Section 6
WEATHER DEPICTION CHART

The weather depiction chart, Figure 6-3, is computer-generated (with human frontal analysis) from METAR reports. The weather depiction chart gives a broad overview of the observed flying category conditions at the valid time of the chart. This chart begins at 01Z each day, is transmitted at 3-hours intervals, and is valid at the time of the plotted data.

PLOTTED DATA

Observations reported by both manual and automated observation locations provide the data for the chart. The right bracket ( ]) indicates the present weather information was obtained by an automated system only. The plotted data for each station are total sky cover, cloud height or ceiling, weather and obstructions to vision, and visibility. If the stations on the chart are crowded together, the weather, visibility, and cloud height may be moved up to 90 degrees around the station for better legibility. When reports are frequently updated, as at some automatic stations (every 20 minutes) or when the weather changes significantly, the observation used is the latest METAR received instead of using the one closest to the stated analysis time.

TOTAL SKY COVER

The amount of sky cover is shown by the station circle shaded as in Figure 6-1.

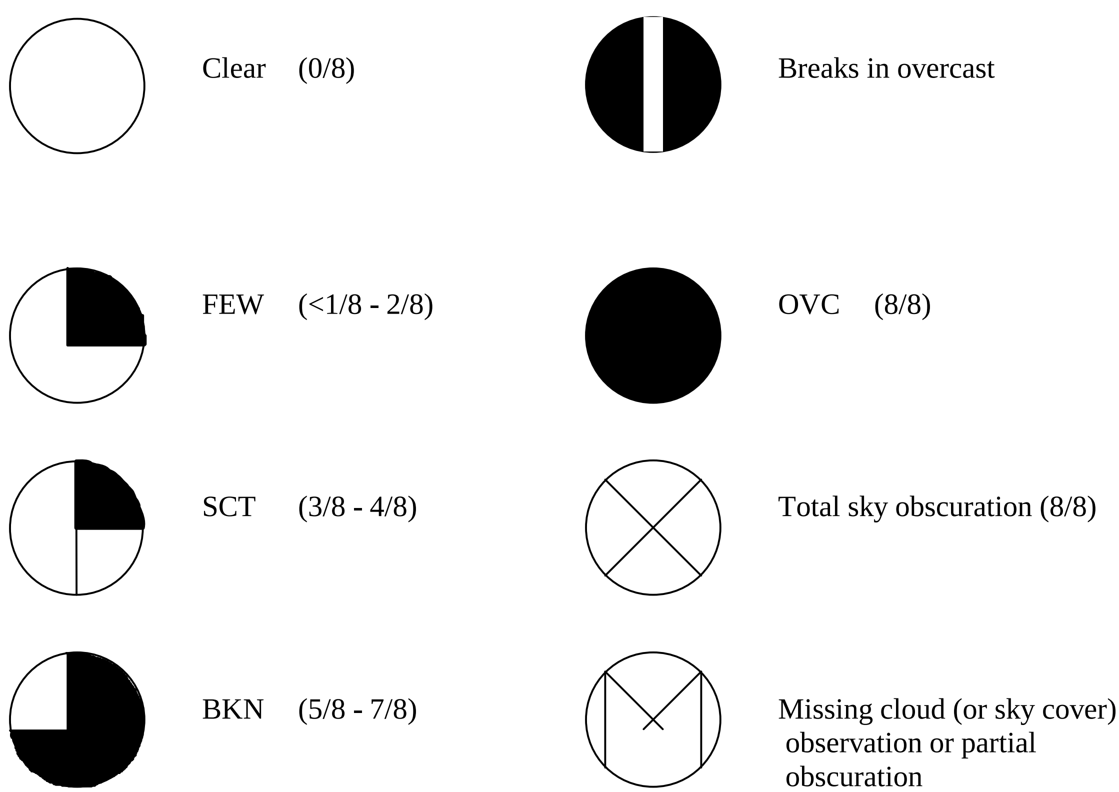


Figure 6-1. Total Sky Cover.

CLOUD HEIGHT

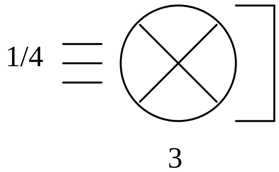
Cloud height above ground level (AGL) is entered under the station circle in hundreds of feet; the same as coded in a METAR report. If total sky cover at a station is scattered, the cloud height entered is the base of the lowest scattered cloud layer. If total sky cover is broken or greater at a station, the cloud height entered is the lowest broken or overcast cloud layer. A totally obscured sky is shown by the sky cover symbol "X" and is accompanied by the height entry of the obscuration (vertical visibility into the obscuration). A partially obscured sky without a cloud layer above, however, is not recognized by the computer program reading the METAR report. It cannot differentiate between a partial obscuration and a missing observation. Therefore, the computer program will enter an "M" in the sky cover circle for either occurrence. Consequently, the user will not know if the observation is missing or a partial obscuration is present. To obtain the most accurate information, the user must consult the METAR report for that specific station. A partially obscured sky with clouds above will have a cloud height entry for the cloud layer, but there will be no entry to indicate that there is a partial obscuration at the surface. So once again the user must consult the METAR report to obtain the most accurate information.

WEATHER AND OBSTRUCTIONS TO VISIBILITY

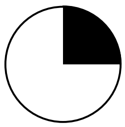
Weather and obstructions to visibility symbols are entered to the left of the station circle. Figure 5-6 explains most of the symbols used. When several types of weather and/or obstructions to visibility are reported at a station, the first one reported in the METAR would usually be the highest coded number in Figure 5-6. Also, for some stations that are not ordinarily plotted, the weather symbol is plotted only if the weather is significant, such as a thunderstorm.

VISIBILITY

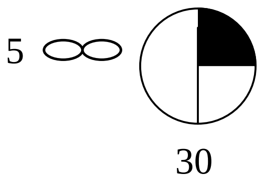
When visibility is 5 miles or less, it is entered to the left of the weather or obstructions to vision symbol. Visibility is entered in statute miles and fractions of a mile.



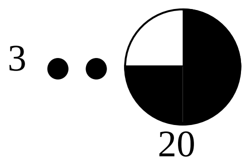
Total sky obscuration and the vertical visibility into the obscuration is 300 feet, visibility ¼, fog, bracket indicates fog was determined by an automated system



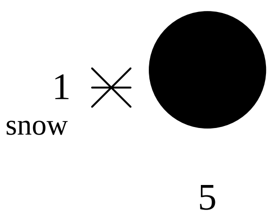
FEW sky coverage (no cloud height is indicated with FEW)



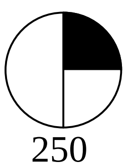
SCT sky coverage, cloud height 3,000’ AGL, visibility 5 miles, haze



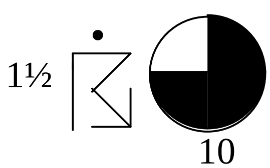
BKN sky coverage, ceiling height 2,000’ AGL, visibility 3 miles, continuous rain



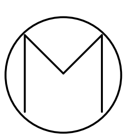
OVC sky coverage, ceiling height 500’ AGL, visibility 1 mile, intermittent



SCT sky coverage, cloud height 25,000’ AGL



BKN sky coverage, ceiling height 1,000’ AGL, visibility 1½ mile, thunderstorm with rain shower



Missing cloud (or sky cover) observation or partial obscuration

Figure 6-2. Examples of Plotting on the Weather Depiction Chart.

ANALYSIS

The chart shows observed ceiling and visibility by categories as follows:

IFR - Ceiling less than 1,000 feet and/or visibility less than 3 miles; hatched area outlined by a smooth line.

MVFR (Marginal VFR) - Ceiling 1,000 to 3,000 feet inclusive and/or visibility 3 to 5 miles inclusive; non-hatched area outlined by a smooth line.

VFR - No ceiling or ceiling greater than 3,000 feet and visibility greater than 5 miles; not outlined.

The three categories are also explained in the lower right portion of the chart for quick reference.
In addition, the chart shows fronts and troughs from the surface analysis for the preceding hour (with one exception being that fronts and troughs are omitted on the 10Z and 23Z charts). These features are depicted the same as the surface chart.

Because space on the chart is limited, only about half the METAR reports are plotted on the chart. The areas for each flight category are determined using all available reports whether or not they are plotted.

USING THE CHART

The weather depiction chart is an ideal place to begin preparing for a weather briefing and flight planning. From this chart, one can get a "bird's eye" view of areas of favorable and adverse weather conditions for chart time. This chart may not completely represent the en route conditions because of variations in terrain and possible weather occurring between reporting stations. Due to the delay between data and transmission time, changes in the weather could occur. One should update the chart with current METAR reports. After initially sizing up the general weather picture, final flight planning must consider forecasts, progs, and the latest pilot, radar, and surface weather reports.

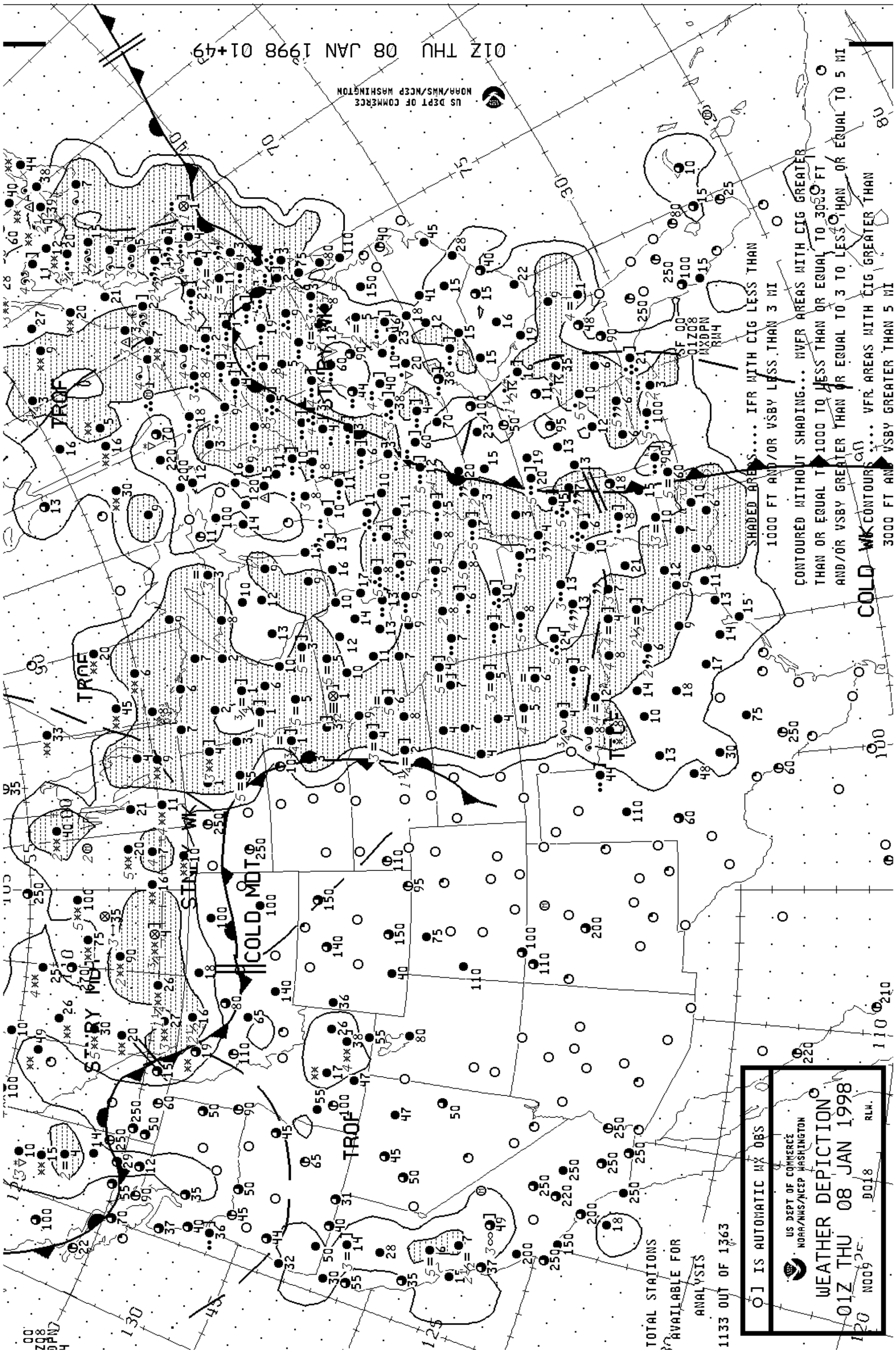


Figure 6-3. Weather Depiction Chart.

Section 7
RADAR SUMMARY CHART

A radar summary chart (Figure 7-1) is a computer-generated graphical display of a collection of automated radar weather reports (SDs). This chart displays areas of precipitation as well as information about type, intensity, configuration, coverage, echo top, and cell movement of precipitation. Severe weather watches are plotted if they are in effect when the chart is valid. The chart is available hourly with a valid time of H+35; i.e., 35 minutes past each hour. Figure 7-2 depicts the WSR-88D radar network from which the radar summary chart is developed.

<u>ECHO (PRECIPITATION) TYPE</u>

The types of precipitation are indicated on the chart by symbols located adjacent to precipitation areas on the chart. Table 7-1 lists the symbols used to denote types of precipitation. Note that these symbols do <u>not</u> reflect the change to METAR. Since the input data for the radar summary chart are the automated SDs, the type of precipitation is determined by computer models and is limited to the ones listed in Table 7-1.

Table 7-1 Key to Radar Chart

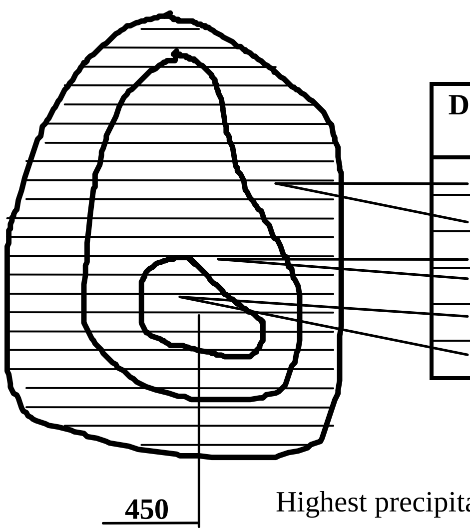
<u>Symbols Used on Chart</u>

Symbol	Meaning	Symbol	Meaning
R	**Rain**	↗ **35**	**Cell movement to the northeastat 35 knots**
RW	**Rain shower**	**LM**	**Little movement**
S	**Snow**	**WS999**	**Severe thunderstorm watch number 999**
SW	**Snow shower**	**WT210**	**Tornado watch number 210**
T	**Thunderstorm**	**SLD**	**8/10 or greater coverage in a line**
NA	**Not available**		**Line of echoes**
NE	**No echoes**		
OM	**Out for maintenance**		

INTENSITY

The intensity is obtained from the amount of energy returned to the radar from the target and is indicated on the chart by contours. Six precipitation intensity levels are reduced into three contour intervals as indicated in Table 7-2. In Figure 7-1, over central Montana is an area of precipitation depicted by one contour. The intensity of the precipitation area would be light to possibly moderate. Whether there is moderate precipitation in the area cannot be determined. However, what can be said is that the maximum intensity is definitely below heavy. When determining intensity levels from this chart, it is recommended that the maximum possible intensity be used. To determine the actual maximum intensity level, the SD for that time period should be examined. It should also be noted that intensity is coded for frozen precipitation (i.e., snow or snow showers). This is due to the fact that the WSR-88D is much more powerful and sensitive than previous radars. Finally, it is very important to remember that the intensity trend is no longer coded on the radar summary chart.

Table 7-2 Precipitation Intensities



Digit	Precipitation Intensity	Rainfall Rate in./hr. Stratiform	Rainfall Rate in./hr. Convective
1	Light	Less than 0.1	Less than 0.2
2	Moderate	0.1-0.5	0.2-1.1
3	Heavy	0.5-1.0	1.1-2.2
4	Very heavy	1.0-2.0	2.2-4.5
5	Intense	2.0-5.0	4.5-7.1
6	Extreme	More than 5.0	More than 7.1

Highest precipitation top in area in hundreds of feet MSL (45,000 feet MSL).

ECHO CONFIGURATION AND COVERAGE

The configuration is the arrangement of echoes. There are three designated arrangements: a LINE of echoes, an AREA of echoes, and an isolated CELL. (See Radar Weather Reports in Section 3 for definitions of the three configurations.)

Coverage is simply the area covered by echoes. All the hatched area inside the contours on the chart is considered to be covered by echoes. When the echoes are reported as a LINE, a line will be drawn through them on the chart. Where there is 8/10 coverage or more, the line is labeled as solid (SLD) at both ends. In the absence of this label, it can be assumed that there is less than 8/10 coverage. For example, in Figure 7-1, there is a solid line of thunderstorms with intense to extreme rain showers over central Georgia.

ECHO TOPS

Echo tops are obtained from both radar and, on occasion, satellite data and displayed for precipitation tops. Echo tops are the maximum heights of the precipitation in hundreds of feet MSL. They should be considered only as approximations because of radar wave propagation limitations. Tops are entered above a short line, with the top height displayed being the highest in the indicated area.

Examples:
220: maximum top 22,000 feet
500: Maximum top 50,000 feet

It is assumed that all precipitation displayed on the chart is reaching the surface. Some examples of top measurements in Figure 7-1 include a top of 15,000 feet MSL over northeast Washington; 23,000 feet over north-central Texas; and 32,000 feet MSL in central Georgia.

ECHO MOVEMENT

Individual cell movement is indicated by an arrow with the speed in knots entered as a number at the top of the arrow head. Little movement is identified by **LM**. For example, in Figure 7-1, the precipitation over north-central Texas is moving southwest at 8 knots. The precipitation in New England area is moving east-northeast at 25 knots. Line or area movement is no longer indicated on the chart.

SEVERE WEATHER WATCH AREAS

Severe weather watch areas are outlined by heavy dashed lines, usually in the form of a large rectangular box. There are two types - tornado watches and severe thunderstorm watches. Referring to Figure 7-1 and Table 7-1, the type of watch and the watch number are enclosed in a small rectangle and positioned as closely as possible to the northeast corner of the watch box. For example, in Figure 7-1, the boxed "WS0005" in northeast Georgia and western South Carolina is a severe thunderstorm watch and is the 5th severe thunderstorm watch issued so far in the year. The watch number is also printed at the bottom of the chart (in Mexico) together with the issuance time and expiration time.

USING THE CHART

The radar summary chart aids in preflight planning by identifying general areas and movement of precipitation and/or thunderstorms. This chart displays drops or ice particles of precipitation size only; it does not display clouds and fog. Therefore, the absence of echoes does not guarantee clear weather, and cloud tops will most likely be higher than the tops of the precipitation echoes detected by radar. The chart must be used in conjunction with other charts, reports, and forecasts.

Examine chart notations carefully. Always determine location and movement of echoes. If echoes are anticipated near the planned route, take special note of echo intensity. Be sure to examine the chart for missing radar reports before assuming "no echoes present." For example, the Rapid City (RAP) radar report in western South Dakota is shown as "not available (NA)."

Suppose the planned flight route goes through an area of widely scattered thunderstorms in which no increase in area is anticipated. If these storms are separated by good VFR weather, they can be visually sighted and circumnavigated. However, widespread cloudiness may conceal the thunderstorms. To avoid these embedded thunderstorms, either use airborne radar or detour the area.
Remember that the radar summary chart is for preflight planning only and should be updated by current WSR-88D images and hourly reports. Once airborne, the pilot must evade individual storms by inflight

observations. This can be done by using visual sighting or airborne radar as well as by requesting radar echo information from Automated Flight Service Station (AFSS) Flight Watch. The AFSS Flight Watch has access to current WSR-88D imagery.

There can be an interpretation problem concerning an area of precipitation that is reported by more than one radar site. For example, station A may report RW with cell movement toward the northeast at 10 knots. For the same area, station B may be reporting TRW with cell movement toward the northeast at 30 knots. This difference in reports may be due to a different perspective and distance of the radar site from the area of echoes. The area may be moving away from station A and approaching station B. The rule of thumb is to use that plotted data associated with the area that presents the greatest hazard to aviation. In this case, the station B report would be used.

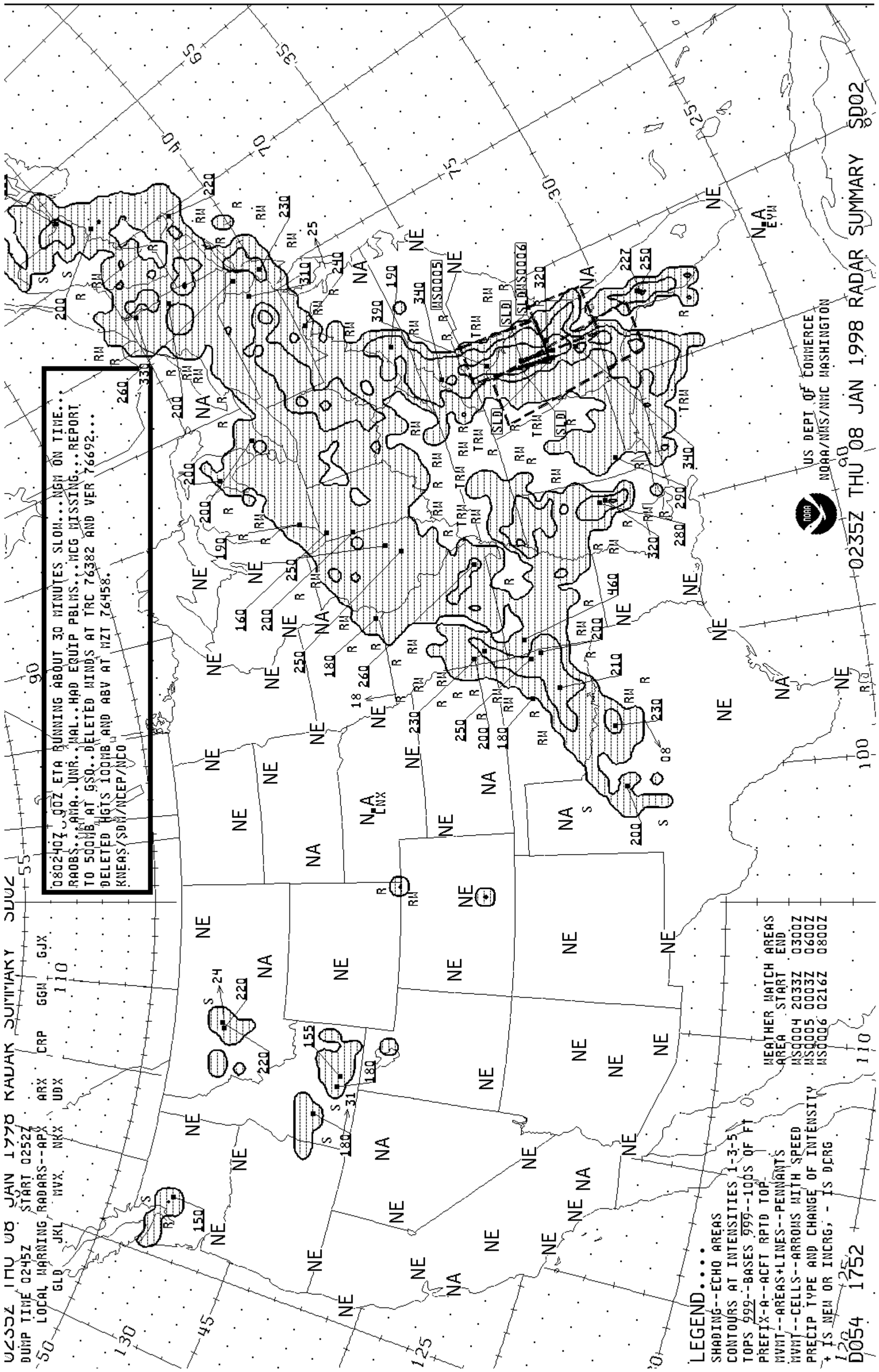


Figure 7-1. Radar Summary Chart.

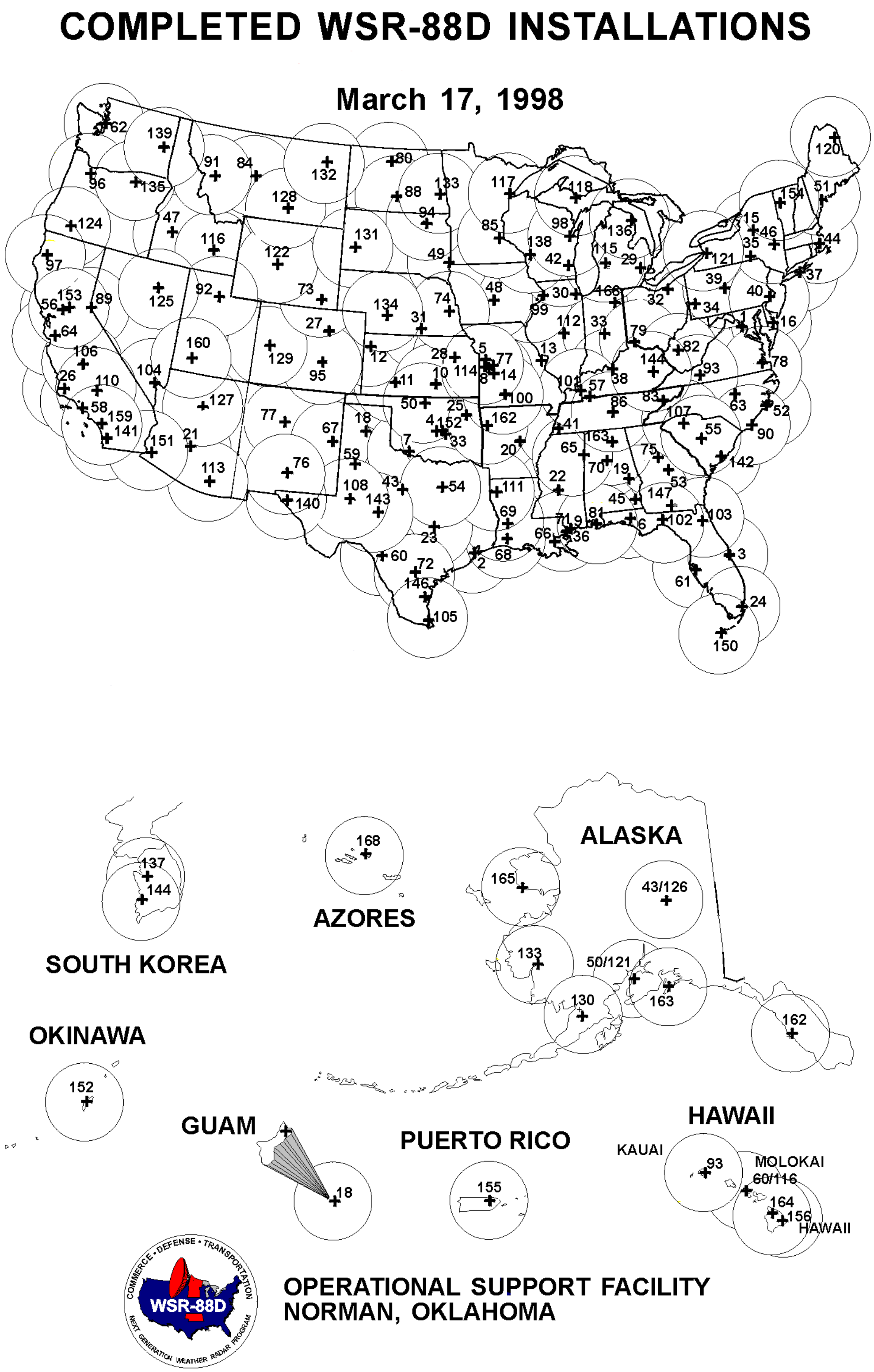


Figure 7-2. WSR-88D Radar Network.

Section 8
CONSTANT PRESSURE ANALYSIS CHARTS

Weather information for computer generated constant pressure charts is observed primarily by balloon-ascending radiosonde packages. Each package consists of weather instruments and a radio transmitter. During ascent instrument data are continuously transmitted to the observation station. Radiosondes are released at selected observational sites across the USA at 00Z and 12Z. The data collected from the radiosondes are used to prepare constant pressure charts twice a day.

Constant pressure charts are prepared for selected values of pressure and present weather information at various altitudes. The standard charts prepared are the 850 mb (hPa), 700 mb (hPa), 500 mb (hPa), 300 mb (hPa), 250 mb (hPa), and 200 mb (hPa) charts. Charts with higher pressures present information at lower altitudes, and charts with lower pressures present information at higher altitudes. Table 8-1 lists the general altitude (pressure altitude) of each constant pressure chart.

