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.

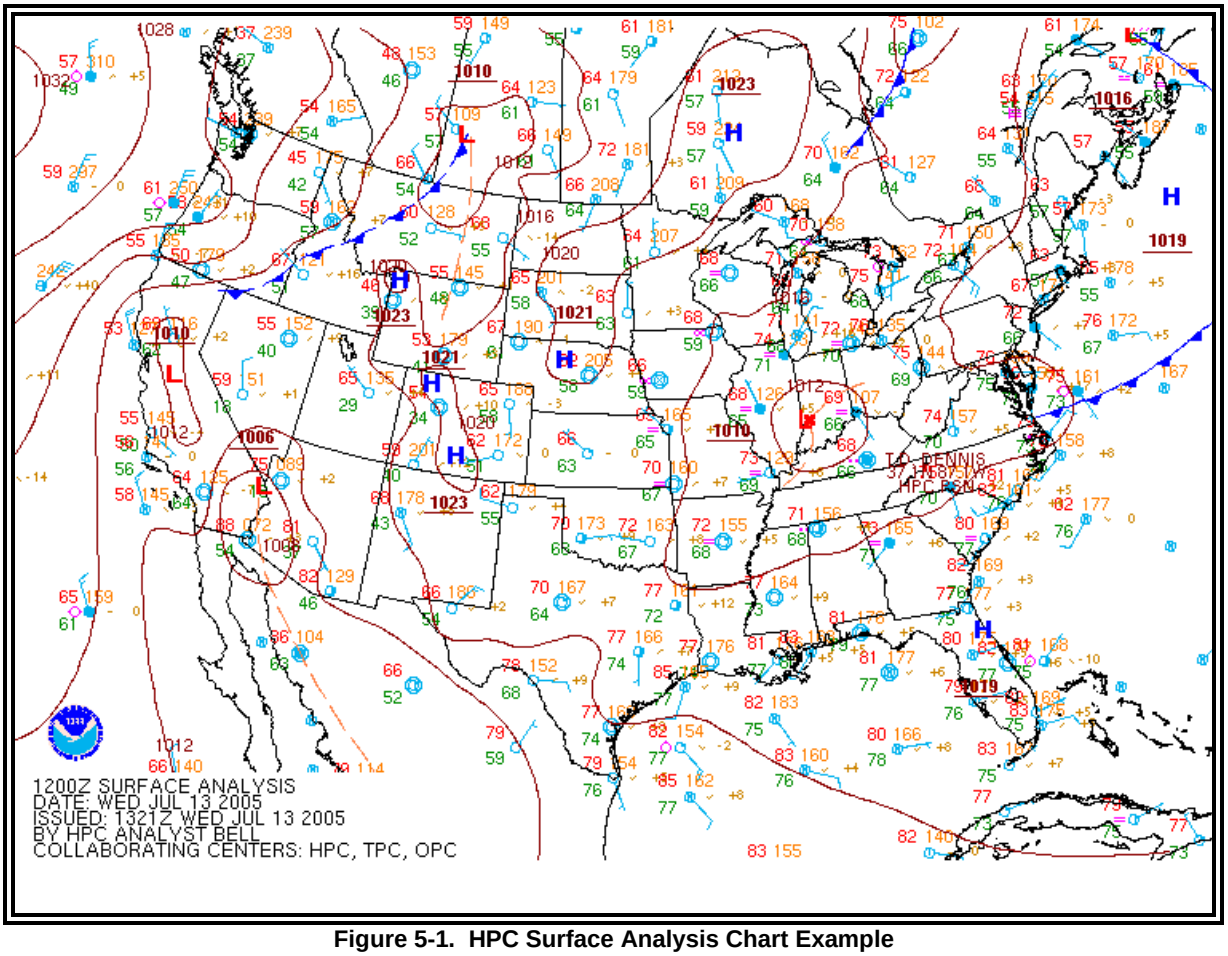


Figure 5-1. HPC Surface Analysis Chart Example

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:

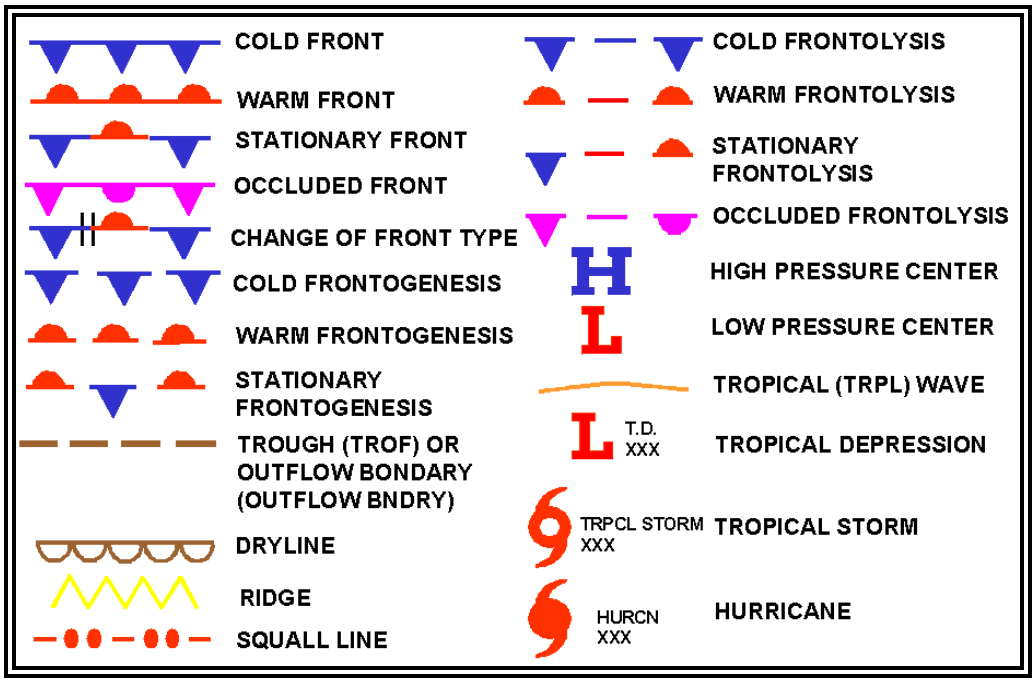


Figure 5-2. HPC Surface Analysis Chart Symbols

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:

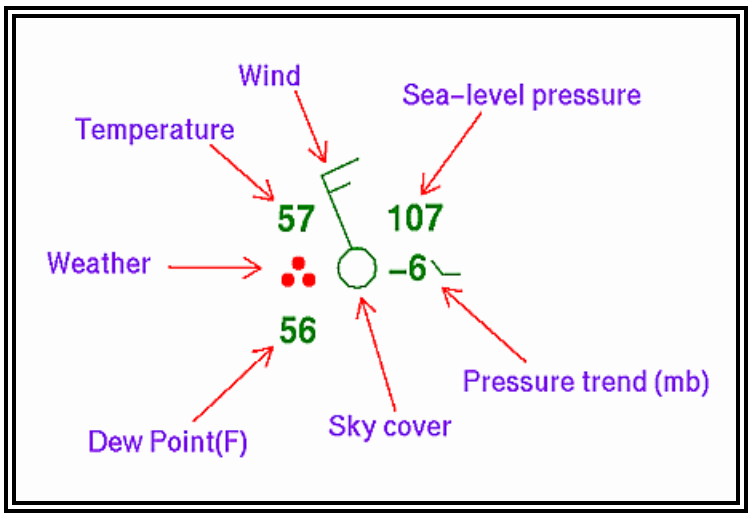


Figure 5-3. HPC Surface Analysis Chart Station Plot Model

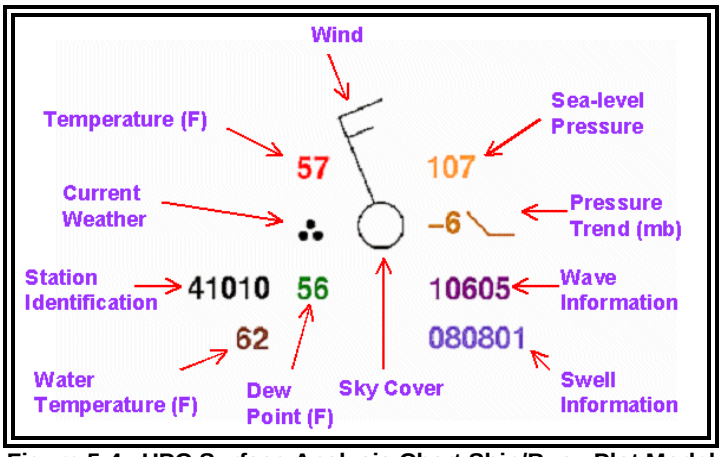


Figure 5-4. HPC Surface Analysis Chart Ship/Buoy Plot Model

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

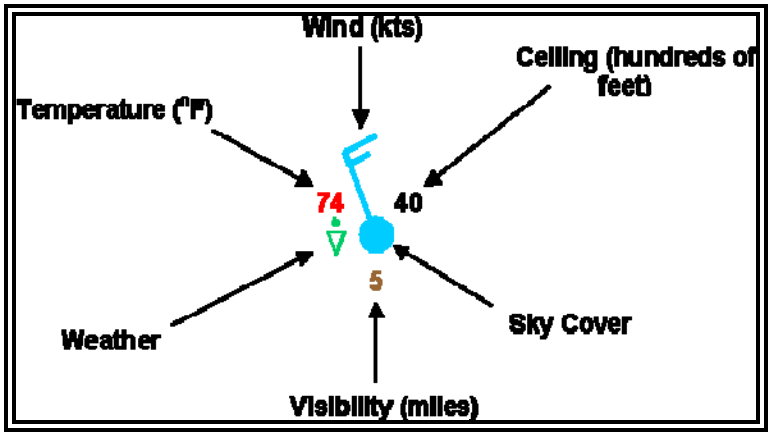


Figure 5-5. HPC Surface Analysis Chart for Aviation Interests Station Plot Model

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:

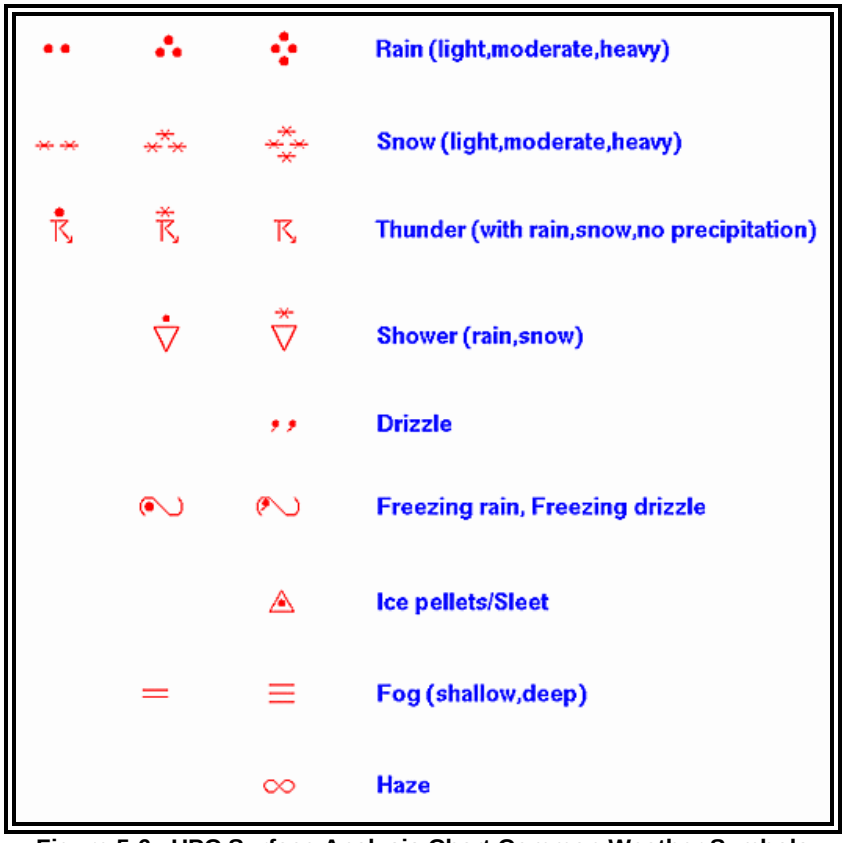


Figure 5-6. HPC Surface Analysis Chart Common Weather Symbols

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:

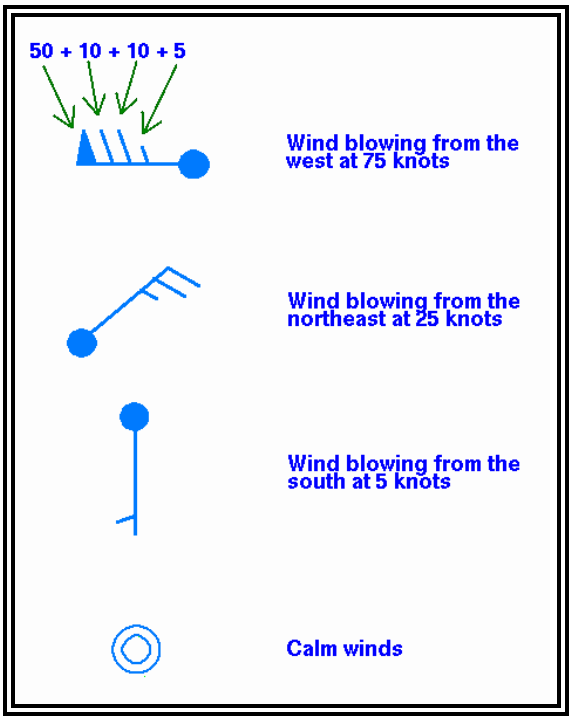


Figure 5-7. HPC Surface Analysis Chart Wind Plotting Model

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:

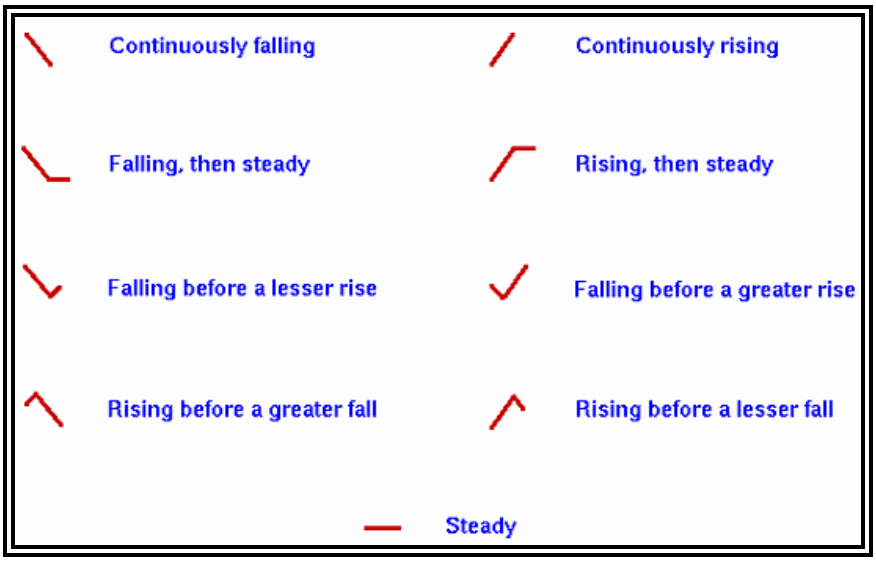


Figure 5-8. HPC Surface Analysis Chart Pressure Trends

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:

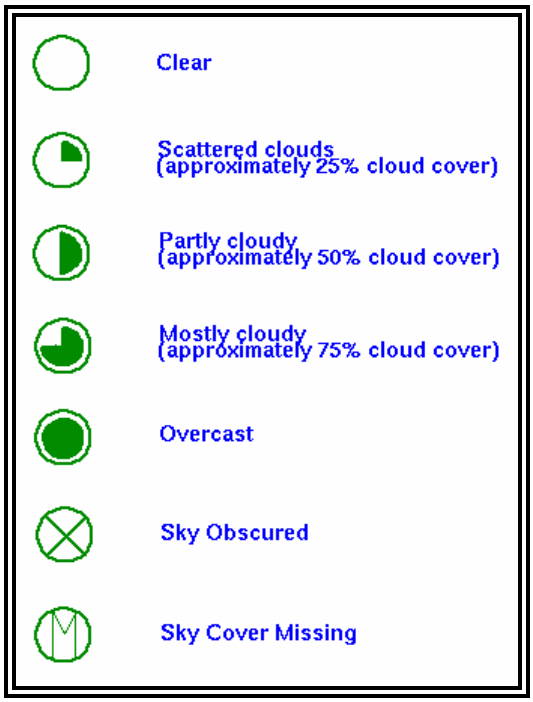


Figure 5-9. HPC Surface Analysis Chart Sky Cover Symbols

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.

