Z through 0800Z.

6.2.3.1 AIRMET Series

The AIRMET series consists of Sierra, Tango, and Zulu.

- AIRMET Sierra describes IFR conditions and/or extensive mountain obscurations.
- AIRMET Tango describes moderate turbulence, sustained surface winds of 30 knots or greater, and non-convective low-level wind shear.

- AIRMET Zulu describes moderate icing and provides freezing level heights.

6.2.3.2 AIRMET Bulletins

AIRMETs are issued in AIRMET bulletins, each containing one or more AIRMET messages. The bulletins are issued on a scheduled basis every 6 hours and, except in Alaska, at 0300, 0900, 1500 and 2100 UTC. In Alaska, AIRMET bulletins are issued every six hours at the same time as the Area Forecast (Section 6.1). An AIRMET bulletin may be issued for each forecast area (Figures 6-10, 6-11, and 6-12).

6.2.3.3 SIGMET Information in AIRMET Bulletin

A reference to the appropriate SIGMET series is included in AIRMET bulletins which cover the affected area and for similar phenomena; for example, **SEE SIGMET BRAVO SERIES**.

6.2.3.4 AIRMET Phenomena Information

An AIRMET message contains the following information as necessary and in the order indicated relating to the phenomena that caused the AIRMET to be issued:

- Location (using locations or geographic features well known nationally if possible)
- Phenomena and its description from Section 6.2.1.1; e.g., **MOD TURB**
- If appropriate, level (altitude), or vertical extent
- Expected beginning and ending time of phenomena, if different from the AIRMET bulletin's valid time
- Remarks

6.2.3.5 AIRMET Remarks

A remark is included at the end of each AIRMET regarding whether the condition is expected to continue after the valid time of the AIRMET.

6.2.3.6 AIRMET Outlook (Except Alaska)

If AIRMET conditions are expected to develop during the 6-hour period after the ending valid time of the AIRMET bulletin, the information is included in an outlook section.

6.2.3.7 AIRMET Outlook (Alaska Only)

If AIRMET conditions are expected to develop during the 6-hour period after the ending valid time of the AIRMET bulletin, the information is included in the appropriate Area Forecast zone.

6.2.4 AIRMET Issuance

AIRMETs are issued from the three Meteorological Watch Offices (MWO) located at the: the Aviation Weather Center (AWC), the Alaska Aviation Weather Unit (AAWU), and the Weather Forecast Office (WFO) in Honolulu. Their areas of responsibility are:

- AWC: The conterminous U.S. and adjacent coastal waters (CONUS) (Figure 6-10).
- AAWU: Alaska and adjacent coastal waters (Figure 6-11).
- WFO Honolulu: Hawaii and adjacent waters (Figure 6-12).