PLOTTED DATA

Data from each observation station are plotted around a station circle on each constant pressure chart. The circle identifies the station position. The data plotted on each chart are temperature, temperature-dew point spread, wind, height of the surface above sea level, and height change of the surface over the previous 12-hour period. The temperature and spread are in degrees Celsius, wind direction is relative to true north, wind speed is in knots, and height and height change are in meters. The station circle is shaded black when the spread is 5 degrees or less (moist atmosphere), and open when spread is more than 5 degrees (dry atmosphere). Figure 8-1 illustrates a station model of the radiosonde data plot. Table 8-2 gives station data plot examples for each constant pressure chart.

Aircraft and satellite observations are also used as information sources for constant pressure charts. A square is used to identify an aircraft reporting position. Data plotted are the flight level of the aircraft in hundreds of feet, temperature, wind, and time to the nearest hour UTC. A star is used to identify a satellite reporting position. Satellite information is determined by identifying cloud drift and height of cloud tops. Data plotted are the flight level in hundreds of feet, time to the nearest hour UTC, and wind. Aircraft and satellite data are plotted on the constant pressure chart closest to their reporting altitudes. Aircraft and satellite information are particularly useful over sparse radiosonde data areas.

ANALYSIS

All constant pressure charts contain analyses of height and temperature variations. Also, selected charts have analyses of wind speed variations. Variations of height are analyzed by contours, variations of temperature by isotherms, and variations of wind speed by isotachs.

CONTOURS

Contours are lines of constant height, in meters, which are referenced to mean sea level. Contours are used to map the height variations of surfaces that fluctuate in altitude. They identify and characterize pressure systems on constant pressure charts.

Contours are drawn as solid lines on constant pressure charts and are identified by a three-digit code located on each contour. To determine the contour height value, affix "zero" to the end of the code. For example, a contour with a "315" code on the 700 mb/hPa chart identifies the contour value as 3,150 meters. Also, affix a "one" in front of the code on all 200 mb/hPa contours and on 250 mb/hPa contours when the code begins with zero. For example, a contour with a "044" code on a 250 mb/hPa chart identifies the contour value as 10,440 meters.

The contour interval is the height difference between analyzed contours. A standard contour interval is used for each chart. The contour intervals are 30 meters for the 850 and 700 mb (hPa) charts, 60 meters for the 500 mb (hPa) chart, and 120 meters for the 300, 250, and 200 mb (hPa) charts.

The contour gradient is the distance between analyzed contours. Contour gradients identify slopes of surfaces that fluctuate in altitude. Strong gradients are closely spaced contours and identify steep slopes. Weak gradients are widely spaced contours and identify shallow slopes.

The contour analysis displays height patterns. Common types of patterns are lows, highs, troughs, and ridges. Contours have curvature for each of these patterns. Contour patterns can be further characterized by size and intensity. Size represents the breadth of a system. Sizes can range from large to small. A large pattern is generally more than 1,000 miles across, and a small pattern is less than 1,000 miles across. Intensities can range from strong to weak. Stronger systems are depicted by contours with stronger gradients and sharper curvatures. Weaker systems are depicted by contours with weaker gradients and weaker curvatures. For example, a chart may have a large, weak high, or a small, strong low.

Contour patterns on constant pressure charts can be interpreted the same as isobar patterns on the surface chart. For example, an area of low height is the same as an area of low pressure.

Winds respond to contour patterns and gradients. Wind directions parallel contours. In the Northern Hemisphere, when looking downwind, contours with relatively lower heights are to the left and contours with relatively higher heights are to the right. Thus, winds flow counterclockwise (cyclonically) around lows and clockwise (anticyclonically) around highs. (In the Southern Hemisphere these directions are reversed.) Winds that rotate are termed circulations. Wind speeds are faster with stronger gradients and slower with weaker gradients. In mountainous areas, winds are variable on pressure charts with altitudes at or below mountain crests. Contours have the effect of "channeling" the wind.

ISOTHERMS

Isotherms are lines of constant temperature. An isotherm separates colder air from warmer air. Isotherms are used to map temperature variations over a surface.

Isotherms are drawn as bold, dashed lines on constant pressure charts. Isotherm values are identified by a two-digit block on each line. The two digits are prefaced by "+" for above-freezing values as well as the zero isotherm and "-" for below-freezing values. Isotherms are drawn at 5-degree intervals on each chart. The zero isotherm separates above-freezing and below-freezing temperatures.

Isotherm gradients identify the magnitude of temperature variations. Strong gradients are closely spaced isotherms and identify large temperature variations. Weak gradients are loosely spaced isotherms and identify small temperature variations.

ISOTACHS

Isotachs are lines of constant wind speed. Isotachs separate higher wind speeds from lower wind speeds. Isotachs are used to map wind speed variations over a surface. Isotachs are analyzed on the 300, 250, and 200 mb (hPa) charts.

Isotachs are drawn as short, fine dashed lines. Isotach values are identified by a two- or three-digit number followed by a "K" located on each line. Isotachs are drawn at 20-knot intervals and begin at 10 knots.

Isotach gradients identify the magnitude of wind speed variations. Strong gradients are closely spaced isotachs and identify large wind speed variations. Weak gradients are loosely spaced isotachs and identify small wind speed variations.

Zones of very strong winds are highlighted by hatches. Hatched and unhatched areas are alternated at 40-knot intervals beginning with 70 knots. Areas between the 70- and 110-knot isotachs are hatched. Areas between the 110- and 150-knot isotachs are unhatched. This alternating pattern is continued until the strongest winds on the chart are highlighted. Highlighted isotachs assist in the identification of jet streams.

THREE-DIMENSIONAL ASPECTS

It is important to assess weather in both the horizontal and vertical dimensions. This not only applies to clouds, precipitation, and other significant conditions, but also pressure systems and winds. The characteristics of pressure systems vary horizontally and vertically in the atmosphere.

The horizontal distribution of pressure systems is depicted by the constant pressure charts and the surface chart (Section 5.) Pressure systems appear on each pressure chart as pressure patterns. Pressure charts identify and characterize pressure systems by their location, type, size, and intensity.

The vertical distribution of pressure systems must be determined by comparing pressure patterns on vertically adjacent pressure charts. For example, compare the surface chart with the 850 mb/hPa chart, 850 mb/hPa with 700 mb/hPa, and so forth. Changes of pressure patterns with height can be in the form of position, type, size, or intensity.

The three-dimensional assessment of pressure systems infers the assessment of the three-dimensional variations of wind.

USING THE CHARTS

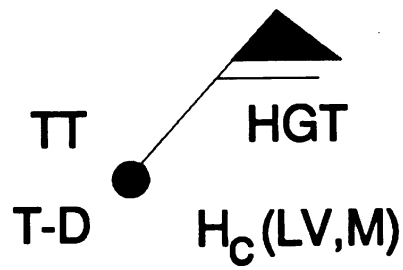
Constant pressure charts are used to provide an overview of selected observed en route flying conditions. Use all pressure charts for a general overview of conditions.

Select the chart closest to the desired flight altitude for assessment of en route conditions. Review the winds along the route. Consider their direction and speed. For high altitude flights, identify jet stream positions. Note whether pressure patterns cause significant wind shifts or speed changes. Determine if these winds will be favorable or unfavorable (tailwind, headwind, crosswind.) Consider vertically adjacent charts and determine if a higher or lower altitude would have a more desirable en route wind. Interpolate winds between charts for flights between chart levels. Review other conditions along the route. Evaluate temperatures by identifying isotherm values and patterns. Evaluate areas with moist air and cloud potential by identifying station circles shaded black.

Consider the potential for hazardous flight conditions. Evaluate the potential for icing. Freezing temperatures and visible liquid forms of moisture produce icing. Evaluate the potential for turbulence. In addition to convective conditions and strong surface winds, turbulence is also associated with wind shear and mountain waves. Wind shear occurs with strong curved flow and speed shear. Strong lows and troughs and strong isotach gradients are indicators of strong shear. Vertical wind shear can be identified by comparing winds on vertically adjacent charts. Mountain waves are caused by strong perpendicular flow across mountain crests. Use winds on the pressure charts near mountain crest level to evaluate mountain wave potential.

Pressure patterns cause and characterize much of the weather. As a general rule, lows and troughs are associated with clouds and precipitation, while highs and ridges are associated with good weather. However, this rule is more complicated when pressure patterns change with height. Compare pressure pattern features on the various pressure charts with other weather charts, such as the weather depiction and radar summary charts. Note the association of pressure patterns on each chart with the weather.

Pressure systems, winds, temperature, and moisture change with time. For example, pressure systems move, change size, and change intensity. Forecast products predict these changes. Compare observed conditions with forecast conditions and be aware of these changes.



Code	Explanation
WIND:	Plotted wind direction and speed by symbol. Direction is to the nearest 10 degrees and speed is to the nearest 5 knots. (See Figure 5-3 for the explanation of the symbols.) If the direction or speed is missing, the wind symbol is omitted and an "M" is plotted in the H_c space. If speed is less than 3 knots, the wind is light and variable, the wind symbol is omitted, and an "LV" is plotted in the H_c space.
HGT:	Plotted height of the constant pressure surface in meters above mean sea level. (See Table 8-1 for decoding.) If data is missing, nothing is plotted in this position.
TT:	Plotted temperature to the nearest whole degree Celsius. A below-zero temperature is prefaced with a minus sign. Position is left blank if data is missing. A bracketed computer-generated temperature is plotted on the 850 mb/hPa chart in mountainous regions when stations have elevations above the 850 mb/hPa pressure level. If two temperatures are plotted, one above the other, the top temperature is used in the analysis.
T-D:	Plotted temperature-dew point spread to the nearest whole degree Celsius. An "X" is plotted when the air is extremely dry. The position is left blank when the information is missing.
$H_{c:}$	Plot of constant pressure surface height change which occurred during the previous 12 hours in tens of meters. For example, a +04 means the height of the surface rose 40 meters and a -12 means the height fell by 120 meters. H_c data is superseded by "LV" or "M" when pertinent.
CIRCLE:	Identifies station position. Shaded black when T-D spread is 5 degrees or less (moist). Unshaded when spread is more than 5 degrees.

Figure 8-1. Radiosonde Data Station Plot.

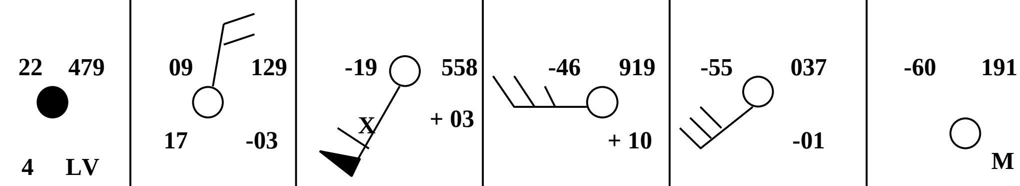
Table 8-1 Features of the Constant Pressure Charts - U.S.

Pressure (millibars/hectoPascals)	Pressure Altitude in feet (flight level)	Pressure Altitude in meters	Temperature/ Dew Point Spread	Isotachs	Contour Interval (meters)	Decode Station Height Plot		Examples of Station Height Plotting	
						Prefix to Plotted Value	Suffix to Plotted Value	Plotted	Height
850	5,000	1,500	yes	no	30	1	___	530	1,530
700	10,000	3,000	yes	no	30	2 or 3*	___	180	3,180
500	18,000	5,500	yes	no	60	_____	0	582	5,820
300	30,000	9,000	yes**	yes	120	_____	0	948	9,480
250	34,000	10,500	yes**	yes	120	1	0	063	10,630
200	39,000	12,000	yes**	yes	120	1	0	164	11,640

NOTE:

1. The pressure altitudes are rounded to the nearest 1,000 for feet and to the nearest 500 for meters.
2. All heights are above mean sea level (MSL).
3. *   Prefix a “2” or “3,” whichever brings the height closer to 3,000 meters.
4. ** Omitted when the air is too cold (temperature less than -41 degrees).

Table 8-2 Examples of Radiosonde Plotted Data



	850 mb	700 mb	500 mb	300 mb	250 mb	200 mb
WIND	light and variable	010/20 KTS	210/60 KTS	270/25 KTS	240/30 KTS	missing
TT	22° C	9° C	-19° C	-46° C	-55° C	-60° C
T-D	4° C	17° C	>29° C	not plotted	not plotted	not plotted
DEW POINT	18° C	-8° C	dry	dry	dry	
HGT	1,479 m	3,129 m	5,580 m	9,190 m	10,370 m	11,910 m
H_c	not plotted	- 30 m	+ 30 m	+ 100 m	- 10 m	not plotted

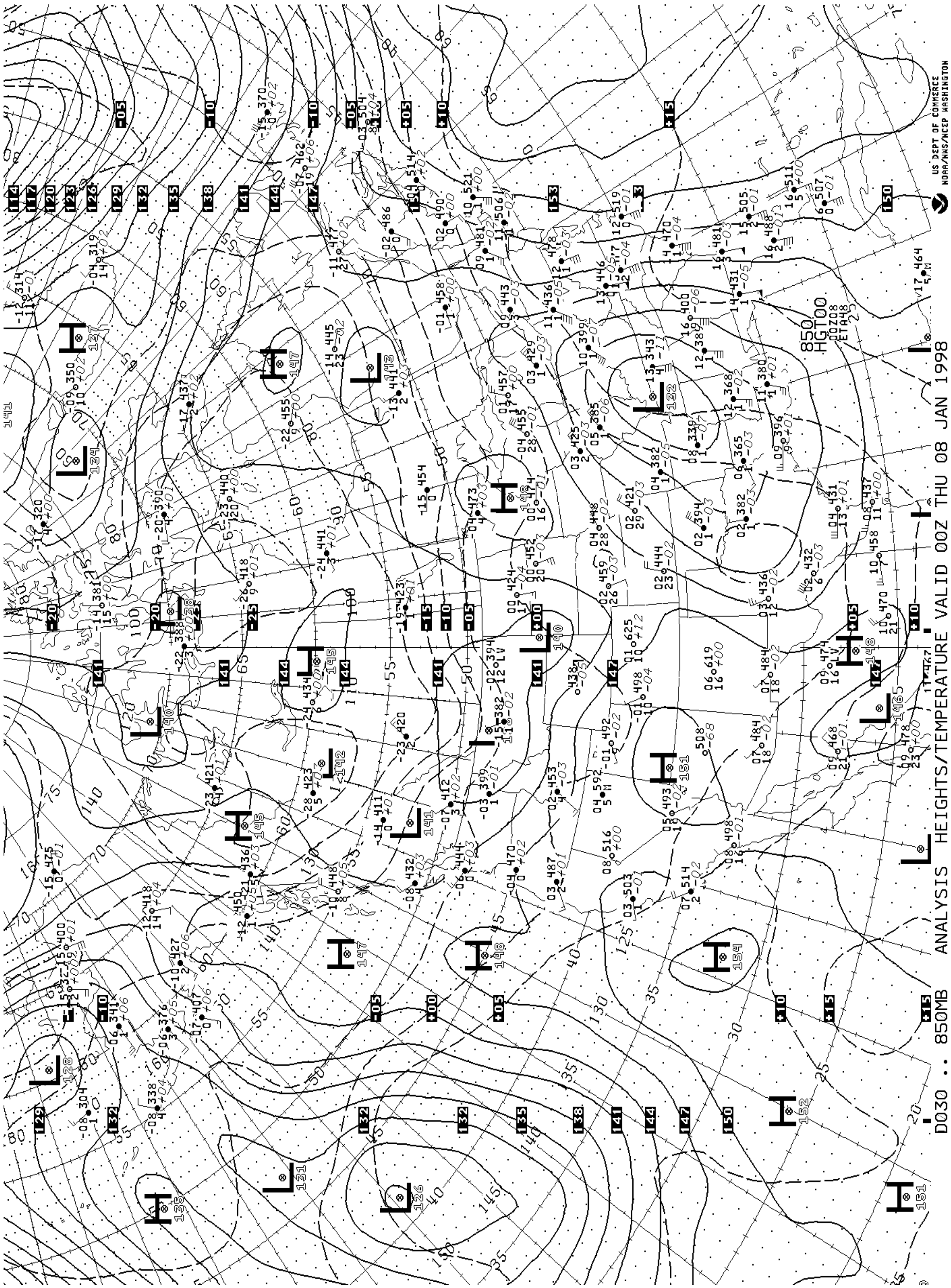


Figure 8-2. 850 Millibar/HectoPascal Analysis.

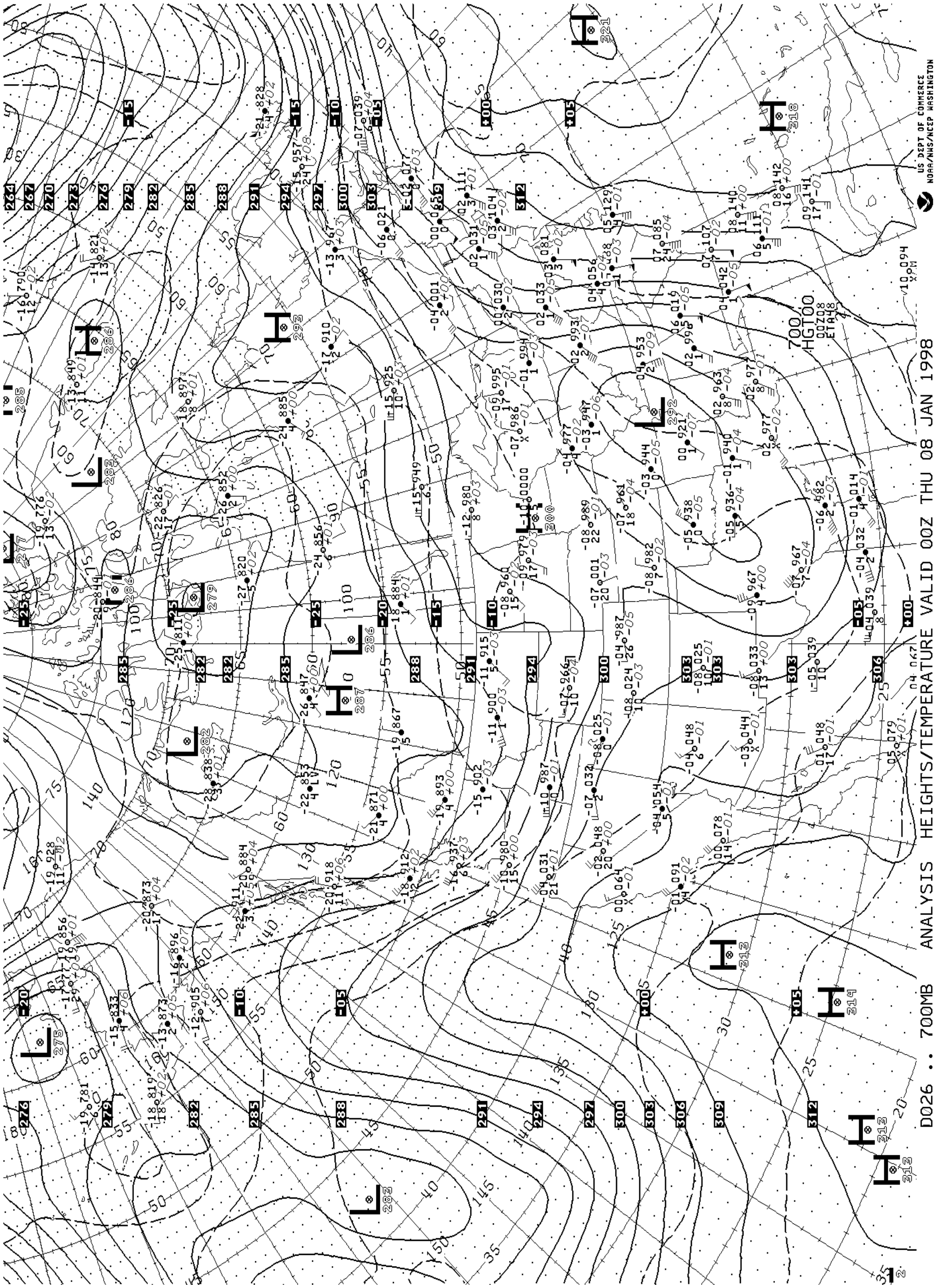


Figure 8-3. 700 Millibar/HectoPascal Analysis.

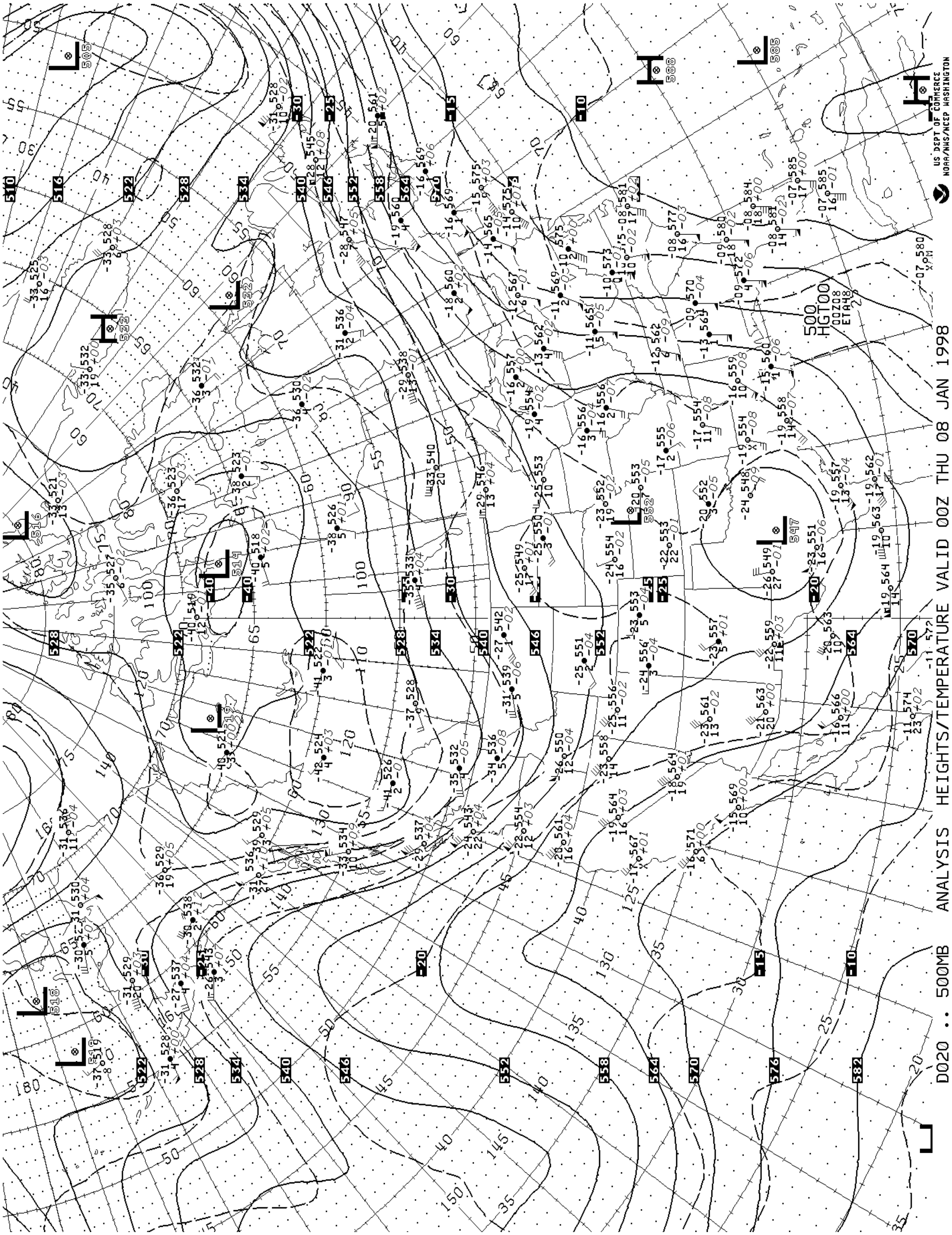


Figure 8-4. 500 Millibar/HectoPascal Analysis.

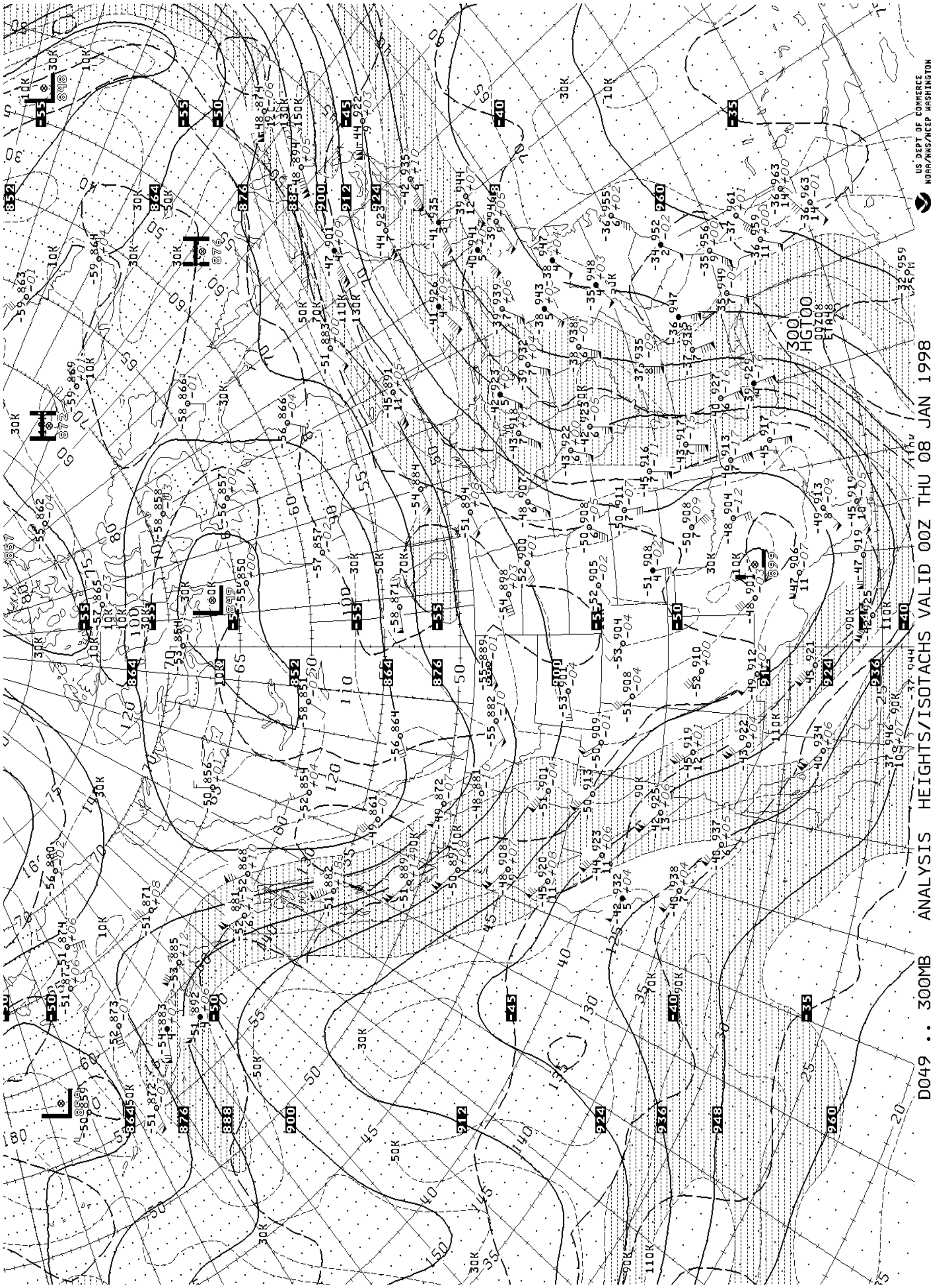


Figure 8-5. 300 Millibar/HectoPascal Analysis.