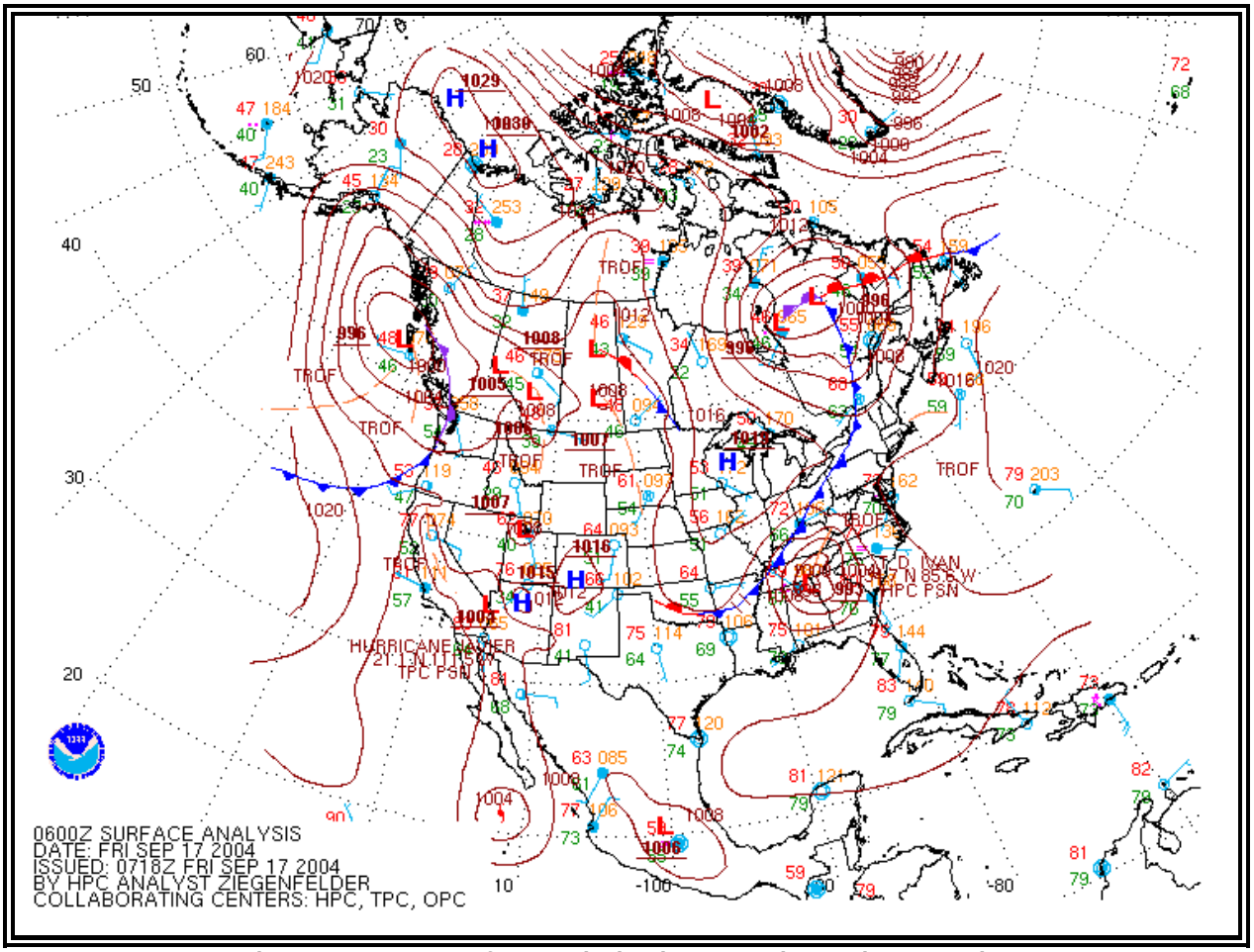


Figure 5-10. HPC Surface Analysis Chart – North America Example

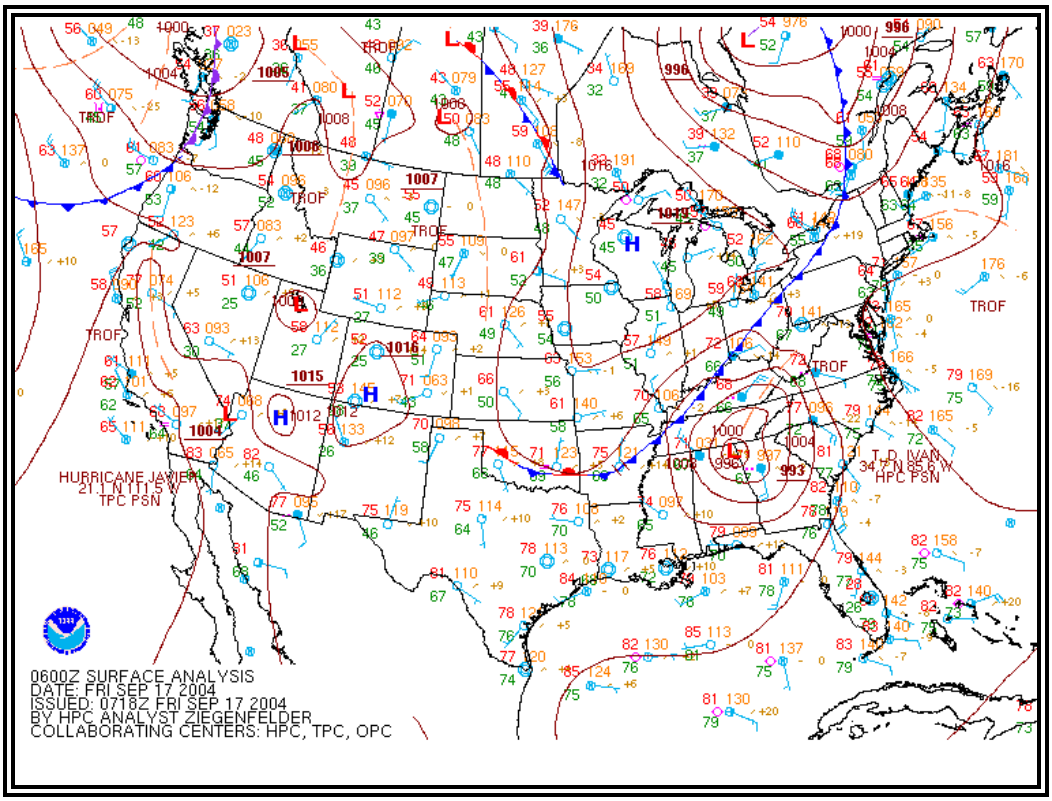


Figure 5-11. HPC Surface Analysis Chart - Contiguous U.S. Example

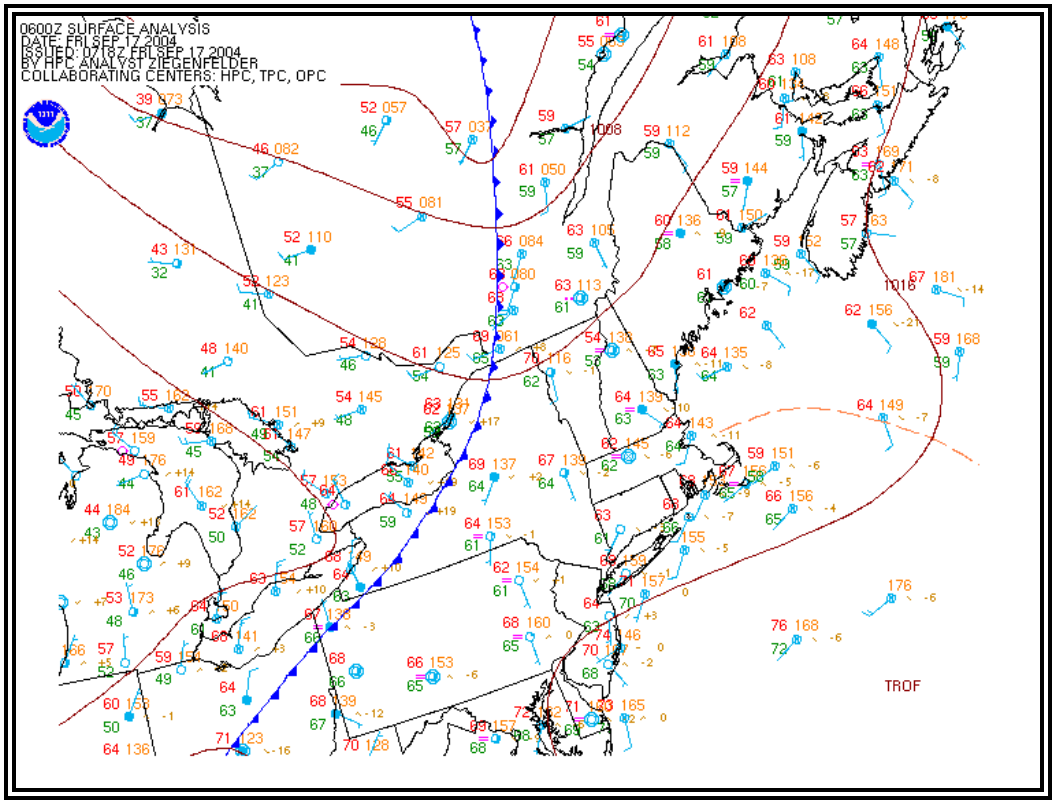


Figure 5-12. HPC Surface Analysis Chart - Northeast U.S. Example

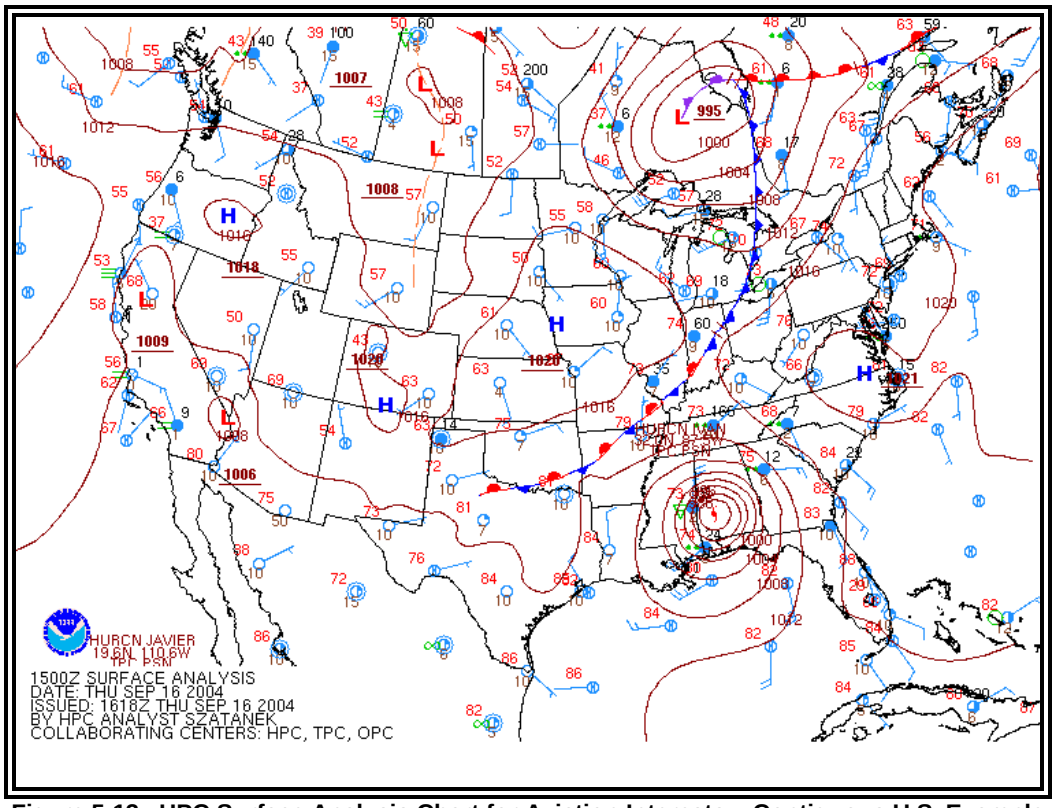


Figure 5-13. HPC Surface Analysis Chart for Aviation Interests – Contiguous U.S. Example

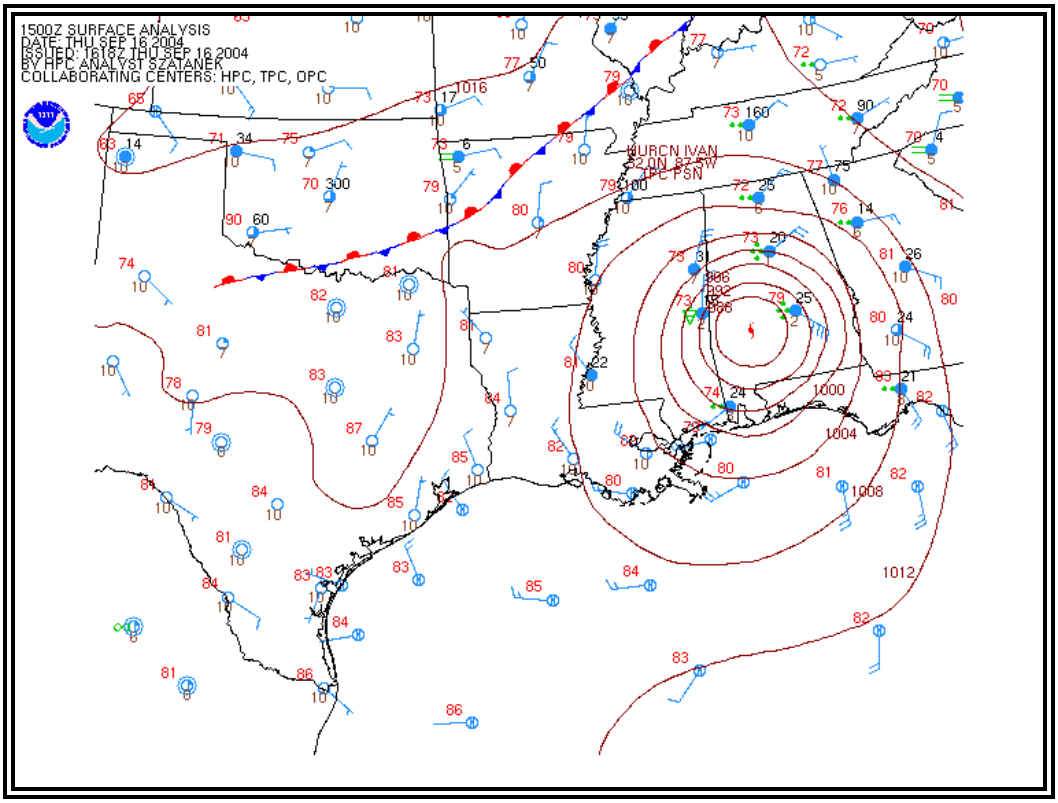


Figure 5-14. HPC Surface Analysis Chart for Aviation Interests – South central U.S. Example

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.

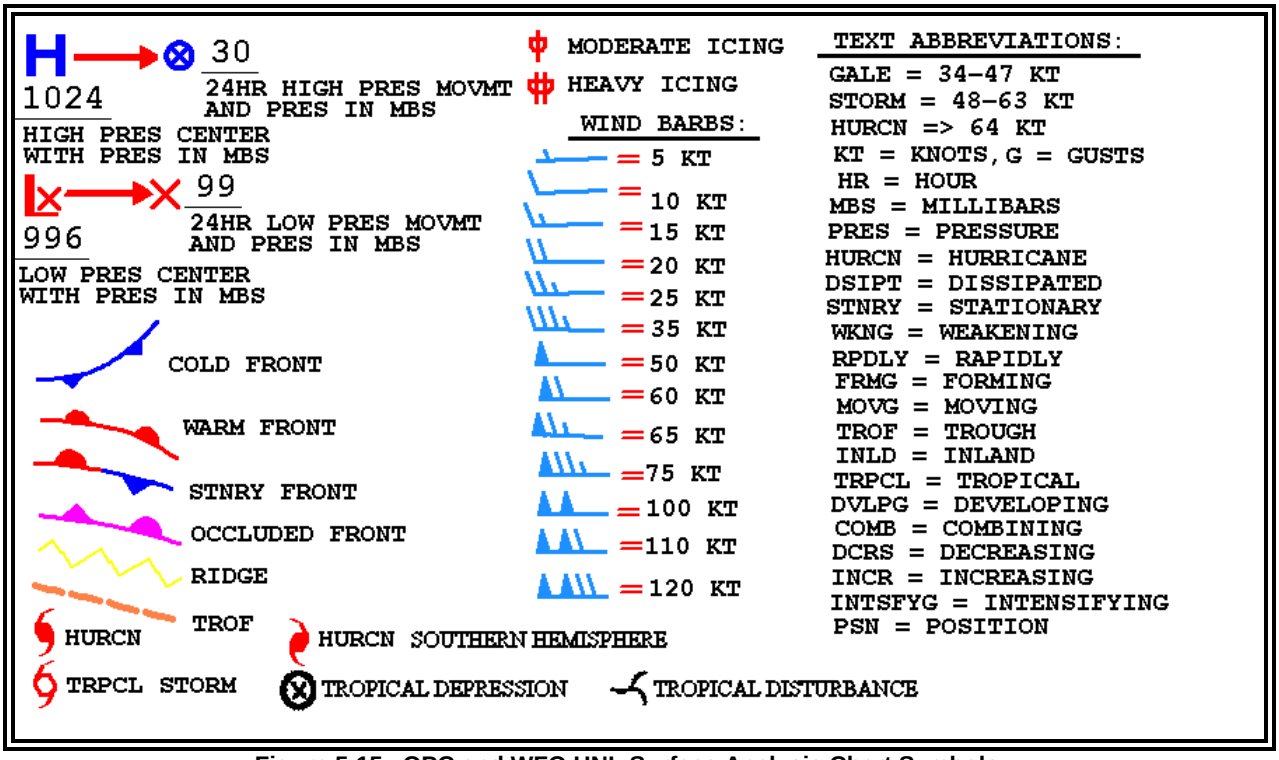


Figure 5-15. OPC and WFO HNL Surface Analysis Chart Symbols

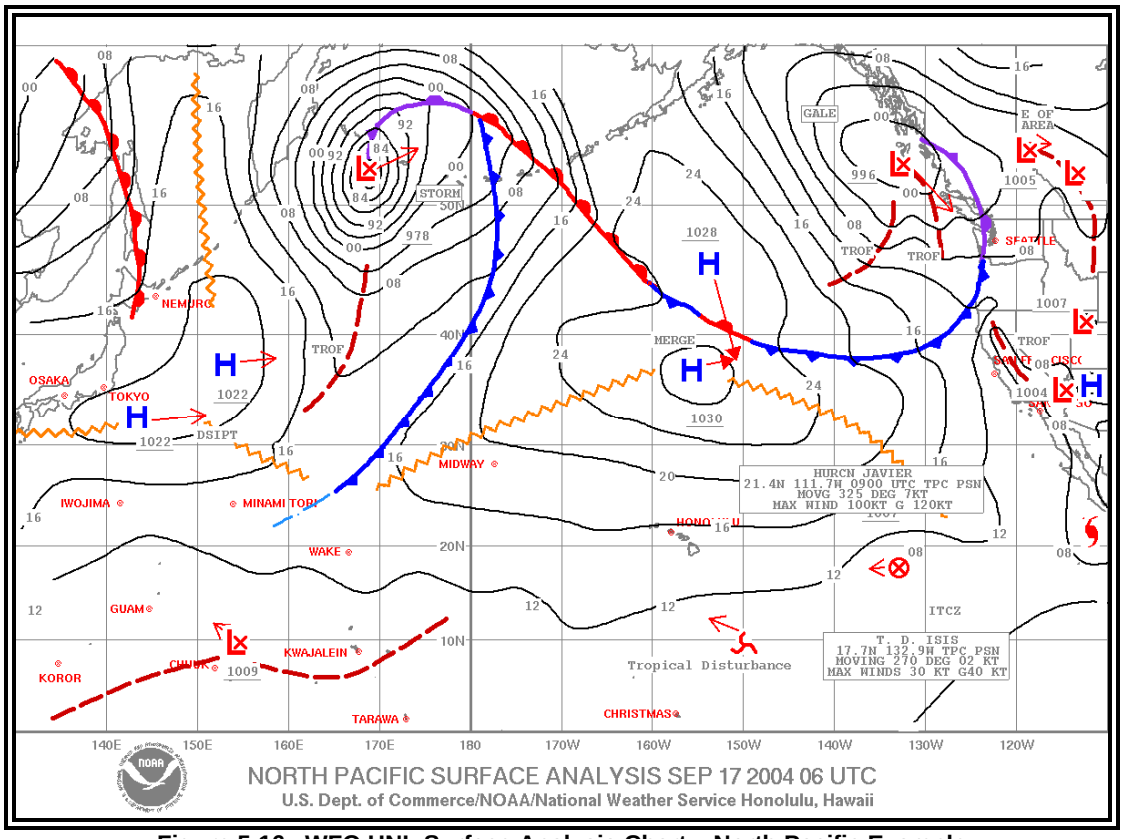


Figure 5-16. WFO HNL Surface Analysis Chart – North Pacific Example

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.