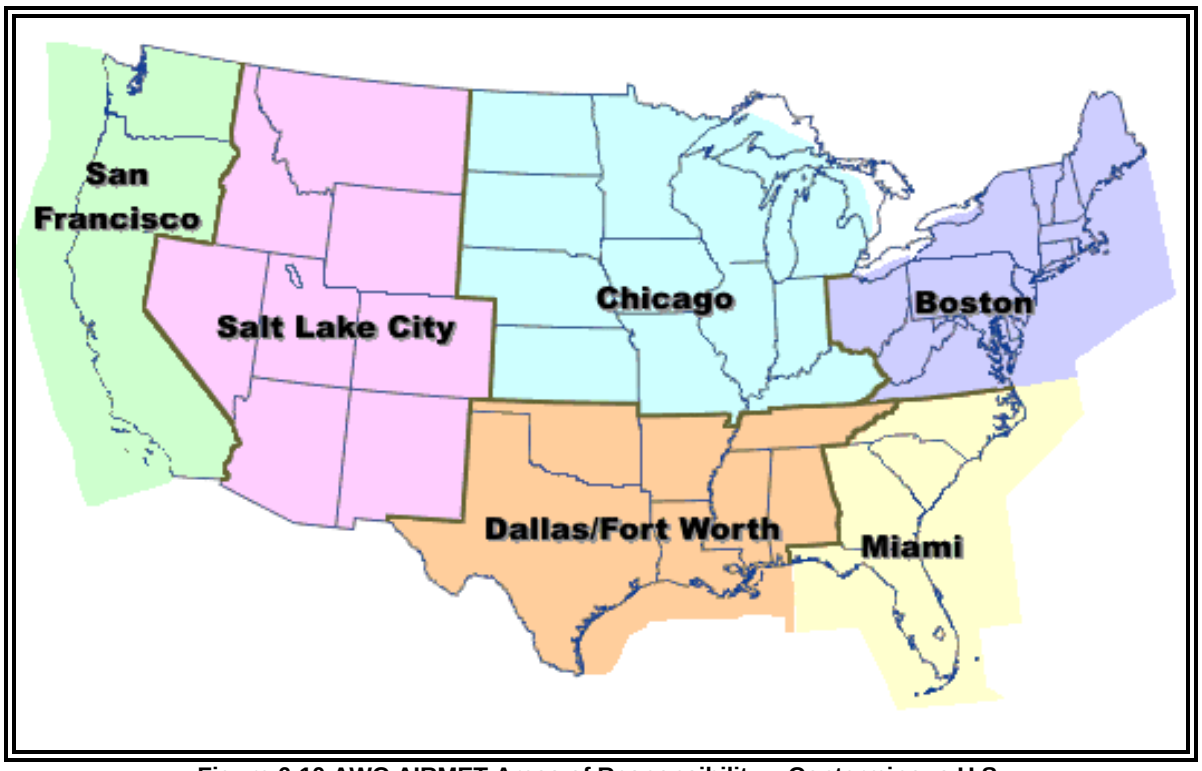


Figure 6-10 AWC AIRMET Areas of Responsibility – Conterminous U.S.