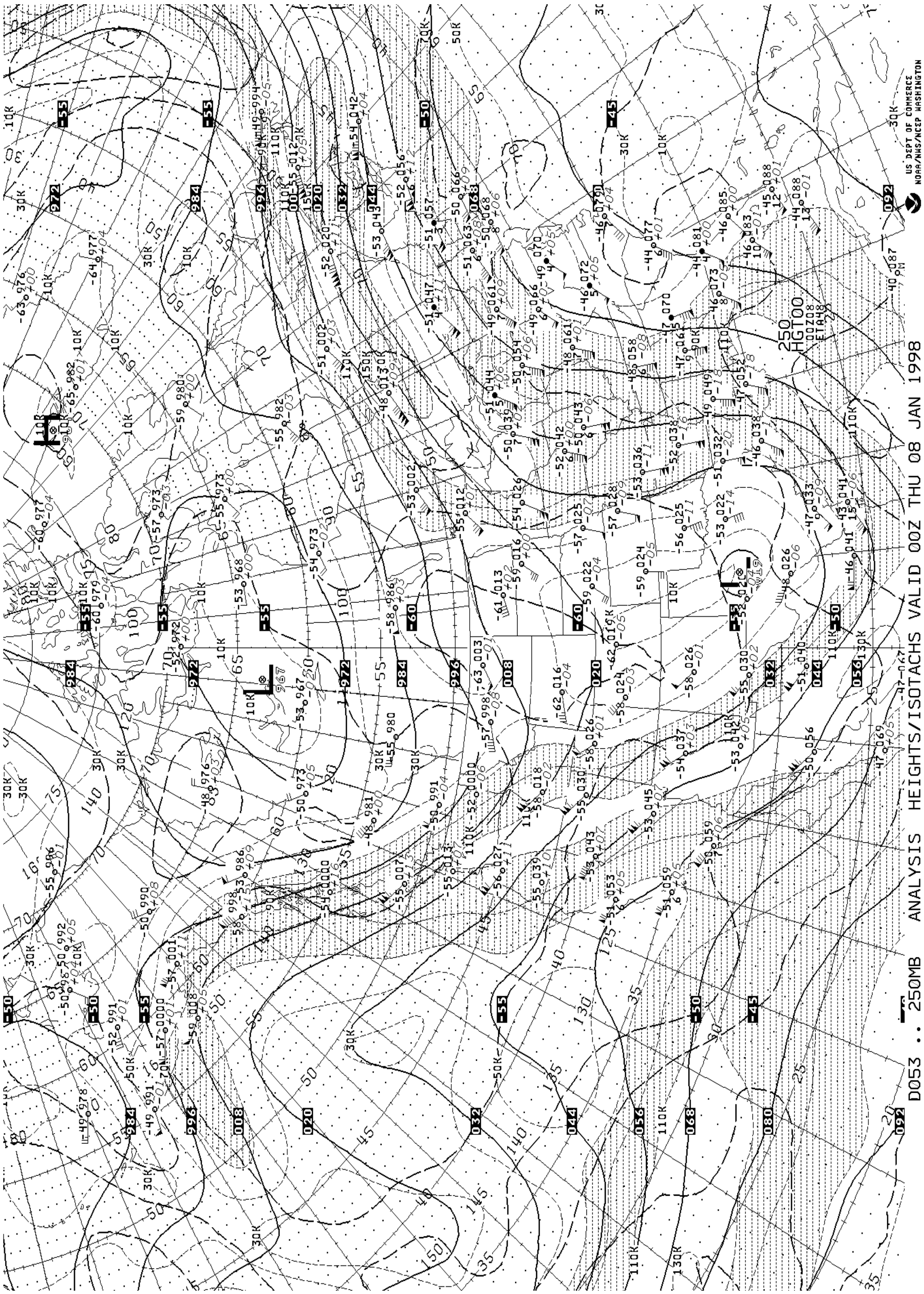


Figure 8-6. 250 Millibar/HectoPascal Analysis.

Section 9
COMPOSITE MOISTURE STABILITY CHART

The composite moisture stability chart (Figure 9-1) is a chart composed of four panels which depict stability, precipitable water, freezing level, and average relative humidity conditions. This computer-generated chart contains information obtained from upper-air observation data and is available twice daily with valid times of 00Z and 12Z.

The availability of upper-air data for analysis (on all panels) is indicated by the shape of the station symbols. Use the legend on the precipitable water panel (Figure 9-3) for the explanation of symbols common to all four panels. Mandatory levels referred to in the legend are the routinely used levels of surface; 1,000; 925; 850; 700; and 500 mb (hPa). Significant levels are nonroutine levels at which significant changes occur in the vertical profile of atmospheric properties during each observation.

STABILITY PANEL

The stability panel (Figure 9-2) is the upper left panel of the composite moisture stability chart. This panel contains two indexes that characterize the moisture and stability of the air. These indexes are the K index (KI) and the lifted index (LI).

K INDEX (KI)

The K index (KI) provides moisture and stability information. KI values range from high positive values to low negative values. A high positive KI implies moist and unstable air. A low or negative KI implies dry and stable air. KIs are considered high when values are at and above +20 and low when values are less than +20.

The KI is calculated by the summation of three terms:

KI = (850 mb/hPa temp - 500 mb/hPa temp)
+ (850 Mb/hPa dew point)
- (700 mb/hPa temp/dew point spread)

The first term (850 mb/hPa temp - 500 mb/hPa temp) describes the vertical temperature profile. The term compares the temperature at about 5,000 feet mean sea level (MSL) with the temperature at about 18,000 feet MSL. The larger the temperature difference, the less stable the air, and the higher the KI. The smaller the temperature difference, the more stable the air, and the lower the KI.

The second term, 850 mb (hPa) dew point, is a measure of the quantity of low-level moisture. The higher the dew point, the higher the moisture, and the higher the KI. The lower the dew point, the lower the moisture, and the lower the KI.

The third term, 700 mb (hPa) temp/dew point spread, is a measure of the level of saturation at 700 mb (hPa). The smaller the spread, the higher the level of saturation, and the higher the KI. The greater the spread, the lower the level of saturation (drier air), and the lower the KI.

The KI can change significantly over a short time period of time due to temperature and moisture changes.

LIFTED INDEX (LI)

The lifted index (LI) is a common measure of atmospheric stability. The LI is obtained by hypothetically displacing a surface parcel upward to 500 mb (hPa) (about 18,000 feet MSL) and evaluating its stability at that level. A surface parcel is a small sample of air with representative surface temperature and moisture conditions. As the parcel is "lifted" it cools due to expansion. The temperature the parcel would have at 500 mb (hPa) is then subtracted from the actual (observed) 500 mb (hPa) temperature. This difference is the LI. LI values can be positive, negative, or zero. The LI does not identify the parcel's stability behavior at any of the intermediate altitudes between the surface and 500 mb (hPa).

A positive LI means a lifted surface parcel of air is stable. With a positive LI, the parcel would be colder and more dense than the surrounding air at 500 mb (hPa). A more dense parcel would resist upward motion. The stable surface parcel is like a rock at the bottom of a pool which, being more dense than the water, would resist being displaced upward. The more positive the LI, the more stable the air. Large positive values (+8 or greater) would indicate very stable air.

A negative LI means a lifted surface parcel of air is unstable. With a negative LI, the parcel would be warmer and less dense than the surrounding air at 500 mb (hPa). A parcel which is less dense than the surrounding air would continue to rise and possibly gain increasing upward speed until stabilizing at some higher altitude. The unstable surface parcel is like a cork at the bottom of a pool which, being less dense than the water, would accelerate upward to the surface of the pool. Large negative values (-6 or less) would indicate very unstable air.

A zero LI means a lifted surface parcel of air is neutrally stable. With a zero LI, the lifted parcel would have the same temperature and density as the air at 500 mb (hPa) and have a tendency to neither rise or sink. A neutrally stable parcel offers no resistance to vertical motion and, without further influence, would remain at the displaced level.

Temperature and moisture changes in the atmosphere change lifted index values. LIs decrease (become less stable) by increasing the surface temperatures, increasing surface dew points (moisture), and/or decreasing 500 mb (hPa) temperatures. Cold lows and troughs aloft with warm humid surface conditions tend to be associated with unstable air. LIs increase (become more stable) by decreasing surface temperatures, decreasing surface dew points, and/or increasing 500 mb (hPa) temperatures. Warm highs and ridges aloft with cool, dry surface conditions tend to be associated with stable air. Note that the LI can change considerably just by daytime heating and nighttime cooling of surface air. Daytime heating will decrease the LI, and nighttime cooling will increase the LI.

PLOTTED DATA

Figure 9-2 shows the two stability indexes that are computed for each upper-air station. The LI is plotted above the station symbol, and the KI is plotted below the symbol. Station circles are blackened for LI values of zero or less. An "M" indicates the value is missing

STABILITY ANALYSIS

The analysis is based on the LI only and highlights weakly stable and unstable areas. Solid lines are drawn for values of +4 and less at intervals of 4 (+4, 0, -4, -8, etc.).

USING THE PANEL

The KI and LI can be used in combination to assess moisture and stability properties of air masses. Air masses can be classified as moist and stable, moist and unstable, dry and stable, and dry and unstable. When used in combination, the KI, although containing stability information, is used primarily to classify moisture information, and the LI primarily to classify stability information. See Figure 9-2. Aberdeen, SD, has air characterized as dry and stable. The KI is 3 (dry) and the LI is 19 (stable). Melbourne, FL, is an example of dry and unstable air. The KI is 8 (dry) and the LI is -1 (unstable). Moist and unstable air is depicted at Key West, FL. The KI is 29 (moist) and the LI is -3 (unstable). The last example, Albany, NY, indicates moist and stable air. The KI is 31 (moist) and the LI is 15 (stable).

Moisture and stability properties of air masses characterize the weather. High KIs are associated with the potential for clouds and precipitation. Weather associated with high LIs and stable air are stratiform clouds and steady precipitation. Weather associated with low and negative LIs are unstable air, convective clouds, and showery precipitation.

The KI and LI can also be used to evaluate thunderstorm information. The KI is an indicator of the probability of thunderstorms (Table 9-1). Higher KIs imply higher probabilities. Lower KIs imply lower probabilities. The low and negative LIs are indicators of intensities of thunderstorms, if they occur. Higher negative LIs imply greater instability and stronger updrafts in thunderstorms. High positive LIs suggest little, if any, chance of thunderstorms.

Air masses classified with negative LIs do not always contain thunderstorms. This can occur for several reasons. Thunderstorm development is inhibited when a layer of stable air is located between the surface and 500 mb (hPa). This stable layer is referred to as a "cap." Inadequate amounts of moisture may also limit thunderstorm development in the presence of negative LIs. It is also possible to have a positive LI and still have thunderstorms develop. This can happen when a layer of air aloft located above stable surface air, such as above a front, is unstable and is sufficiently lifted, or if temperature and moisture conditions change rapidly and stabilities decrease.

Seasons affect the use of the KI regarding thunderstorm information. During the warmer seasons of spring, summer, and fall, a high KI generally indicates conditions are favorable for thunderstorms (Table 9-1). During winter with cold temperatures, fairly high values do not necessarily mean conditions are favorable for thunderstorms. Cold 850 mb (hPa) temperatures mean low dew points (low moisture.) The temperature profile term can generate high KI values, but low dew points may mean inadequate moisture to support thunderstorm development.

Table 9-1 Thunderstorm Potential

Lifted Index (LI)	Severe Potential
0 to -2	Weak
-2 to -6	Moderate
≤ -6	Strong

K Index (KI)	Thunderstorm Probability
< 15	near 0%
15 - 19	20%
20 - 25	21% - 40%
26 - 30	41% - 60%
31 - 35	61% - 80%
36 - 40	81% - 90%
> 40	near 100%

PRECIPITABLE WATER PANEL

The precipitable water panel (Figure 9-3) is the upper right panel of the composite moisture stability chart. This panel is an analysis of the quantity of water vapor in the atmosphere from the surface to the 500 mb (hPa) level (18,000 feet MSL). The quantity of water vapor is shown as precipitable water, which is the amount of liquid water that would result if all the water vapor were condensed.

Two constant factors affect precipitable water reports. Warm air is capable of holding higher quantities of water vapor than cold air. Therefore, warm air masses generally have more precipitable water than cold air masses. For example, precipitable water values are higher during summer months than during winter months. Also, high elevation stations have smaller vertical columns of air between surface and 500 mb (hPa) than low elevation stations. Therefore, higher elevation stations tend to have lower precipitable water than lower stations.

PLOTTED DATA

Precipitable water values are plotted above each station symbol to the nearest hundredth of an inch. The percent relative to normal for the month is plotted below the station symbol. Blackened circles indicate stations with precipitable water values of 1.00 inch or more. An "M" plotted above the station symbol indicates missing data.

ANALYSIS

Isopleths (lines of equal values) of precipitable water are drawn and labeled for every 0.25 inches with heavier isopleths drawn at 0.50-inch intervals.

USING THE CHART

This panel is used to determine the quantity of water vapor in the air between the surface and 500 mb (hPa) (18,000 feet MSL). Higher moisture content indicates "more fuel" for convective conditions. In Figure 9-3, Glasgow, MT, has a plot of ".22/100." This indicates that 22 hundreds of an inch of precipitable water is present, which is the average for the month. At Oklahoma City, OK, the ".72/196" indicates that 72 hundredths of an inch of precipitable water is present, which is 196 percent of normal (about double) for any day during this month. At Aberdeen, SD, the percent of normal value is not plotted due to insufficient climatological data.

FREEZING LEVEL PANEL

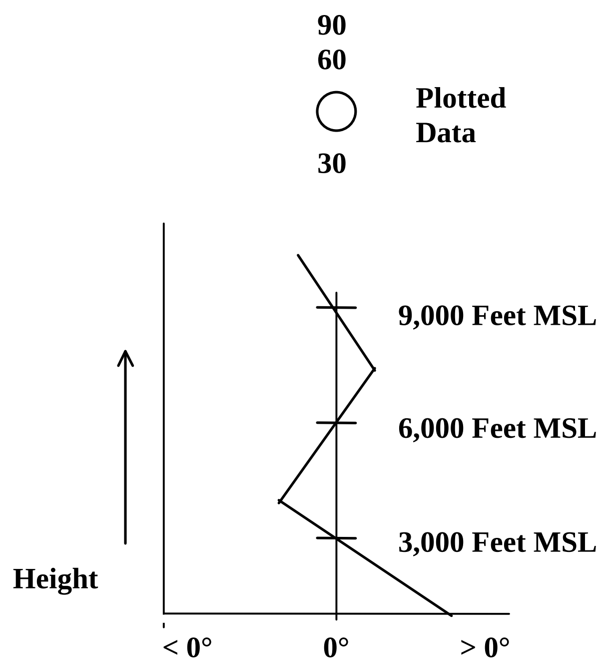
The freezing level panel (Figure 9-4) is the lower left panel of the composite moisture stability chart. This panel is an analysis of observed freezing levels. The freezing level is the height above MSL at which the temperature is zero degrees Celsius.

Freezing levels are affected by air mass temperatures. Colder air masses have lower freezing levels, and warmer air masses have higher freezing levels. Freezing levels change with the movement of contrasting cold and warm air masses. For example, freezing levels tend to lower behind cold fronts and rise ahead of warm fronts.

Generally, a station has one freezing level. Relative to the freezing level, the lower levels have above-freezing temperatures, and the upper levels have below-freezing temperatures. During very cold periods, all temperatures over a station may be below freezing and there would be no freezing level.

During colder periods of the year, and with certain weather systems such as fronts, stations may have more than one freezing level. There would be several layers of air with alternating above-freezing and below-freezing temperatures. A report from such a station would contain multiple freezing levels. Table 9-2 illustrates a vertical temperature profile drawn relative to zero degrees Celsius which contains multiple freezing levels. In this table there are two layers with above-freezing temperatures and two layers with below-freezing temperatures. Above-freezing layers extend from the surface to 3,000 feet MSL and from 6,000 to 9,000 feet MSL. Below-freezing layers extend from 3,000 to 6,000 feet MSL and above 9,000 feet MSL.

Table 9-2 Vertical Temperature Profile with Freezing Levels



PLOTTED DATA

Observed freezing levels are plotted on the chart in hundreds of feet MSL. Multiple freezing level events have plots for each freezing level. BF is plotted on the chart to indicate below-freezing temperatures at the surface. "M" indicates missing data. Note in Table 9-2 the freezing level plots associated with the illustrated vertical temperature profile. Table 9-3 provides examples of several station plots for various types of freezing level conditions.

ANALYSIS

Freezing levels are analyzed with contours (lines of constant height) and are drawn as solid lines. The lines are drawn with intervals of 4,000 feet beginning with 4,000 feet. Multiple freezing levels are analyzed for the lowest freezing level. Contours are labeled in hundreds of feet MSL. The surface freezing level is drawn and labeled as the 32-degree Fahrenheit (0° C)isotherm. The surface freezing level line encloses stations with BF data plots.

USING THE PANEL

The freezing level chart is used to assess freezing level heights and their values relative to flight profiles. In Figure 9-4, Salt Lake City, UT, is an example where all temperatures above the station were below freezing (below 0° C or 32° F.) Lake Charles, LA, depicts a single freezing level at 11,500 feet MSL. North Platte, NE, is an example of multiple freezing levels. The temperatures were below freezing at the surface but warmed to above freezing between 4,400 and 6,100 feet MSL. Above 6,100 feet MSL the temperatures were again below freezing.

In areas with single freezing levels, flights above the freezing level will be in below-freezing temperatures, and flights below the freezing level will be in above-freezing temperatures. In areas with multiple freezing levels, there are multiple layers of above- and below-freezing temperatures. According to Figure 9-4, a flight en route from Seattle, WA, to Portland, OR, at 7,000 feet would be flying above the freezing level and in below-freezing temperatures. A flight en route at 7,000 feet from Atlanta, GA, to Washington, DC, would be flying below the freezing level and in above-freezing temperatures.

Special care must be exercised to properly identify the altitudes of layers with above and below freezing temperatures when there is a potential for icing conditions.

Table 9-3 Plotting Freezing Levels

Plotted	Interpretation
○ **BF**	**Entire observation is below freezing (0 degrees Celsius).**
28 ✕	**Freezing level is at 2,800 feet MSL; temperatures below freezing above 2,800 feet MSL. All significant levels are missing.**
120 □	**Freezing level at 12,000 feet; temperatures above 12,000 feet are below freezing. Some mandatory levels are missing.**
110 **51** ○ **BF**	**Temperatures are below freezing from the surface to 5,100 feet; above freezing from 5,100 to 11,000 feet MSL; and below freezing above 11,000 feet MSL.**
90 **34** ○ **3**	**Lowest freezing level is at 300 feet; below freezing from 300 feet to 3,400 feet; above freezing from 3,400 to 9,000 feet; and below freezing above 9,000 feet.**
M ○	**Data is missing.**

AVERAGE RELATIVE HUMIDITY PANEL

The average relative humidity panel (Figure 9-5) is the lower right panel of the composite moisture stability chart. This panel is an analysis of the average relative humidity for the layer surface to 500 mb (hPa).

Relative humidity is the ratio of the quantity of water vapor in a sample of air compared to the air's capacity to hold water vapor expressed in percent. The air's capacity to hold water vapor depends primarily on its temperature and, to a lesser extent, its pressure. Warm air can hold more water vapor than cold air. Air at lower pressure can hold more water vapor than air at higher pressure.

Average relative humidities of the layer are changed primarily by vertical motion of air. Upward motion increases relative humidities, and downward motion decreases relative humidities.

Relative humidity is an indicator of the degree to which air is saturated. Air is saturated when it contains all of the water vapor it can hold. High relative humidities (moist air) identify air which is at or close to saturation. Air with high relative humidites often contain clouds and may produce precipitation. Low relative humidities (dry air) identify air that is not close to saturation. Low relative humidity air tends to be free of clouds.

PLOTTED DATA

The average relative humidity is plotted above each station symbol. Blackened circles indicate stations with humidities of 50 percent and higher. An "M" indicates the value is missing.

ANALYSIS

Isopleths of relative humidity, called isohumes, are drawn and labeled every 10 percent, with more heavily shaded isohumes drawn for values of 10, 50, and 90 percent.

USING THE PANEL

This panel is used to determine the average relative humidity of air from the surface to 500 mb (hPa). Areas with high average relative humidities have a higher probability of thick clouds and possibly precipitation. Areas with low average relative humidities have a lower probability of thick clouds, although shallow cloud layers may be present. Weather-producing systems, such as lows and fronts, which are moving into areas with high average relative humidities have a high probability of developing clouds and precipitation. Significant values of average relative humidities which support the possibility of developing clouds and precipitation are 50% and higher with unstable air, and 70% and higher for stable air. Weather-producing systems affecting areas with low average relative humidities, 30% and less, may produce only a few clouds, if any. According to Figure 9-5, much of Arkansas has very moist air with average relative humidities greater than 90%, while western Arizona has dry air with average relative humidities less than 30%.

High values of relative humidity do not necessarily mean high values of water vapor content (precipitable water). For example in Figure 9-3, Oakland, CA, had less water vapor content than Miami, FL (.64 and 1.43 respectively). However, in Figure 9-5, the average relative humidities are the same for both stations. If rain were falling at both stations, the result would likely be lighter precipitation totals for Oakland.

USING THE CHART

This chart is used to identify the distribution of moisture, stability, and freezing level properties of the atmosphere. These properties and their association with weather systems provide important insights into existing and forecast weather conditions as well as possible aviation weather hazards.

Generally these properties tend to move with the associated weather systems, such as lows, highs, and fronts. Contrasting property values within weather systems are redistributed relative to the systems by advecting winds. Also, changes in property values relative to the systems can occur as a result of development and dissipation processes. In some instances property values will remain stationary relative to geographical features, such as mountains and coastal regions.

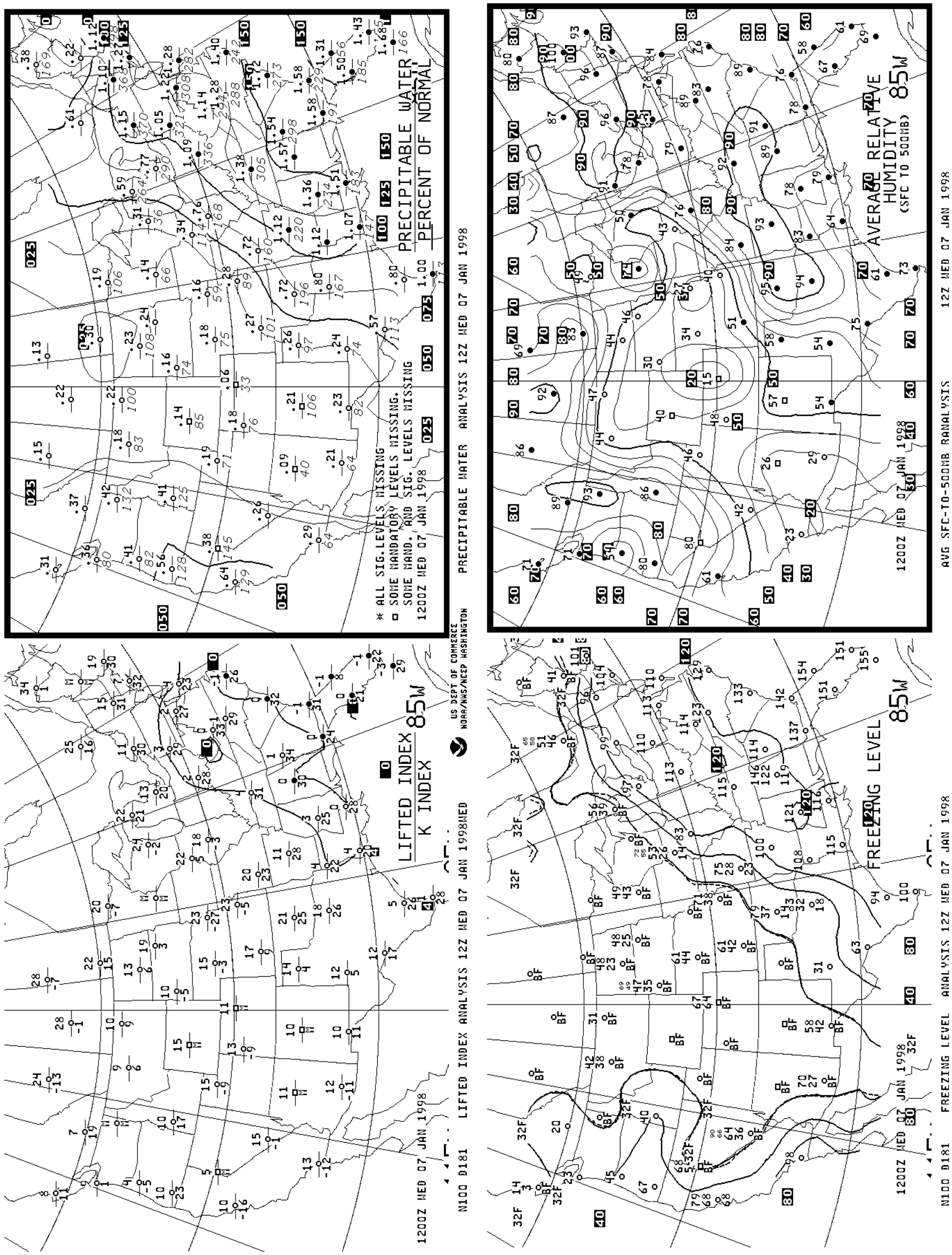


Figure 9-1. Composite Moisture Stability Chart.

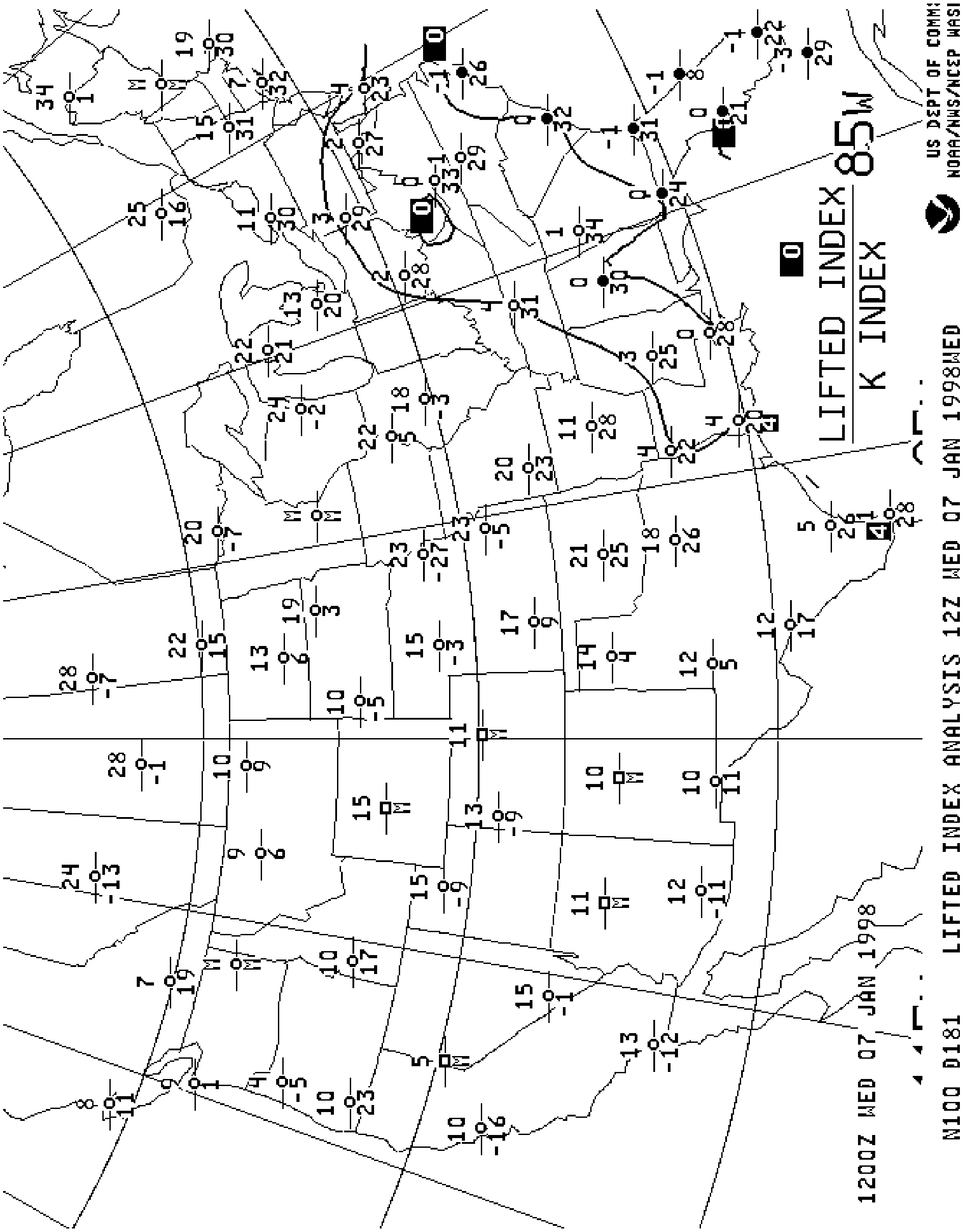


Figure 9-2. Stability Panel.