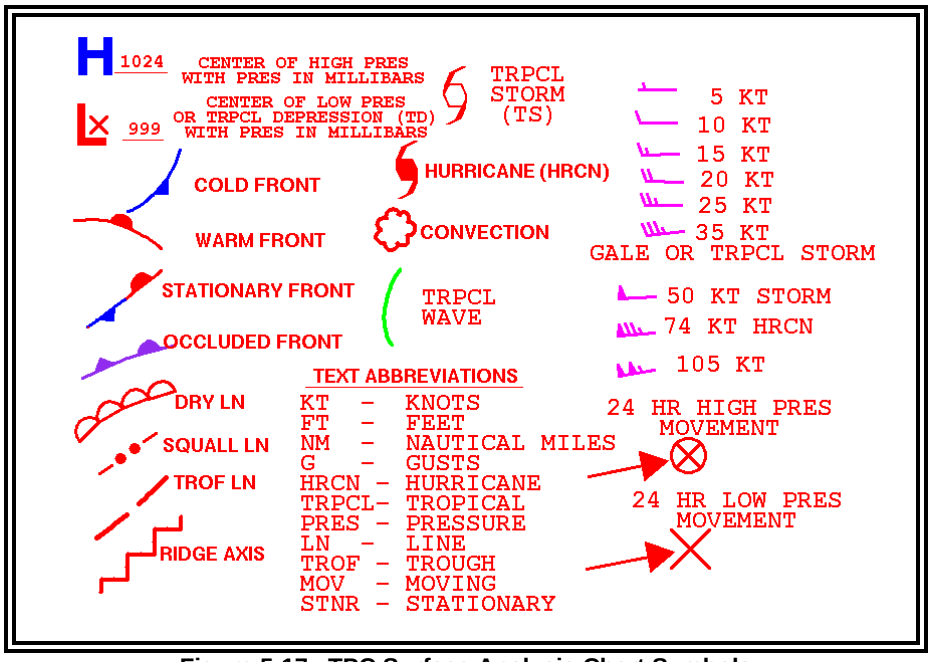


Figure 5-17. TPC Surface Analysis Chart Symbols

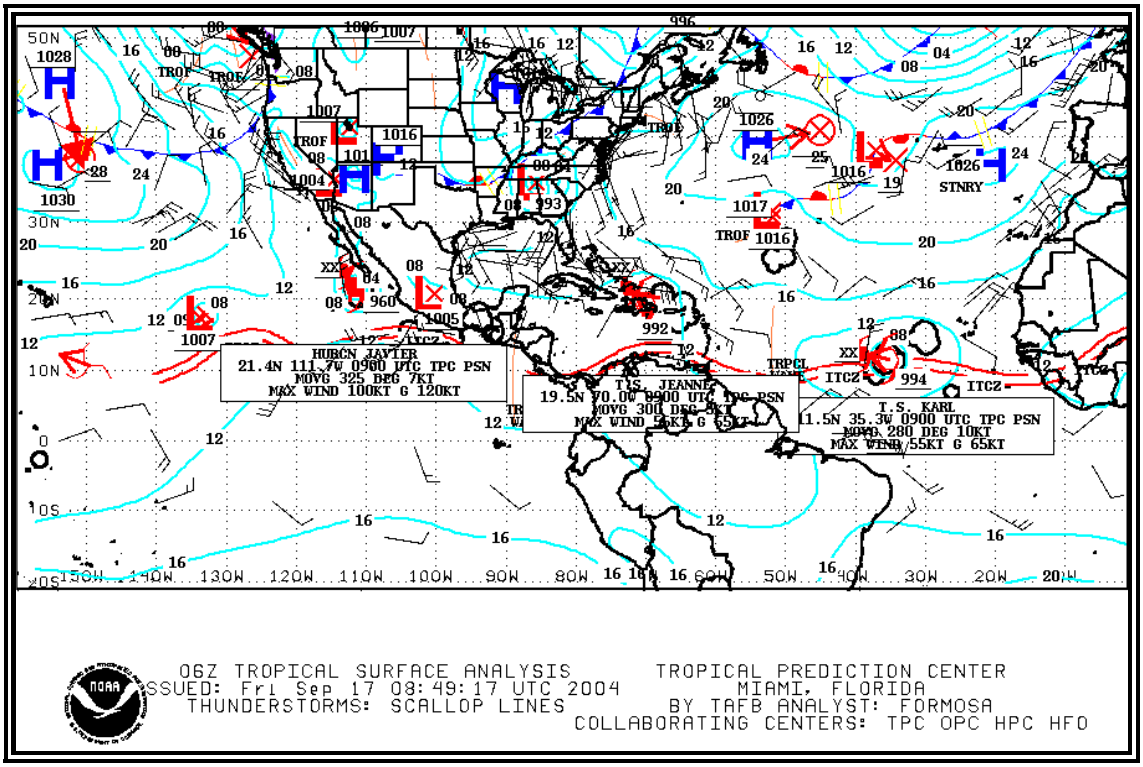


Figure 5-18. TPC Tropical Surface Analysis Chart Example

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:

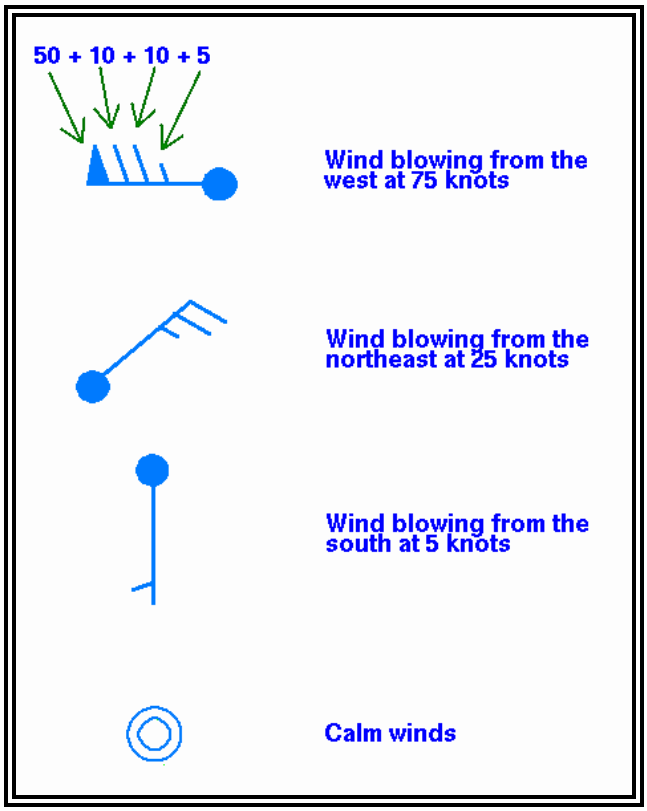


Figure 5-19: TPC Surface Analysis Chart Wind Plotting Model

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

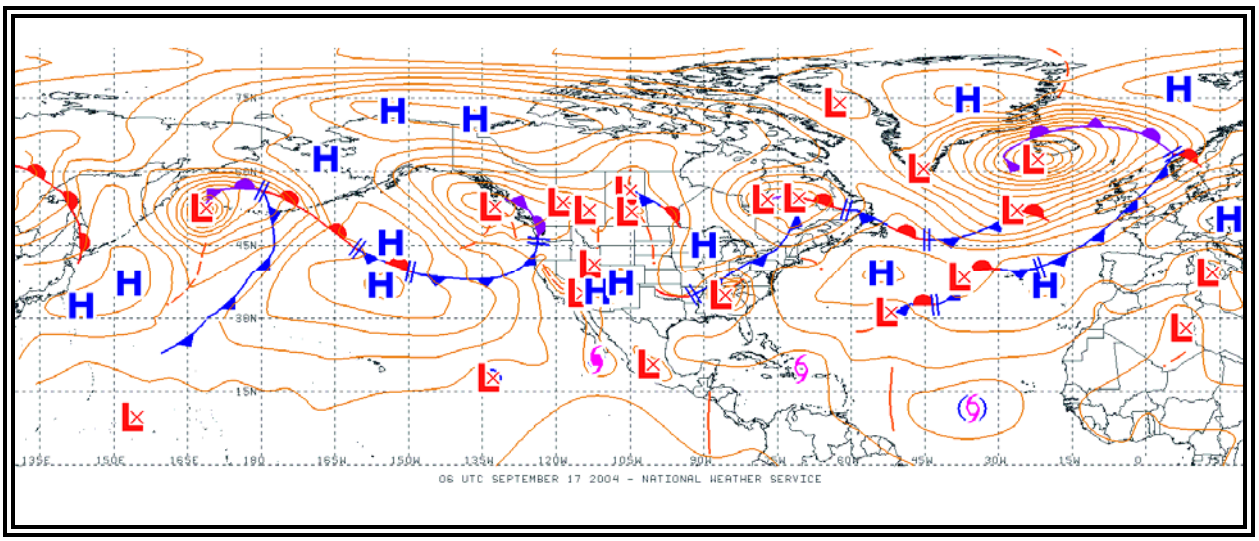


Figure 5-20. Unified Surface Analysis Chart Example

5.1.5.2 Analysis Symbols

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

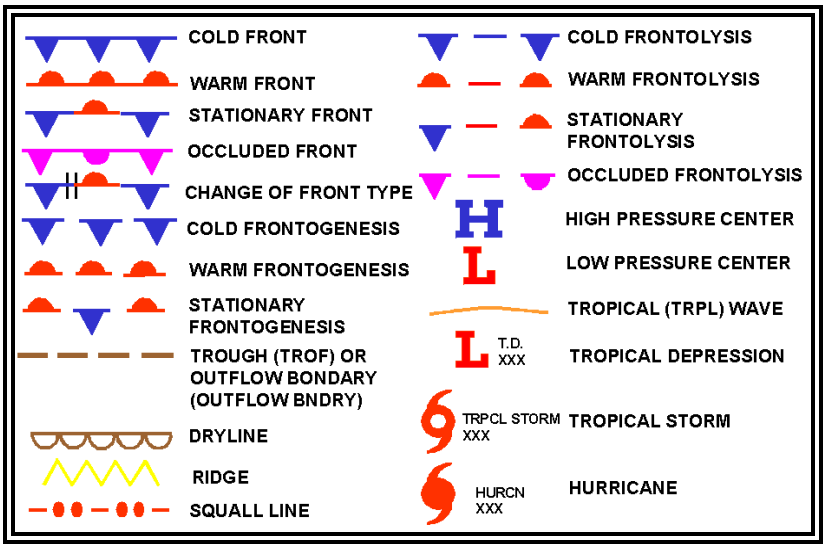


Figure 5-21. Unified Surface Analysis Chart Symbols

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.

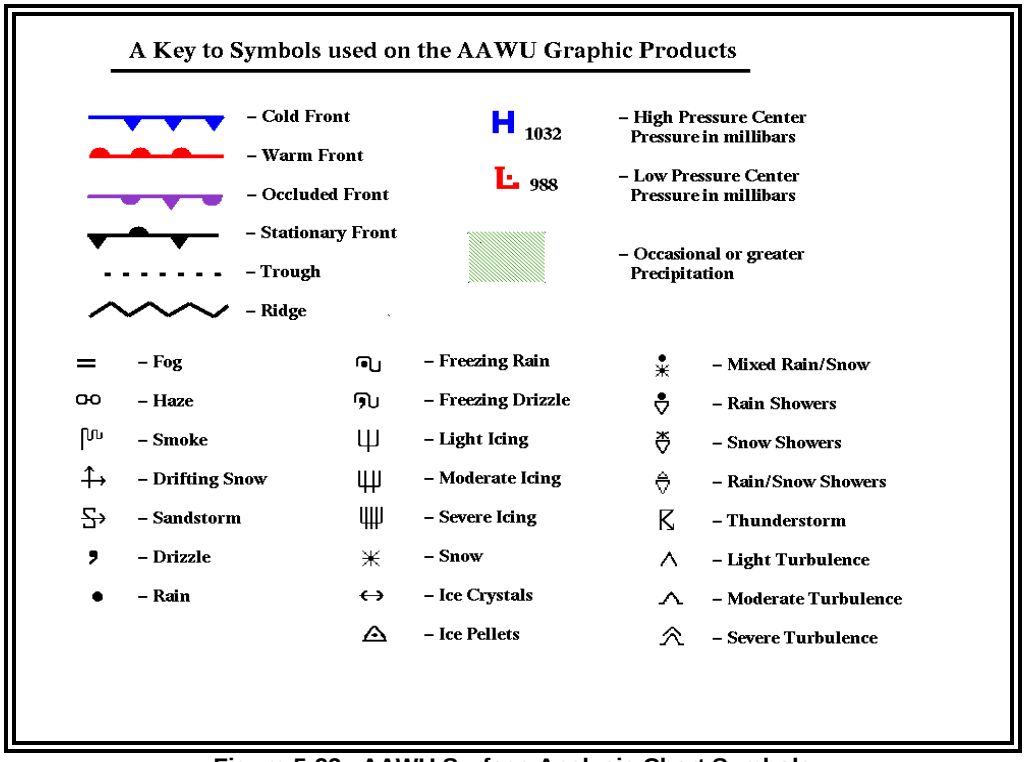


Figure 5-22. AAWU Surface Analysis Chart Symbols

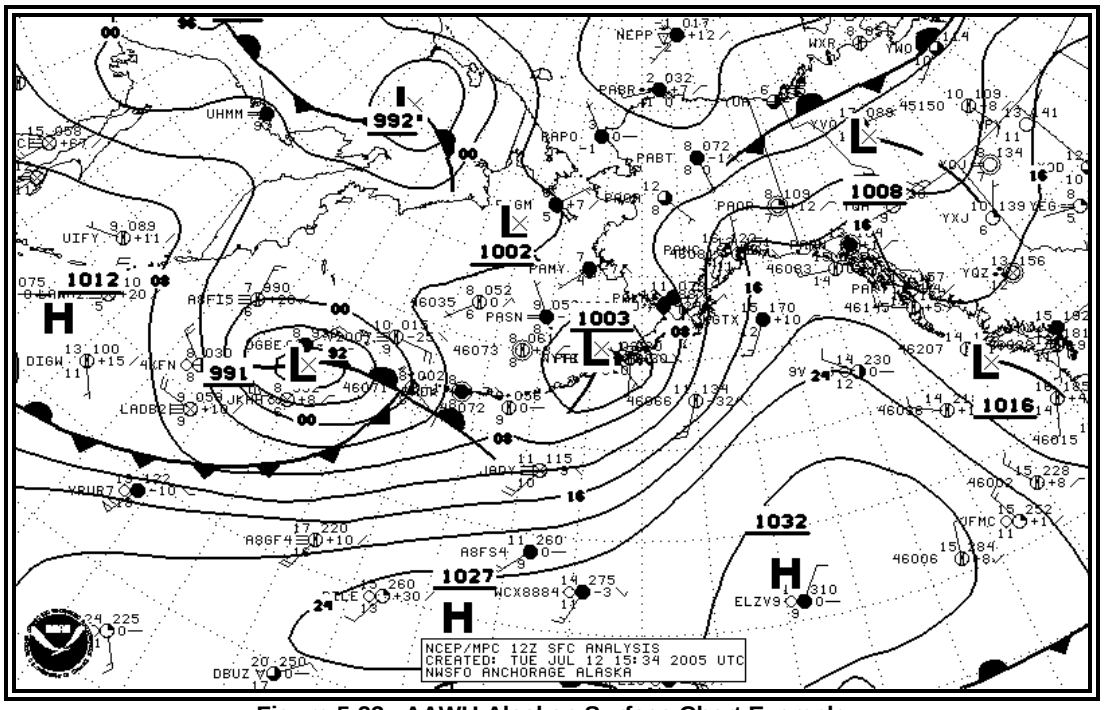


Figure 5-23. AAWU Alaskan Surface Chart Example

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.