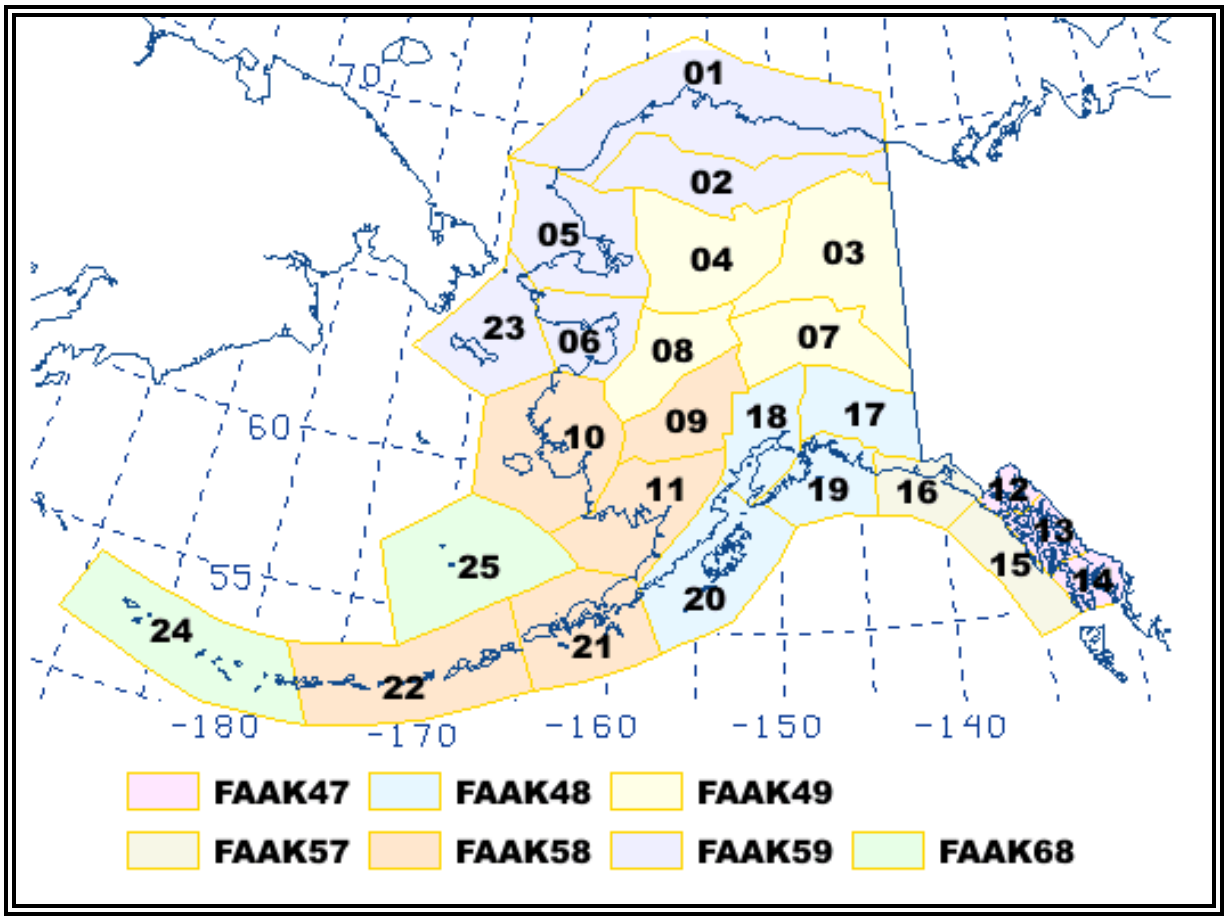


Figure 6-11. AAWU Flight Advisory and Area Forecast Zones - Alaska

Table 6-6. AAWU Flight Advisory and Area Forecast Zones – Alaska

1	Arctic Coast Coastal	**14**	Southern Southeast Alaska
2	North Slopes of the Brooks Range	**15**	Coastal Southeast Alaska
3	Upper Yukon Valley	**16**	Eastern Gulf Coast
4	Koyukuk and Upper Kobuk Valley	**17**	Copper River Basin
5	Northern Seward Peninsula-Lower Kobuk Valley	**18**	Cook Inlet-Susitna Valley
6	Southern Seward Peninsula-Eastern Norton Sound	**19**	Central Gulf Coast
7	Tanana Valley	**20**	Kodiak Island
8	Lower Yukon Valley	**21**	Alaska Peninsula-Port Heiden to Unimak Pass
9	Kuskowim Valley	**22**	Unimak Pass to Adak
10	Yukon-Kuskowim Delta	**23**	St. Lawrence Island-Bering Sea Coast
11	Bristol Bay	**24**	Adak to Attu
12	Lynn Canal and Glacier Bay	**25**	Pribilof Islands and Southeast Bering Sea
13	Central Southeast Alaska		

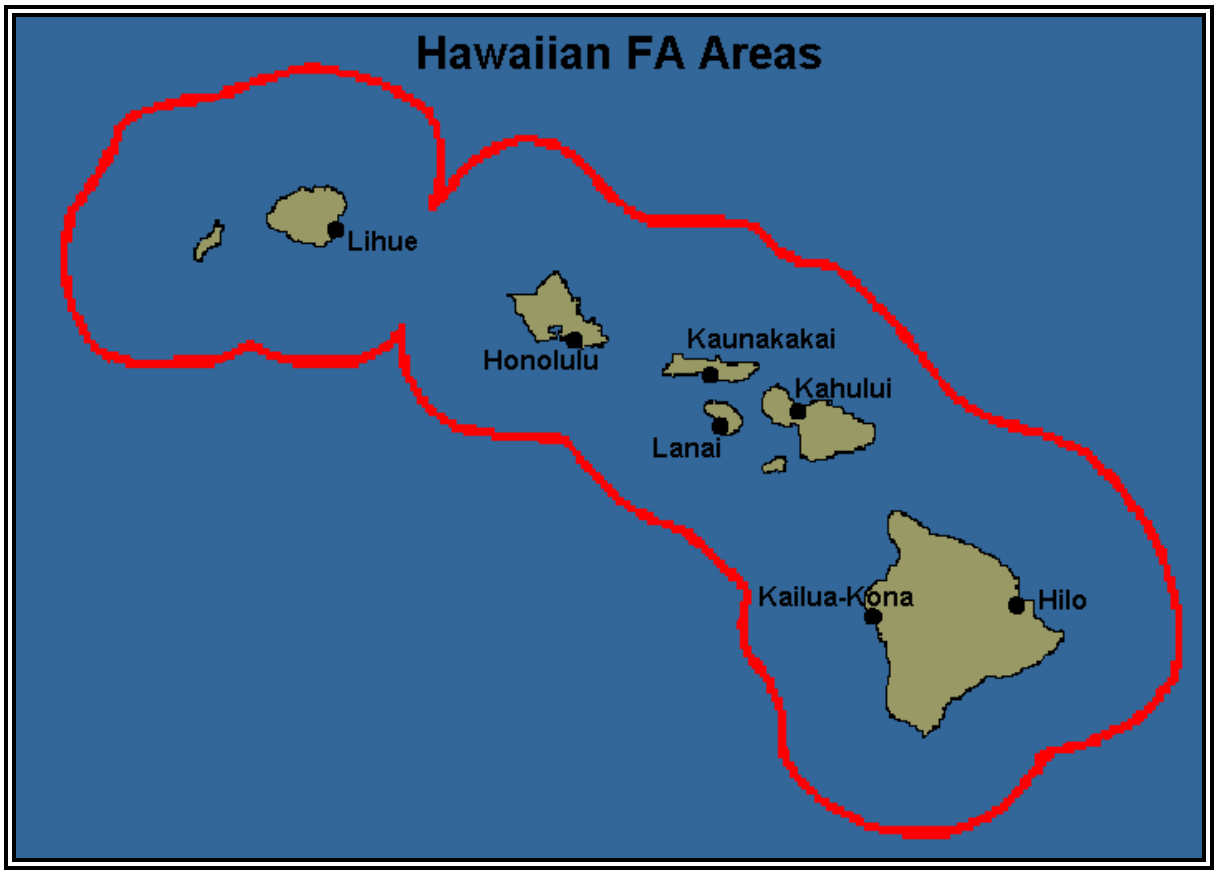


Figure 6-12. WFO Honolulu AIRMET Areas of Responsibility - Hawaii

6.2.4.1 AIRMET Valid Time

AIRMETs are issued for conditions occurring or expected to develop within the six-hour (6) valid time of the AIRMET Bulletin. An AIRMET's valid period is the same as the AIRMET bulletin's valid time unless otherwise noted.