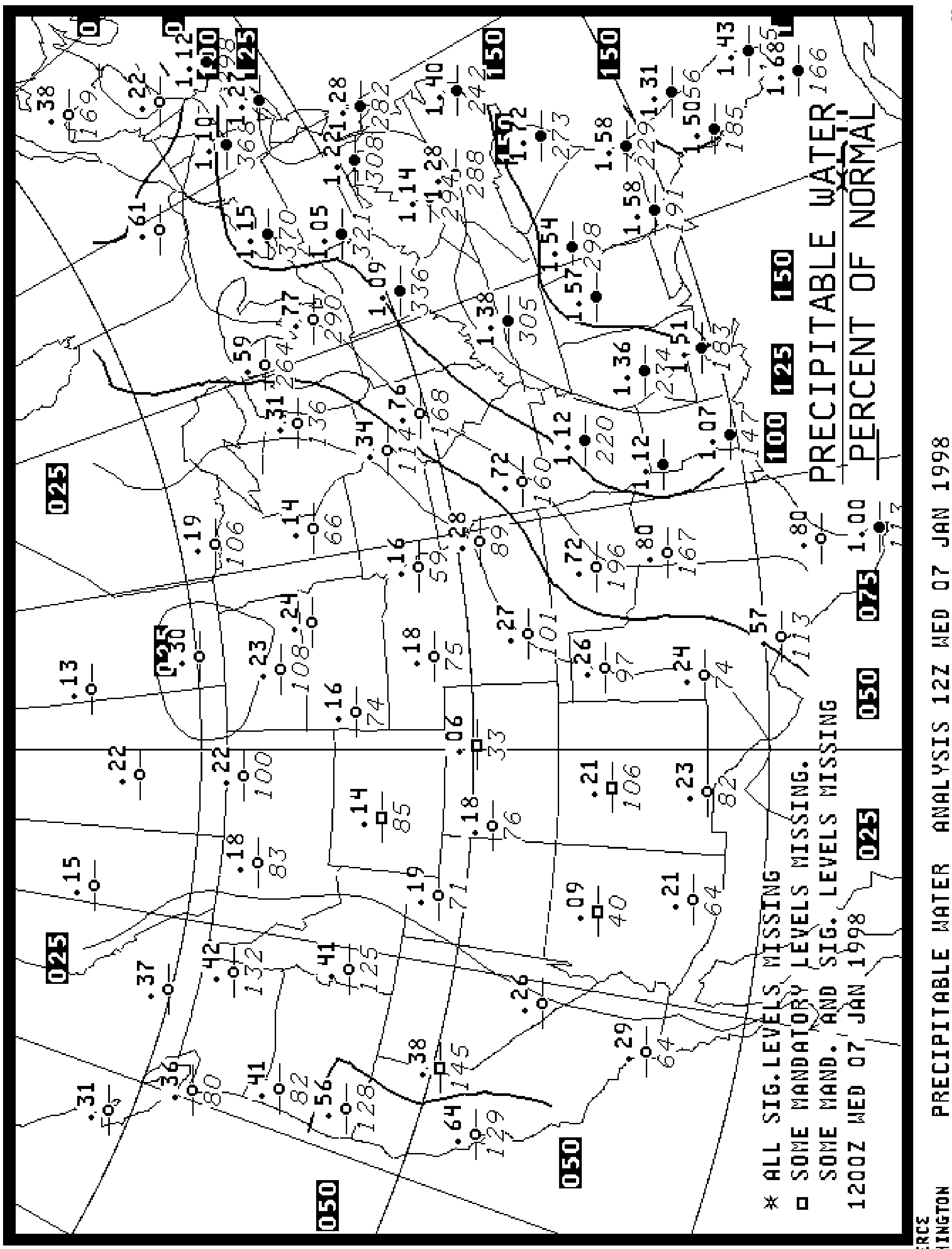


Figure 9-3. Precipitable Water Panel.

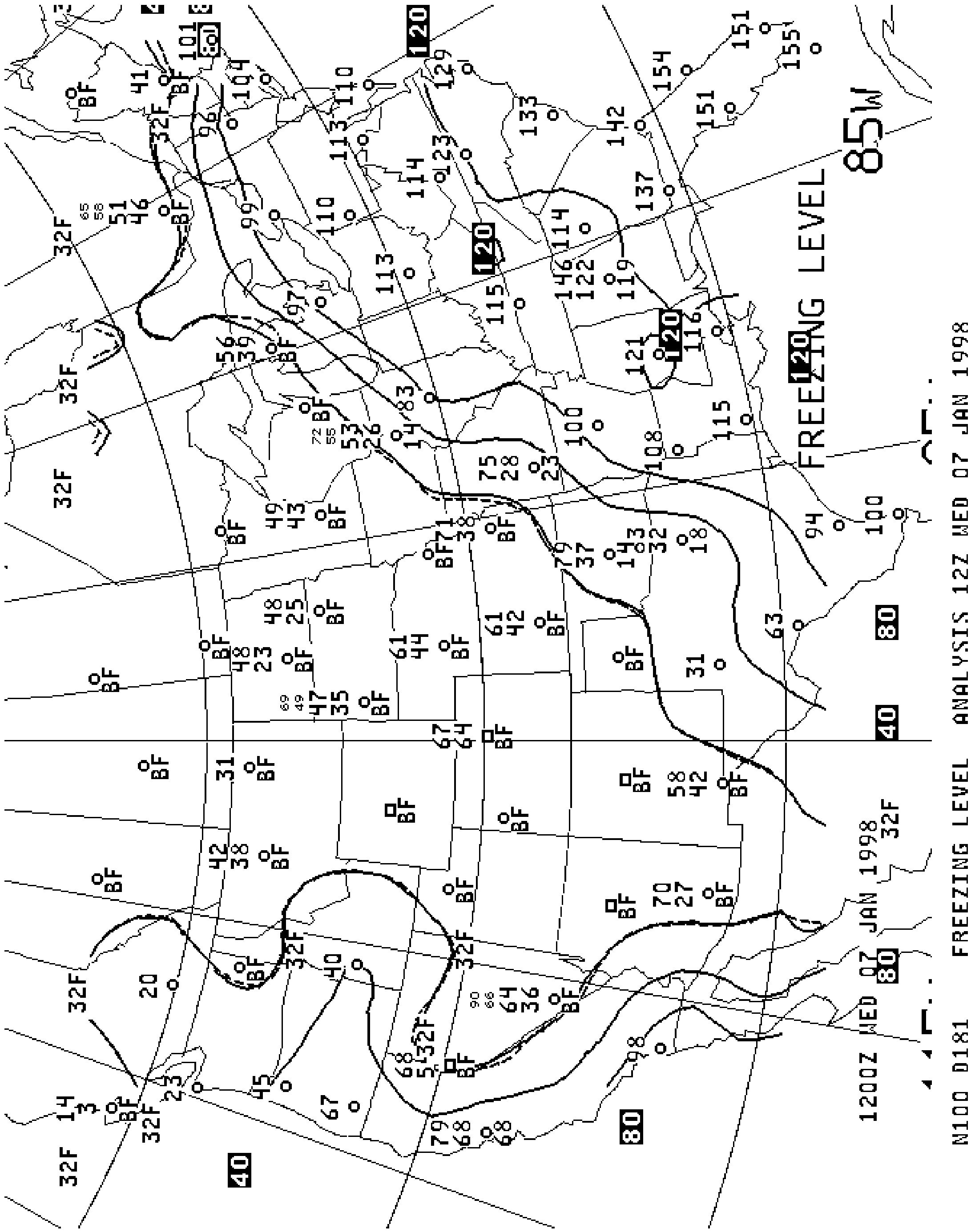


Figure 9-4. Freezing Level Panel.

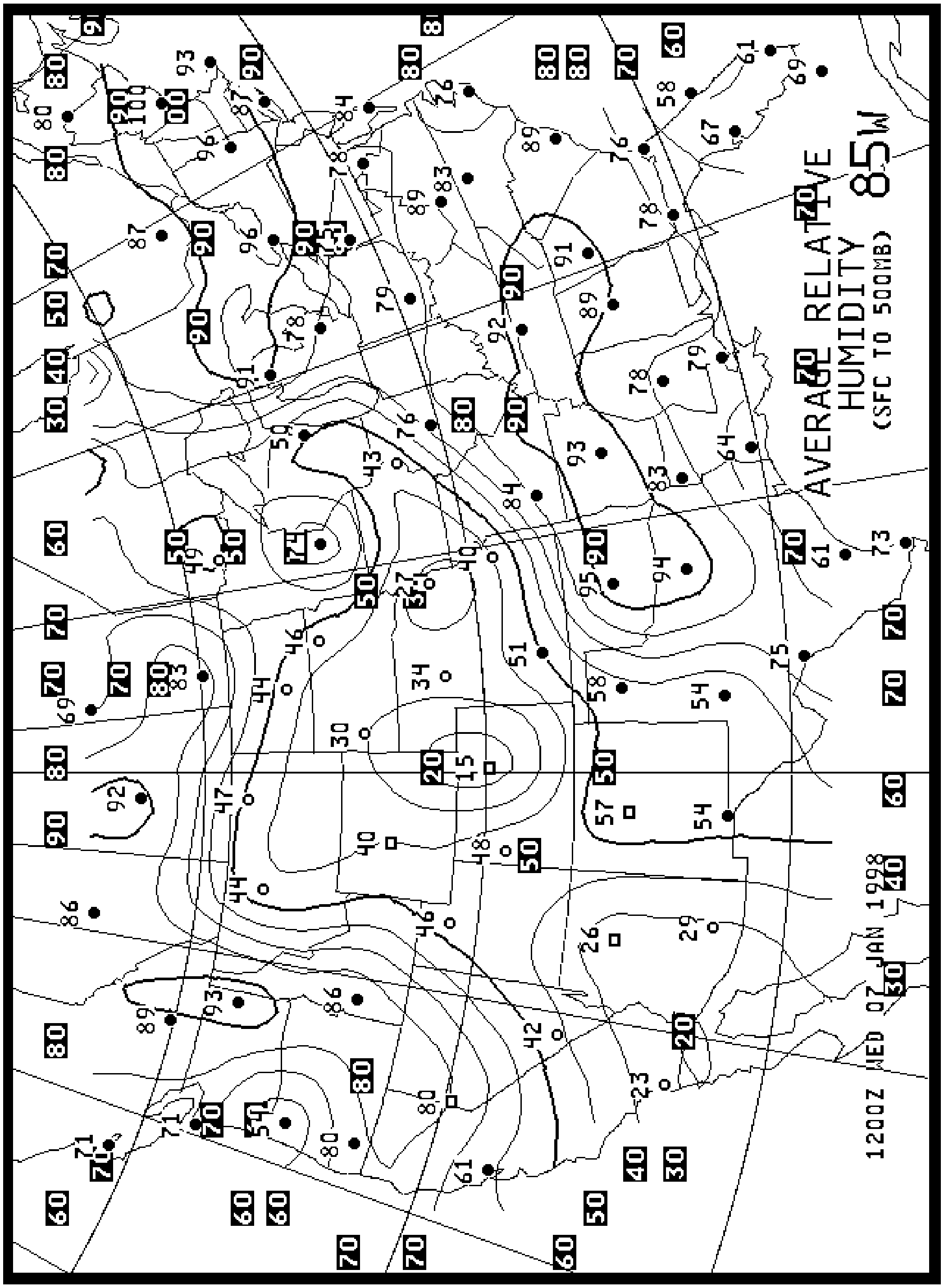


Figure 9-5. Average Relative Humidity Panel.

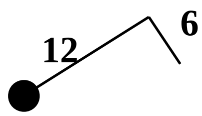
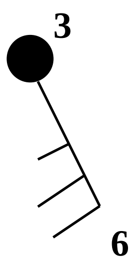
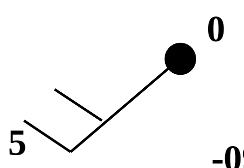
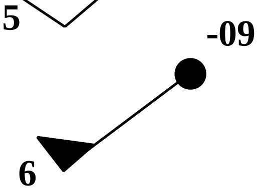
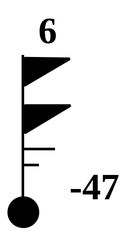
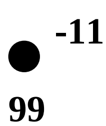
Section 10
WINDS AND TEMPERATURES ALOFT CHARTS

Winds aloft charts, both forecast and observed, are computer-generated products. The forecast winds aloft charts also contain forecast temperatures aloft.

FORECAST WINDS AND TEMPERATURES ALOFT (FD)

Forecast winds and temperatures aloft (FD) charts are prepared for eight levels on eight separate panels. The levels are 6,000; 9,000; 12,000; 18,000; 24,000; 30,000; 34,000; and 39,000 feet MSL. They are available daily, and the 12-hour progs are valid at 1200Z and 0000Z. A legend on each panel shows the valid time and the level of the panel. Levels below 18,000 feet are in true altitude, and levels 18,000 feet and above are in pressure altitude. Figure 10-1 shows examples from a winds and temperatures aloft forecast chart. Figure 10-2 provides a closer view of the winds and temperature aloft forecast chart. Temperature is in whole degrees Celsius for each forecast point and is entered above and to the right of the station circle. Arrows with pennants and barbs, similar to those used on the surface map, show wind direction and speed. Wind direction is drawn to the nearest 10 degrees with the second digit of the coded direction entered at the outer end of the arrow. To determine wind direction, obtain the general direction from the arrow, and then use the digit to determine the direction to the nearest 10 degrees. For example, a wind in the northwest quadrant with a digit of “3” indicates 330 degrees. A calm or light and variable wind is shown by “99” entered to the lower left of the station circle. See Table 10-1 for examples of plotted temperatures and winds with their interpretations.

Table 10-1 Plotted Winds and Temperatures

Plotted	*Interpretation*
	12 degrees Celsius, wind 060 degrees at 5 knots
	3 degrees Celsius, wind 160 degrees at 25 knots
	0 degrees Celsius, wind 250 degrees at 15 knots
	-9 degrees Celsius, wind 260 degrees at 50 knots
	-47 degrees Celsius, wind 360 degrees at 115 knots
	-11 degrees Celsius, wind calm or light and variable

OBSERVED WINDS ALOFT

Charts of observed winds for selected levels are sent twice daily on a four-panel chart valid at 1200Z and 0000Z. The chart depicts winds and temperatures at the second standard level, 14,000, 24,000, and 34,000 feet. Figure 10-3 is an example of this chart, and Figure 10-4 is an example of one of the panels. Wind direction and speed are shown by arrows, the same as on the forecast charts. A calm or light and variable wind is shown as "LV" and a missing wind as "M," both plotted to the lower right of the station circle. The station circle is filled in when the reported temperature/dew point spread is 5 degrees Celsius or less. Observed temperatures are included on the upper two panels of this chart (24,000 feet and 34,000 feet). A dotted bracket around the temperature means a calculated temperature.

The second standard level (Figure 10-3) for a reporting station is found between 1,000 and 2,000 feet above the surface, depending on the station elevation. The second standard level is used to determine low-level wind shear and frictional effects on lower atmosphere winds. To compute the second standard level, find the next thousand-foot level above the station elevation and add 1,000 feet to that level. For example, the next thousand-foot level above Oklahoma City, OK, (station elevation 1,290 feet MSL) is 2,000 feet MSL. The second standard level for Oklahoma City, OK, (2,000 feet + 1,000 feet) is 3,000 feet MSL or 1,710 feet AGL.

For example:

Station:	Amarillo, TX	Bismarck, ND	Topeka, KS	Key West, FL
Station elevation:	3,604 MSL	1,677 MSL	879 MSL	0 MSL
Next thousand-foot level above station:	4,000 MSL	2,000 MSL	1,000 MSL	1,000 MSL
	+1,000	+1,000	+1,000	+1,000
Second standard level:	5,000 MSL or 1,396 AGL	3,000 MSL or 1,323 AGL	2,000 MSL or 1,121 AGL	2,000 MSL or 2,000 AGL

Note that the 12,000 foot MSL panel is true altitude, while the 24,000 and 34,000 feet MSL panels are in pressure altitude. (See Figure 10-1.)

USING THE CHARTS

The use of the winds aloft chart is to determine winds at a proposed flight altitude or to select the best altitude for a proposed flight. Temperatures also can be determined from the forecast charts. Interpolation must be used to determine winds and temperatures at a level between charts and data when the time period is other than the valid time of the chart.

Forecast winds are generally preferable to observed winds since they are more relevant to flight time. Although observed winds are 5 to 8 hours old when received, they still can be a useful reference to check for gross errors on the 12-hour prog.

INTERNATIONAL FLIGHTS

Computer-generated forecast charts of winds and temperatures aloft are available for international flights at specified levels. The U.S. National Centers of Environmental Prediction (NCEP), near Washington D.C., is a component of the World Area Forecast System (WAFS). NCEP is designated in the WAFS as both a World Area Forecast Center and a Regional Area Forecast Center (RAFC). Its main function as a World Area Forecast Center is to prepare global forecasts in grid-point form of upper winds and upper air temperatures and to supply the forecasts to associated RAFCs. One of NCEP's main RAFC functions is to prepare and supply to users charts of forecast winds, temperatures, and significant weather.

For example, Figures 10-5 and 10-6, are originated by NCEP. The flight level of Figure 10-5 is 34,000 feet MSL, and Figure 10-6 is 45,000 feet MSL. This, along with the valid time of the chart and the data base time (data from which the forecast was derived), makes up the legend along an edge of each chart.

Forecast winds are expressed in knots for spot locations with directions and speed depicted in the same manner as the U.S. forecast winds and temperatures aloft chart (Figure 10-1). Forecast temperatures are depicted for spot locations inside circles that are expressed in degrees Celsius. For charts with flight levels (FL) at or below FL180 (18,000 feet), temperatures are depicted as negative (-) or positive (+). On charts for FLs above FL180, temperatures are always negative and no sign is depicted.

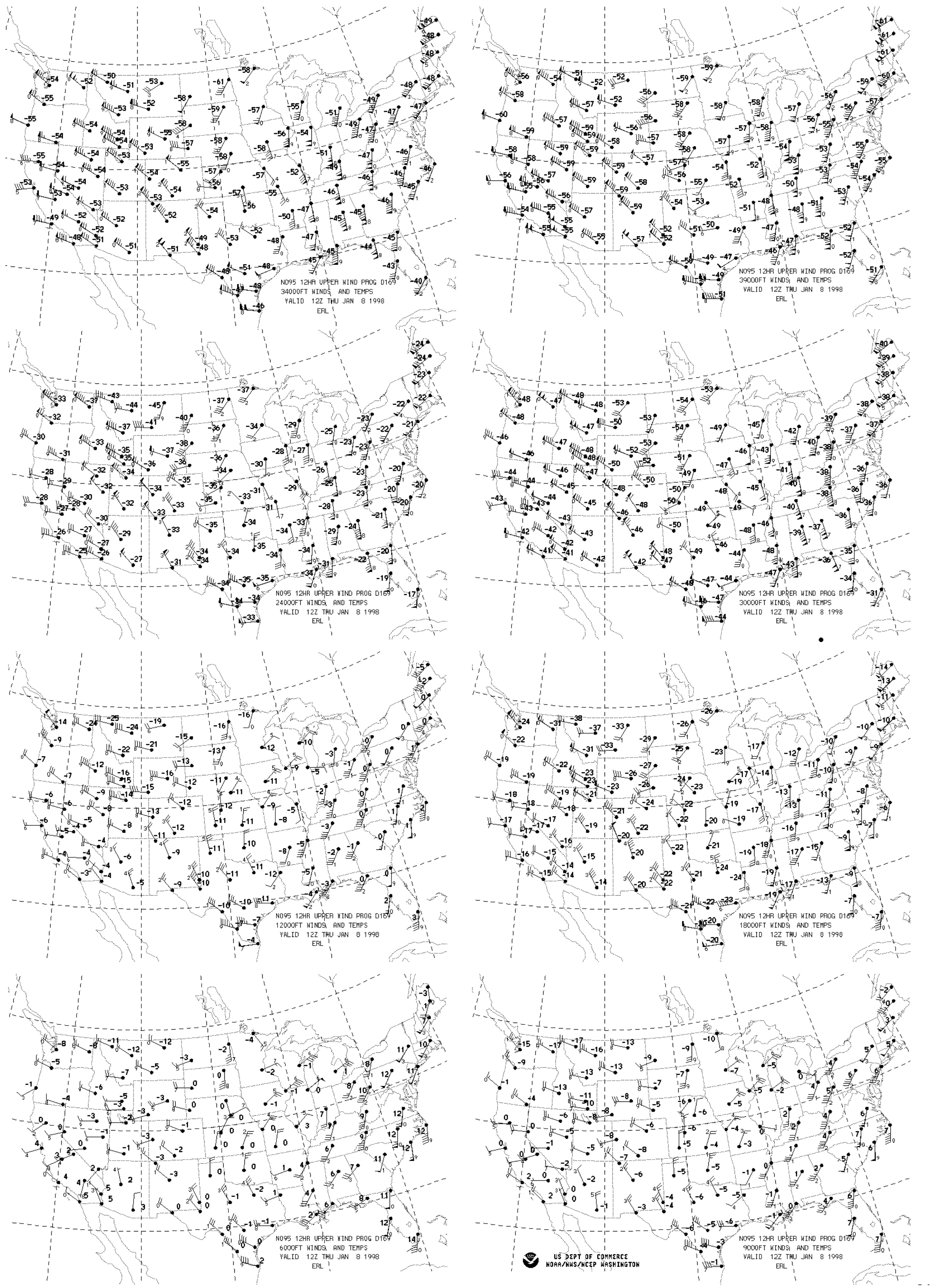


Figure 10-1. Forecast Winds and Temperatures Aloft Chart.

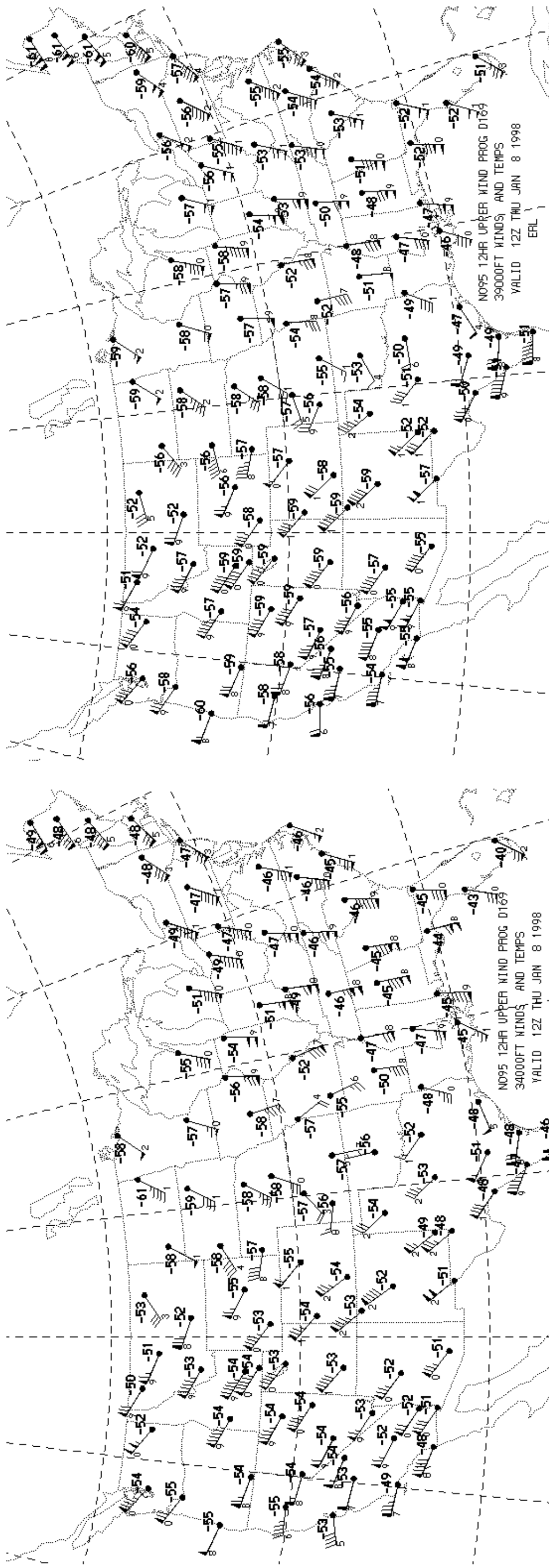


Figure 10-2. Panels from Forecast Winds and Temperatures Aloft Chart.

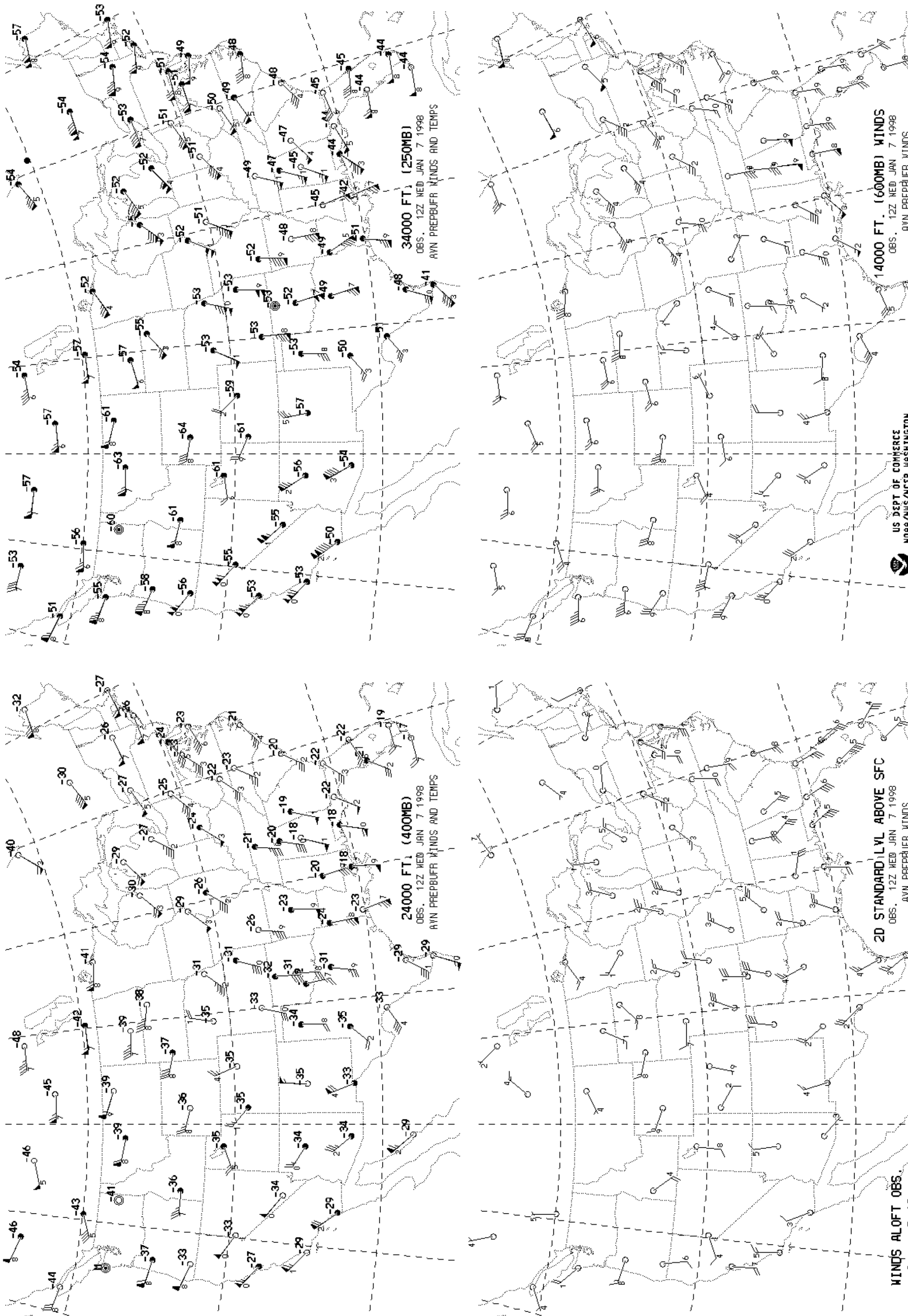


Figure 10-3. Observed Winds and Temperatures Aloft Chart.