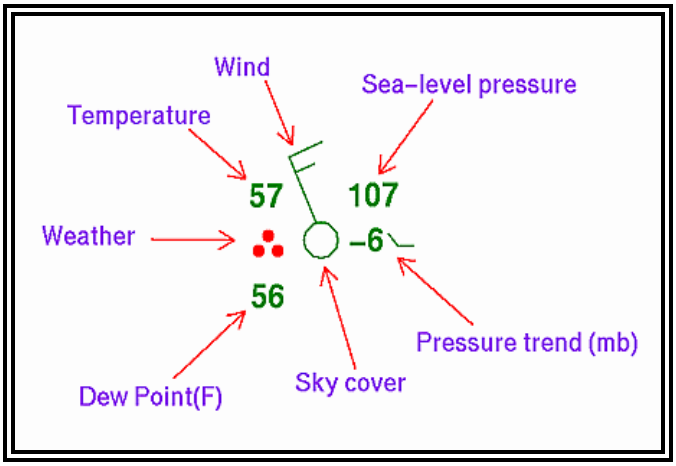


Figure 5-24. AAWU Surface Analysis Chart Station Plot Model

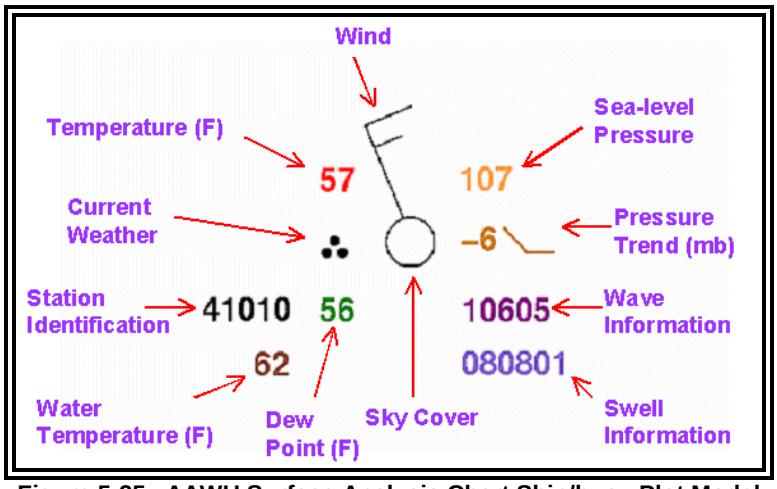


Figure 5-25. AAWU Surface Analysis Chart Ship/buoy Plot Model

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.

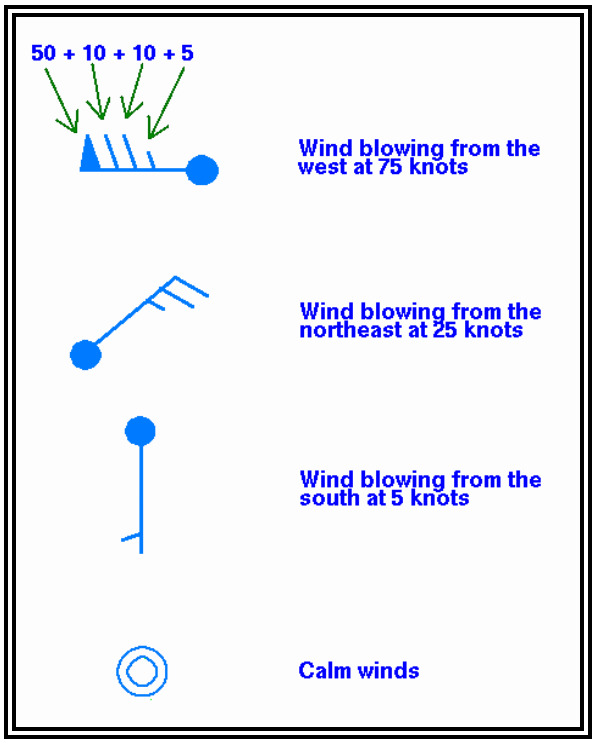


Figure 5-26: AAWU Surface Analysis Chart Wind Plotting Model

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.

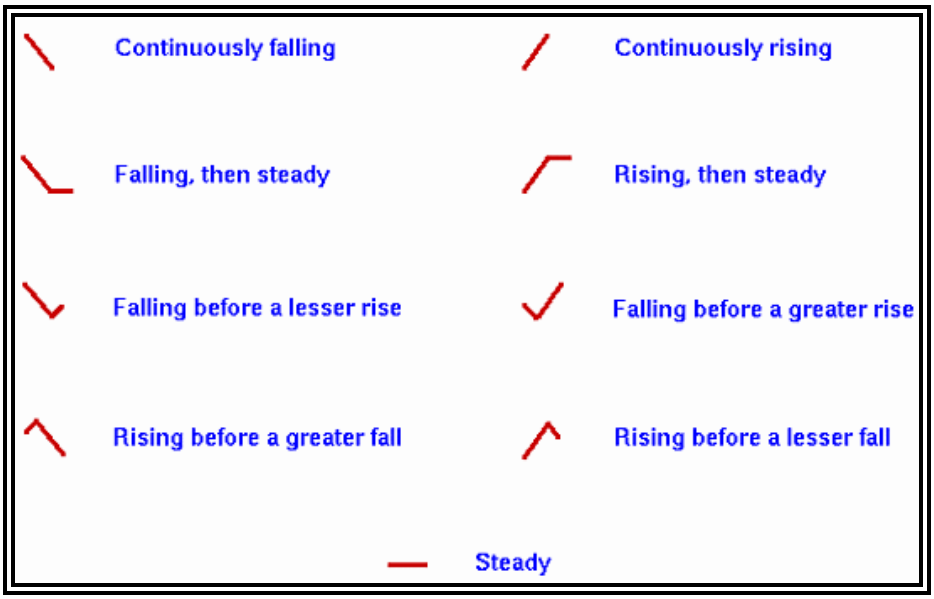


Figure 5-27. AAWU Surface Analysis Chart Pressure Trends

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:

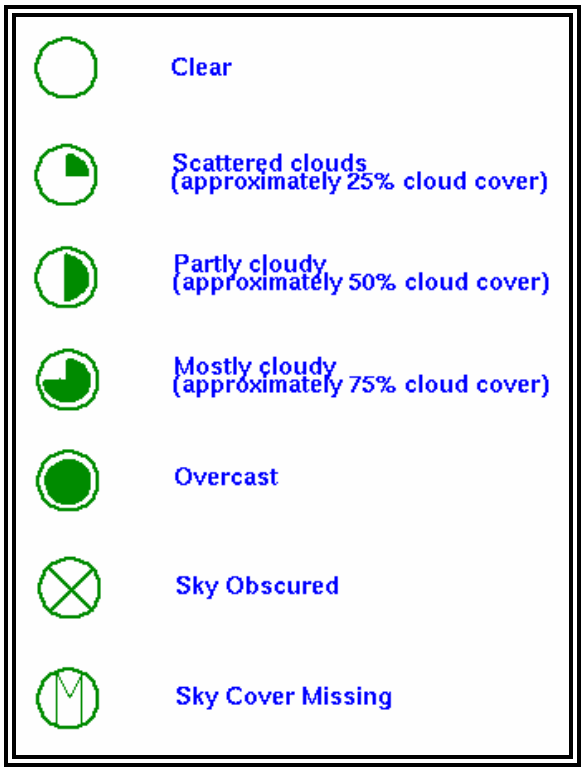


Figure 5-28. AAWU Surface Analysis Chart Sky Cover Symbols

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.

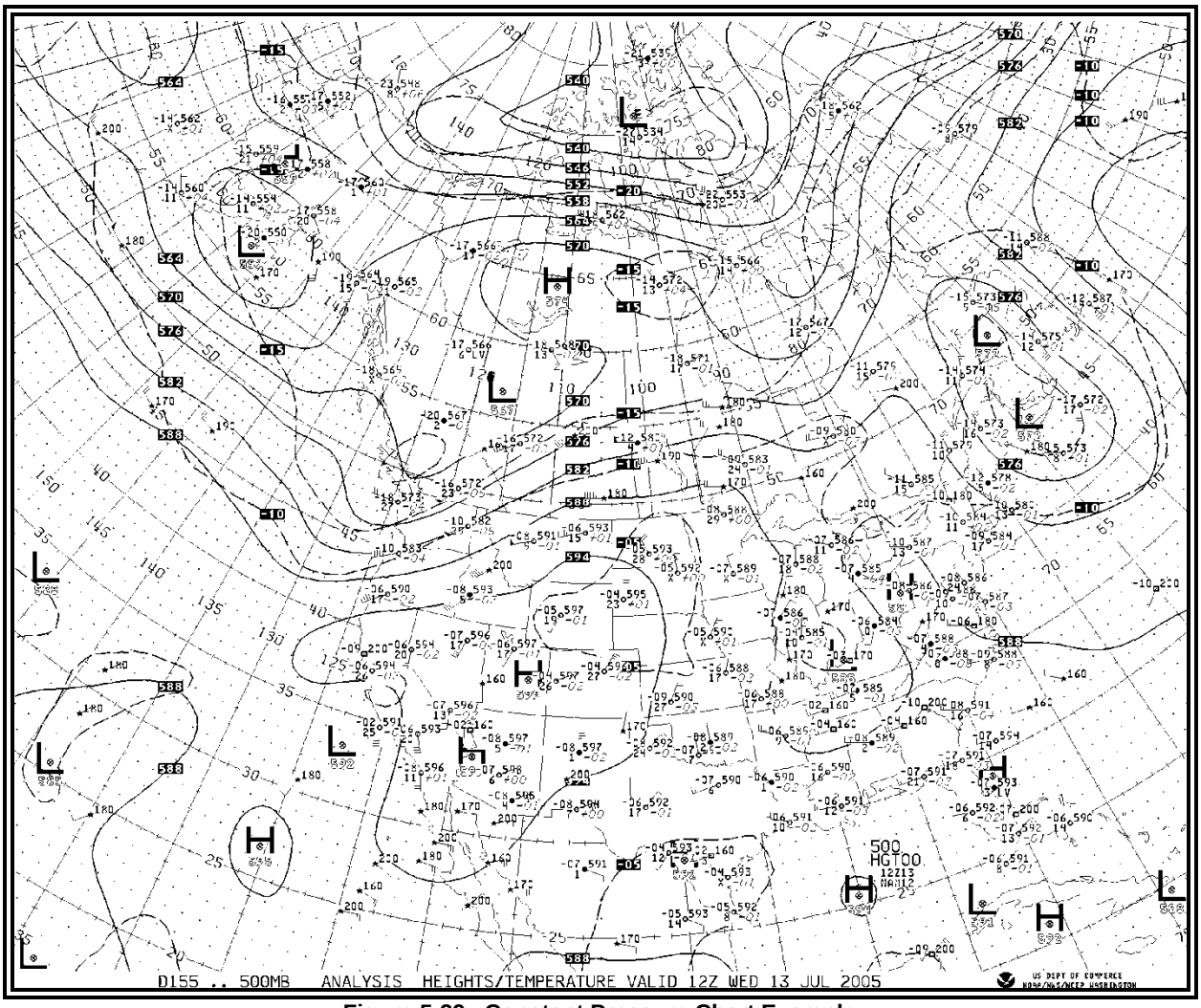


Figure 5-29. Constant Pressure Chart Example

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

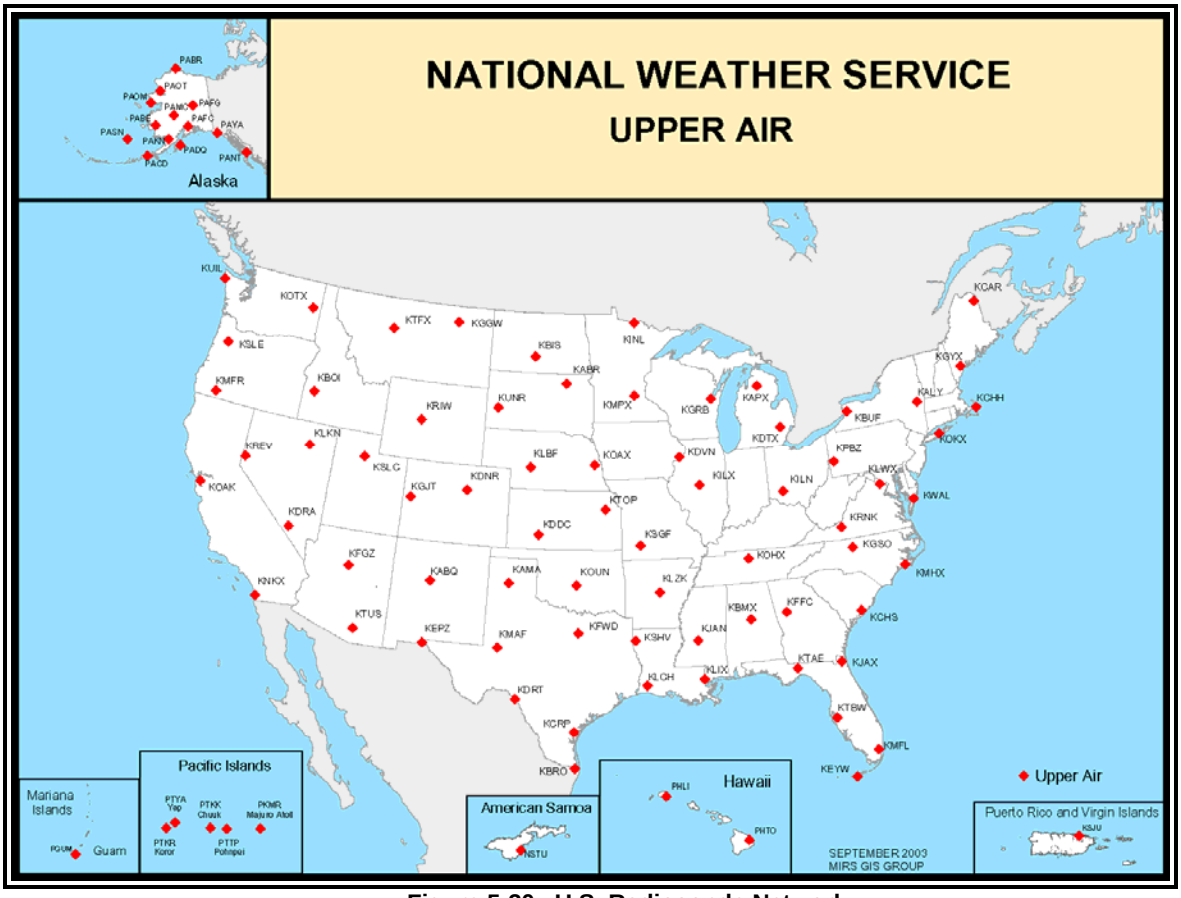


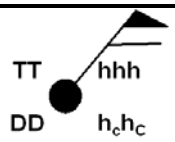
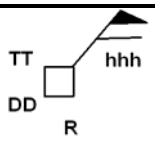
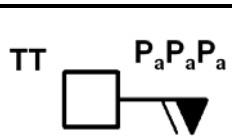
Figure 5-30. U.S. Radiosonde Network

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

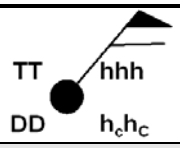
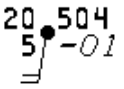
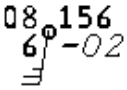
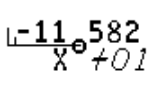
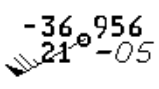
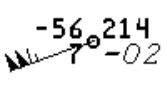
Note: Pressure altitudes are rounded to the nearest 1,000 for feet and 500 for meters.
* Prefix a "2" or "3," whichever brings the height closer to 3,000 meters.

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

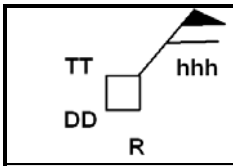
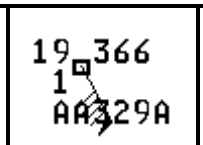
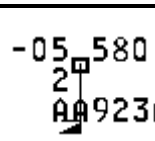
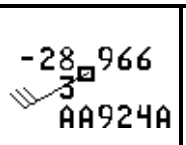
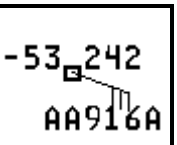
Wind speed is analyzed with isotachs which are lines of constant wind speed. They are drawn on the 300-mb and 200-mb charts with short-dashed lines at 20-knot intervals beginning with10 knots. They are labeled with a two- or three-digit number followed by a **K** for knots. Regions of high wind speeds 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.

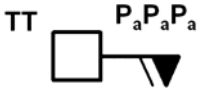
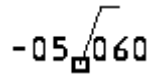
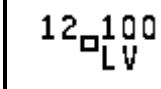
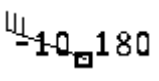
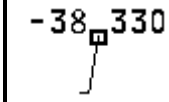
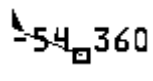
Pressure patterns cause and characterize much of the weather. Typically, lows and troughs are associated with bad weather, clouds and precipitation, while highs and ridges are associated with good weather.

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

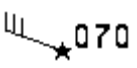
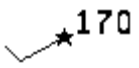
***** Wind direction assumes that north is at the top of the page. Latitude and longitude lines, as well as other geographical references, must be used to determine actual compass direction.

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.