6.2.4.2 AIRMET Updates and Amendments

Unscheduled updates to AIRMET bulletins are issued as necessary. If an AIRMET is amended, **AMD** is added after the date/time group on the FAA product line (Figure 6-9, Line1). **UPDT** is added to the end of the line containing the list of affected states. This issue time of the AIRMET bulletin is updated to reflect the time beginning valid time with the ending valid time remaining unchanged.

6.2.4.3 AIRMET Corrections

AIRMETs containing errors are corrected by adding **COR** after the date/time group on the FAA product line (Figure 6-9, Line 1). The issuance time is updated with the ending valid time unchanged. UPDT is added to the third line after the list of affected states.

6.2.4.3.1 Example of a Corrected/Amended AIRMET

```
SLCZ WA 222000 COR/AMD
AIRMET ZULU UPDATE 3 FOR ICE AND FZ LVL VALID UNTIL 230200
.
AIRMET ICE...ID MT WY CO... UPDT
```

```
FROM GTF TO 80NW RAP TO BFF TO GLD TO DEN TO OCS TO TWF TO BOI TO GTF
MOD ICE BTW 080 AND FL200. FZ LVLS SFC-080 OVR MOST OF AREA RSG TO
080-100 OVR SWRN PORTIONS AREA. CONDS CONTG BYD 02Z THRU 08Z.
.
FRZLVL...RANGING FROM SFC-130
    040...GEG-DBS-OCS-CYS
    080...FMG-DTA-DBL-AKO
    120...LAS-ABQ-TCC
```

6.2.5 AIRMET Examples

```
CHIS WA 171345
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 172000
.
AIRMET IFR...NE KS
FROM 60NE BFF TO ANW TO 40NE OBH TO OSW TO 40N GAG TO 40N GLD TO 60NE
BFF
CIG BLW 010/VIS BLW 3SM PCPN BR. CONDS ENDG 18Z.
.
AIRMET IFR...MO IL IN KY
FROM CVG TO HNN TO HMV TO BWG TO RZC TO SGF TO 60S DEC TO CVG
CIG BLW 010/VIS BLW 3SM BR. CONTG BYD 20Z ENDG 23Z.
```

AIRMET Sierra bulletin for the Chicago Area Forecast region issued on the 17th day of the month at 1345 UTC and contains two AIRMETS. This is the 3rd AIRMET Sierra bulletin update issued for IFR and Mountain Obscurations and is valid until the 17th day of the month at 2000 UTC.

The first AIRMET is for IFR conditions affecting Nebraska and Kansas. Bounded within an area from 60 nautical miles (NM) northeast of Scottsbluff, Nebraska; to Ainsworth, Nebraska; to 40 NM northeast of Wolbach, Nebraska; to Oswego, Kansas; to 40 NM miles north of Gage, Oklahoma; to 60 NM miles northeast of Scottsbluff, Nebraska. Ceilings below 1,000 feet and visibilities less than 3 statute miles (SM) with precipitation and mist. Conditions are forecast to end by 1800 UTC.

The second AIRMET is for IFR conditions affecting Missouri, Illinois, Indiana and Kentucky. Bounded within an area from Covington, Kentucky; to Henderson, West Virginia; to Holston Mountain, Tennessee; to Bowling Green, Kentucky; to Razorback, Arkansas; to Springfield, Missouri; to 60 NM miles south of Decatur, Illinois; to Covington, Kentucky. Ceilings below 1,000 feet and visibilities less than 3 SM due to mist. Conditions are forecast to continue beyond 2000 UTC and end by 2300 UTC.

```
HNLS WA 080945
AIRMET SIERRA UPDATE 1 FOR IFR VALID UNTIL 081600.
.
NO SGFNT IFR EXP.
```

AIRMET Sierra bulletin for the Hawaii forecast region issued on the 8th day of the month at 0945 UTC. This is the 1st AIRMET Sierra bulletin update issued for IFR and Mountain Obscurations and is valid until the 8th day of the month at 1600 UTC.

No conditions meeting IFR criteria are expected.

```
HNLT WA 080945
AIRMET TANGO UPDT 1 FOR TURB VALID UNTIL 081600
.
AIRMET TURB...HI
OVR AND IMT S THRU W OF MT OF ALL ISLANDS.
MOD TURB BLW 060. COND CONT BYD 1600Z THRU 22Z.
```

AIRMET Tango bulletin for the Hawaii Area Forecast region issued on the 8th day of the month at 0945 UTC. This is the 1st AIRMET Tango bulletin update issued for turbulence and is valid until the 8th day of the month at 1600 UTC.