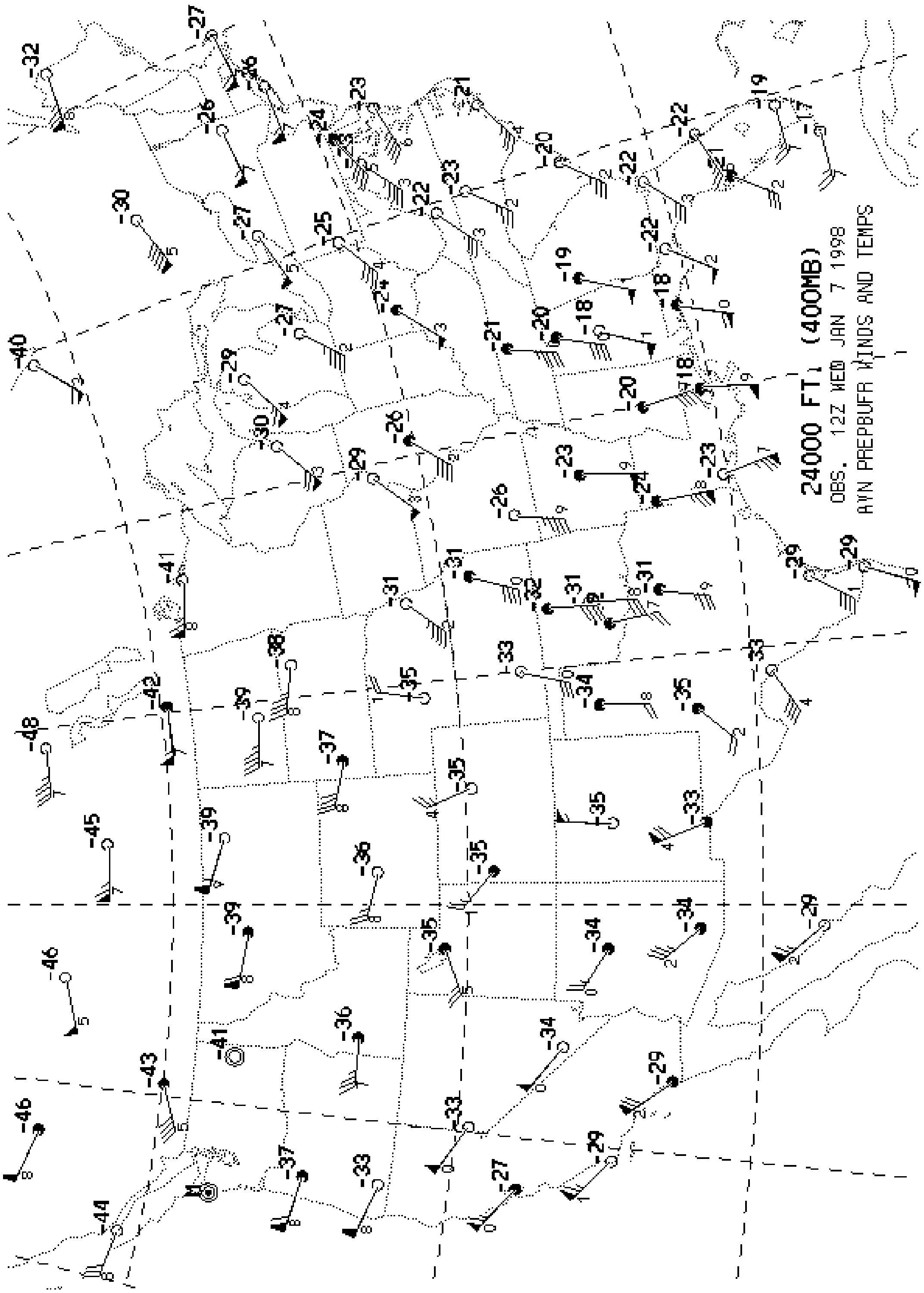


Figure 10-4. Panel from Observed Winds and Temperatures Aloft Chart.

Section 11
SIGNIFICANT WEATHER PROGNOSTIC CHARTS

Significant weather prognostic charts (progs) (Figure 11-1) portray forecasts of selected weather conditions at specified valid times. Each valid time is the time at which the forecast conditions are expected to occur. Forecasts are made from a comprehensive set of observed weather conditions. The observed conditions are extended forward in time and become forecasts by considering atmospheric and environmental processes. Forecasts are made for various periods of time. A 12-hour prog is a forecast of conditions which has a valid time 12 hours after the observed data base time, thus a 12-hour forecast. A 24-hour prog is a 24-hour forecast, and so on. For example, a 12-hour forecast based on 00Z observations is valid at 12Z. Altitude information on the prog charts is referenced to mean sea level (MSL) and compatible with aviation. Altitudes below 18,000 feet are true altitudes while above 18,000 feet are pressure altitudes or flight levels (FL). The prog charts for the conterminous United States are generated for two general time periods. Day 1 progs are forecasts for the first 24-hour period. Day 2 progs are forecasts for the second 24-hour period. Day 1 prog charts are prepared for two altitude references in the atmosphere. Forecast information for the surface to 24,000 feet is provided by the low-level significant weather prog chart. Forecast information from above 24,000 to 60,000 feet is provided by the high-level significant weather prog chart. The day 2 prog chart is prepared without regard to altitude and is provided by the 36- and 48-hour surface prog chart.

U.S. LOW-LEVEL SIGNIFICANT WEATHER (SIG WX) PROG

The low-level significant weather prog chart (Figure 11-1) is a day 1 forecast of significant weather for the conterminous United States. Weather information provided pertains to the layer from surface to FL240 (400 mbs.) The information is provided for two forecast periods, 12 hours and 24 hours. The chart is composed of four panels. The two lower panels depict the 12- and 24-hour surface progs that are produced at Hydrometeorolgical Prediction Center (HPC) in Camp Springs, Maryland. The two upper panels depict the 12- and 24-hour significant weather progs that are produced at the Aviation Weather Center (AWC) in Kansas City, Missouri. The chart is issued four times a day; and the observation data base times for each issuance are 00Z, 06Z, 12Z, and 18Z.

SURFACE PROG PANELS

The surface prog panels display forecast positions and characteristics of pressure systems, fronts, and precipitation.

Surface Pressure Systems

Surface pressure systems are depicted by pressure centers, troughs, and, on selected panels, isobars. High and low pressure centers are identified by "Hs" and "Ls" respectively. The central pressure of each center is specified. Pressure troughs are identified by long dashed lines and labeled "TROF." Isobars are shown on selected panels. Isobars are drawn as solid lines and portray pressure patterns. The value of each isobar is identified by a two-digit code placed on each isobar. Isobars are drawn with intervals of 8 mbs relative to the 1,000 mb isobar. Note that this interval is larger than the 4-mb interval used on the surface analysis chart. The 8-mb interval provides a less sensitive analysis of pressure patterns than the 4-mb interval. Occasionally, nonstandard isobars will be drawn using 4-mb intervals to highlight patterns with weak pressure gradients. Nonstandard isobars are drawn as dashed lines. Examples of standard isobars drawn are the 992; 1,000; and 1,008 mb isobars.

Fronts

Surface fronts are depicted on each panel. Formats used are the standard symbols and three-digit characterization code used on the surface analysis chart. (See Section 5.)

Precipitation

Solid lines enclose precipitation areas. Symbols specify the forms and types of precipitation. (See Table 11-1.) A mix of precipitation is indicated by the use of two pertinent symbols separated by a slash. Identifying symbols are positioned within or adjacent to the precipitation areas. Precipitation conditions are described further by the use of shading. Stable precipitation events are classified as continuous or intermittent. Continuous precipitation is a dominant and widespread event and, therefore, shaded. Intermittent precipitation is a periodic and patchy event and unshaded. Shading is also used to characterize the coverage of unstable precipitation events. Areas with more than half coverage are shaded, and half or less coverage are unshaded. (See Table 11-2.) A bold dashed line is used to separate precipitation with contrasting characteristics within an outlined area. For example, a dashed line would be used to separate an area of snow from an area of rain.

Table 11-1 Standard Weather Symbols

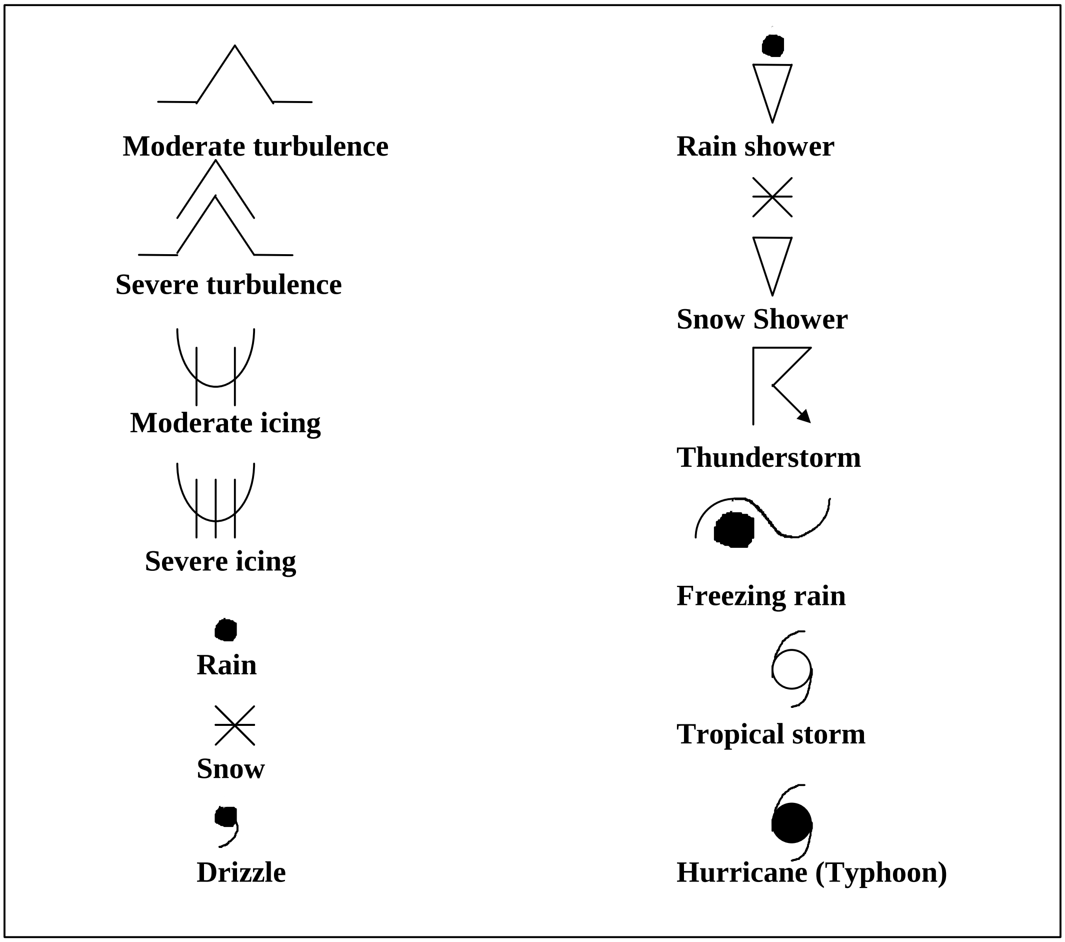
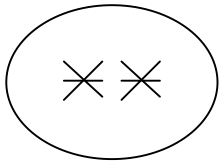
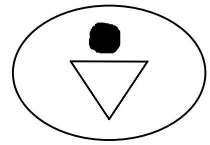
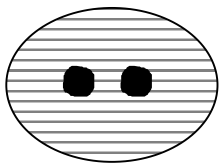
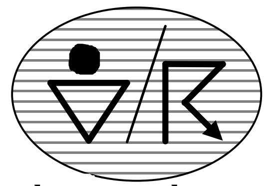


Table 11-2 Significant Weather Prog Symbols

 **Intermittent snow**	 **Rain showers covering half or less the area**
 **Continuous rain**	 **Rain showers and thunderstorms covering more than half the area**

SIGNIFICANT WEATHER PANELS

The significant weather panels display forecast weather flying categories, freezing levels, and turbulence for the layer surface to FL240. A legend on the chart illustrates symbols and criteria used for these conditions. (See Figure 11-1.)

Weather Flying Categories

The weather flying categories are visual flight rules (VFR), marginal VFR (MVFR), and instrument flight rules (IFR). Ceiling and visibility criteria used for each category are the same as used for the weather depiction chart. (See Section 6.) IFR areas are enclosed by solid lines. MVFR areas are enclosed by scalloped lines. All other areas are VFR.

Freezing Levels

The surface freezing level is depicted by a zigzag line and labeled "SFC." The surface freezing level separates above-freezing from below-freezing temperatures at the Earth's surface. Freezing levels aloft are depicted by thin, short dashed lines. Lines are drawn at 4,000-foot intervals beginning at 4,000 feet and labeled in hundreds of feet. For example, "80" identifies the 8,000-foot contour. Freezing level heights are referenced to MSL. The lines are discontinued where they intersect corresponding altitudes of the Rocky Mountains. The freezing level values for locations between lines is determined by linear interpolation. For example, the freezing level midway between the 4,000 and 8,000 foot lines is 6,000 feet. Areas with forecast multiple freezing levels have lines drawn to the highest freezing level. For example, with freezing levels forecast at 2,000, 6,000, and 8,000 feet, the analysis is drawn to the 8,000 foot value. Notice that not all freezing levels are identified with a multiple freezing level event. Information about the 2,000- and 6,000-foot freezing levels in this example would not be displayed. Surface-based multiple freezing levels are located over areas which have below-freezing temperatures at the surface and above-freezing temperatures within at least one layer aloft. Freezing rain and freezing drizzle (freezing precipitation) are associated with surface-based multiple freezing levels. The intersection of the surface freezing level line and freezing level contours encloses an area with surface-based multiple freezing levels.

Turbulence

Areas of moderate or greater turbulence are enclosed by bold, long dashed lines. Turbulence intensities are identified by symbols. The vertical extent of turbulence layers is specified by top and base heights in hundreds of feet. Height values are relative to MSL with the top and base heights separated by a line. A top height of "240" indicates turbulence at or above 24,000 feet. (The upper limit of the prog is 24,000 feet.) The base height is omitted where turbulence reaches the surface. For example, "080/ " identifies a turbulence layer from the surface to 8,000 feet MSL. Thunderstorms always imply a variety of hazardous conditions to aviation including moderate or greater turbulence. Generally, turbulence conditions implied with thunderstorms is not depicted on the chart. However, for added emphasis, moderate to severe turbulence surface to above 24,000 feet is depicted for areas that have thunderstorms with more than half coverage on the surface prog. Intensity symbols and layer altitudes appear within or adjacent to the forecast area.

USING THE CHART

The low-level significant weather prog chart provides an overview of selected flying weather conditions up to 24,000 feet for day 1. Much insight can be gained by evaluating the individual fields of pressure patterns, fronts, precipitation, weather flying categories, freezing levels, and turbulence displayed on the chart. In addition, certain inferences can be made from the chart. Surface winds can be inferred from surface pressure patterns. Structural icing can be inferred in areas which have clouds and precipitation, above freezing levels, and in areas of freezing precipitation. The low-level prog chart can also be used to obtain an overview of the progression of weather during day 1. The progression of weather is the change in position, size, and intensity of weather with time. Progression analysis is accomplished by comparing charts of observed conditions with the 12- and 24-hour prog panels. Progression analysis adds insight to the time-continuity of the weather from before flight time to after flight time. The low-level prog chart makes the comprehension of weather details easier and more meaningful. A comprehensive overview of weather conditions does not provide sufficient information for flight planning. Additional weather details are required. Essential weather details are provided by observed reports, forecast products, and weather advisories. Weather details are often numerous. An effective overview of observed and prog charts allows the many essential details to fit into place and have continuity.

36- AND 48-HOUR SURFACE PROG

The 36- and 48-hour surface prog chart (Figure 11-2) is a day 2 forecast of general weather for the conterminous United States. The chart is an extension of the day 1 U.S. low-level significant weather prog chart issued from the same observed data base time. These two prog charts make up a forecast package. The chart is issued twice daily. The observation data base times for each issuance are 00Z and 12Z. For example, a chart issued based on 00Z Tuesday observations has a 36-hour valid time of 12Z Wednesday and a 48-hour valid time of 00Z Thursday. The chart is composed of two panels and a forecast discussion. The two panels contain the 36- and 48-hour surface progs.

SURFACE PROG PANELS

The surface prog panels display forecast positions and characteristics of pressure patterns, fronts, and precipitation.

Surface Pressure Systems

Surface pressure systems are depicted by pressure centers, troughs, and isobars. Formats used for each feature are the same as used for the surface prog panels of the U.S. low-level significant weather prog chart.

Fronts

Surface fronts are depicted by using the standard symbols and three-digit characterization code used on the surface analysis chart. (See Section 5.)

Precipitation

Precipitation areas are outlined on each panel. Formats used to locate and characterize precipitation are the same as used for the surface prog panels of the U.S. low-level prog chart.

FORECAST DISCUSSION

The forecast discussion is a discussion of the day 1 and day 2 forecast package. The discussion will include identification and characterization of weather systems and associated weather conditions portrayed on the prog charts.

USING THE CHART

The 36- and 48-hour surface prog chart provides an outlook of general weather conditions for day 2. The 36- and 48-hour prog can also be used to assess the progression of weather through day 2.

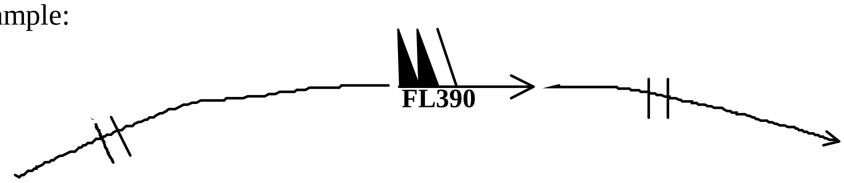
HIGH-LEVEL SIGNIFICANT WEATHER PROG

The high-level significant weather prog (Figures 11-3 and 11-4) is a day 1 forecast of significant weather. Weather information provided pertains to the layer from above 24,000 to 60,000 feet (FL250-FL600). The prog covers a large portion of the Northern Hemisphere and a limited portion of the Southern Hemisphere. Coverage ranges from the eastern Asiatic coast eastward across the Pacific, North America, and the Atlantic into Europe and northwestern Africa. The prog extends southward into northern South America. The area covered by the prog is divided into sections. Each section covers a part of the forecast area. Some sections overlap. The various sections are formatted on polar or Mercator projection background maps and issued as charts. Each prog chart is issued four times a day. The valid times are 00Z, 06Z, 12Z, and 18Z. Conditions routinely appearing on the chart are jet streams, cumulonimbus clouds, turbulence, and tropopause heights. Surface fronts are also included to add perspective. Other conditions will appear on the chart as pertinent. They are tropical cyclones, squall lines, volcanic eruption sites, and sandstorms and dust storms.

Jet Streams

Jet streams with a maximum speed of more than 80 knots are identified by bold lines. Jet stream lines lie along the core of maximum winds. Arrowheads on the lines indicate the orientation of each jet stream. Double hatched lines positioned along the jet core identify changes of wind speed. These speed indicators are drawn at 20-knot intervals and begin with 100 knots. Wind speed maximums along the jet core are characterized by wind symbols and altitudes. A standard wind symbol (shaft, pennants, and barbs) is placed at each pertinent position to identify velocity. The altitude in hundreds of feet prefaced with "FL" is placed adjacent to each wind symbol.

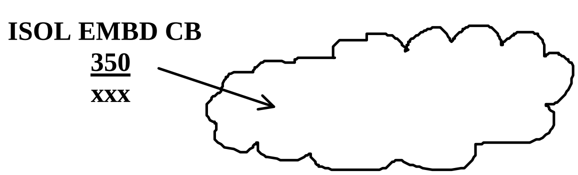
Example:

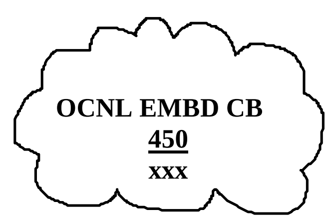


Cumulonimbus Clouds

Cumulonimbus clouds (CBs) are thunderstorm clouds. Areas of CBs meeting select criteria are enclosed by scalloped lines. The criteria are widespread CBs within an area or along a line with little or no space between individual clouds, and CBs are embedded in cloud layers or concealed by haze or dust. The prog does not display isolated or scattered CBs (one-half or less coverage) which are not embedded in clouds, haze, or dust. Cumulonimbus areas are identified with "CB" and characterized by coverage and tops. Coverages are identified as isolated (ISOL), occasional (OCNL), and frequent (FRQ). Isolated and occasional CBs are further characterized as embedded (EMBD.) Coverage values for the identifiers are: isolated - less than 1/8; occasional - 1/8 to 4/8; and frequent - more than 4/8. Tops are identified in hundreds of feet using the standard top and base format. Bases extend below 24,000 feet (below the prog's forecast layer) and are encoded "XXX." The identification and characterization of each cumulonimbus area will appear within or adjacent to the outlined area. Thunderstorms always imply a variety of aviation hazards including moderate or greater turbulence and hail.

Examples:

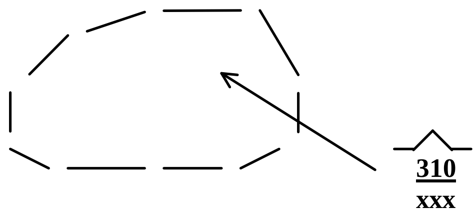




Turbulence

Areas of moderate or greater turbulence are enclosed by bold dashed lines. Turbulence conditions identified are those associated with wind shear zones and mountain waves. Wind shear zones include speed shears associated with jet streams and areas with sharply curved flow. Turbulence associated with thunderstorms is not identified. (Thunderstorms imply turbulence.) Turbulence intensities are identified by symbols. The vertical extent of turbulence layers is specified by top and base heights in hundreds of feet. Turbulence bases which extends below the layer of the chart are identified with "XXX." Top and base heights are separated by a line. Height values are pressure altitudes. For example, "310/XXX" identifies a layer of turbulence from below FL240 to FL310.

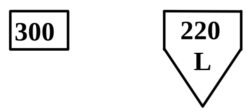
Example:



Tropopause Heights

Tropopause heights are plotted in hundreds of feet at selected locations. Heights are enclosed by rectangles. Centers of high and low heights are identified with "H" and "L" respectively along with their heights and enclosed by polygons.

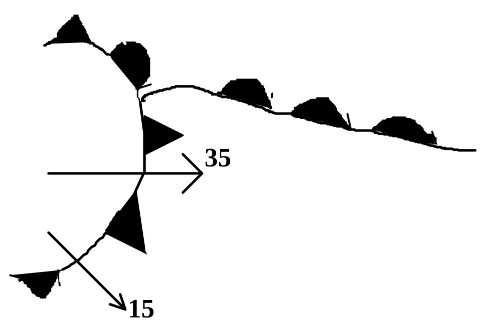
Examples:



Surface Fronts

Surface fronts are depicted on the prog to provide added perspective. Symbols used are the standard symbols used on the surface analysis chart. Movements of fronts are identified at selected positions. A vector with a number plotted adjacent to the vector identifies the direction and speed of movement. (See Section 5.)

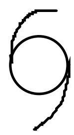
Example:



Tropical Cyclones

The positions of hurricanes, typhoons, and tropical storms are depicted by symbols. The only difference between the hurricane/typhoon symbol and tropical storm symbol is the circle of the hurricane/typhoon symbol is shaded in. When pertinent, the name of each storm is positioned adjacent to the symbol. Cumulonimbus cloud activity meeting chart criteria is identified and characterized relative to each storm.

Example:



Tropical Storm

Squall Lines

Severe squall lines are lines of CBs with 5/8 coverage or greater. Squall lines are identified by long dashed lines, and each dash is separated by a "v." Cumulonimbus cloud activity meeting chart criteria is identified and characterized with each squall line.

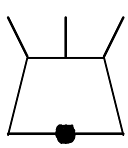
Example:

——— V ——— V ———

Volcanic Eruption Sites

Volcanic eruption sites are identified by a trapezoidal symbol. The dot on the base of the trapezoid locates the latitude and longitude of the volcano. The name of the volcano, its latitude, and its longitude are noted adjacent to the symbol. Pertinent SIGMETs containing information regarding volcanic ash will be in effect.

Example:

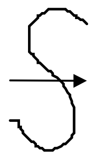


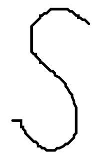
TUNGURAHUA
1.5S 78.4W

Sandstorms and Dust Storms

Areas of widespread sandstorms and dust storms are labeled by symbol. The symbol with the arrow depicts areas of widespread sandstorm or dust storm, while the symbol without the arrow depicts severe sandstorm or dust haze.

Example:





USING THE CHART

The high-level sig weather prog is used to get an overview of selected flying weather conditions above 24,000 feet. Much insight can be gained by evaluating jet streams, cumulonimbus clouds, turbulence, associated surface fronts, significant tropical storm complexes including tropical cyclones, squall lines, sandstorms, and dust storms.

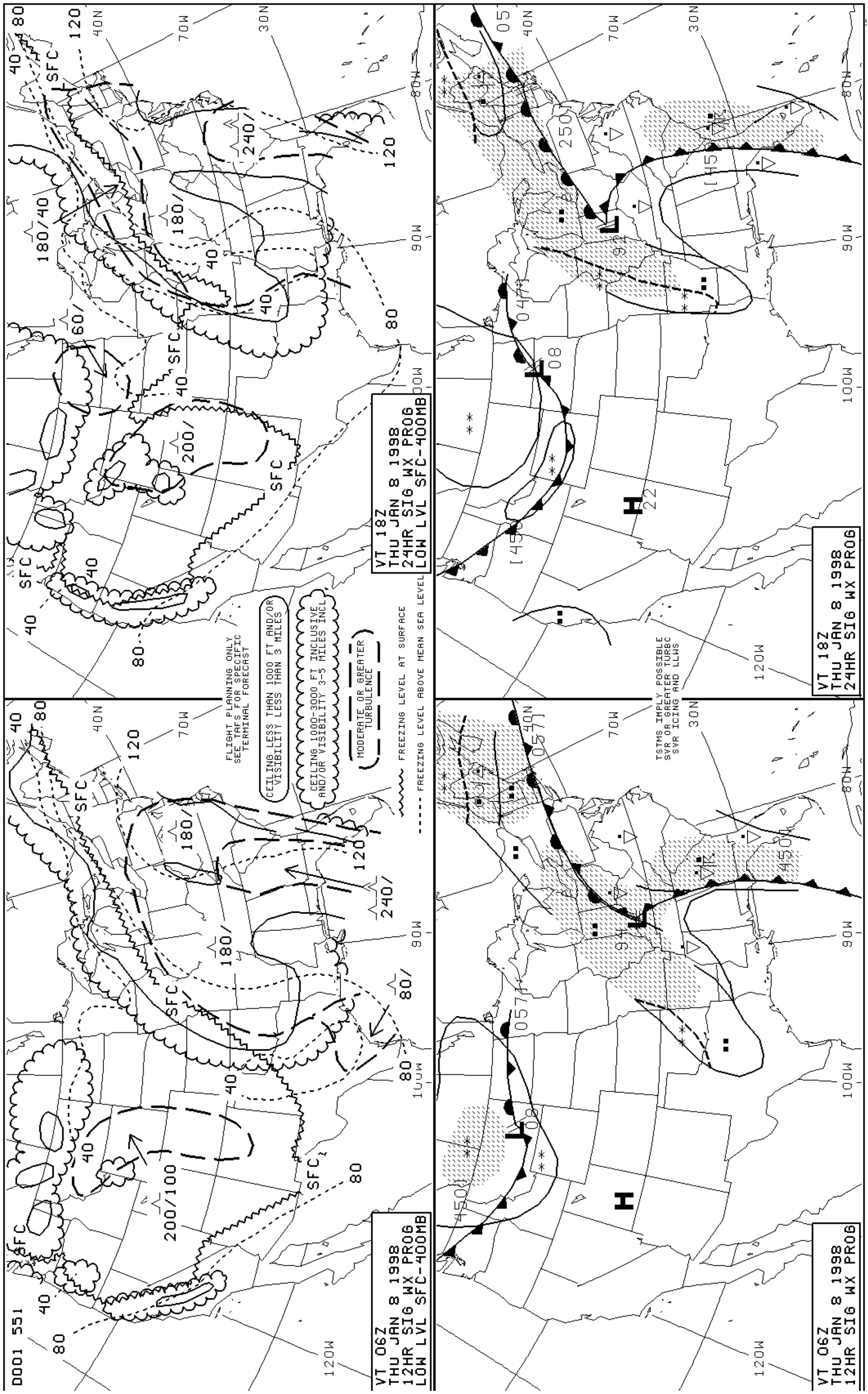
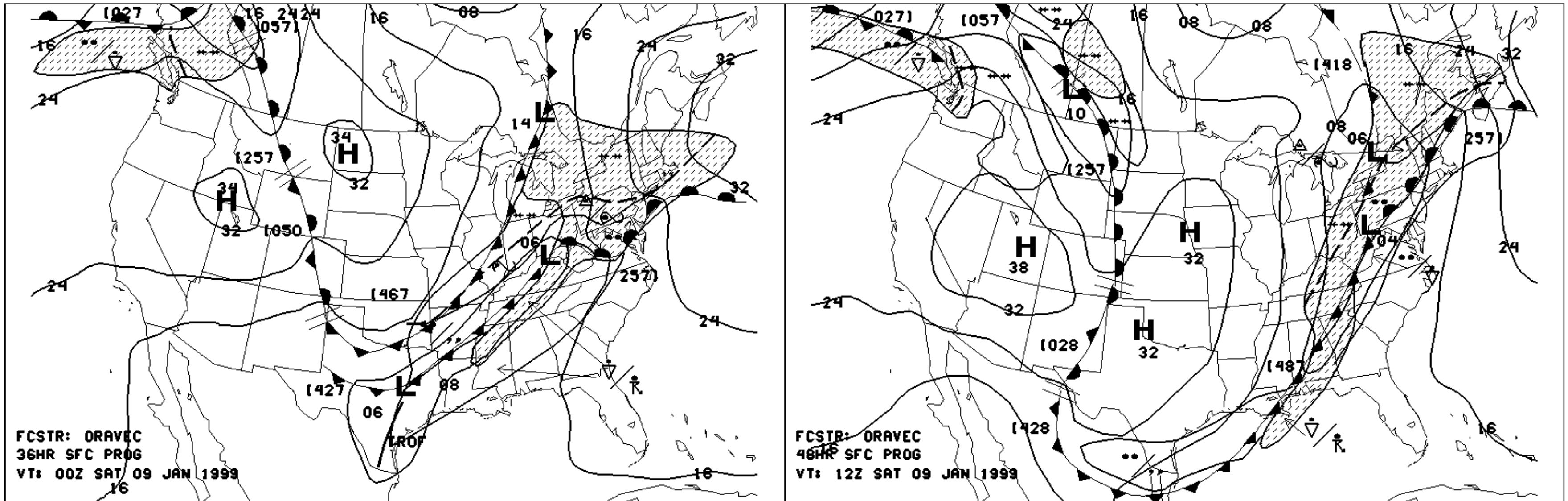


Figure 11-1. U.S. Low-Level Significant Weather Prog.