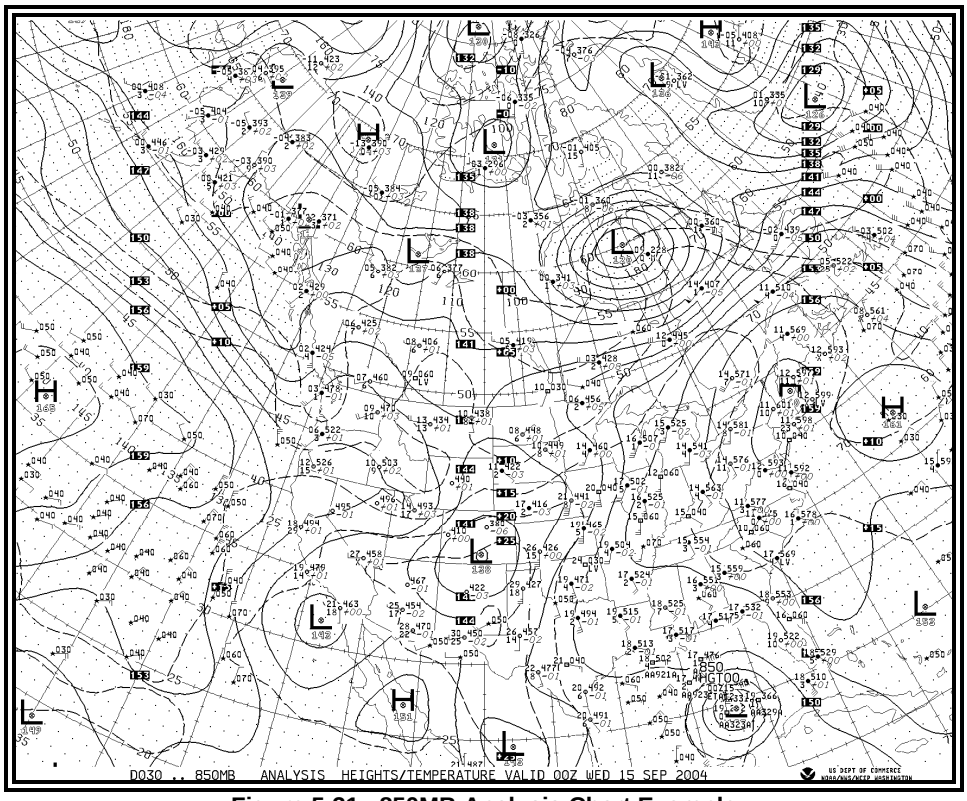


Figure 5-31. 850MB Analysis Chart Example

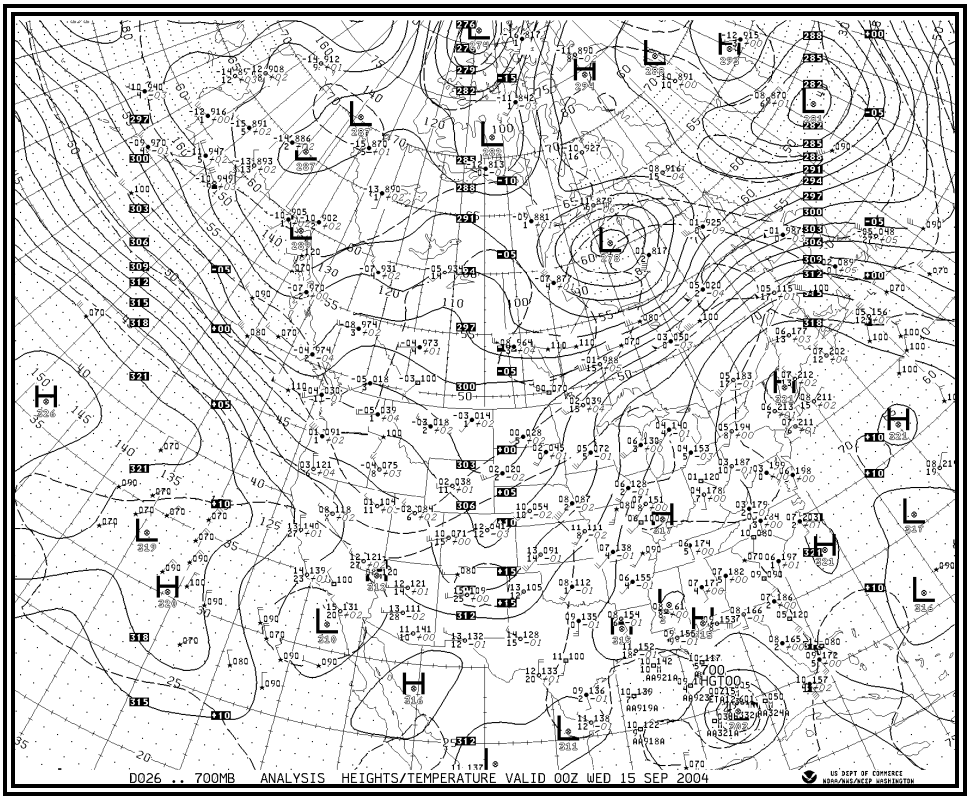


Figure 5-32. 700MB Analysis Chart Example

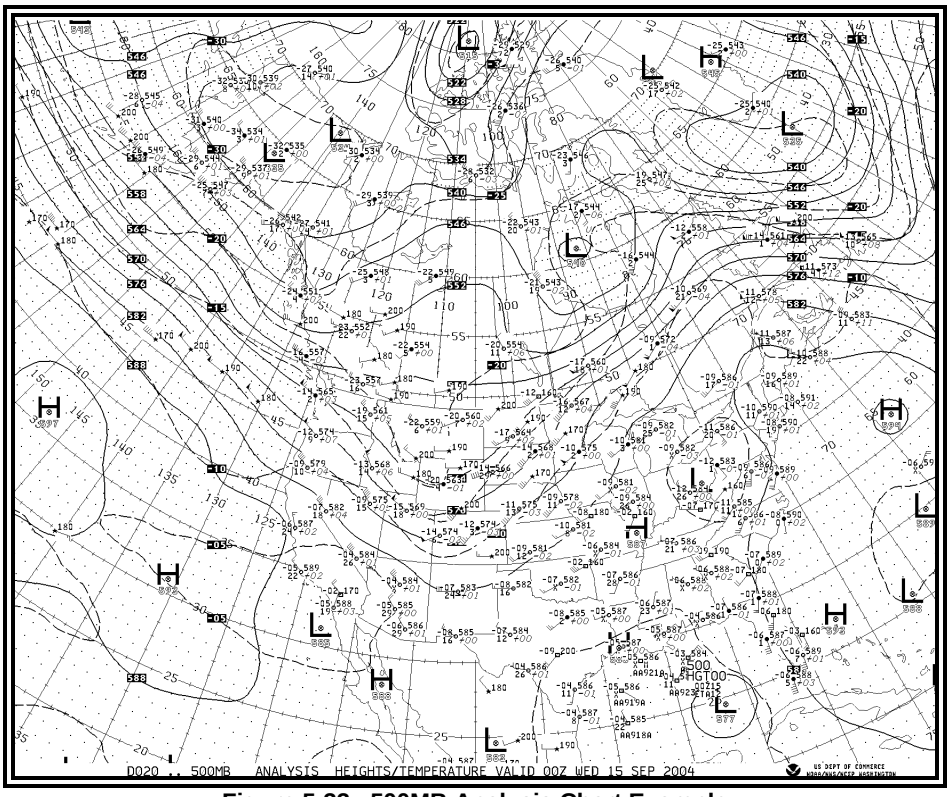


Figure 5-33. 500MB Analysis Chart Example

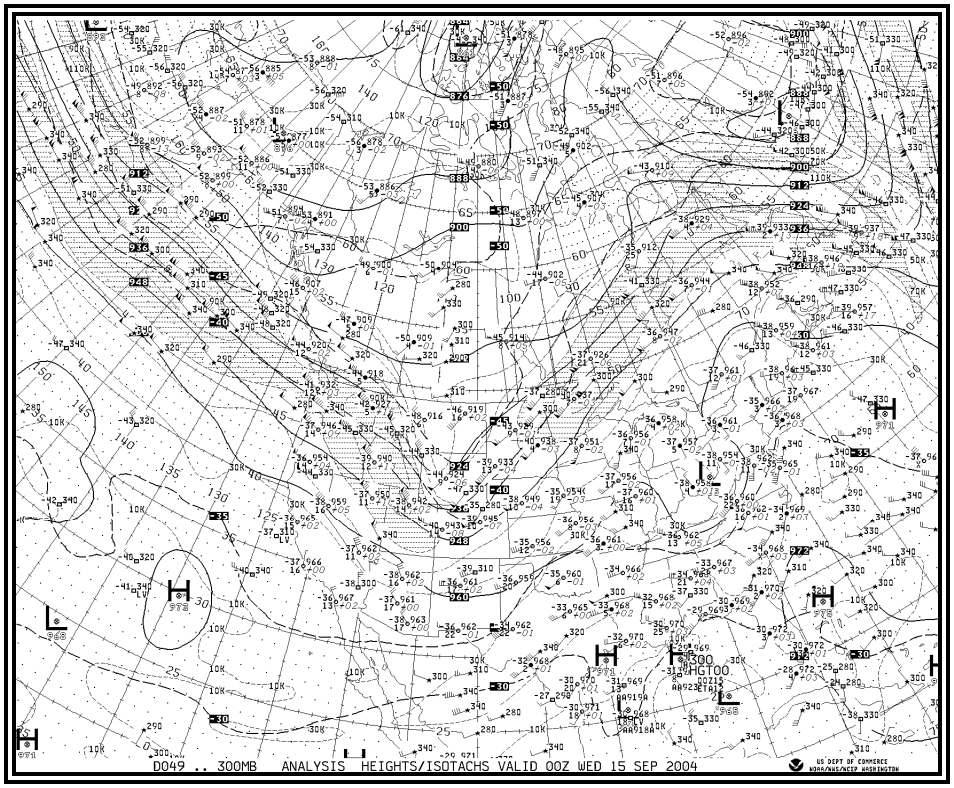


Figure 5-34. 300MB Analysis Chart Example

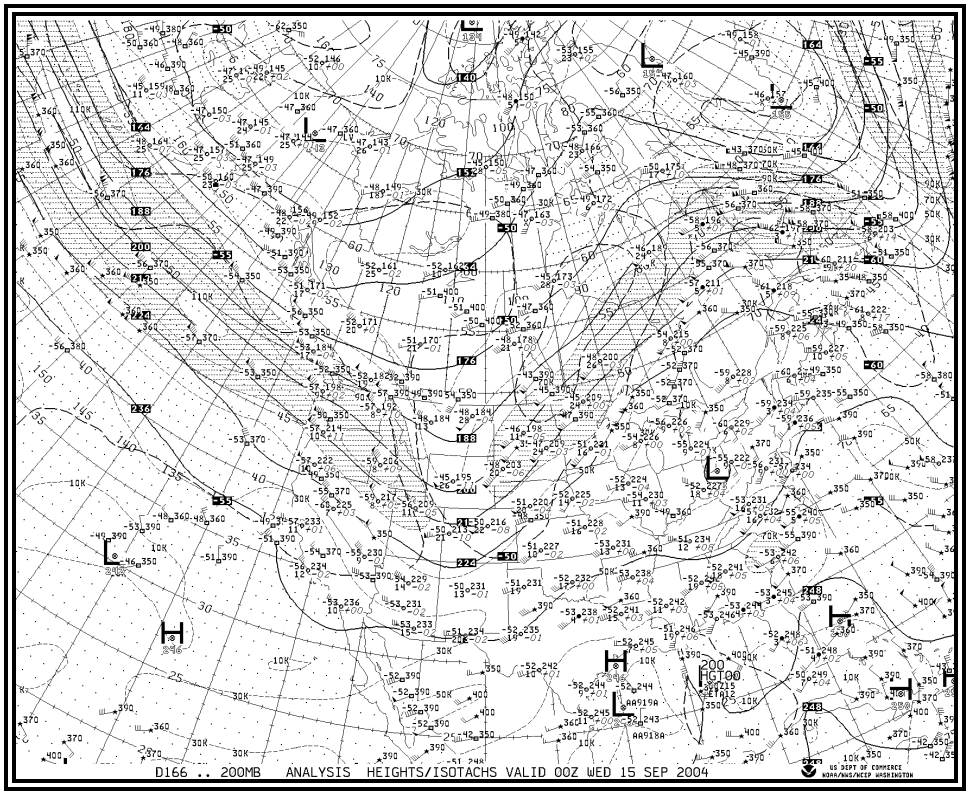


Figure 5-35. 200MB Analysis Chart Example

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.

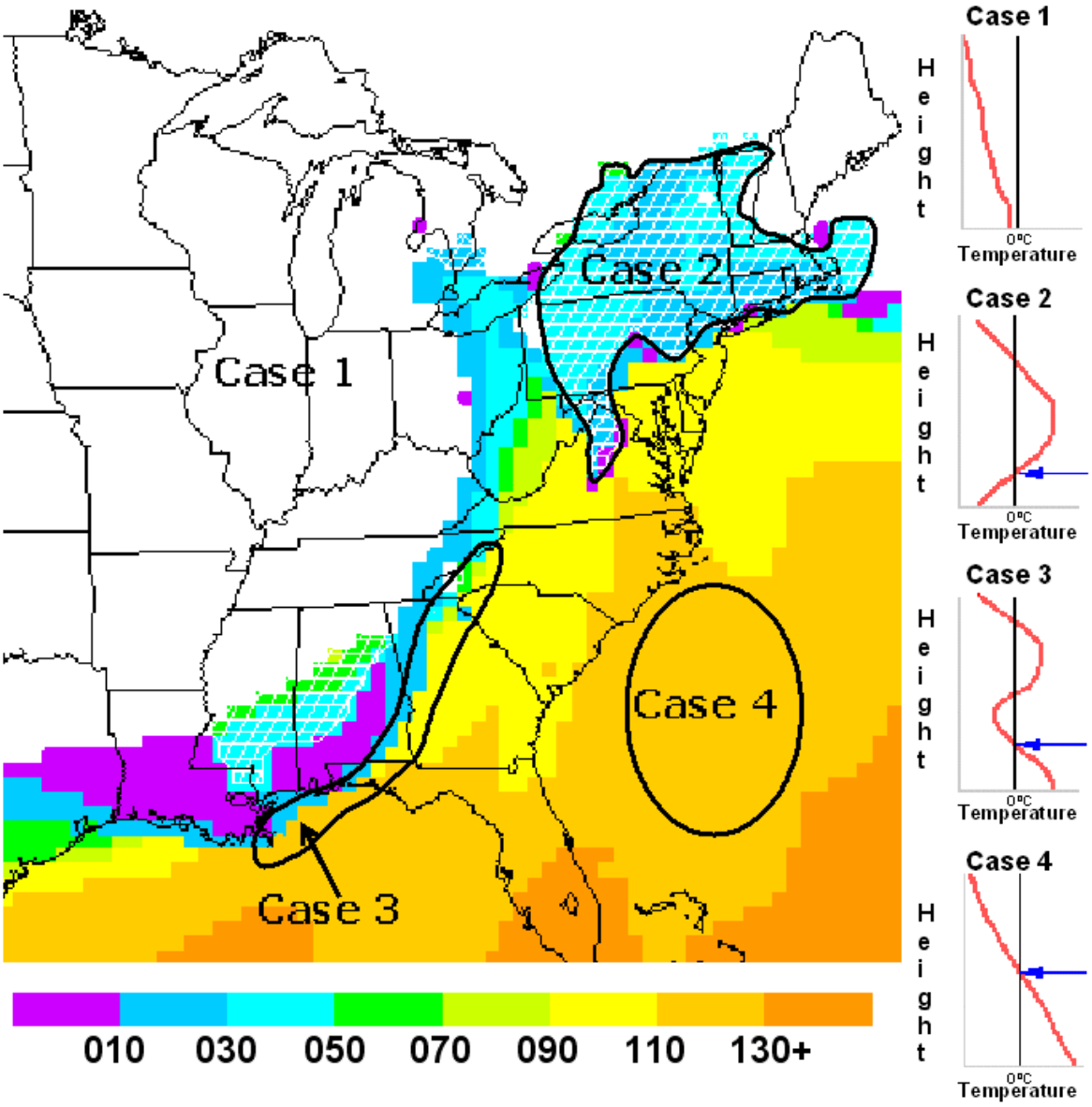


Figure 5-36. RUC 00-hour Freezing Level Graphic Example

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)

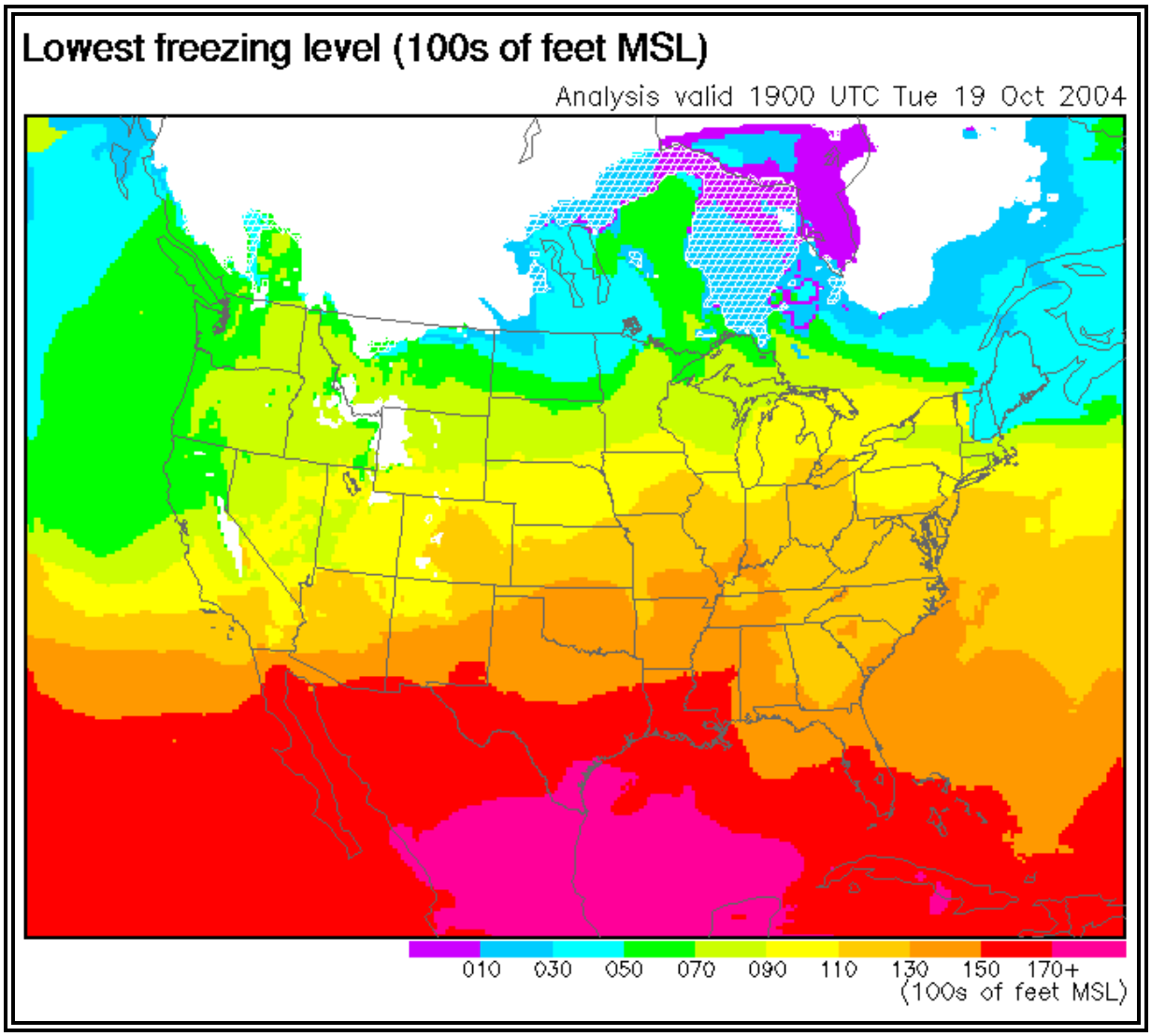


Figure 5-37. ADDS Freezing Level Graphic Example

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.