AIRMET for turbulence for Hawaii. Over and immediately south through west of the mountains for all islands. Moderate turbulence is expected below 6,000 feet above MSL. Conditions are expected to continue beyond 1600 UTC through 2200 UTC.

```
SFOZ WA 171345
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 172000
.
AIRMET ICE...WA OR ID MT
FROM 60SSW YXH TO 70ESE MLP TO PDT TO PDX TO SWA TO BLI TO 60SSW YXH
MOD ICE BTN 120 AND FL200. CONDS CONTG BYD 20Z THRU 02Z.
.
FRZLVL...RANGING FROM 090-160
   120...ONP-LKV-REO
   160...SNS-40SW BTY
```

AIRMET Zulu bulletin for the San Francisco Area Forecast area issued on the 17th day of the month at 1345 UTC. This is the 2nd AIRMET Zulu bulletin update issued for icing and freezing levels and is valid until the 17th day of the month at 2000 UTC.

AIRMET for icing for Washington, Oregon, Idaho, and Montana. Bounded within an area from 60 miles south-southwest of Medicine Hat, Alberta; to 70 NM miles east-southeast of Mullan Pass, Idaho; to Pendleton, Oregon; to Portland, Oregon; to Seattle, Washington; to Billings, Montana; to 60 NM miles south-southwest of Medicine Hat, Alberta. Moderate icing between 12,000 and 20,000 feet above MSL. Conditions continuing beyond 2000 UTC through 0200 UTC.

Freezing levels over the area ranging between 9,000 and 16,000 feet above MSL, Freezing level at 12,000 feet above MSL along a line from the Newport, Oregon VOR to the Lake County, Oregon VOR to the Rome, Oregon VOR. Freezing level at 16,000 feet above MSL along a line from the Salinas, California VOR to 40 NM southwest of the Beatty, Nevada VOR.

6.3 Center Weather Advisory (CWA)

A Center Weather Advisory (CWA) is an aviation weather warning for conditions meeting or approaching national in-flight advisory (AIRMET, SIGMET or SIGMET for convection) criteria. The CWA is primarily used by aircrews to anticipate and avoid adverse weather conditions in the en route and terminal environments. CWAs are available on the Aviation Weather Center (AWC) web site at: http://aviationweather.gov/products/cwsu/.

6.3.1 CWA Issuance

CWAs are issued by the NWS Center Weather Service Units (CWSUs). CWSU areas of responsibility in the contiguous U.S. are depicted on Figure 6-13. CWSU Anchorage area of responsibility for Alaska is depicted on Figure 6-14.