NCEP PROGNOSTIC DISCUSSION FROM 1200Z THU JAN 07 1999
HYDROMETEOROLOGICAL PREDICTION CENTER...NWS...CAMP SPRINGS MD
REF 12 TO 48 HR MANUAL GRAPHICS

THE LATEST MODEL RUNS ARE IN GOOD AGRMNT WITH THE OVERALL TREND OF AMPLIFICATION TO THE BROAD CYCLONIC FLOW ACRS THE U.S. AS THE UPR RIDGE BUILDS OVR THE NERN PAC AND A DOWNSTREAM TROF AMPLIFIES OVR THE MS VALLEY. THERE ARE...HOWEVER...SOME FAIRLY SGFNT DIFFS WITH THE DETAILS OF THIS AMPLIFICATION AND THE ASSOC SFC FEATURES. ATTM...WE PREFER THE NGM/AVN SOLN WHICH IS FCSTG A SLIGHTLY MORE AMPLIFIED TROF DIGGING SEWD BY EARLY SAT INTO THE MID MS VALLEY GIVEN THE AMPLITUDE OF THE UPSTREAM NERN PAC UPR RIDGE. IN ADDITION...THE ETA HAS SHOWN SOME PROBLEMS THIS YEAR IN SIMILAR FLOW REGIMES IN NOT FCSTG ENOUGH AMPLIFICATION TO DIGGING VORTS. THE SENSIBLE WX EFFECTS FROM THIS MORE AMPLIFIED SOLN WOULD BE A SLOWER EWD PUSH TO THE MAIN N-S BAROCLINIC BNDRY STRENGTHENING OVR THE OH VALLEY FRI INTO SAT THAN THE ETA IS SUGGESTING. THIS MORE AMPLIFIED UPR TROF SHOULD ALSO SUPPORT INCREASED POST FRONTAL PCPN DEVELOPING OVR THE MID MS VALLEY LATE FRI AND SPREADING NEWD INTO THE OH VALLEY BY EARLY FRI. THIS POST FRONTAL PCPN WL LIKELY BE CHANGING FROM RAIN TO SNOW AS THE TROF AMPLIFIES AND PULLS IN COLDER AIR WITH POSSIBLE ACCUMULATIONS IN THE 3 TO 6" RANGE. ACCUMULATING SNOWS ALSO LIKELY TO SPREAD NEWD TONIGHT THRU THE CNTRL APPALACHIANS AND INTO THE MID ATL AND NERN U.S. ON FRI IN ASSOC WITH A LEAD AREA OF WARM ADVECTION PUSHING NEWD AHEAD OF THE AMPLIFYING UPSTREAM TROF. A CHANGE OVER TO A MIX BAG OF PCPN IS LIKELY ACRS NEARLY ALL OF THE NERN U.S. FRI INTO SAT AS WARMER AIR WL STREAM NEWD AHEAD OF THE UPSTREAM AMPLIFYING TROF. ACRS THE LOWER MS VALLEY/CNTRL GULF COAST...LOCALLY HVY RAINS WL LIKELY CONT INTO AT LEAST TONIGHT ALONG A STNRY FRONTAL BNDRY ACRS THIS REGION. FRONTAL CONVECTION SHOULD THEN SPREAD NEWD INTO THE TN VALLEY FRI INTO SAT AS LOW TO MID LEVEL DYNAMICS STRENGTHEN ALONG THE AFOREMENTIONED N-S STRENGTHENING FRONTAL BNDRY. ACRS THE MID SECTION OF THE NATION...A REINFORCING SHOT OF ARCTIC AIR WL CONT TO PUSH QUICKLY SWD INTO THE NRN PLAINS TONIGHT AND THEN SWD ACRS THE REMAINDER OF THE PLAINS FRI INTO SAT. POST FRONTAL LIGHT SNOWS LIKELY IN THE ARCTIC AIR ACRS THE NRN PLAINS FROM TONIGHT INTO EARLY SAT. ADDITIONAL LIGHT SNOWS MAY STREAK SEWD INTO THE NRN PLAINS ON SAT AHEAD OF A DEVELOPING ALBERTA CLIPPER PUSHING SEWD ALONG THE ARCTIC FRONT. TRANQUIL WX FOR THE GTBASIN AND W THIS PERIOD AS SFC HIGH PRESSURE BUILDS IN RESPONSE TO THE UPSTREAM AMPLIFYING RIDGE. THIS GTBASIN SFC RIDGE WL STRENGTHEN THE SANTA ANA'S ACRS SRN CA BY SAT WITH HIGH WINDS POSSIBLE.
ORAVEC/FORECAST OPERATIONS BRANCH
(*PLEASE NOTE*: THE HPC WEB ADDRESS HAS CHANGED: GRAPHICS ARE NOW

Figure 11-2. U.S. Low-Level 36- and 48-hour Significant Weather Prog.

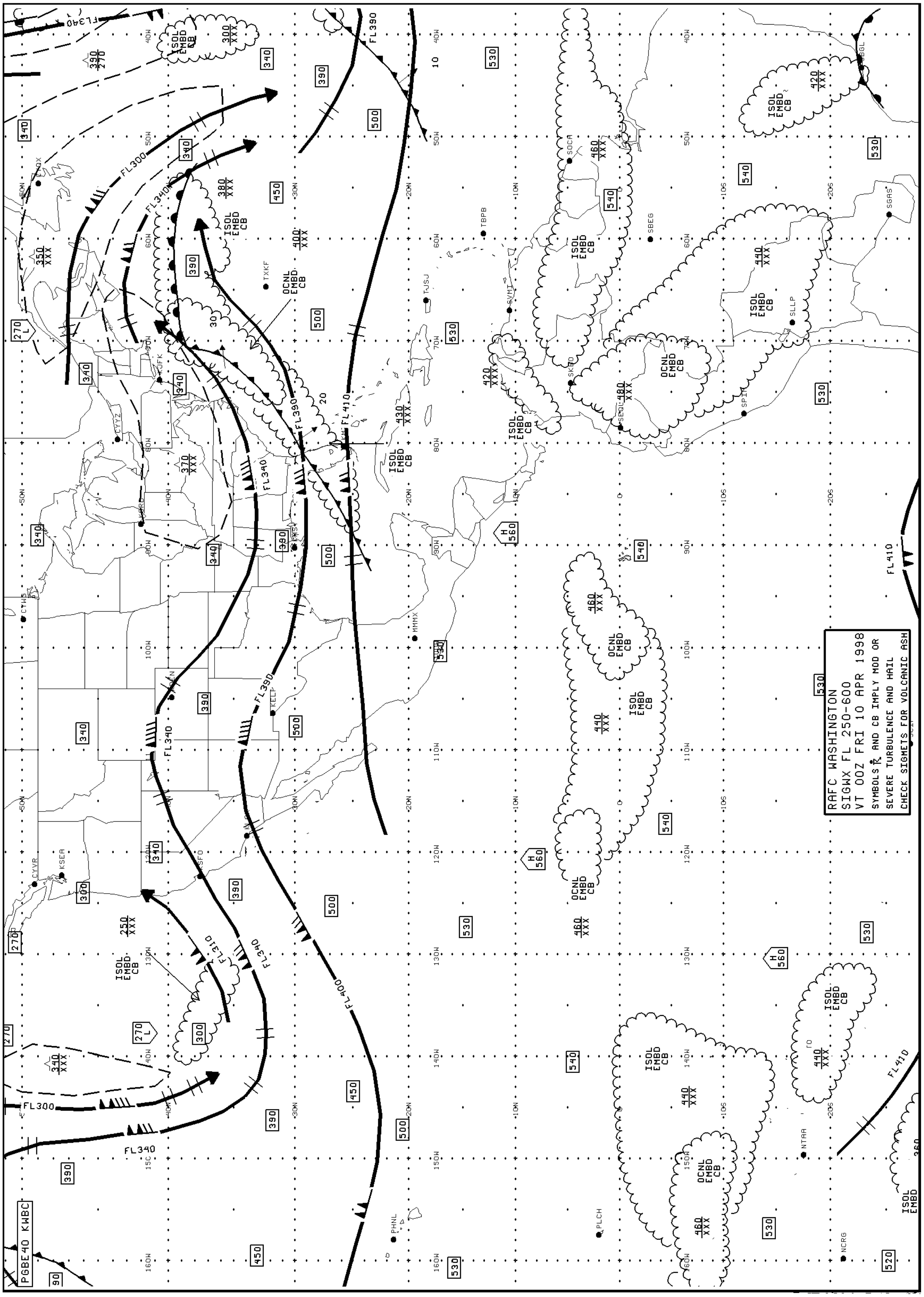


Figure 11-3. U.S. High-Level Significant Weather Prog.

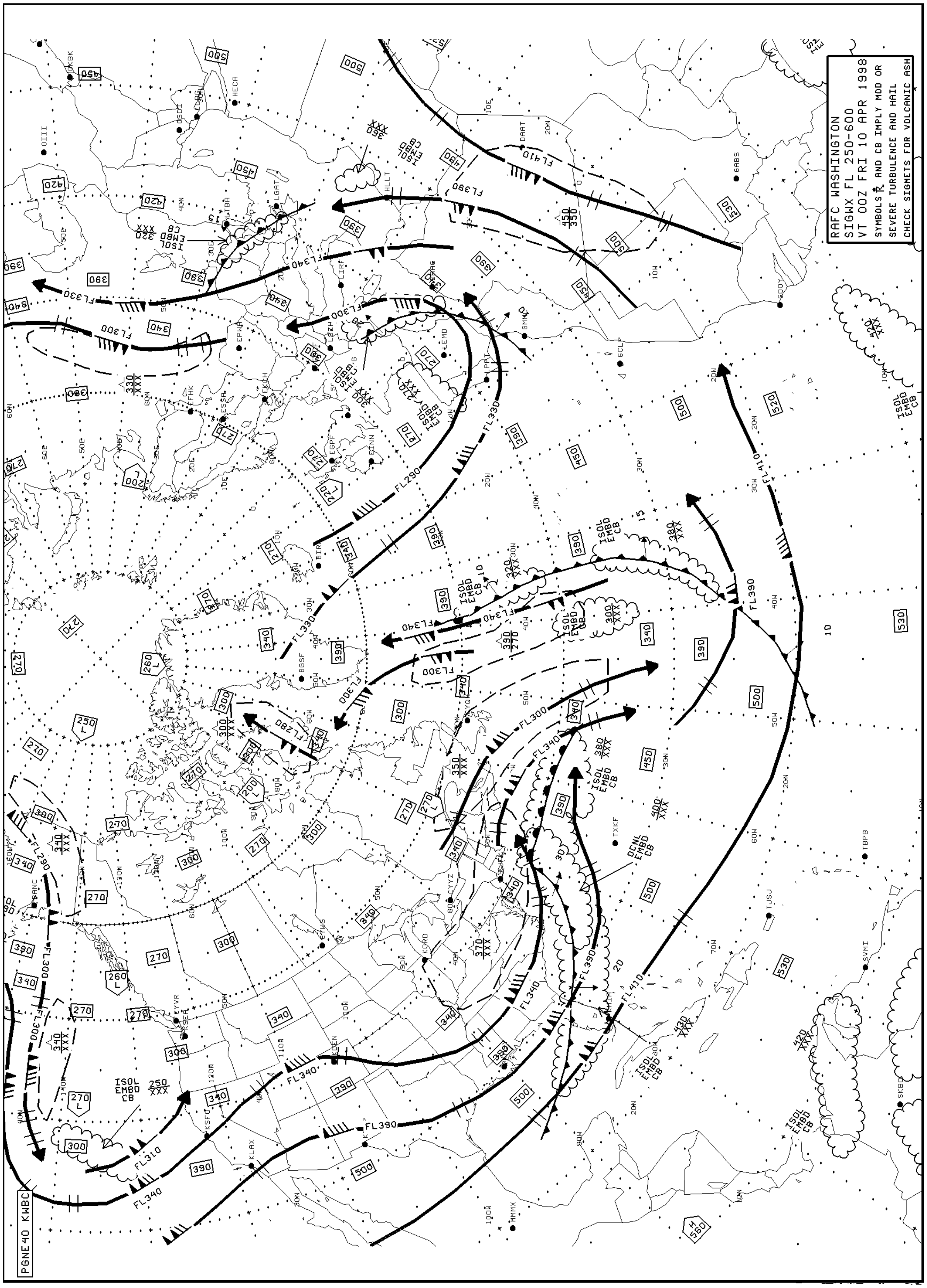


Figure 11-4. International High-Level Significant Weather Prog.

Section 12
CONVECTIVE OUTLOOK CHART

The convective outlook chart (Figure 12-1) delineates areas forecast to have thunderstorms. This chart is presented in two panels. The left-hand panel is the Day 1 Convective Outlook, and the right-hand panel is the Day 2 Convective Outlook. These guidance products are produced at the Storm Prediction Center (SPC) in Norman, OK.

DAY 1 CONVECTIVE OUTLOOK

The Day 1 Convective Outlook (Figure 12-1) outlines areas in the continental United States where thunderstorms are forecasted during the Day 1 period. It is issued five times daily. The first issuance is 06Z and is the initial Day 1 Convective Outlook that is valid 12Z that day until 12Z the following day. The other issuances are 1300Z, 1630Z, 2000Z, and 0100Z, and all issuances are valid until 12Z the following day.

The outlook issued qualifies the level of risk (i.e., SLGT, MDT, HIGH) as well as the areas of general thunderstorms.

DAY 2 CONVECTIVE OUTLOOK

The Day 2 Convective Outlook contains the same information as the Day 1 Convective Outlook. It is issued twice a day. It is initially issued at 0830Z during standard time and 0730Z during daylight time. It is updated at 1730Z. The timeframe covered is from 12Z the following day to 12Z the next day. For example, if today is Monday, the Day 2 Convective Outlook will cover the period 12Z Tuesday to 12Z Wednesday.

The outlook issued qualifies the level of risk (i.e., SLGT, MDT, HIGH) as well as the areas of general thunderstorms.

LEVELS OF RISK

Risk areas come in three varieties and are based on the expected number of severe thunderstorm reports per geographical unit and forecaster confidence. Table 12-1 indicates the labels that appear on both the Day 1 and Day 2 Convective Outlook charts.

Table 12-1 Notations of Risk

NOTATION	EXPLANATION
SEE TEXT	**Used for those situations where a SLGT risk was considered but at the time of the forecast, was not warranted.**
SLGT (Slight risk)	**A high probability of 5 to 29 reports of 1 inch or larger hail, and/or 3-5 tornadoes, and/or 5 to 29 wind events,…or…a low/moderate probability of moderate to high risk being issued later if some conditions come together**
MDT (Moderate risk)	**A high probability of at least 30 reports of hail 1 inch or larger; or 6-19 tornadoes; or numerous wind events (30).**
HIGH (High risk)	**A high probability of at least 20 tornadoes with at least two of them rated F3 (or higher), or an extreme derecho causing widespread (50 or more) wind events with numerous higher-end wind (80 mph or higher) and structural damage reports**

SEE TEXT is used for those situations where a slight risk was considered, but at the time of the forecast, was not warranted. Although there is no severe outlook for the labeled area, users should read the text of the convective outlook (AC) forecast message to learn more about the potential for a threat to develop if some particular conditions do come together.

Slight (SLGT) risk implies well-organized severe thunderstorms are expected but in small numbers and/or low coverage.

Moderate (MDT) risks imply a greater concentration of severe thunderstorms, and in most situations, greater magnitude of severe weather.

High (HIGH) risk almost always means a major severe weather outbreak is expected, with great coverage of severe weather and enhanced likelihood of extreme severe events (i.e., violent tornadoes or unusually intense damaging wind events). SPC issues a public information statement (PWO) describing a "particularly dangerous situation" when HIGH risk areas are in effect, and it sometimes issues a PWO for MDT risk situations. Some National Weather Service (NWS) offices will include in their public forecasts the phrase "some thunderstorms may be severe" when a MDT or HIGH risk is issued.

In addition to the severe risk areas, general thunderstorms (non-severe) are outlined, but with no label on the graphic map.

USING THE CHART

The Day 1 and Day 2 Convective Outlooks Charts are flight planning tools used to determine forecast areas of thunderstorms.

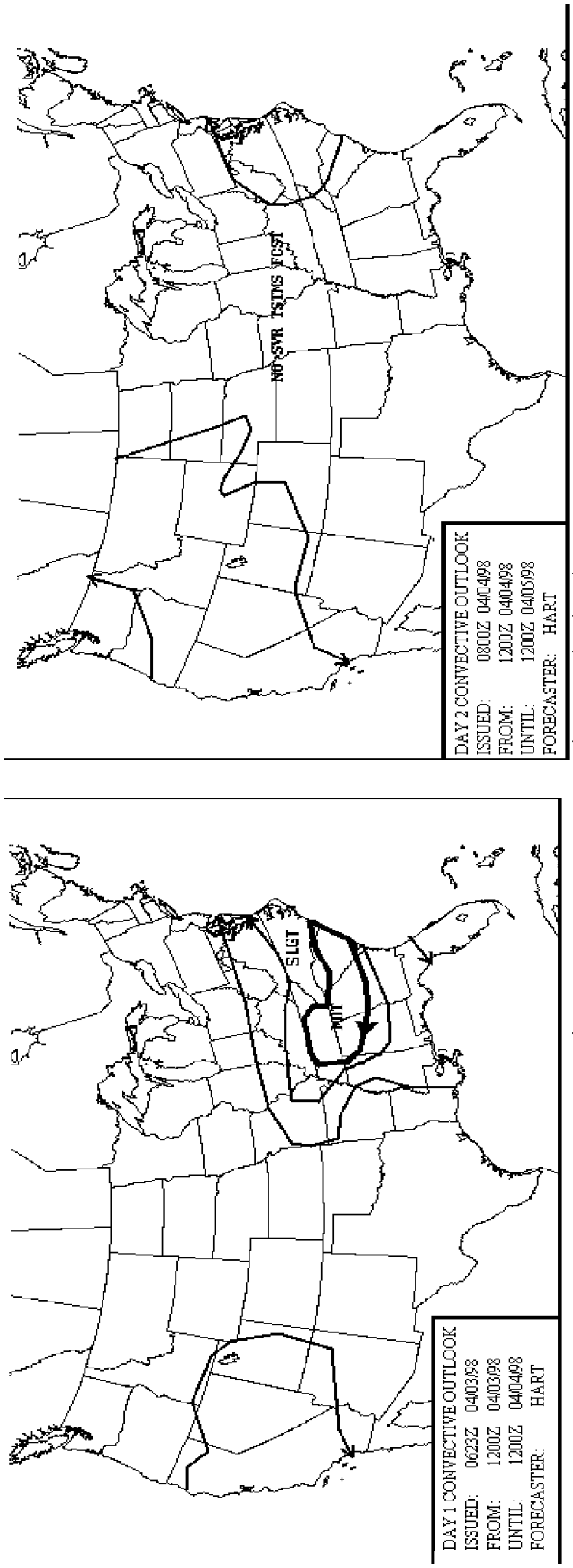


Figure 12-1. Severe Weather Outlook Chart.

Section 13
VOLCANIC ASH ADVISORY CENTER (VAAC) PRODUCTS

The Volcanic Ash Advisory Center (VAAC) may issue two products when there is a volcanic eruption: the Volcanic Ash Advisory Statement (VAAS) and forecast charts of ash dispersion. The U.S. VAACs are the AAWU in Anchorage, Alaska, and the Washington, D.C. VAAC located in Camp Springs, Maryland. Other international centers contribute to the tracking of volcanic ash events. The VAACs do not issue routine products but create and issue them when a volcanic eruption occurs. The products are based on information from PIREPs, MWO SIGMETs, satellite observations, and volcanic observatory reports. Since the products are triggered by the occurrence of an eruption, pilot reports concerning volcanic activity are extremely important.

VOLCANIC ASH ADVISORY STATEMENT (VAAS)

Usually the first VAAC product to be issued is the Volcanic Ash Advisory Statement(VAAS). The VAAS is required to be issued within 6 hours of an eruption and every 6 hours after that. However, it can be issued more frequently if new information about the eruption is received. The VAAS summarizes the currently known information about the eruption. It may include the location of the volcano, height of the volcano summit, height of the ash plume, a latitude/longitude box of the ash dispersion cloud, and a forecast of ash dispersion. The height of the ash cloud is estimated by meteorologists analyzing satellite imagery and satellite cloud drift winds combined with any pilot reports, volcano observatory reports, and upper-air wind reports. The VAASs are transmitted to users via the Global Telecommunications System (GTS), the World Area Forecast System (WAFS), the Aeronautical Fixed Telecommunications Network (AFTN), the FAA communications system (WMWCR), and the NWS Family of Services. In addition, VAASs are available on several Internet sites listed on the last page of this document.

Example of a VAAS:
FVAK20 PANC 190323
VOLCANIC ASH ADVISORY - ALERT
ALASKA AVIATION WEATHER UNIT
NATIONAL WEATHER SERVICE ANCHORAGE AK
ISSUED 0300 UTC SUNDAY JULY 19 1998 BY ANCHORAGE VAAC

VOLCANO: KARYMSKY (1000-13) 98-01
KAMCHATKA 54.05N 159.43E 1486 M 4875 FT

SOURCES OF INFORMATION: PILOT REPORT

ERUPTION DETAILS: ERUPTION TO FL100 REPORTED BY PILOT REPORT AT 19/0200 UTC VIA WASHINGTON DC VAAC.

ASH CLOUD DESCRIPTION: N/A

ASH CLOUD TRAJECTORY: NE 10 KT.

12 HOUR OUTLOOK: IF ASH PERSISTS ALOFT AT 12 HOURS THE FORECAST AREA FROM THE PUFF MODEL BELOW 15000FT IS 56N 161E, 55N 166E, 54N 165E, 55N 162E.

ADDITIONAL INFORMATION: NO ERUPTION VISIBLE ON SATELLITE IMAGERY DUE TO CLOUD IN AREA.

THIS WILL BE THE ONLY ADVISORY ISSUED FOR THIS EVENT.

DAC JUL98 AAWU

VOLCANIC ASH FORECAST TRANSPORT AND DISPERSION (VAFTAD) CHART

The Volcanic Ash Forecast Transport and Dispersion (VAFTAD) Chart, Figures 13-1 and 13-2, is generated by a three-dimensional time-dependent dispersion model developed by the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (ARL). The VAFTAD model focuses on hazards to aircraft flight operations caused by a volcanic eruption with an emphasis on the ash cloud location in time and space. It uses National Centers for Environmental Prediction (NCEP) forecast data to determine the location of ash concentrations over 6-hour and 12-hour intervals, with valid times beginning 6, 12, 24, and 36 hours following a volcanic eruption. This computer-prepared chart is not issued on a routine basis, but only as volcanic eruptions are reported. Since the VAFTAD chart is triggered by the occurrence of volcanic eruption, PIREPs concerning volcanic activity are very important. Initial input to the VAFTAD model run and the resulting chart include: geographic region, volcano name, volcano latitude and longitude, eruption date and time, and initial ash cloud height. Utilizing the NCEP meteorological forecast guidance, volcanic ash particle transport and dispersion are depicted horizontally and vertically through representative atmospheric layers. The charts from an actual eruption will be labeled with ALERT. Another possible reason to generate a chart could be for potential volcanic eruption. This chart would be labeled WATCH as shown on Figure 13-1.

VAFTAD PRODUCT

The VAFTAD product presents the relative concentrations of ash following a volcanic eruption for three layers of the atmosphere in addition to a composite of ash concentration through the atmosphere. Atmospheric layers depicted are: surface to flight level (FL) 200, surface to FL550 (composite), FL200 to FL350, and FL350 to FL550. Figure 13-1 shows 8 panels of ash cloud relative concentrations for 12 to 24 hours; and Figure 13-2 shows 18 to 24 hours after a volcanic eruption. Note that the first 6 hours after the volcanic eruption are not depicted. An appropriate SIGMET will be issued by an MWO for that period concerning the volcanic eruption and the area affected by the ash cloud. The four panels in any column are valid for the same time interval (specified and located below the third panel). The top three panels in each column provide the ash location and relative concentrations for an atmospheric layer, identified by top and bottom flight levels. The highest layer is at the top of the chart. Volcano eruption information is given in the legend at the lower left (see Figure 13-1) which includes the volcano name (with location symbol), latitude and longitude, eruption date and time, duration, and ash column height.

USING THE CHART

The VAFTAD chart is strictly for advanced flight planning purposes. It is not intended to take the place of SIGMETs regarding volcanic eruptions and ash.

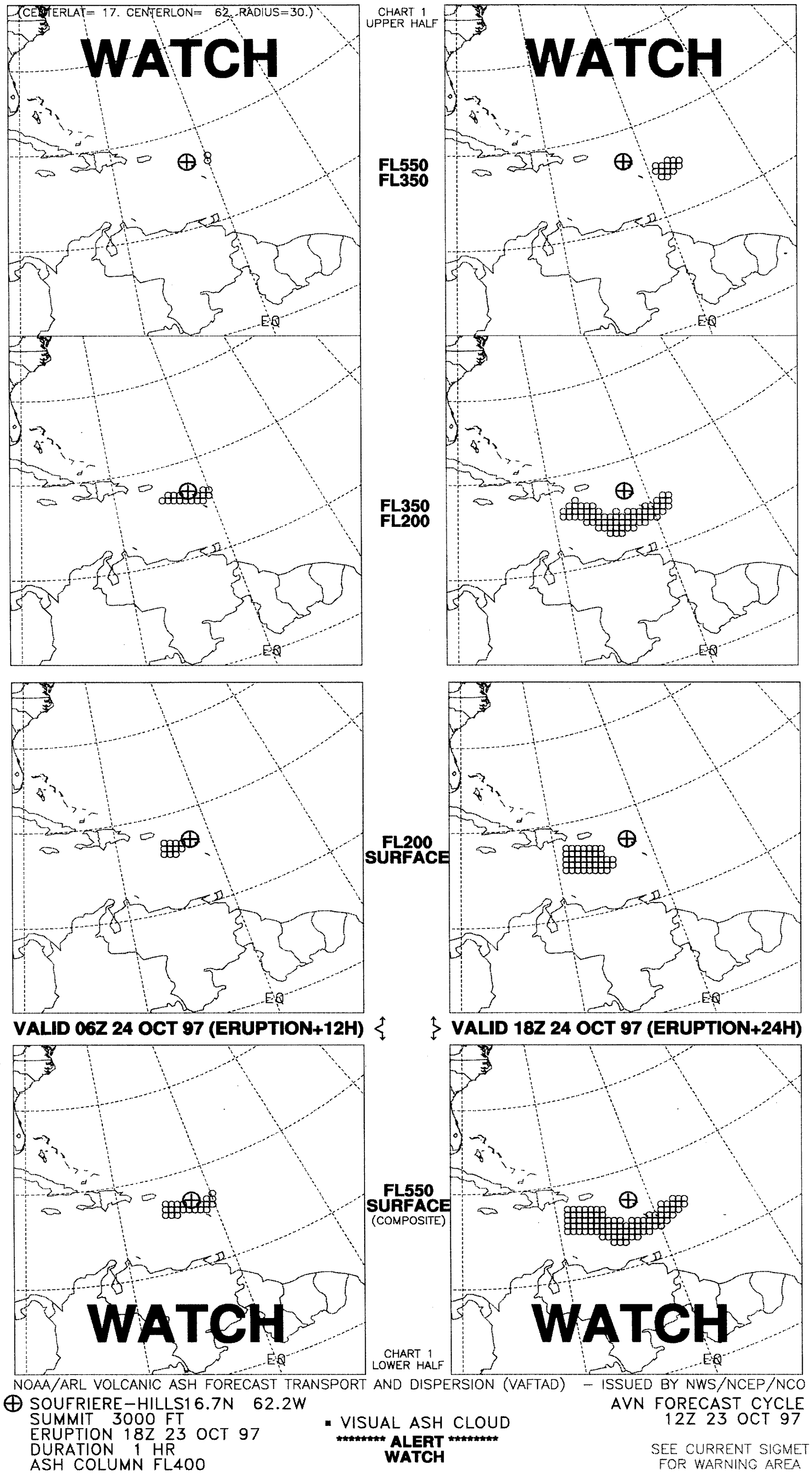


Figure 13-1. Volcanic Ash Forecast Chart.