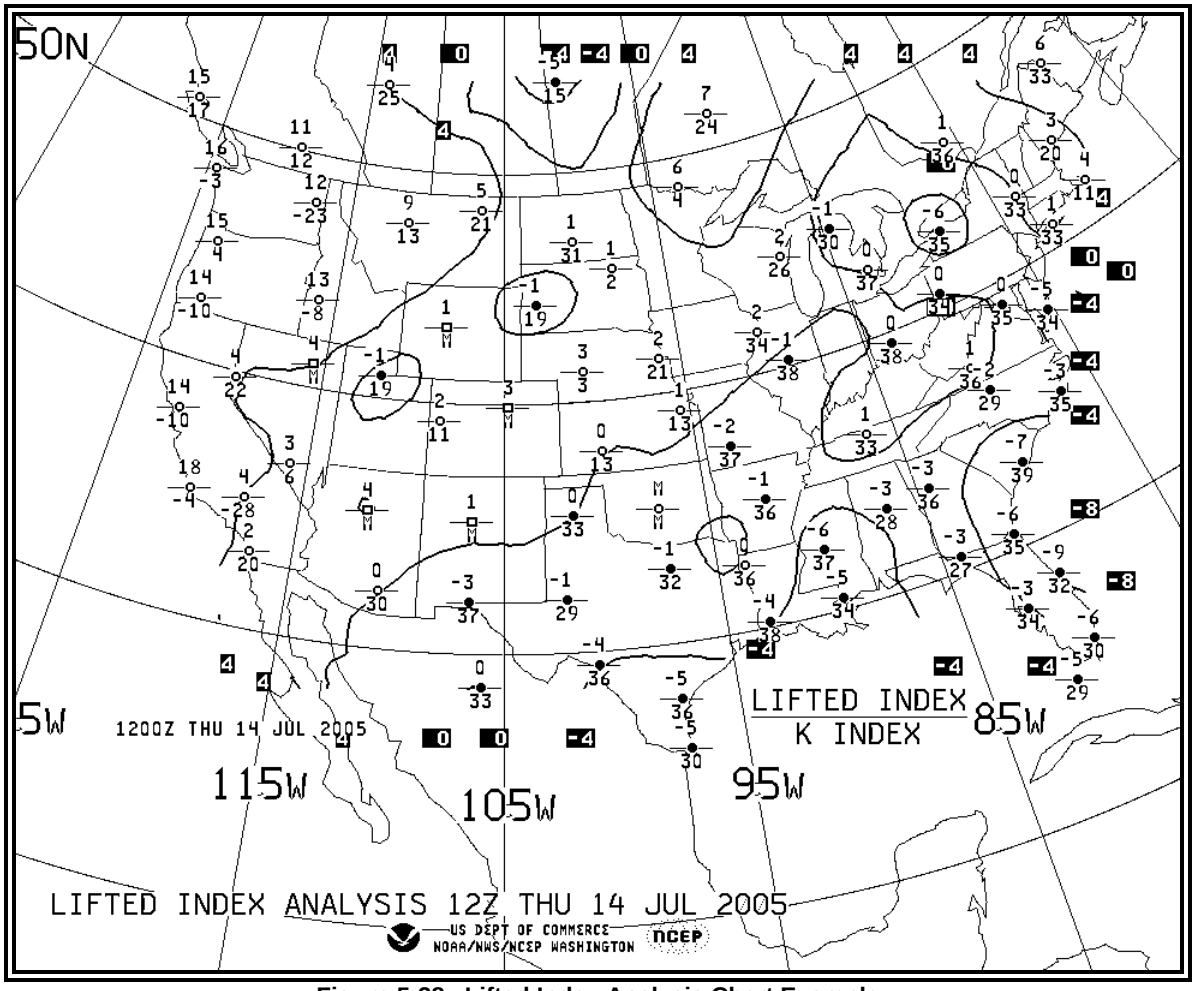


Figure 5-38. Lifted Index Analysis Chart Example

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

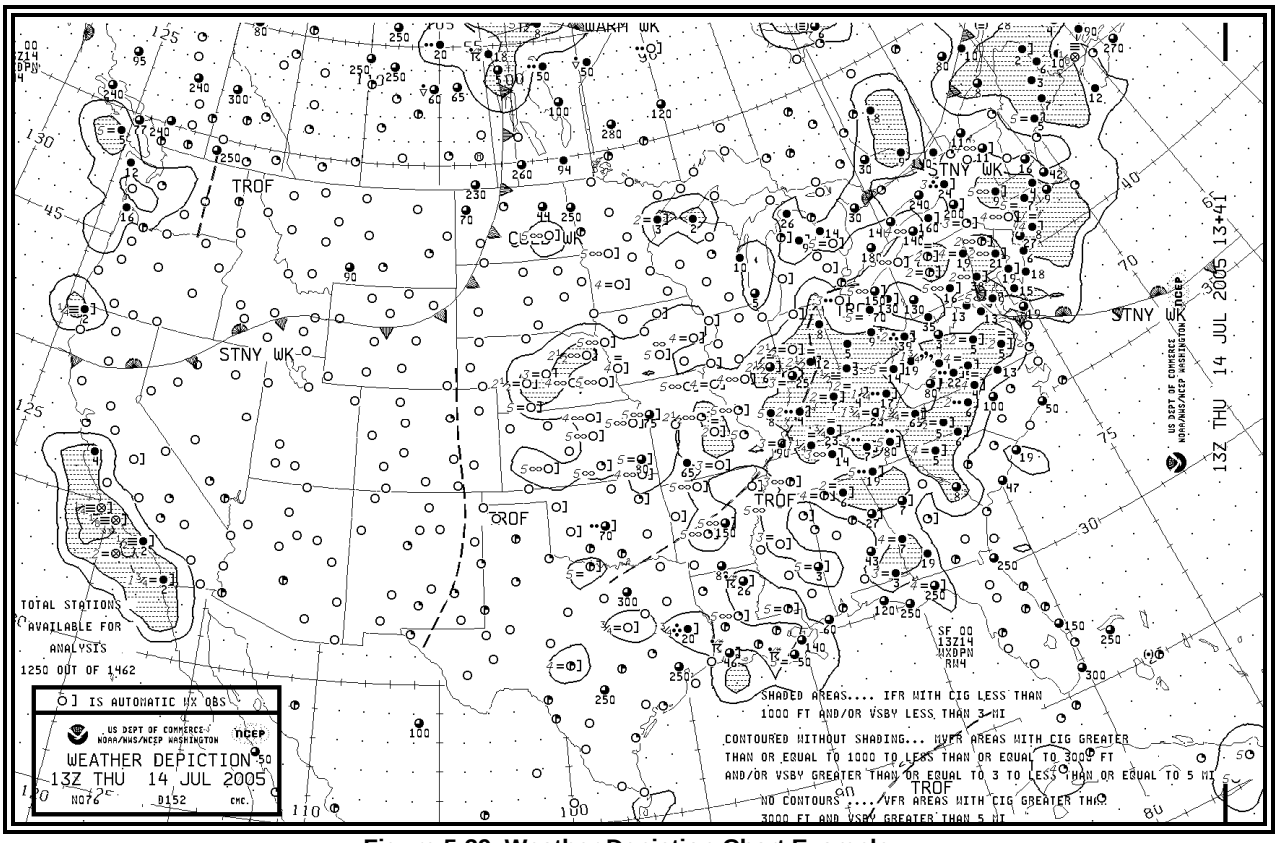


Figure 5-39. Weather Depiction Chart Example

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.

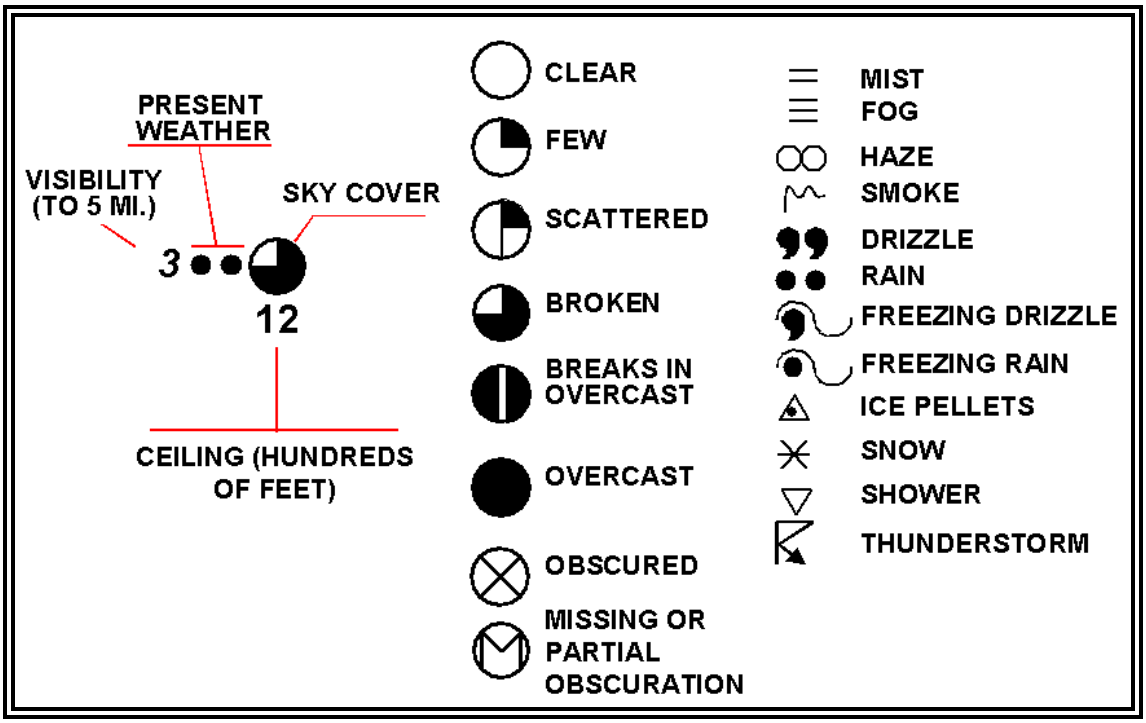


Figure 5-40. Weather Depiction Chart Station Plot Model

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.

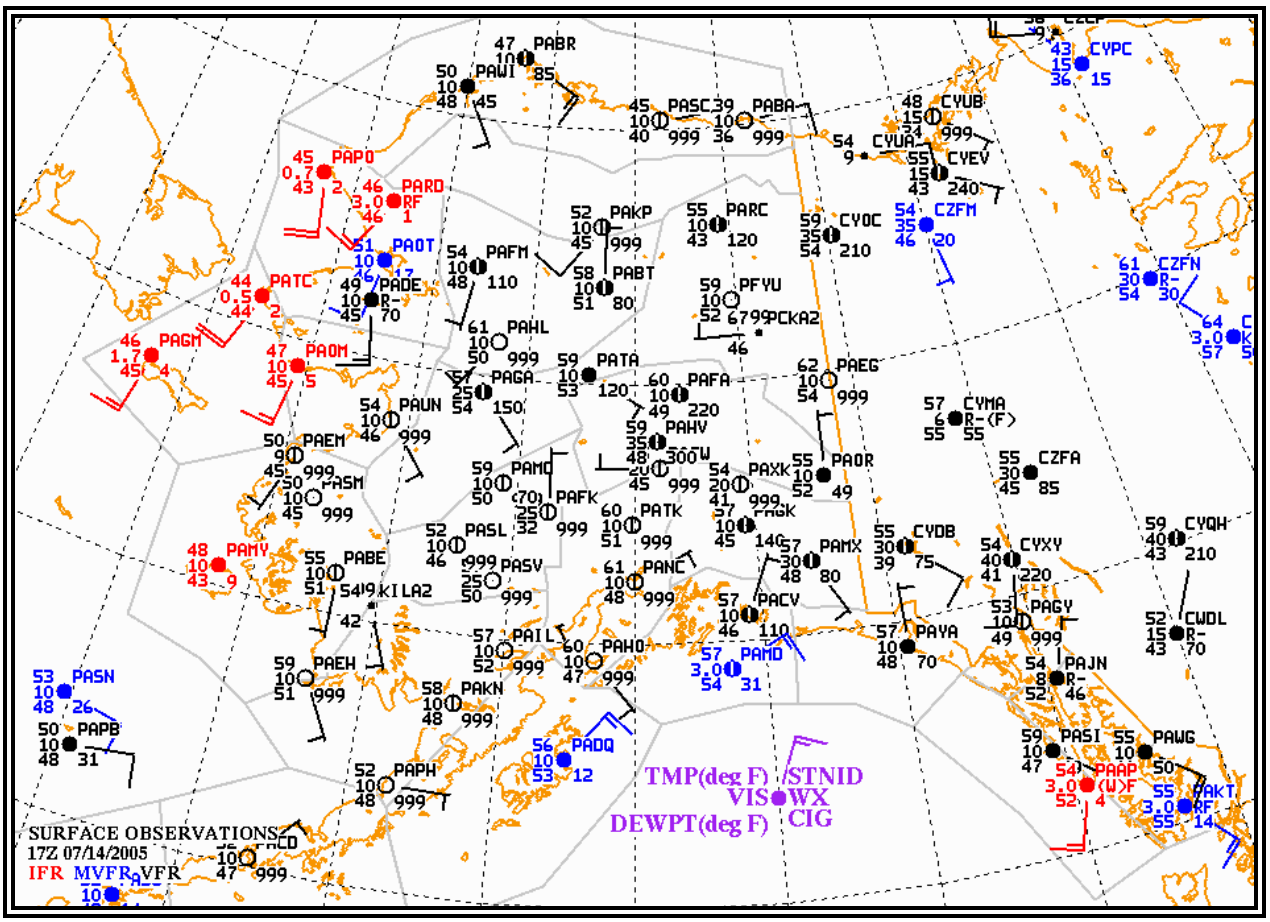


Figure 5-41. AAWU Alaska Weather Depiction Chart Example

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.

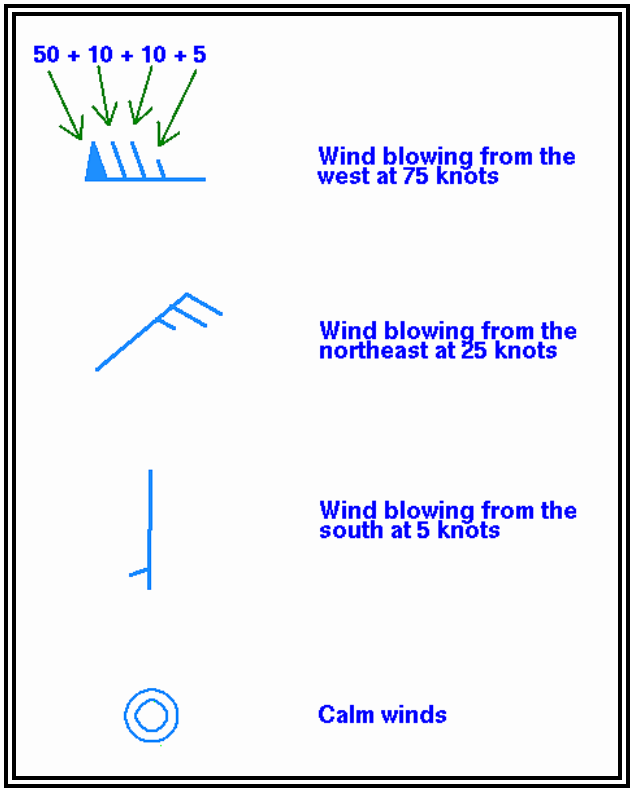


Figure 5-43. AAWU Alaska Weather Depiction Chart Wind Symbols

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.