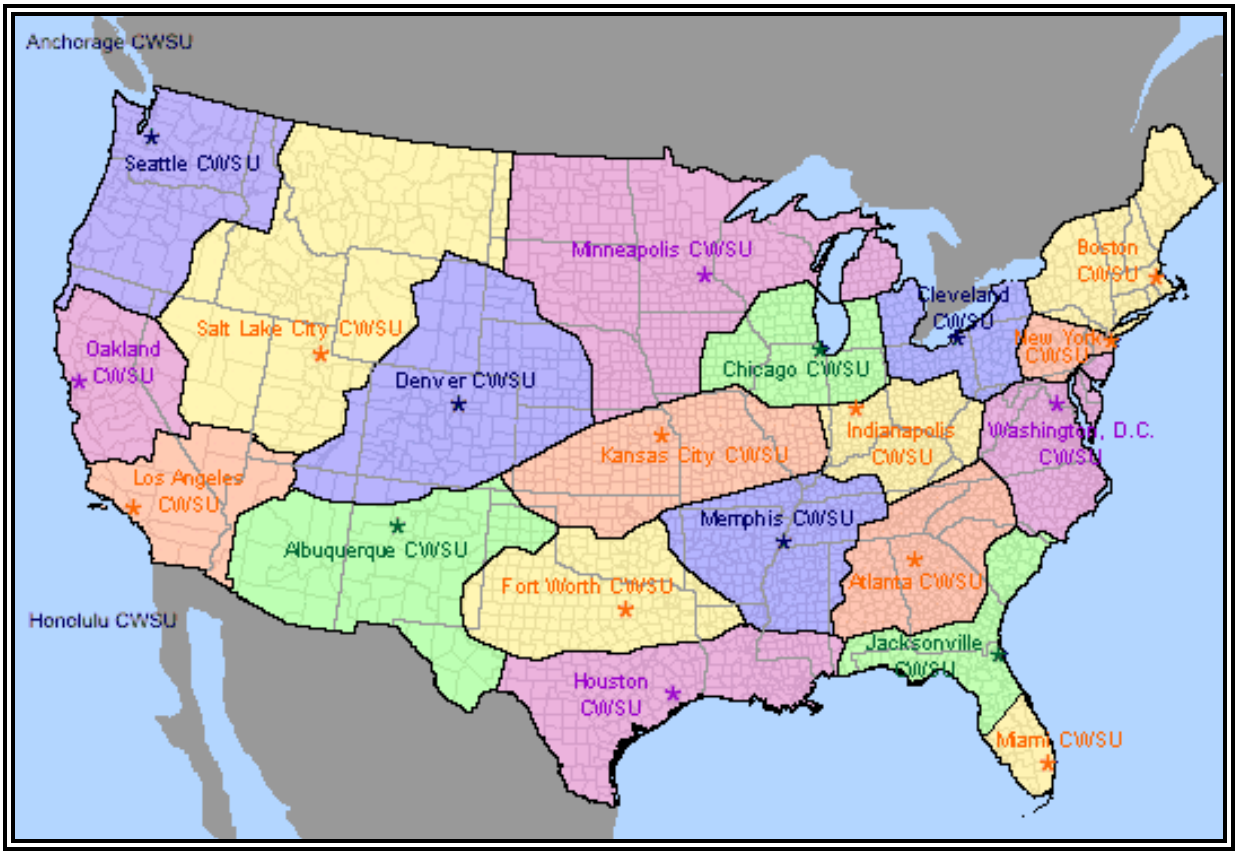


Figure 6-13. Center Weather Service Unit (CWSU) Areas of Responsibility, Contiguous U.S.

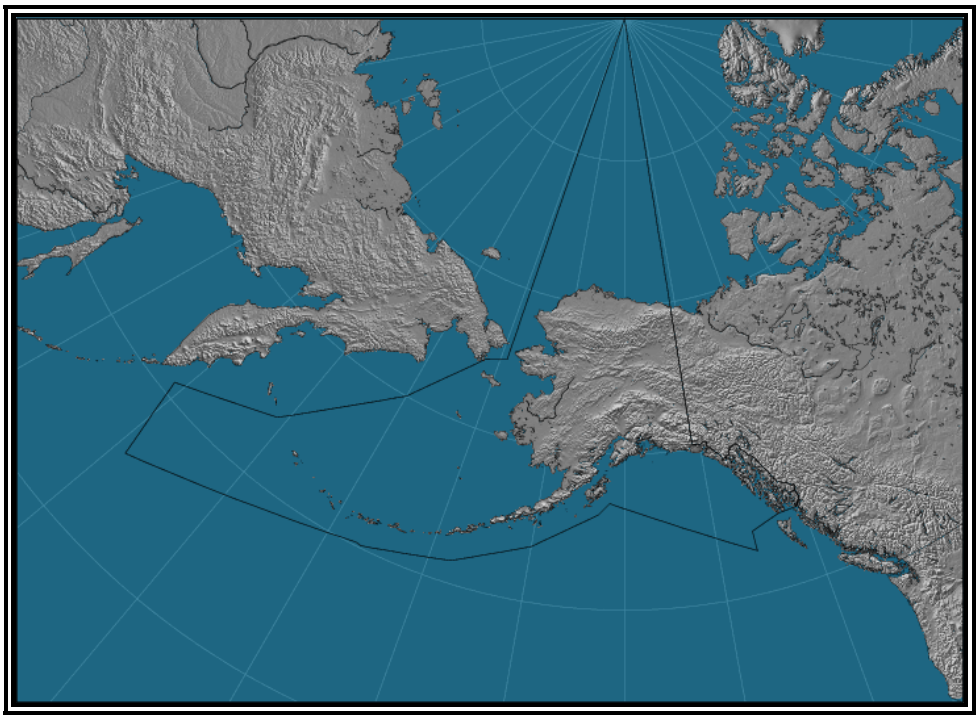


Figure 6-14. CWSU Anchorage, AK (PAZA) Area of Responsibility

CWAs are valid for up to two (2) hours and may include forecasts of conditions expected to begin within two (2) hours of issuance. If conditions are expected to persist after the advisory's valid period, a statement to that effect is included in the last line of the text. Additional CWAs will subsequently be issued as appropriate. Notice of significant changes in the phenomenon described in a CWA is provided by a new CWA issuance for that phenomenon. If the forecaster deems it necessary, CWAs may be issued hourly for convective activity.

6.3.2 CWA Communications Headers (UCWA / CWA)

The Urgent CWA (**UCWA**) communications header is intended for those situations where weather conditions have an immediate effect on the safe flow of air traffic within the ARTCC area of responsibility. It is only used when the CWSU meteorologist believes any delay in dissemination to FAA facilities would impact aviation safety. The routine CWA header is used for subsequent issuances of the same phenomenon.

6.3.3 CWA Criteria

CWAs are used in the four (4) following situations:

- **Precede an Advisory**
  - o When the AWC has not yet issued an advisory, but conditions meet or will soon meet advisory criteria.
  - o In the case of an impending advisory, the CWA can be issued as an Urgent CWA (UCWA) to allow the fastest possible dissemination.