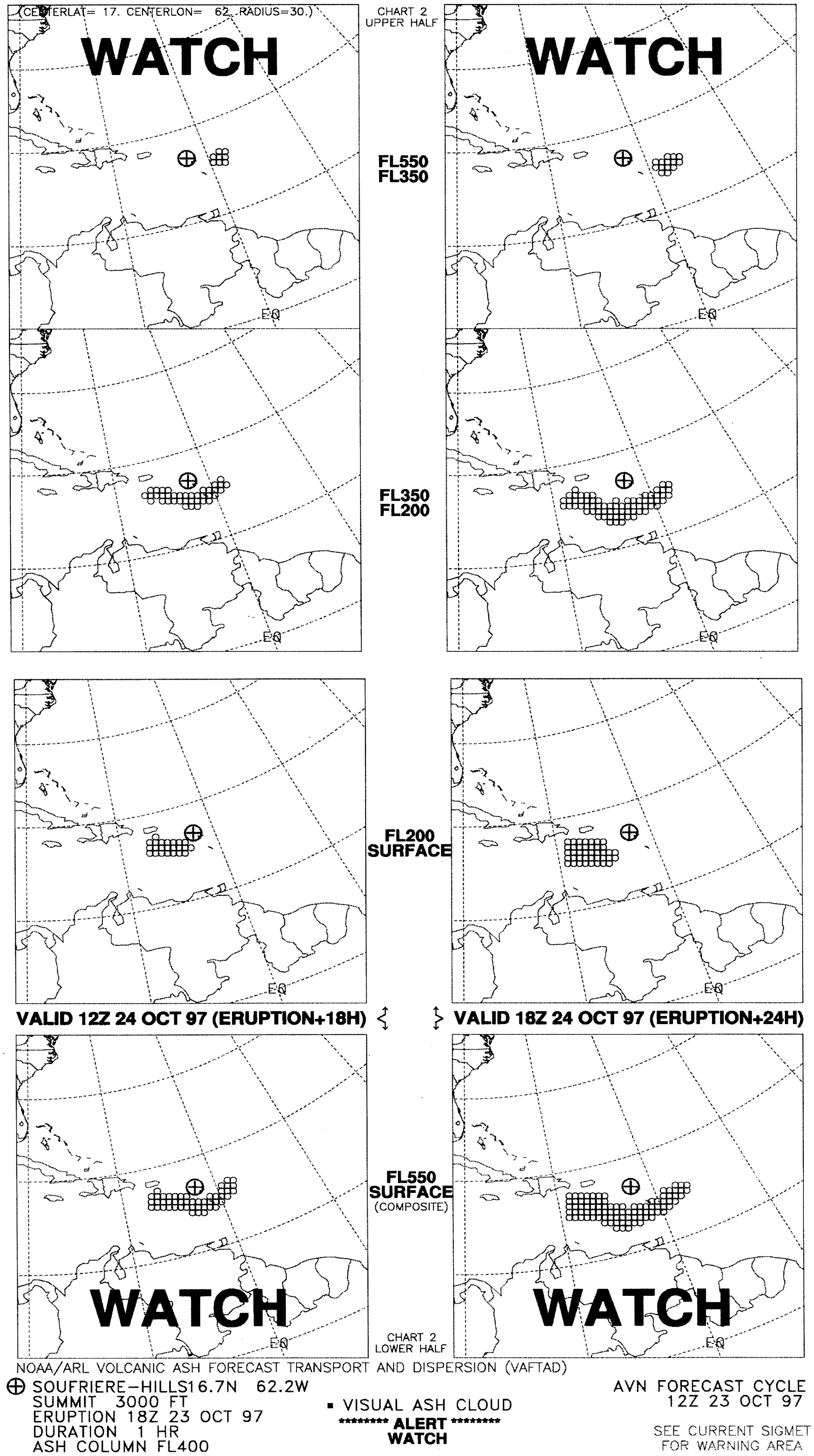


Figure 13-2. Volcanic Ash Forecast Chart.

Section 14
TURBULENCE LOCATIONS, CONVERSION AND DENSITY ALTITUDE TABLES, CONTRACTIONS AND ACRONYMS, SCHEDULE OF PRODUCTS, NATIONAL WEATHER SERVICE STATION IDENTIFIERS, WSR-88D SITES, AND INTERNET ADDRESSES

This section provides text, graphs, and tables that can be used by the pilot to further understand the weather. Information included covers:

1. Locations of probable turbulence
2. Standard conversions table
3. Density altitude and chart
4. Contractions and acronyms
5. Scheduled issuance and valid times of forecast products
6. National Weather Service station identifiers and WSR-88D sites
7. Internet addresses

LOCATIONS OF PROBABLE TURBULENCE

Turbulence occurs due to either terrain features or weather phenomenon which can produce intensities from light to extreme. The type and intensity of the turbulence will depend on the situations as described in the following paragraphs.

LIGHT TURBULENCE

Light turbulence can be caused by obstruction of the wind in hilly or mountainous terrain. Even with light winds, there can be enough displacement of the wind to produce small-scale eddies or turbulence.

Weather conditions that can cause light turbulence are associated with clear-air convective currents over a heated surface or near and in small cumulus clouds. Weak wind shear in the vicinity of troughs aloft, lows aloft, jet streams, or the tropopause can cause light turbulence. Also in the lower 5,000 feet of the atmosphere, light turbulence can occur when winds are near 15 knots or where the air is colder than the underlying surfaces.

MODERATE TURBULENCE

Moderate turbulence will be reported in mountainous areas with a wind component of 25 to 50 knots perpendicular to and near the level of the ridge. The turbulence will be located at all levels from the surface to 5,000 feet above the tropopause. The areas most likely to have moderate turbulence is within 5,000 feet of the ridge level, at the base of relatively stable layers below the base of the tropopause, or within the tropopause layer. The turbulence will extend downstream from the lee of the ridge for 150 to 300 miles.

Also, moderate turbulence can be encountered in and near towering cumuliform clouds and thunderstorms (in the dissipating stage).

Moderate turbulence can occur in the lower 5,000 feet of the troposphere when surface winds are 30 knots or more, where heating of the underlying surface is unusually strong, where there is an invasion of very cold air, or in fronts aloft.

Wind shear in the vertical direction that exceeds 6 knots per 1,000 feet and/or horizontal wind shear that exceeds 18 knots per 150 miles will produce moderate turbulence.

SEVERE TURBULENCE

Severe turbulence is likely in mountainous areas with a wind component exceeding 50 knots perpendicular to and near the level of the ridge. The location of the severe turbulence will be in 5,000-foot layers at and below the ridge level in rotor clouds or rotor action, at the tropopause, and sometimes at the base of other stable layers below the tropopause. The severe turbulence will extend downstream from the lee of the ridge for 50 to 150 miles.

Severe turbulence can be encountered in and near growing and mature thunderstorms and occasionally in other towering cumuliform clouds.

Severe turbulence will also occur 50 to 100 miles on the cold side of the center of the jet stream, in troughs aloft, and in lows aloft where vertical wind shear exceeds 10 knots per 1,000 feet, and horizontal wind shear exceeds 40 knots per 150 miles.

EXTREME TURBULENCE

Extreme turbulence will be found in mountain wave situations. The turbulence will be located in and below the level of well-developed rotor clouds. Sometimes the turbulence extends to the ground.

Besides mountain wave situations, extreme turbulence will occur in severe thunderstorms. A severe thunderstorm is indicated by large hailstones (diameter ¾ inch or greater), strong radar echoes, or continuous lightning.

STANDARD CONVERSION TABLE

This table can be used as a quick reference for conversion between metric and English units.

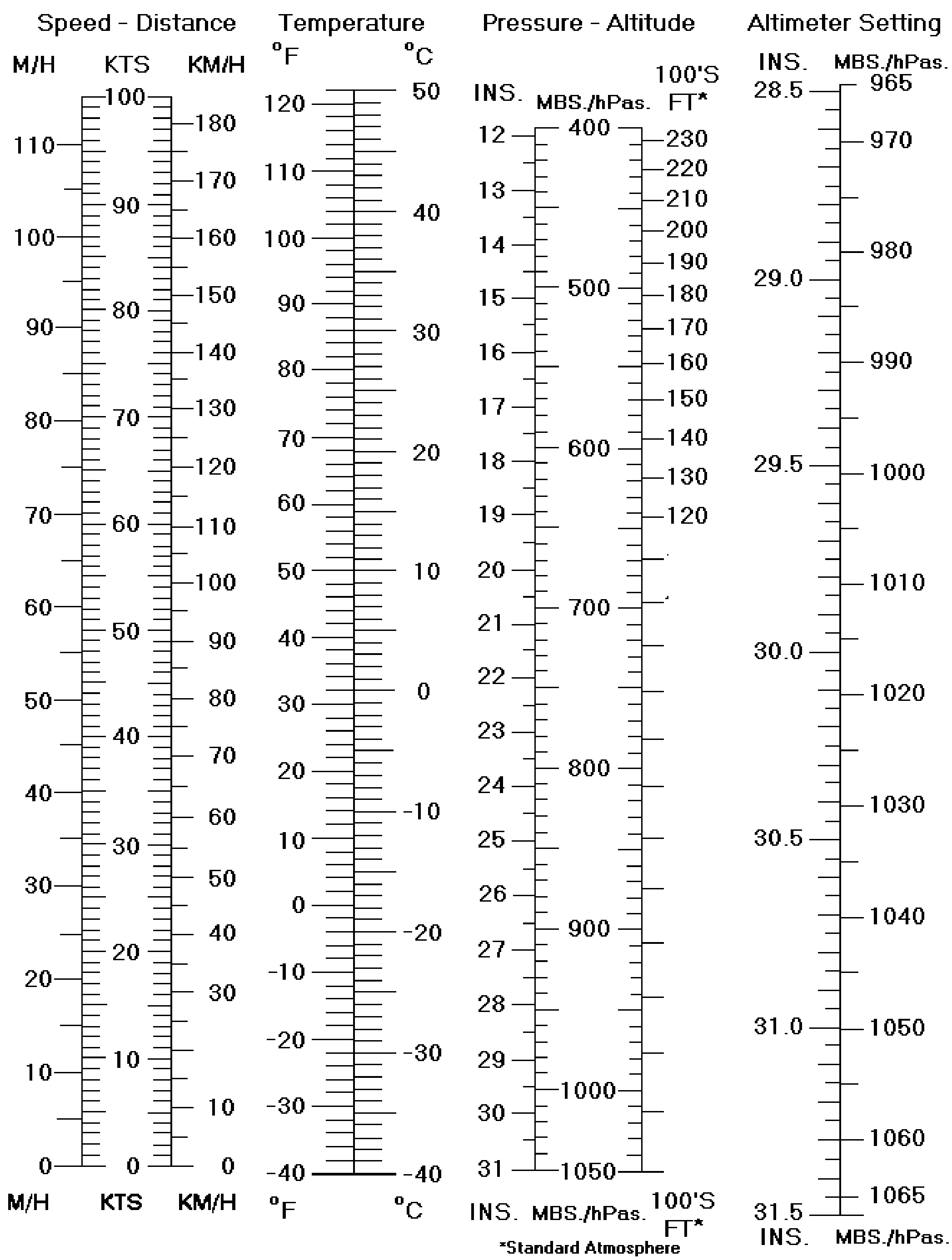


Figure 14-1. Standard Conversion Table.

DENSITY ALTITUDE

Density altitude can affect the takeoff, climb, and landing performance of any aircraft. The distance required to take off and land and the rate of climb are affected by density altitude.

Aircraft will perform better in low density altitude conditions. Low density altitude conditions exist when the air is dense. This occurs when the temperature is cold combined with a high pressure system. The air is the most dense in this situation and the aircraft will perform as if it were at a lower altitude. For example, a plane is at an airport with a station elevation of 7,000 feet MSL. The atmospheric conditions at that airport indicate a low density altitude situation. The density altitude is calculated to be 5,500 feet MSL. The plane will perform as if it were at 5,500 feet MSL instead of 7,000 feet MSL. This low density altitude situation will decrease takeoff and landing roll while increasing the initial rate of climb.

While low density altitude increases aircraft performance, high density altitude can lead to an aircraft accident. High density altitude situations are more prevalent at higher elevations. High temperatures combined with a low pressure system will produce a high density altitude situation. (The air is least dense in this situation.) Airports in mountainous terrain are more susceptible to high density altitude situations because they already have a high station elevation. The combination of a high station elevation, high temperatures, and low pressure will produce a very high density altitude situation. For example, a plane is at an airport with a station elevation of 7,000 feet MSL. Using the values of station elevation, temperature, and pressure, the density altitude is calculated to be 12,000 feet MSL. Any aircraft taking off or landing at that airport will perform as if it were at an airport with a station elevation of 12,000 MSL. For some aircraft, a high density altitude situation will indicate an altitude higher than the service ceiling of that specific aircraft. In that case, if a pilot attempts to take off during a high density situation, the aircraft will not be able to gain altitude but stay in ground effect and possibly crash.

Use Figure 14-2 to find density altitude either on the ground or aloft. Set the aircraft's altimeter at 29.92 inches. The altimeter will indicate pressure altitude. Read the outside air temperature. Enter the graph at the pressure altitude value and move horizontally to the temperature value. Read the density altitude from the sloping lines.

Examples:
Density altitude in flight: Pressure altitude is 9,500 feet and the temperature is -8 degrees C. Find 9,500 feet on the left of the chart and move to -8 degrees C. Density altitude is 9,000 feet. See dot on the chart that is labeled number 1.

Density altitude for takeoff: Pressure altitude is 4,950 feet and the temperature is 97 degrees F. Enter the graph at 4,950 feet and move across to 97 degrees F. Density altitude is 8,200 feet. See dot on the chart that is labeled number 2.

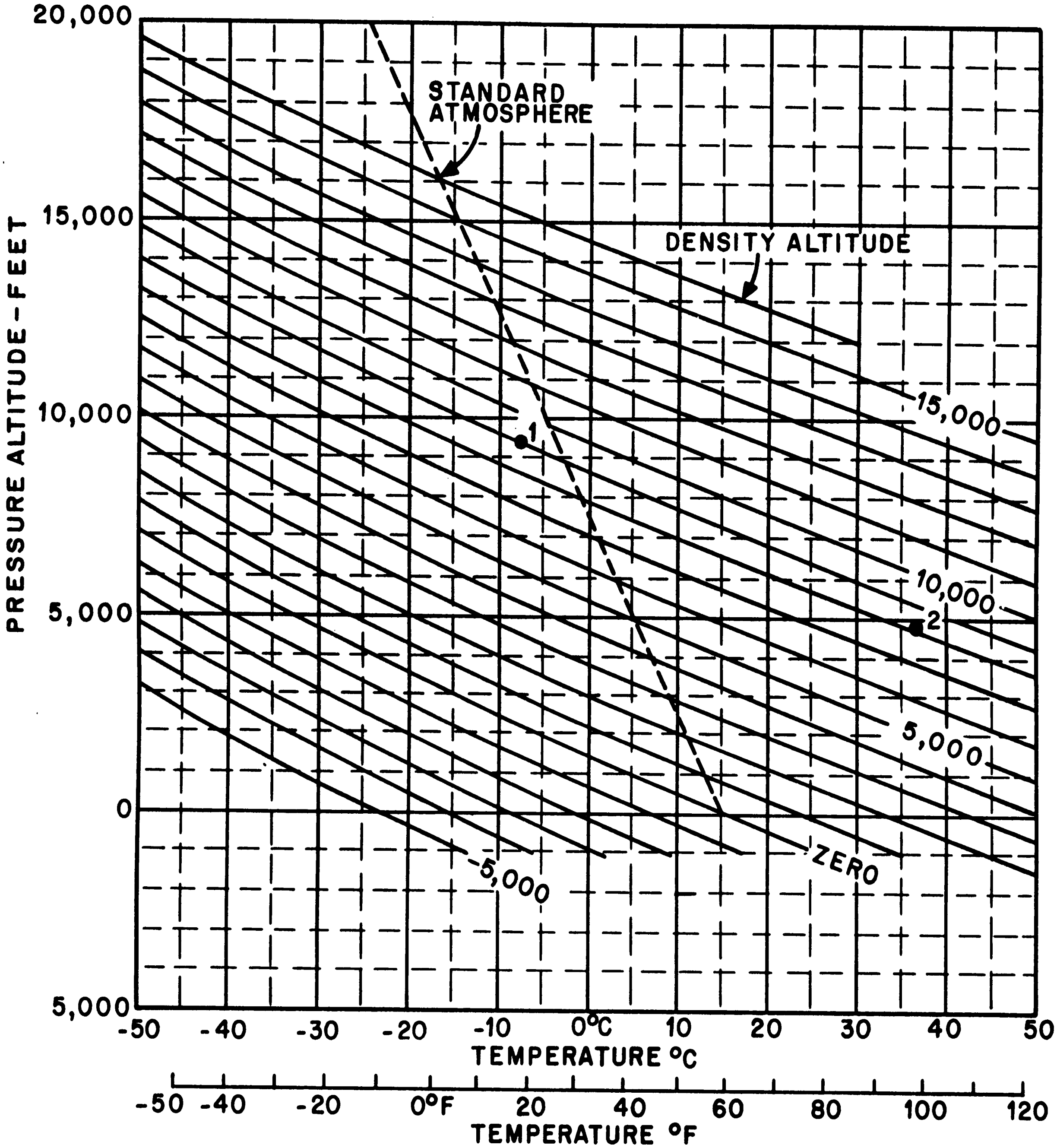


Figure 14-2. Density Altitude Computation Chart.

CONTRACTIONS AND ACRONYMS

Contractions and acronyms are used extensively in surface reports, pilot reports, and forecasts.

A

AAWU – Alaskan Aviation Weather Unit
ABNDT - Abundant
ABNML - Abnormal
ABT - About
ABV - Above
AC - Convective outlook or altocumulus
ACC - Altocumulus castellanus
ACCUM - Accumulate
ACFT - Aircraft
ACLT - Accelerate
ACLTD - Accelerated
ACLTG - Accelerating
ACLTS - Accelerates
ACPY - Accompany
ACRS - Across
ACSL - Altocumulus standing lenticular
ACTV - Active
ACTVTY - Activity
ACYC - Anticyclone
ADJ - Adjacent
ADL - Additional
ADQT - Adequate
ADQTLY - Adequately
ADRNDCK - Adirondack
ADVCT - Advect
ADVCTD - Advected
ADVCTG - Advecting
ADVCTN - Advection
ADVCTS - Advects
ADVN - Advance
ADVNG - Advancing
ADVY - Advisory
ADVYS - Advisories
AFCT - Affect
AFCTD - Affected
AFCTG - Affecting
AFDK - After dark
AFOS - Automated Field Operations System
AFSS - Automated Flight Service Station
AFT - After
AFTN - Afternoon
AGL - Above ground level
AGN - Again
AGRD - Agreed
AGRS - Agrees
AGRMT - Agreement
AHD - Ahead
AK - Alaska
AL - Alabama
ALF - Aloft
ALG - Along
ALGHNY - Allegheny
ALQDS - All quadrants
ALSTG - Altimeter setting
ALT - Altitude
ALTA - Alberta
ALTHO - Although
ALTM - Altimeter
ALUTN - Aleutian
AMD - Amend
AMDD - Amended
AMDG - Amending
AMDT - Amendment
AMP - Amplify
AMPG - Amplifying
AMPLTD - Amplitude
AMS - Air mass
AMT - Amount
ANLYS - Analysis
ANS - Answer
AOA - At or above
AOB - At or below
AP - Anomalous Propagation
APCH - Approach
APCHG - Approaching
APCHS - Approaches
APLCN - Appalachian
APLCNS - Appalachians
APPR - Appear
APPRG - Appearing
APPRS - Appears
APRNT - Apparent
APRNTLY - Apparently
APRX - Approximate
APRXLY - Approximately
AR - Arkansas
ARL – Air Resources Lab
ARND - Around
ARPT - Airport

ASAP - As soon as possible
ASSOCD - Associated
ASSOCN - Association
ATLC - Atlantic
ATTM - At this time
ATTN - Attention
AVBL - Available
AVG - Average
AVN - Aviation model
AWC – Aviation Weather Center
AWT - Awaiting
AZ - Arizona
AZM - Azimuth

B

BACLIN - Baroclinic
BAJA - Baja, California
BATROP - Barotropic
BC - British Columbia
BCH - Beach
BCKG - Backing
BCM - Become
BCMG - Becoming
BCMS - Becomes
BDA - Bermuda
BDRY - Boundary
BFDK - Before dark
BFR - Before
BGN - Begin
BGNG - Beginning
BGNS - Begins
BHND - Behind
BINOVC - Breaks in overcast
BKN - Broken
BLD - Build
BLDG - Building
BLDUP - Buildup
BLKHLS - Black Hills
BLKT - Blanket
BLKTG - Blanketing
BLKTS - Blankets
BLO - Below clouds
BLW - Below
BLZD - Blizzard
BN - Blowing sand
BND - Bound
BNDRY - Boundary
BNDRYS - Boundaries
BNTH - Beneath
BOOTHEEL - Bootheel
BR - Branch
BRF - Brief
BRK - Break
BRKG - Breaking
BRKHIC - Breaks in higher clouds
BRKS - Breaks
BRKSHR - Berkshire
BRM - Barometer
BS - Blowing snow
BTWN - Between
BYD - Beyond

C

C - Celsius
CA - California
CAA - Cold air advection
CARIB - Caribbean
CASCDS - Cascades
CB - Cumulonimbus
CC - Cirrocumulus
CCLDS - Clear of clouds
CCLKWS - Counterclockwise
CCSL - Cirrocumulus standing lenticular
CDFNT - Cold front
CFP - Cold front passage
CHC - Chance
CHCS - Chances
CHG - Change
CHGD - Changed
CHGG - Changing
CHGS - Changes
CHSPK - Chesapeake
CI - Cirrus
CIG - Ceiling
CIGS - Ceilings
CLD - Cloud
CLDNS - Cloudiness
CLDS - Clouds
CLKWS - Clockwise
CLR - Clear
CLRG - Clearing
CLRS - Clears
CMPLX - Complex
CNCL - Cancel
CNCLD - Canceled
CNCLG - Canceling
CNCLS - Cancels
CNDN - Canadian
CNTR - Center
CNTRD - Centered

CNTRL - Central
CNTY - County
CNTYS - Counties
CNVG - Converge
CNVGG - Converging
CNVGNC - Convergence
CNVTN - Convection
CNVTV - Convective
CNVTVLY - Convectively
CONFDC - Confidence
CO - Colorado
COMPR - Compare
COMPRG - Comparing
COMPRD - Compared
COMPRS - Compares
COND - Condition
CONT - Continue
CONTD - Continued
CONTLY - Continually
CONTG - Continuing
CONTRAILS - Condensation trails
CONTS - Continues
CONTDVD - Continental Divide
CONUS - Continental U.S.
COORD - Coordinate
COR - Correction
CPBL - Capable
CRC - Circle
CRLC - Circulate
CRLN - Circulation
CRNR - Corner
CRNRS - Corners
CRS - Course
CS - Cirrostratus
CSDR - Consider
CSDRBL - Considerable
CST - Coast
CSTL - Coastal
CT - Connecticut
CTGY - Category
CTSKLS - Catskills
CU - Cumulus
CUFRA - Cumulus fractus
CVR - Cover
CVRD - Covered
CVRG - Covering
CVRS - Covers
CWSU - Center Weather Service Units
CYC - Cyclonic
CYCLGN - Cyclogenesis

D

DABRK - Daybreak
DALGT - Daylight
DBL - Double
DC - District of Columbia
DCR - Decrease
DCRD - Decreased
DCRG - Decreasing
DCRGLY - Decreasingly
DCRS - Decreases
DE - Delaware
DEG - Degree
DEGS - Degrees
DELMARVA - Delaware-Maryland-Virginia
DFCLT - Difficult
DFCLTY - Difficulty
DFNT - Definite
DFNTLY - Definitely
DFRS - Differs
DFUS - Diffuse
DGNL - Diagonal
DGNLLY - Diagonally
DIGG - Digging
DIR - Direction
DISC - Discontinue
DISCD - Discontinued
DISCG - Discontinuing
DISRE - Disregard
DISRED - Disregarded
DISREG - Disregarding
DKTS - Dakotas
DLA - Delay
DLAD - Delayed
DLT - Delete
DLTD - Deleted
DLTG - Deleting
DLY - Daily
DMG - Damage
DMGD - Damaged
DMGG - Damaging
DMNT - Dominant
DMSH - Diminish
DMSHD - Diminished
DMSHG - Diminishing
DMSHS - Diminishes
DNS - Dense
DNSLP - Downslope
DNSTRM - Downstream
DNWND - Downwind
DP - Deep

DPND - Deepened
DPNG - Deepening
DPNS - Deepens
DPR - Deeper
DPTH - Depth
DRFT - Drift
DRFTD - Drifted
DRFTG - Drifting
DRFTS - Drifts
DRZL - Drizzle
DSCNT - Descent
DSIPT - Dissipate
DSIPTD - Dissipated
DSIPTG - Dissipating
DSIPTN - Dissipation
DSIPTS - Dissipates
DSND - Descend
DSNDG - Descending
DSNDS - Descends
DSNT - Distant
DSTBLZ - Destabilize
DSTBLZD - Destabilized
DSTBLZG - Destabilizing
DSTBLZS - Destabilizes
DSTBLZN - Destabilization
DSTC - Distance
DTRT - Deteriorate
DTRTD - Deteriorated
DTRTG - Deteriorating
DTRTS - Deteriorates
DURC - During climb
DURD - During descent
DURG - During
DURN - Duration
DVLP - Develop
DVLPD - Developed
DVLPG - Developing
DVLPMT - Development
DVLPS - Develops
DVRG - Diverge
DVRGG - Diverging
DVRGNC - Divergence
DVRGS - Diverges
DVV - Downward vertical velocity
DWNDFTS - Downdrafts
DWPNT - Dew point
DWPNTS - Dew points

E

E - East
EBND - Eastbound
EFCT - Effect
ELNGT - Elongate
ELNGTD - Elongated
ELSW - Elsewhere
EMBDD - Embedded
EMERG - Emergency
ENCTR - Encounter
ENDG - Ending
ENE - East-northeast
ENELY - East-northeasterly
ENERN - East-northeastern
ENEWD - East-northeastward
ENHNC - Enhance
ENHNCD - Enhanced
ENHNCG - Enhancing
ENHNCS - Enhances
ENHNCMNT - Enhancement
ENTR - Entire
ERN - Eastern
ERY - Early
ERYR - Earlier
ESE - East-southeast
ESELY - East-southeasterly
ESERN - East-southeastern
ESEWD - East-southeastward
ESNTL - Essential
ESTAB - Establish
EST - Estimate
ETA - Estimated time of arrival or ETA model
ETC - Et cetera
ETIM - Elapsed time
EVE - Evening
EWD - Eastward
EXCLV - Exclusive
EXCLVLY - Exclusively
EXCP - Except
EXPC - Expect
EXPCD - Expected
EXPCG - Expecting
EXTD - Extend
EXTDD - Extended
EXTDG - Extending
EXTDS - Extends
EXTN - Extension
EXTRAP - Extrapolate
EXTRAPD - Extrapolated
EXTRM - Extreme
EXTRMLY - Extremely
EXTSV - Extensive

F

F - Fahrenheit
FA - Aviation area forecast
FAM - Familiar
FCST - Forecast
FCSTD - Forecasted
FCSTG - Forecasting
FCSTR - Forecaster
FCSTS - Forecasts
FIG - Figure
FILG - Filling
FIR – Flight information region
FIRAV - First available
FL - Florida or flight level
FLG - Falling
FLRY - Flurry
FLRYS - Flurries
FLT - Flight
FLW - Follow
FLWG - Following
FM - From
FMT - Format
FNCTN - Function
FNT - Front
FNTL - Frontal
FNTS - Fronts
FNTGNS - Frontogenesis
FNTLYS - Frontolysis
FORNN - Forenoon
FPM - Feet per minute
FQT - Frequent
FQTLY - Frequently
FRM - Form
FRMG - Forming
FRMN - Formation
FROPA - Frontal passage
FROSFC - Frontal surface
FRST - Frost
FRWF - Forecast wind factor
FRZ - Freeze
FRZLVL - Freezing level
FRZN - Frozen
FRZG - Freezing
FT - Feet
FTHR - Further
FVRBL - Favorable
FWD - Forward
FYI - For your information