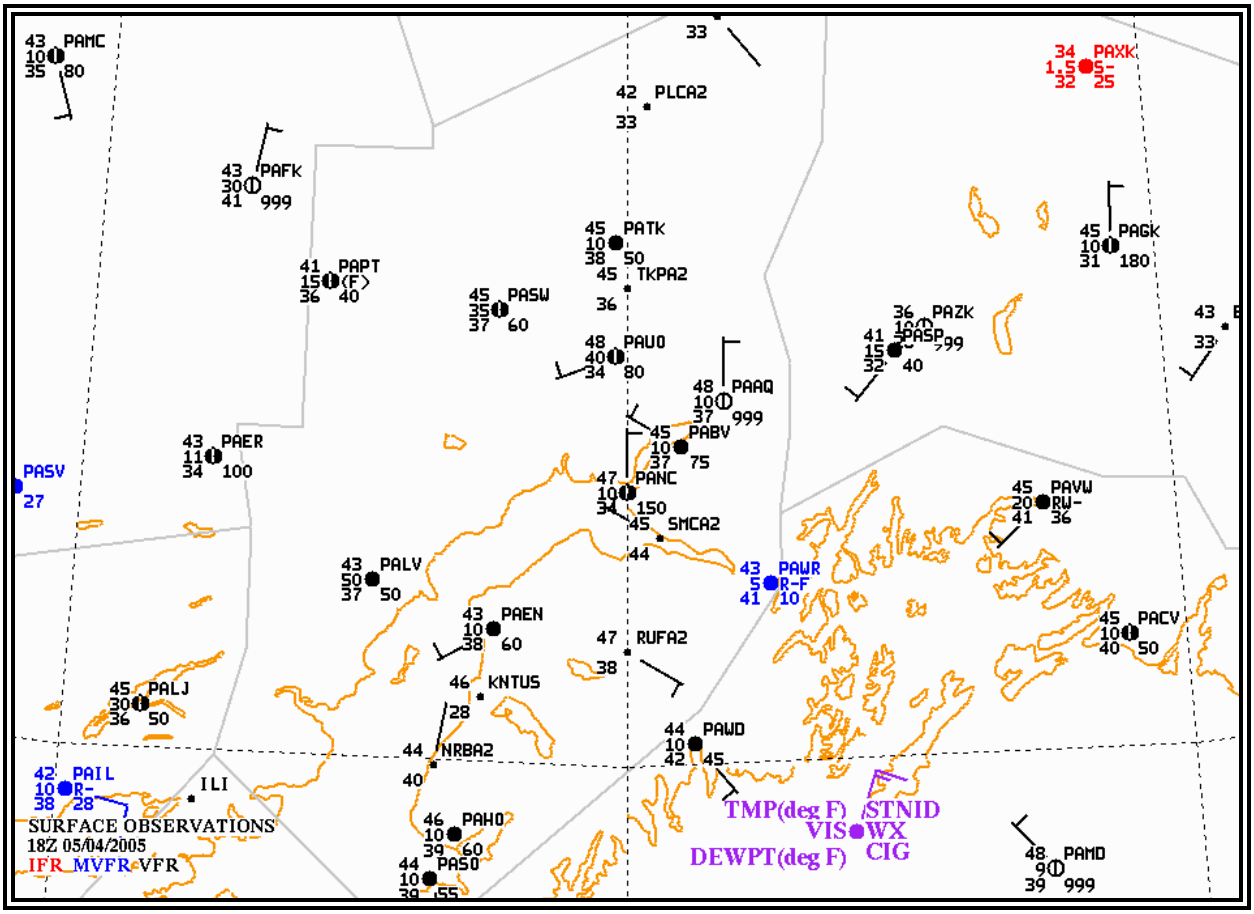


Figure 5-44. AAWU Alaska Weather Depiction Chart – South Central Alaska Example

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

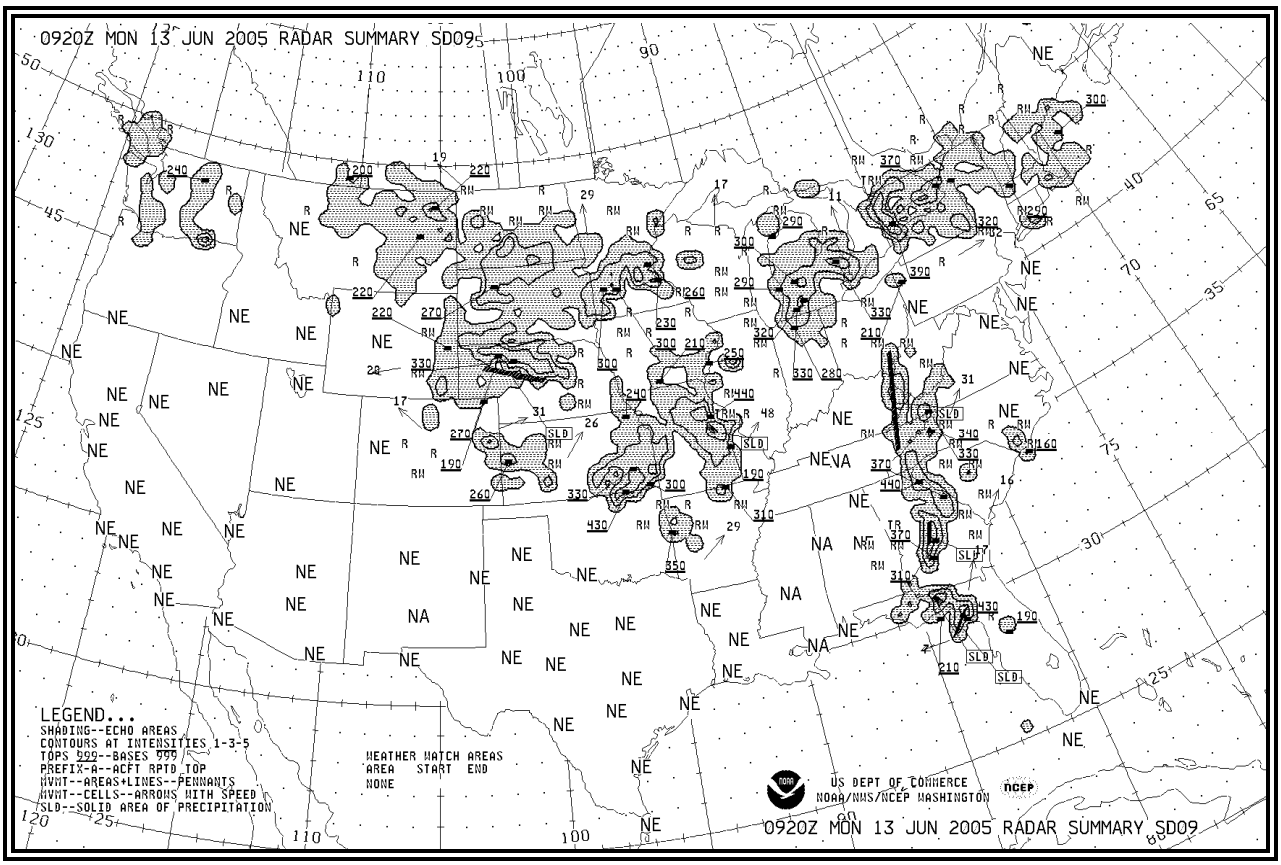


Figure 5-45. Radar Summary Chart Example

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).

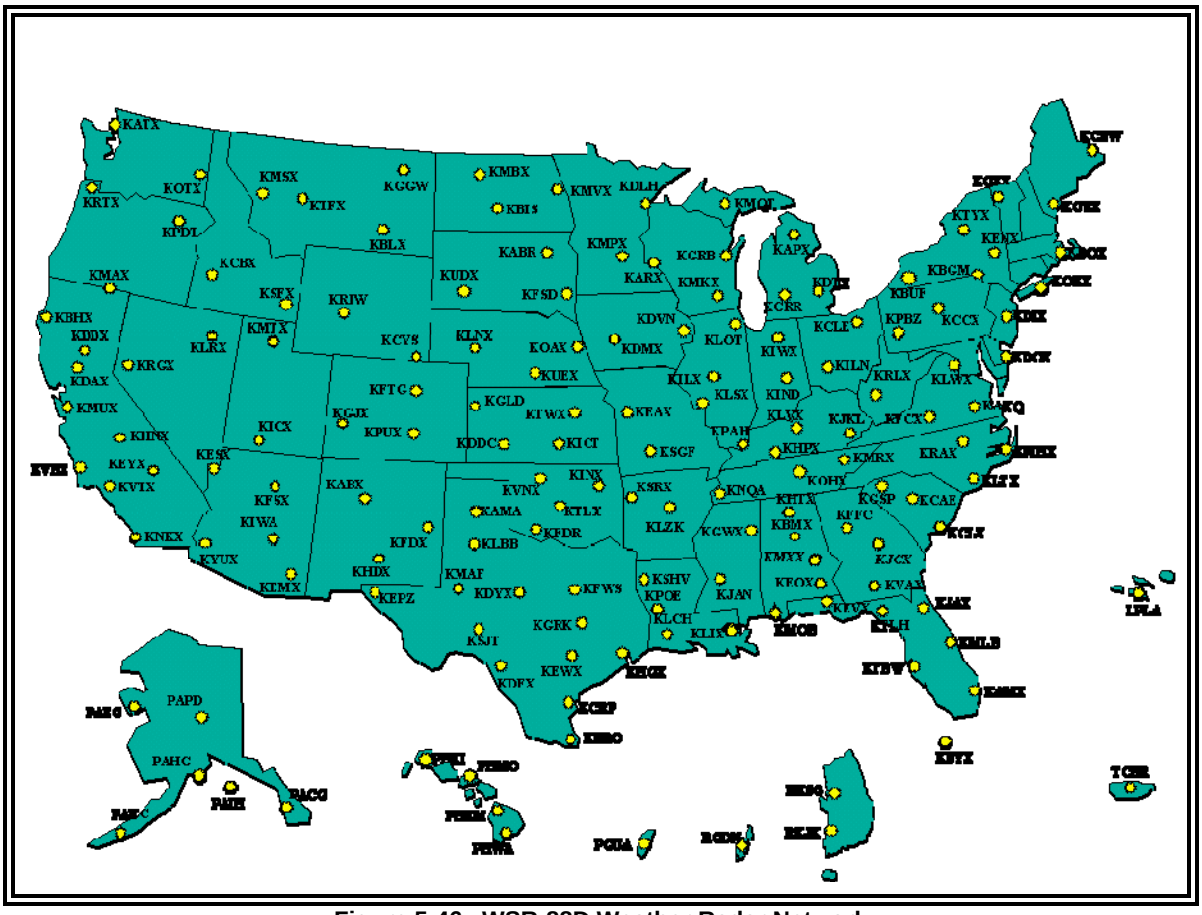


Figure 5-46. WSR-88D Weather Radar Network

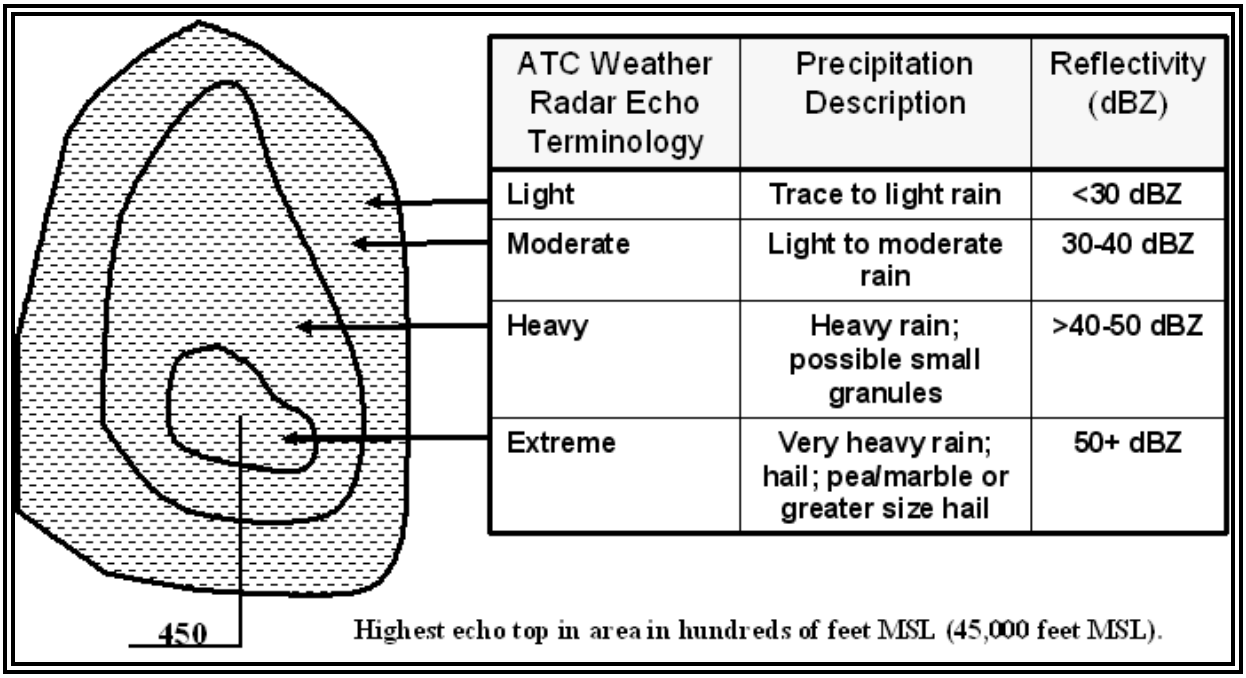


Figure 5-47. Radar Summary Chart Precipitation Intensity

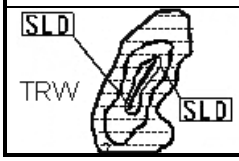
5.7.2.3 Echo Coverage

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

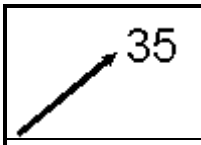
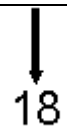
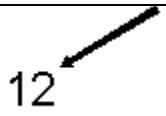
SYMBOL	MEANING
SLD	8/10ths or greater coverage in a line.
	Line of echoes.
	Solid line of thunderstorms with intense to extreme precipitation.

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

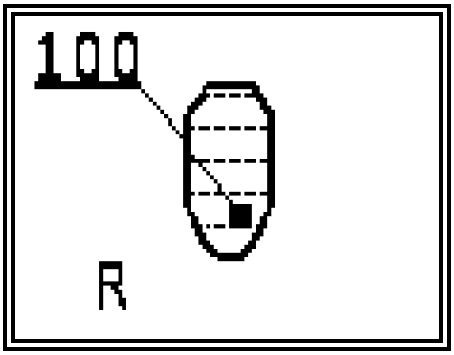


Figure 5-48. Radar Summary Chart Maximum Top Example

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.

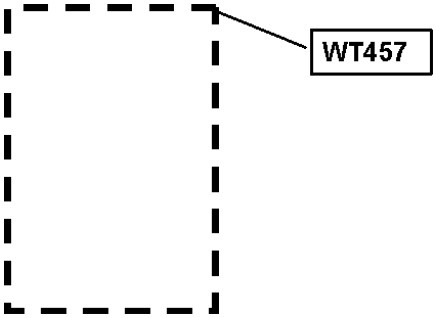
Tops are plotted in 3-digit groups representing height in hundreds of feet MSL and are underlined. Where it is necessary to offset a top for reasons of insufficient space, a line is drawn from one end of the underline to a small black square which represents the location of the top.

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.

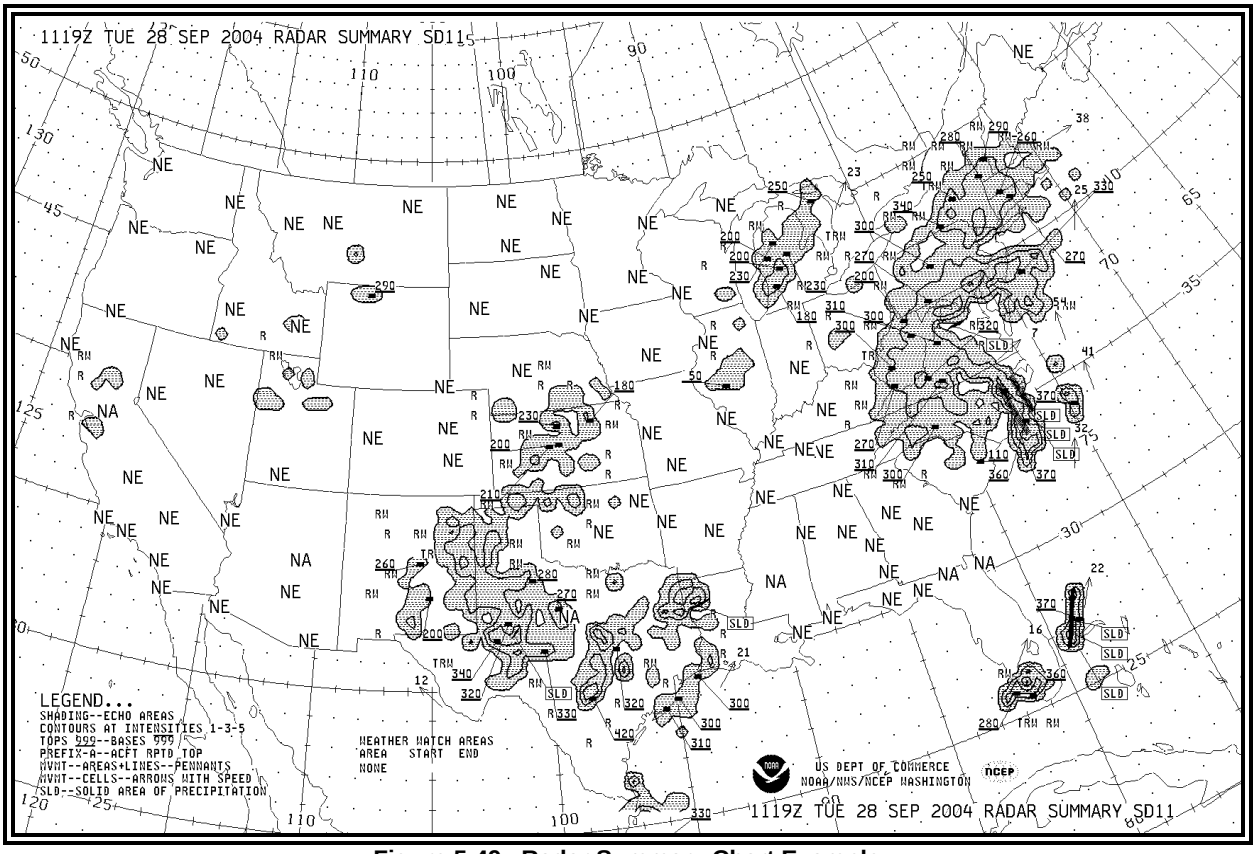


Figure 5-49. Radar Summary Chart Example

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).