- **Refine an existing Advisory**
  - o To supplement an existing AWC advisory for the purpose of refining or updating the location, movement, extent, or intensity of the weather event relevant to the ARTCC's area of responsibility.

- **Highlight significant conditions not meeting Advisory criteria**
  - When conditions do not meet advisory criteria, but conditions, in the judgment of the CWSU meteorologist, will adversely impact air traffic within the ARTCC area of responsibility.

- **To cancel a CWA when the phenomenon described in the CWA is no longer expected.**

6.3.4 CWA Format

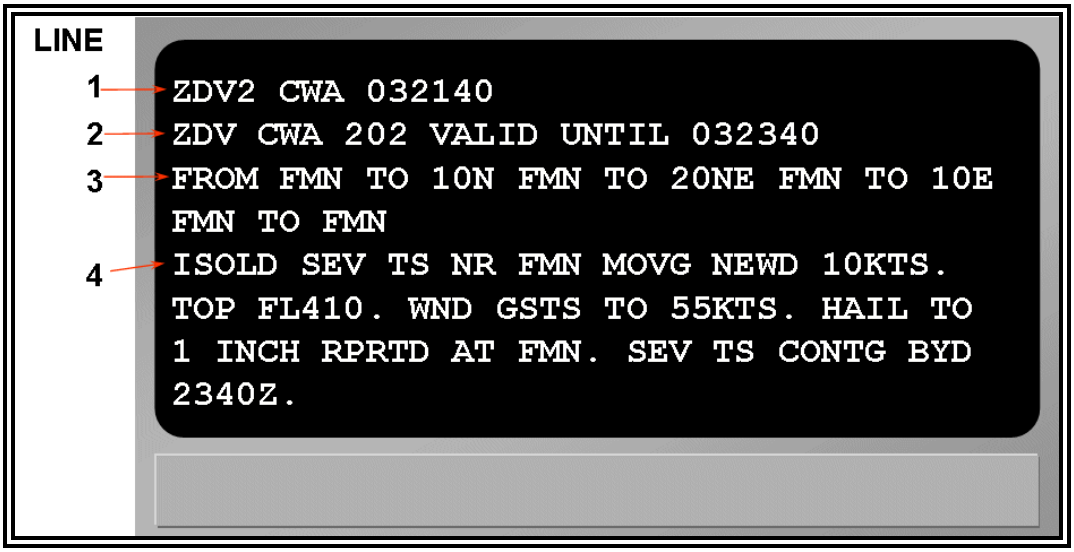


Figure 6-15. Center Weather Advisory (CWA) Decoding Example

Table 6-7. Decoding a Center Weather Advisory (CWA)

Line	Content	Description
1	ZDV 2 CWA 032140	ARTCC Identification Phenomenon Number (single digit, 1-6) Product Type (UCWA/CWA) Beginning and/or issuance UTC date/time
2	ZDV CWA 2 02 VALID TIL 032340Z	ARTCC Identification Product Type Phenomenon Number (single digit, 1-6) Issuance Number (issued sequentially for each Phenomenon Number) Ending valid UTC date/time
3	FROM FMN TO 10N FMN TO 20NE FMN TO 10E FMN TO FMN	Phenomenon Location
4	ISOLD SEV TS NR FMN MOVG NEWD 10KTS. TOP FL410. WND GSTS TO 55KTS. HAIL TO 1 INCH RPRTD AT FMN. SEV TS CONTG BYD 2340Z	Phenomenon Description

Time permitting, any CWA overlapping into another center's airspace is coordinated and a statement is included in the text, e.g., **SEE ZOB CWA 201 FOR TS CONDS IN ZOB CTA** (CTA is control area). If issuance prior to coordination is necessary, a statement regarding the area(s) affected is included in the text, e.g., **LINE TS EXTDS NW INTO ZOB CTA**.

AIRMETs/SIGMETs being augmented by the CWA will be referenced in a text remark, e.g. **SEE CONVECTIVE SIGMET 8W**.

The CWA in Figure 6-15 is decoded as follows:

(Line 1) Center Weather Advisory issued for the Denver ARTCC (ZDV) CWSU. The "2" after ZDV in the first line denotes this is the second meteorological event of the local calendar day. This CWA was issued/begins on the 3rd day of the month at 2140 UTC.

(Line 2) The Denver ARTCC (ZDV) is identified again. The "202" in the second line denotes the phenomena number again (2) and the issuance number (02) for this phenomenon. This CWA is the valid until the 3rd day of the at 2340 UTC.

(Line 3) From Farmington, New Mexico to 10 nautical miles north of Farmington, New Mexico to 20 nautical miles northeast of Farmington, NM to 10 nautical mile east of Farmington, New Mexico to Farmington, New Mexico.

(Line 4) Isolated severe thunderstorms near Farmington moving northeastward at 10 knots. Tops to Flight Level 410. Wind gusts to 55 knots. Hail to one inch reported at Farmington. Severe thunderstorms continuing beyond 2340 UTC.