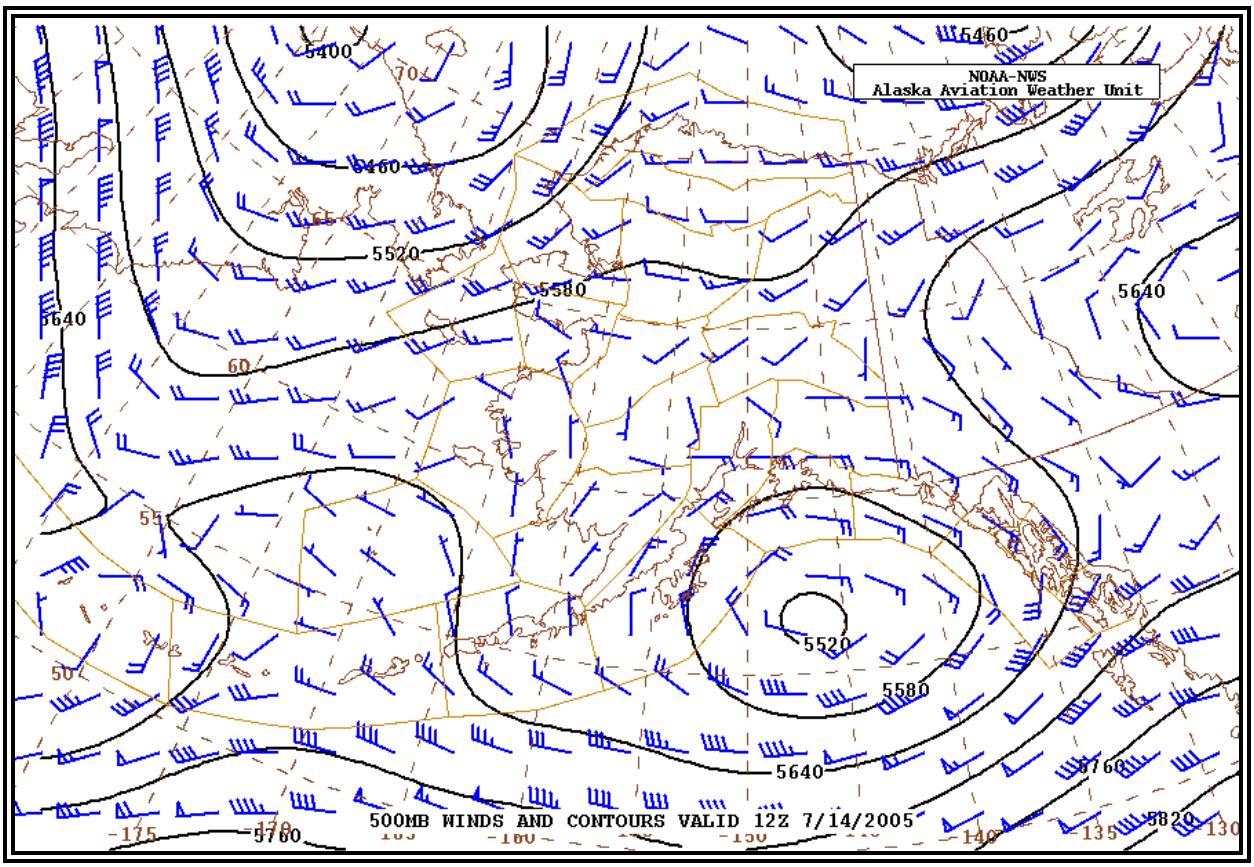


Figure 5-50. Alaskan Initial Geopotential Heights and Winds Chart Example

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.

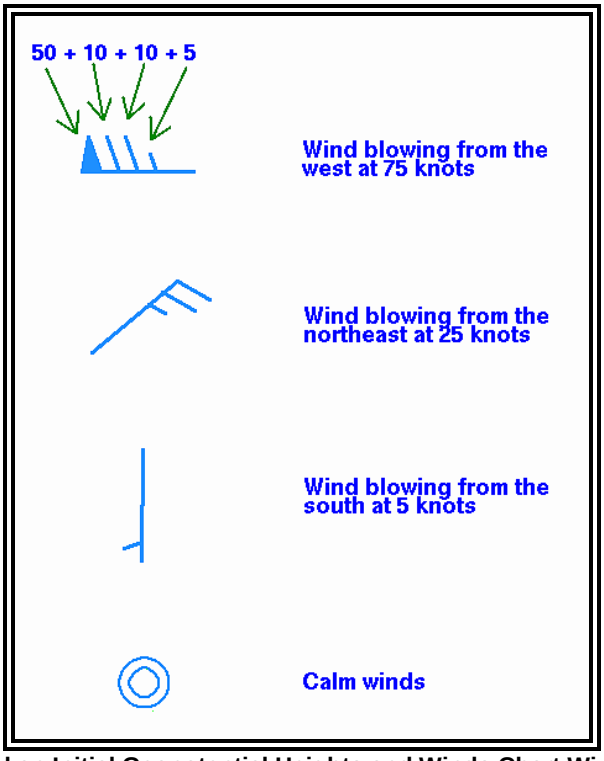


Figure 5-51. Alaskan Initial Geopotential Heights and Winds Chart Wind Plotting Model

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.

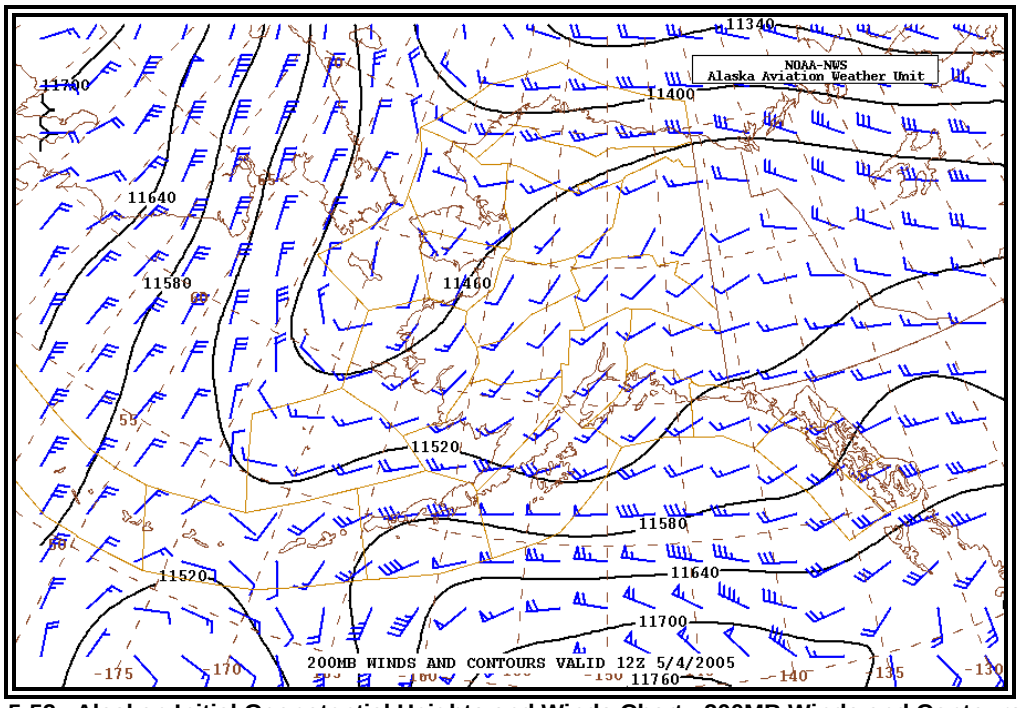


Figure 5-52. Alaskan Initial Geopotential Heights and Winds Chart - 200MB Winds and Contours Chart Example

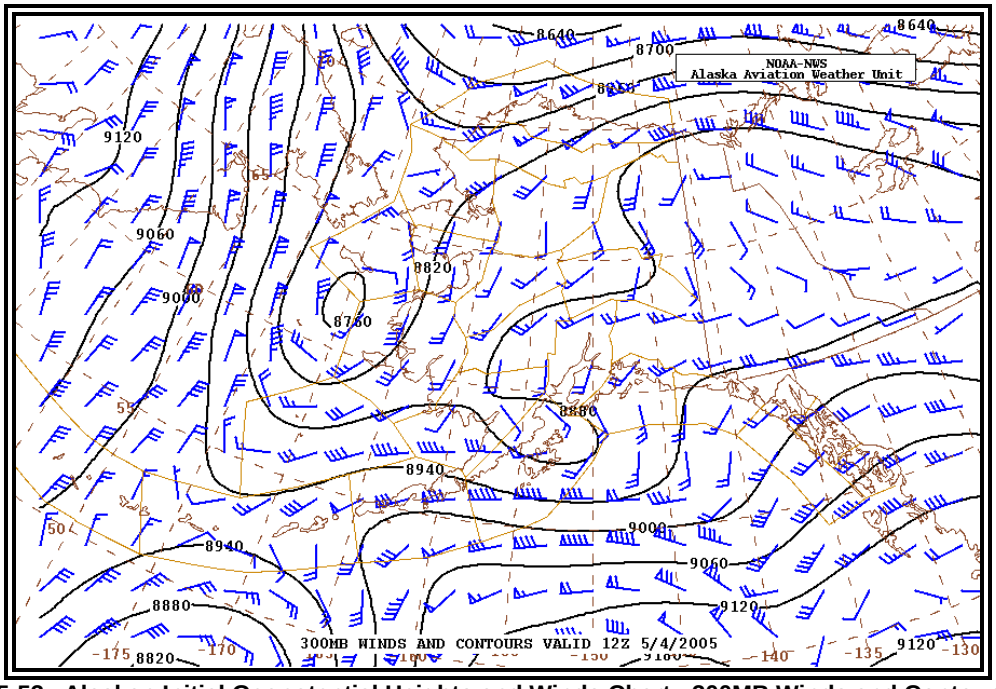


Figure 5-53. Alaskan Initial Geopotential Heights and Winds Chart - 300MB Winds and Contours Chart Example

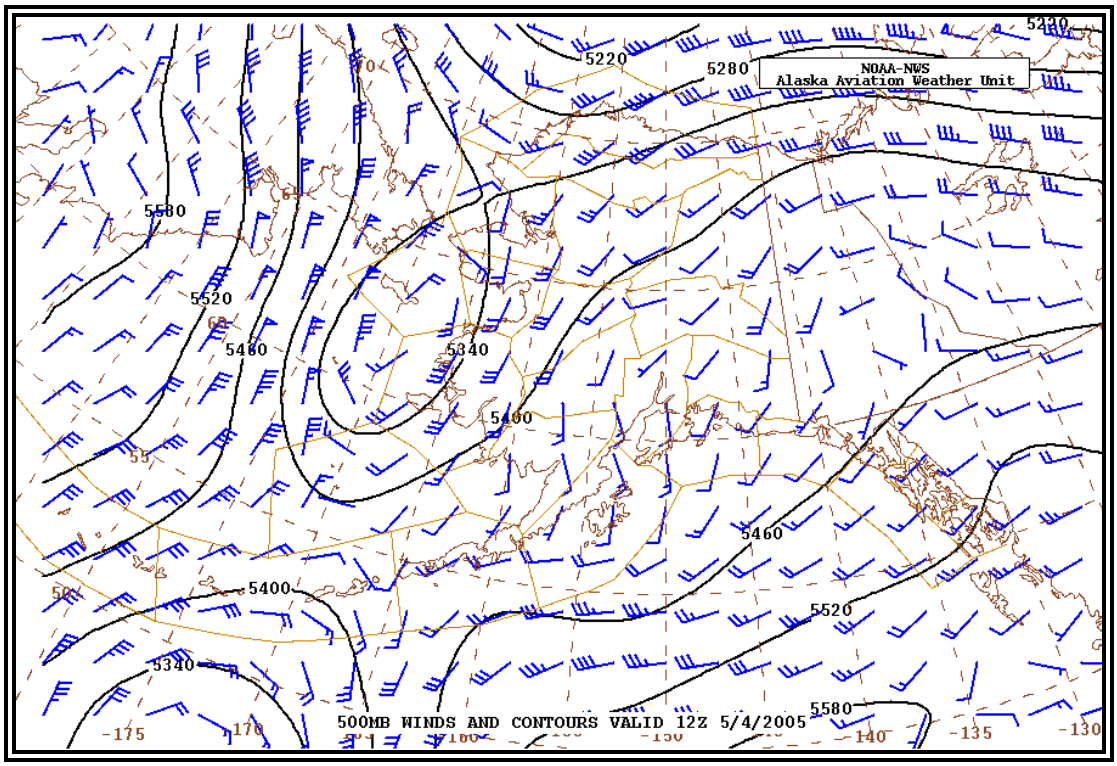


Figure 5-54. Alaskan Initial Geopotential Heights and Winds Chart - 500MB Winds and Contours Chart Example

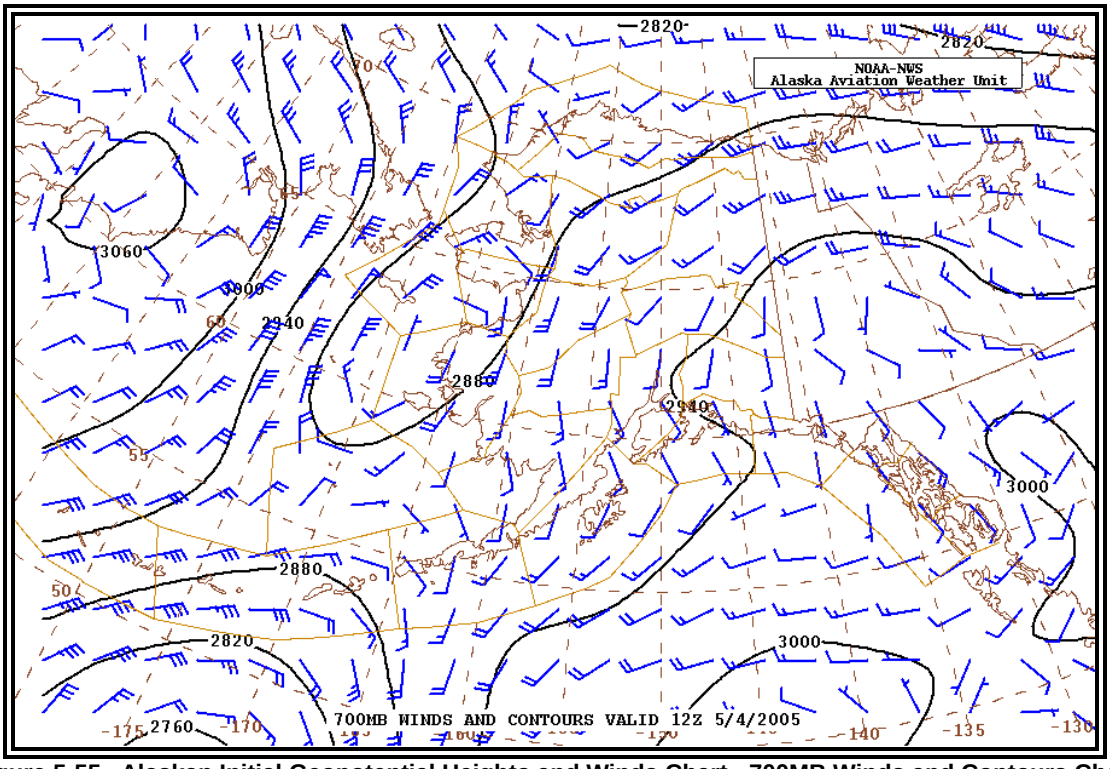


Figure 5-55. Alaskan Initial Geopotential Heights and Winds Chart - 700MB Winds and Contours Chart Example

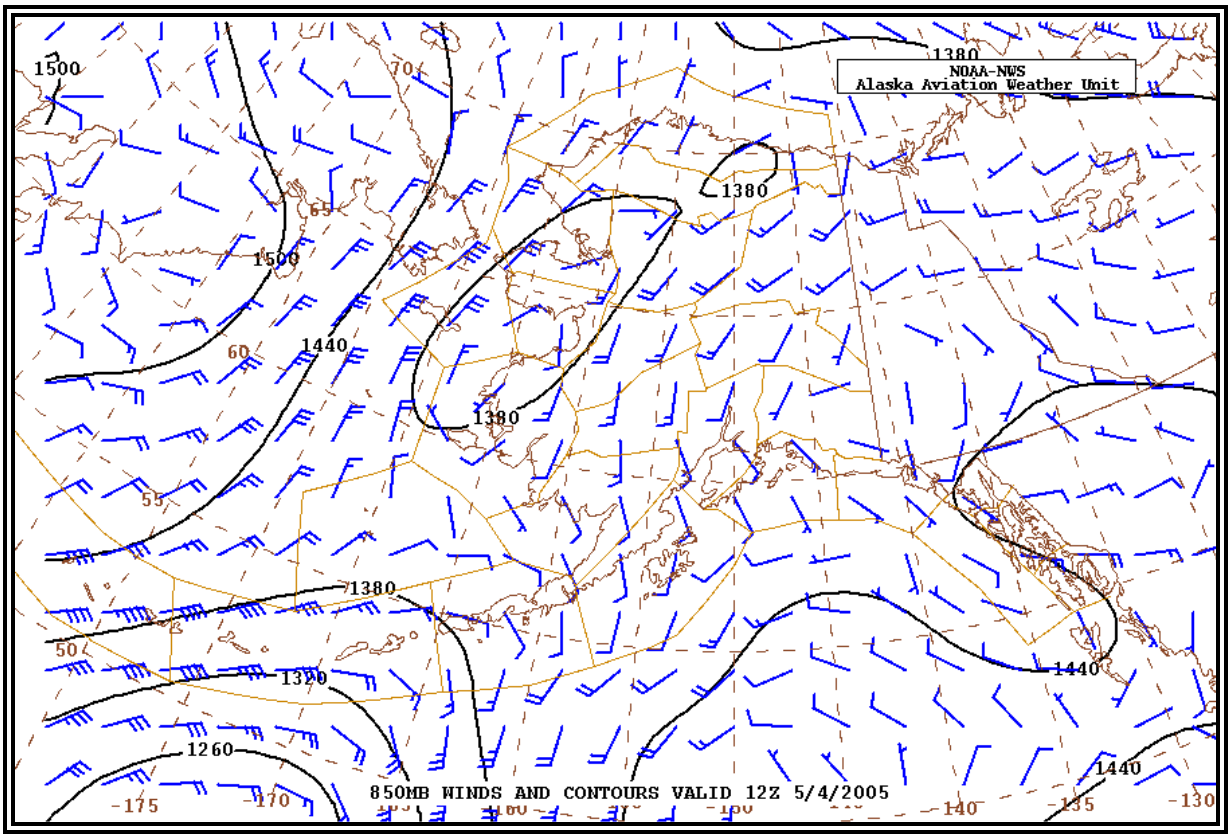


Figure 5-56. Alaskan Initial Geopotential Heights and Winds Chart - 850MB Winds and Contours Chart Example