6.3.5 Examples

```
ZME1 CWA 081300

ZME CWA 101 VALID TIL 081500
FROM MEM TO JAN TO LIT TO MEM
OCNL TS MOV FM 26025KT. TOPS TO FL450.
```

Center Weather Advisory issued for the Memphis, Tennessee ARTCC on the 8th day of the month at 1300 UTC. The 1 after the ZME in the first line denotes this CWA has been issued for the first weather phenomenon to occur for the local calendar day. The 101 in the second line denotes the phenomenon number again (1) and the issuance number (01) for this phenomenon. The CWA is valid until the 8th of the month at 1500 UTC. From Memphis, Tennessee to Jackson, Mississippi to Little Rock, Arkansas to Memphis, Tennessee. Occasional thunderstorms moving from 260 degrees at 25 knots. Tops to flight level 450.

```
ZLC3 CWA 271645

ZLC CWA 303 VALID TIL 271745
CNL CWA 302.
SEE CONVECTIVE SIGMET 8W.
```

Center Weather Advisory issued for the Salt Lake City, Utah ARTCC on the 27th day of the month at 1645 UTC. The 3 after the ZLC in the first line denotes this CWA has been issued for the third weather phenomenon to occur for the local calendar day. The 303 in the second line

denotes the phenomenon number again (3) and the issuance number (03) for this phenomenon. The CWA is valid until the 27th day of the month at 1745 UTC. CWA number 302 has been cancelled. See Convective SIGMET 8W.

```
ZME1 CWA 040100

ZME CWA 101 VALID TIL 040300
VCY MEM
SEV CLR ICE BLW 020 DUE TO FZRA. NUMEROUS ACFT REP RAPID
ACCUMULATION OF ICE DRG DES TO MEM. NO ICE REPS ABV 020. CONDS CONTG
AFT 03Z. NO UPDATES AFT 040200Z.
```

Center Weather Advisory issued for the Memphis, Tennessee ARTCC on the 4th day of the month at 0100 UTC. The 1 after the ZLC in the first line denotes this CWA has been issued for the first weather phenomenon to occur for the local calendar day. The 101 in the second line denotes the phenomenon number again (1) and the issuance number (01) for this phenomenon. The CWA is valid until the 4th day of the month at 0300 UTC. For the Memphis, Tennessee vicinity. Severe clear icing below 2,000 feet MSL due to freezing rain. Numerous aircraft report rapid accumulation of icing during descent to Memphis. No icing reports above 2,000 feet MSL. Conditions continuing after 0300 UTC. No updates after 4th day of the month at 0200 UTC.

```
ZNY5 UCWA 021400

ZNY CWA 502 VALID TIL 021600
FROM BGM TO 18WNW JFK TO HAR TO SLT TO BGM
NUMEROUS ACFT REP SEV TURB AND WS BLW 020.
CONDS EXTD NE INTO ZBW CTA. CONDS EXP TO CONT AFT 16Z.
```

Center Weather Advisory issued for the New York ARTCC on the 2nd day of the month at 1400 UTC. The 5 after the ZNY in the first line denotes this CWA has been issued for the fifth weather phenomenon to occur for the local calendar day. The 502 in the second line denotes the phenomenon number again (5) and the issuance number (02) for this phenomenon. The CWA is valid until the 2nd day of the month at 1600 UTC. From Binghamton, New York; to 18 nautical miles west-northwest of New York (JFK Airport), New York; to Harrisburg, Pennsylvania; to Slate Run, Pennsylvania; to Binghamton, New York. Numerous aircraft report severe turbulence and wind shear below 2,000 feet MSL. Conditions extending northeast into Nashua, New Hampshire control area. Conditions expected to continue after 1600 UTC.

```
ZNY4 UCWA 041500

ZNY CWA 401 VALID TIL 041700
40N SLT TO 18WNW JFK
DEVELOPING LINE TS 25 NM WIDE MOV 24020KT. TOPS ABV FL350.
LINE TS EXTDS NW INTO ZOB CTA.
```

Urgent Center Weather Advisory issued for the New York ARTCC on the 4th day of the month at 1500 UTC. The 4 after the ZNY in the first line denotes this CWA has been issued for the fourth weather phenomenon to occur for the local calendar day. The 401 in the second line denotes the phenomenon number again (4) and the issuance number (01) for this phenomenon. The

CWA is valid until the 4th day of the month at 1700 UTC. From 40 nautical miles north of Slate Run, Pennsylvania; to 18 nautical miles west-northwest of New York (JFK Airport), New York. Developing line of thunderstorms 25 nautical miles wide moving from 240 degrees at 20 knots. Tops above flight level 350. The line of thunderstorms extends northwest into the Oberlin, Ohio control area.