G

G - Gust
GA - Georgia
GEN - General
GENLY - Generally
GEO - Geographic
GEOREF - Geographical reference
GF - Fog
GICG - Glaze icing
GLFALSK - Gulf of Alaska
GLFCAL - Gulf of California
GLFMEX - Gulf of Mexico
GLFSTLAWR - Gulf of St. Lawrence
GND - Ground
GRAD - Gradient
GRDL - Gradual
GRDLY - Gradually
GRT - Great
GRTLY - Greatly
GRTLKS - Great Lakes
GSTS - Gusts
GSTY - Gusty
GTS – Global Telecommunication System

H

HAZ - Hazard
HDFRZ - Hard freeze
HDSVLY - Hudson Valley
HDWND - Head wind
HGT - Height
HI - High
HI - Hawaii
HIER - Higher
HIFOR - High level forecast
HLF - Half
HLTP - Hilltop
HLSTO - Hailstones
HND - Hundred
HPC – Hydrometeorological Prediction Center
HR - Hour
HRS - Hours
HRZN - Horizon
HTG - Heating
HURCN - Hurricane
HUREP - Hurricane report
HV - Have
HVY - Heavy
HVYR - Heavier
HVYST - Heaviest
HWVR - However

HWY - Highway

I

IA - Iowa
IC - Ice (in PIREPs only)
ICAO - International Civil Aviation Organization
ICG - Icing
ICGIC - Icing in clouds
ICGICIP - Icing in clouds and in precipitation
ICGIP - Icing in precipitation
ID - Idaho
IFR - Instrument flight rules
IL - Illinois
IMDT - Immediate
IMDTLY - Immediately
IMPL - Impulse
IMPLS - Impulses
IMPT - Important
INCL - Include
INCLD - Included
INCLG - Including
INCLS - Includes
INCR - Increase
INCRD - Increased
INCRG - Increasing
INCRGLY - Increasingly
INCRS - Increases
INDC - Indicate
INDCD - Indicated
INDCG - Indicating
INDCS - Indicates
INDEF - Indefinite
INFO - Information
INLD - Inland
INSTBY - Instability
INTCNTL - Intercontinental
INTL - International
INTMD - Intermediate
INTMT - Intermittent
INTMTLY - Intermittently
INTR - Interior
INTRMTRGN - Intermountain region
INTS - Intense
INTSFCN - Intensification
INTSFY - Intensify
INTSFYD - Intensified
INTSFYG - Intensifying
INTSFYS - Intensifies
INTSTY - Intensity
INTVL - Interval
INVRN - Inversion
IOVC - In overcast
INVOF - In vicinity of
IP - Ice pellets
IPV - Improve
IPVG - Improving
ISOL - Isolate
ISOLD - Isolated

J

JCTN - Junction
JTSTR - Jet stream

K

KFRST - Killing frost
KLYR - Smoke layer aloft
KOCTY - Smoke over city
KS - Kansas
KT - Knots
KY - Kentucky

L

LA - Louisiana
LABRDR - Labrador
LAT - Latitude
LAWRS - Limited aviation weather reporting station
LCL - Local
LCLY - Locally
LCTD - Located
LCTN - Location
LCTMP - Little change in temperature
LEVEL - Level
LFTG - Lifting
LGRNG - Long-range
LGT - Light
LGTR - Lighter
LGWV - Long wave
LI - Lifted Index
LIS - Lifted Indices
LK - Lake
LKS - Lakes
LKLY - Likely
LLJ - Low level jet
LLWAS - Low-level wind shear alert system
LLWS - Low-level wind shear
LMTD - Limited

LMTG - Limiting
LMTS - Limits
LN - Line
LO - Low
LONG - Longitude
LONGL - Longitudinal
LRG - Large
LRGLY - Largely
LRGR - Larger
LRGST - Largest
LST - Local standard time
LTD - Limited
LTG - Lightning
LTGCC - Lightning cloud-to-cloud
LTGCG - Lightning cloud-to-ground
LTGCCCG - Lightning cloud-to-cloud cloud-to-ground
LTGCW - Lightning cloud-to-water
LTGIC - Lightning in cloud
LTL - Little
LTLCG - Little change
LTR - Later
LTST - Latest
LV - Leaving
LVL - Level
LVLS - Levels
LWR - Lower
LWRD - Lowered
LWRG - Lowering
LYR - Layer
LYRD - Layered
LYRS - Layers

M

MA - Massachusetts
MAN - Manitoba
MAX - Maximum
MB - Millibars
MCD - Mesoscale discussion
MD - Maryland
MDFY - Modify
MDFYD - Modified
MDFYG - Modifying
MDL - Model
MDLS - Models
MDT - Moderate
MDTLY - Moderately
ME - Maine
MED - Medium
MEGG - Merging
MESO - Mesoscale
MET - Meteorological
METAR - Aviation routine weather report
METRO - Metropolitan
MEX - Mexico
MHKVLY - Mohawk Valley
MI - Michigan
MID - Middle
MIDN - Midnight
MIL - Military
MIN - Minimum
MISG - Missing
MLTLVL - Melting level
MN - Minnesota
MNLD - Mainland
MNLY - Mainly
MO - Missouri
MOGR - Moderate or greater
MOV - Move
MOVD - Moved
MOVG - Moving
MOVMT - Movement
MOVS - Moves
MPH - Miles per hour
MRGL - Marginal
MRGLLY - Marginally
MRNG - Morning
MRTM - Maritime
MS - Mississippi
MSG - Message
MSL - Mean sea level
MST - Most
MSTLY - Mostly
MSTR - Moisture
MT - Montana
MTN - Mountain
MTNS - Mountains
MULT - Multiple
MULTILVL - Multilevel
MWO – Meteorological Watch Office
MXD - Mixed

N

N - North
NAB - Not above
NAT - North Atlantic
NATL - National
NAV - Navigation
NB - New Brunswick

NBND - Northbound
NBRHD - Neighborhood
NC - North Carolina
NCEP - National Center of Environmental Prediction
NCO – NCEP Central Operations
NCWX - No change in weather
ND - North Dakota
NE - Northeast
NEB - Nebraska
NEC - Necessary
NEG - Negative
NEGLY - Negatively
NELY - Northeasterly
NERN - Northeastern
NEWD - Northeastward
NEW ENG - New England
NFLD - Newfoundland
NGM - Nested grid model
NGT - Night
NH - New Hampshire
NIL - None
NJ - New Jersey
NL - No layers
NLT - Not later than
NLY - Northerly
NM - New Mexico
NMBR - Number
NMBRS - Numbers
NML - Normal
NMRS - Numerous
NNE - North-northeast
NNELY - North-northeasterly
NNERN - North-northeastern
NNEWD - North-northeastward
NNW - North-northwest
NNWLY - North-northwesterly
NNWRN - North-northwestern
NNWWD - North-northwestward
NNNN - End of message
NOAA - National Oceanic and Atmospheric Administration
NOPAC - Northern Pacific
NPRS - Nonpersistent
NR - Near
NRLY - Nearly
NRN - Northern
NRW - Narrow
NS - Nova Scotia
NTFY - Notify
NTFYD - Notified
NV - Nevada
NVA - Negative vorticity advection
NW - Northwest
NWD - Northward
NWLY - Northwesterly
NWRN - Northwestern
NWS - National Weather Service
NY - New York
NXT - Next

O

OAT - Outside air temperature
OBND - Outbound
OBS - Observation
OBSC - Obscure
OBSCD - Obscured
OBSCG - Obscuring
OCFNT - Occluded front
OCLD - Occlude
OCLDS - Occludes
OCLDD - Occluded
OCLDG - Occluding
OCLN - Occlusion
OCNL - Occasional
OCNLY - Occasionally
OCR - Occur
OCRD - Occurred
OCRG - Occurring
OCRS - Occurs
OFC - Office
OFP - Occluded frontal passage
OFSHR - Offshore
OH - Ohio
OK - Oklahoma
OMTNS - Over mountains
ONSHR - On shore
OR - Oregon
ORGPHC - Orographic
ORIG - Original
OSV - Ocean station vessel
OTLK - Outlook
OTP - On top
OTR - Other
OTRW - Otherwise
OUTFLO - Outflow
OVC - Overcast
OVHD - Overhead
OVNGT - Overnight
OVR - Over
OVRN - Overrun

OVRNG - Overrunning
OVTK - Overtake
OVTKG - Overtaking
OVTKS - Overtakes

P

PA - Pennsylvania
PAC - Pacific
PATWAS - Pilot's automatic telephone weather answering service
PBL - Planetary boundary layer
PCPN - Precipitation
PD - Period
PDMT - Predominant
PEN - Peninsula
PERM - Permanent
PGTSND - Puget Sound
PHYS - Physical
PIBAL - Pilot balloon observation
PIREP - Pilot weather report
PL – Ice pellets
PLNS - Plains
PLS - Please
PLTO - Plateau
PM - Postmeridian
PNHDL - Panhandle
POS - Positive
POSLY - Positively
PPINA - Radar weather report not available
PPINE - Radar weather report no echoes observed
PPSN - Present position
PRBL - Probable
PRBLY - Probably
PRBLTY - Probability
PRECD - Precede
PRECDD - Preceded
PRECDG - Preceding
PRECDS - Precedes
PRES - Pressure
PRESFR - Pressure falling rapidly
PRESRR - Pressure rising rapidly
PRIM - Primary
PRIN - Principal
PRIND - Present indications are
PRJMP - Pressure jump
PROB - Probability
PROC - Procedure
PROD - Produce
PRODG - Producing
PROG - Forecast
PROGD - Forecasted
PROGS - Forecasts
PRSNT - Present
PRSNTLY - Presently
PRST - Persist
PRSTS - Persists
PRSTNC - Persistence
PRSTNT - Persistent
PRVD - Provide
PRVDD - Provided
PRVDG - Providing
PRVDS - Provides
PS - Plus
PSBL - Possible
PSBLY - Possibly
PSBLTY - Possibility
PSG - Passage
PSN - Position
PSND - Positioned
PTCHY - Patchy
PTLY - Partly
PTNL - Potential
PTNLY - Potentially
PTNS - Portions
PUGET - Puget Sound
PVA - Positive vorticity advection
PVL - Prevail
PVLD - Prevailed
PVLG - Prevailing
PVLS - Prevails
PVLT - Prevalent
PWB - Pilot weather briefing
PWR - Power

Q

QN - Question
QSTNRY - Quasistationary
QTR - Quarter
QUAD - Quadrant
QUE - Quebec

R

R - Rain
RADAT - Radiosonde additional data
RAOB - Radiosonde observation
RCH - Reach

RCHD - Reached
RCHG - Reaching
RCHS - Reaches
RCKY - Rocky
RCKYS - Rockies
RCMD - Recommend
RCMDD - Recommended
RCMDG - Recommending
RCMDS - Recommends
RCRD - Record
RCRDS - Records
RCV - Receive
RCVD - Received
RCVG - Receiving
RCVS - Receives
RDC - Reduce
RDGG - Ridging
RDVLP - Redevelop
RDVLPG - Redeveloping
RDVLPMT - Redevelopment
RE - Regard
RECON - Reconnaissance
REF - Reference
RES - Reserve
REPL - Replace
REPLD - Replaced
REPLG - Replacing
REPLS - Replaces
REQ - Request
REQS - Requests
REQSTD - Requested
RESP - Response
RESTR - Restrict
RGD - Ragged
RGL - Regional model
RGLR - Regular
RGN - Region
RGNS - Regions
RGT - Right
RH - Relative humidity
RI - Rhode Island
RIOGD - Rio Grande
RLBL - Reliable
RLTV - Relative
RLTVLY - Relatively
RMK - Remark
RMN - Remain
RMND - Remained
RMNDR - Remainder
RMNG - Remaining
RMNS - Remains
RNFL - Rainfall
ROT - Rotate
ROTD - Rotated
ROTG - Rotating
ROTS - Rotates
RPD - Rapid
RPDLY - Rapidly
RPLC - Replace
RPLCD - Replaced
RPLCG - Replacing
RPLCS - Replaces
RPRT - Report
RPRTD - Reported
RPRTG - Reporting
RPRTS - Reports
RPT - Repeat
RPTG - Repeating
RPTS - Repeats
RQR - Require
RQRD - Required
RQRG - Requiring
RQRS - Requires
RSG - Rising
RSN - Reason
RSNG - Reasoning
RSNS - Reasons
RSTR - Restrict
RSTRD - Restricted
RSTRG - Restricting
RSTRS - Restricts
RTRN - Return
RTRND - Returned
RTRNG - Returning
RTRNS - Returns
RUF - Rough
RUFLY - Roughly
RVS - Revise
RVSD - Revised
RVSG - Revising
RVSS - Revises
RWY - Runway

S

S - South
SAB – Satellite Analysis Branch
SASK - Saskatchewan
SATFY - Satisfactory
SBND - Southbound
SBSD - Subside

SBSDD - Subsided
SBSDNC - Subsidence
SBSDS - Subsides
SC - South Carolina or stratocumulus
SCND - Second
SCNDRY - Secondary
SCSL -Stratocumulus standing lenticular
SCT - Scatter
SCTD - Scattered
SCTR - Sector
SD - South Dakota
SE - Southeast
SEC - Second
SELY - Southeasterly
SEPN - Separation
SEQ - Sequence
SERN - Southeastern
SEV - Severe
SEWD -Southeastward
SFC - Surface
SG - Snow grains
SGFNT - Significant
SGFNTLY - Significantly
SHFT - Shift
SHFTD - Shifted
SHFTG - Shifting
SHFTS - Shifts
SHLD - Shield
SHLW - Shallow
SHRT - Short
SHRTLY - Shortly
SHRTWV - Shortwave
SHUD - Should
SHWR - Shower
SIERNEV - Sierra Nevada
SIG - Signature
SIGMET - Significant meteorological information
SIMUL - Simultaneous
SKC - Sky clear
SKED - Schedule
SLD - Solid
SLGT - Slight
SLGTLY - Slightly
SLO - Slow
SLOLY - Slowly
SLOR - Slower
SLP - Slope
SLPG - Sloping
SLW - Slow
SLY - Southerly
SM - Statute mile
SML - Small
SMLR - Smaller
SMRY - Summary
SMTH - Smooth
SMTHR - Smoother
SMTHST - Smoothest
SMTM - Sometime
SMWHT - Somewhat
SN - Snow
SNBNK - Snowbank
SNFLK - Snowflake
SNGL - Single
SNOINCR - Snow increase
SNOINCRG - Snow increasing
SNST - Sunset
SOP - Standard operating procedure
SPC – Storm Prediction Center
SPCLY - Especially
SPD - Speed
SPKL - Sprinkle
SPLNS - Southern Plains
SPRD - Spread
SPRDG - Spreading
SPRDS - Spreads
SPRL - Spiral
SQ - Squall
SQLN - Squall line
SR - Sunrise
SRN - Southern
SRND - Surround
SRNDD - Surrounded
SRNDG - Surrounding
SRNDS - Surrounds
SS - Sunset
SSE - South-southeast
SSELY - South-southeasterly
SSERN - South-southeastern
SSEWD - South-southeastward
SSW - South-southwest
SSWLY - South-southwesterly
SSWRN - South-southwestern
SSWWD - South-southwestward
ST - Stratus
STAGN - Stagnation
STBL - Stable
STBLTY - Stability
STD - Standard
STDY - Steady
STFR - Stratus fractus
STFRM - Stratiform

STG - Strong
STGLY - Strongly
STGR - Stronger
STGST - Strongest
STM - Storm
STMS - Storms
STN - Station
STNRY - Stationary
SUB - Substitute
SUBTRPCL - Subtropical
SUF - Sufficient
SUFLY - Sufficiently
SUG - Suggest
SUGG - Suggesting
SUGS - Suggests
SUP - Supply
SUPG - Supplying
SUPR - Superior
SUPSD - Supersede
SUPSDG - Superseding
SUPSDS - Supersedes
SVG - Serving
SVRL - Several
SW - Southwest
SWD - Southward
SWWD - Southwestward
SWLY - Southwesterly
SWRN - Southwestern
SX - Stability index
SXN - Section
SYNOP - Synoptic
SYNS - Synopsis
SYS - System

T

TAF - Aviation terminal forecast
TCNTL - Transcontinental
TCU - Towering cumulus
TDA - Today
TEMP - Temperature
THK - Thick
THKNG - Thickening
THKNS - Thickness
THKR - Thicker
THKST - Thickest
THN - Thin
THNG - Thinning
THNR - Thinner
THNST - Thinnest
THR - Threshold
THRFTR - Thereafter
THRU - Through
THRUT - Throughout
THSD - Thousand
THTN - Threaten
THTND - Threatened
THTNG - Threatening
THTNS - Threatens
TIL - Until
TMPRY - Temporary
TMPRYLY - Temporarily
TMW - Tomorrow
TN - Tennessee
TNDCY - Tendency
TNDCYS - Tendencies
TNGT - Tonight
TNTV - Tentative
TNTVLY - Tentatively
TOPS - Tops
TOVC - Top of overcast
TPG - Topping
TRBL - Trouble
TRIB - Tributary
TRKG - Tracking
TRML -Terminal
TRMT - Terminate
TRMTD - Terminated
TRMTG - Terminating
TRMTS - Terminates
TRNSP - Transport
TRNSPG - Transporting
TROF - Trough
TROFS - Troughs
TROP - Tropopause
TRPCD - Tropical continental air mass
TRPCL - Tropical
TRRN - Terrain
TRSN - Transition
TS - Thunderstorm
TSFR - Transfer
TSFRD - Transferred
TSFRG - Transferring
TSFRS - Transfers
TSNT - Transient
TURBC - Turbulence
TURBT - Turbulent
TWD - Toward
TWDS - Towards
TWI - Twilight
TWRG - Towering
TX - Texas

U

UA - Pilot weather reports
UDDF - Up- and downdrafts
UN - Unable
UNAVBL - Unavailable
UNEC - Unnecessary
UNKN - Unknown
UNL - Unlimited
UNRELBL - Unreliable
UNRSTD - Unrestricted
UNSATFY - Unsatisfactory
UNSBL - Unseasonable
UNSTBL - Unstable
UNSTDY - Unsteady
UNSTL - Unsettle
UNSTLD - Unsettled
UNUSBL - Unusable
UPDFTS - Updrafts
UPR - Upper
UPSLP - Upslope
UPSTRM - Upstream
URG - Urgent
USBL - Usable
UT - Utah
UTC – Universal Time Coordinate
UVV - Upward vertical velocity
UWNDS - Upper winds

V

VA - Virginia
VAAC – Volcanic Ash Advisory Center
VAAS – Volcanic Ash Advisory Statement
VAL - Valley
VARN - Variation
VCNTY - Vicinity
VCOT - VFR conditions on top
VCTR - Vector
VFR - Visual flight rules
VFY - Verify
VFYD - Verified
VFYG - Verifying
VFYS - Verifies
VLCTY - Velocity
VLCTYS - Velocities
VLNT - Violent
VLNTLY - Violently
VMC - Visual meteorological conditions
VOL - Volume
VORT - Vorticity
VR - Veer
VRG - Veering
VRBL - Variable
VRISL - Vancouver Island, BC
VRS - Veers
VRT MOTN - Vertical motion
VRY - Very
VSB - Visible
VSBY - Visibility
VSBYDR - Visibility decreasing rapidly
VSBYIR - Visibility increasing rapidly
VT - Vermont
VV - Vertical velocity

W

W - West
WA - Washington
WAA - Warm air advection
WAFS – Word Area Forecast System
WBND - Westbound
WDLY - Widely
WDSPRD - Widespread
WEA - Weather
WFO - Weather Forecast Office
WFSO - Weather Forecast Service Office
WFP - Warm front passage
WI - Wisconsin
WIBIS - Will be issued
WINT - Winter
WK - Weak
WKDAY - Weekday
WKEND - Weekend
WKNG - Weakening
WKNS - Weakens
WKR - Weaker
WKST - Weakest
WKN - Weaken
WL - Will
WLY - Westerly
WND - Wind
WNDS - Winds
WNW - West-northwest
WNWLY - West-northwesterly
WNWRN - West-northwestern
WNWWD - West-northwestward
WO - Without
WPLTO - Western Plateau

WRM - Warm
WRMG - Warming
WRN - Western
WRMR - Warmer
WRMST - Warmest
WRMFNT - Warm front
WRMFNTL - Warm frontal
WRNG - Warning
WRS - Worse
WS - Wind shear
WSHFT - Windshift
WSFO - Weather Service Forecast Office
WSTCH - Wasatch Range
WSW - West-southwest
WSWLY - West-southwesterly
WSWRN - West-southwestern
WSWWD - West-southwestward
WTR - Water
WTSPT - Waterspout
WUD - Would
WV - West Virginia
WVS - Waves
WW - Severe weather watch
WWD - Westward
WX - Weather
WY - Wyoming

X

XCP - Except
XPC - Expect
XPCD - Expected
XPCG - Expecting
XPCS - Expects
XPLOS - Explosive
XTND - Extend
XTNDD - Extended
XTNDG - Extending
XTRM - Extreme
XTRMLY - Extremely

Y

YDA - Yesterday
YKN - Yukon
YLSTN - Yellowstone

Z

ZN - Zone
ZNS - Zones

SCHEDULED ISSUANCE AND VALID TIMES OF FORECAST PRODUCTS

Table 14-1 shows scheduled issuance and valid times of the TAFs. All times are UTC.

Table 14-1 Scheduled Issuance and Valid Times of TAFs

Scheduled Issuance Times	Valid Period	Transmission Period
00	00-00	2320-2340
06	06-06	0520-0540
12	12-12	1120-1140
18	18-18	1720-1740

The Table 14-2 has scheduled issuance and valid times of the TWEBs. All times are UTC.

Table 14-2 Scheduled Issuance and Valid Times of TWEBs

Scheduled Issuance Times	Valid Period	Transmission Period
02	02-14	0130-0140
08	08-20	0730-0740
14	14-02	1330-1340
20	20-08	1930-1940

Table 14-3 shows the scheduled issuance times of the FAs for their respective areas. The FA is valid 1 hour after issuance time. All times are UTC. The times the FA is issued depends on whether the FA area is in local standard or local daylight time.

Table 14-3 Scheduled Issuance Times of FAs

Area Forecast (FA)	Boston and Miami (LDT/LST)	Chicago and Ft. Worth (LDT/LST)	San Francisco and Salt Lake City (LDT/LST)	Alaska (LDT/LST)	Hawaii
1st issuance	0845/0945	0945/1045	1045/1145	0145/0245	0345
2nd issuance	1745/1845	1845/1945	1945/2045	0745/0845	0945
3rd issuance	0045/0145	0145/0245	0245/0345	1345/1445	1545
4th issuance				1945/2045	2145

Table 14-4 shows the scheduled issuance times of the Gulf of Mexico FA. All times are UTC.

Table 14-4 Scheduled Issuance Times of the Gulf of Mexico FA

Gulf of Mexico FA	Issuance Times (LDT/LST)
1st issuance	1040/1140
2nd issuance	1740/1840

NATIONAL WEATHER SERVICE STATION IDENTIFIERS

NORTHEAST REGION

AKQ - Norfolk/Wakefield, VA
ALY - Albany/East Berne, NY
BGM - Binghamton, NY
BOX - Boston/Taunton, MA
BTV - Burlington, VT
BUF - Buffalo, NY
CLE - Cleveland, OH
CTP - State College, PA
GYX - Portland/Gray, ME
ILN - Cincinnati/Wilmington, OH
LWX - Washington, DC/Sterling, VA
OKX - New York City/Brookhaven, NY
PBZ - Pittsburgh/Coraopolis, PA
PHI - Philadelphia, PA/Mount Holly, NJ
RLX - Charleston/Ruthdale, WV
RNK - Roanoke/Blacksburg, VA

SOUTHCENTRAL REGION

AMA - Amarillo, TX
BMX - Birmingham, AL
BRO - Brownsville, TX
CRP - Corpus Christi, TX
EPZ - El Paso, TX/Santa Theresa, NM
EWX - Austin/San Antonio, TX
FWD - Dallas/Forth Worth, TX
HGX - Houston/Dickinson, TX
JAN - Jackson, MS
LCH - Lake Charles, LA
LIX - New Orleans/Slidell, LA
LUB - Lubbock, TX
LZK - North Little Rock, AR
MAF - Midland, TX
MEG - Memphis/Germantown, TN
MOB - Mobile, MS
MRX - Knoxville/Tri Cities, TN
OHX - Nashville/Old Hickory, TN
OUN - Oklahoma City/Norman, OK
SHV - Shreveport, LA
SJT - San Angelo, TX
TSA - Tulsa, OK

SOUTHEAST REGION

CAE - Columbia, SC
CHS - Charleston, SC
FFC - Atlanta/Peachtree City, GA
GSP - Greenville-Spartanburg/Greer, SC
ILM - Wilmington, NC
JAX - Jacksonville, FL
MFL - Miami, FL
MHX - Morehead City/Newport, NC
MLB - Melbourne, FL
RAH - Raleigh/Durham, NC
TAE - Tallahassee, FL
TBW - Tampa/Ruskin, FL
TJSJ - San Juan, PR

MOUNTAIN REGION

ABQ - Albuquerque, NM
BIL - Billings, MT
BOI - Boise, ID
BOU - Denver/Boulder, CO
CYS - Cheyenne, WY
FGZ - Flagstaff/Bellemont, AZ
GGW - Glasgow, MT
GJT - Grand Junction, CO
LKN - Elko, NV
MSO - Missoula, MT
PIH - Pocatello, ID
PSR - Phoenix, AZ
PUB - Pueblo, CO
REV - Reno, NV
RIW - Riverton, WY
SLC - Salt Lake City, UT
TFX - Great Falls, MT
TWC - Tucson, AZ
VEF - Las Vegas, NV

NORTHCENTRAL REGION

ABR - Aberdeen, SD
APX - Alpena/Gaylord, MI
ARX - La Crosse, WI
BIS - Bismarck, ND
DDC - Dodge City, KS
DLH - Duluth, MN
DMX - Des Moines/Johnston, IA
DTX - Detroit/Pontiac, MI
DVN - Quad Cities/Davenport, IA

FGF - Fargo/Grand Forks, ND
EAX - Kansas City/Pleasant Hill, MO
FSD - Sioux Falls, SD
GID - Hastings, NE
GLD - Goodland, KS
GRB - Green Bay, WI
GRR - Grand Rpaids, MI
ICT - Wichita, KS
ILX - Lincoln, IL
IND - Indianapolis, IN
JKL - Jackson/Noctor, KY
LBF - North Platte, NE
LMK - Louisville, KY
LOT - Chicago/Romeoville, IL
LSX - St Louis, MO
MPX - Minneapolis/Chanhassen, MN
MKX - Milwaukee/Dousman, WI
MQT - Marquette, MI
OAX - Omaha/Valley, NE
PAH - Paducah, KY
SGF - Springfield, MO
TOP - Topeka, KS
UNR - Rapid City, SD

WEST COAST REGION

EKA - Eureka, CA
HNX - Hanford, CA
LOX - Los Angeles/Oxnard, CA
MFR - Medford, OR
MTR - San Francisco/Monterey, CA
OTX - Spokane, WA
PDT - Pendelton, OR
PQR - Portland, OR
SEW - Seattle, WA
SGX - San Diego, CA
STO - Sacramento, CA

ALASKAN REGION

PAFC - Anchorage, AK
PAFG - Fairbanks, AK
PAJK - Juneau, AK

PACIFIC REGION

PGUA - Tiyan, GU
PHFO - Honolulu, HI

WSR-88D SITES

ABC Bethel, AK
ABR Aberdeen, SD
ABX Albuquerque, NM
ACG Sitka/Biorka Island, AK
AEC Nome, AK
AHG Anchorage/Nikiski, AK
AIH Middleton Island, AK
AKC King Salmon, AK
AKQ Norfolk/Wakefield, VA
AMA Amarillo, TX
AMX Miami, FL
APD Fairbanks, AK
APX Gaylord, MI
ARX La Crosse, WI
ATX Seattle-Tacoma/Camano Island, WA
BBX Marysville/Beale AFB, CA
BGM Binghamton, NY
BHX Eureka/Bunker Hill, CA
BIS Bismarck, ND
BIX Keesler AFB, MS
BLX Billings/Yellowstone County, MT
BMX Birmingham/Alabaster, AL
BOX Boston/Taunton, MA
BRO Brownsville, TX
BUF Buffalo/Cheektowaga, NY
BYX Key West/Boca Chica Key, FL
CAE Columbia, SC
CBW Caribou/Hodgdon, ME
CBX Boise/Ada County, ID
CCX State College/Rush, PA
CLE Cleveland, OH
CLX Charleston/Grays, SC
CRP Corpus Christi, TX
CXX Burlington/Colchester, VT
CYS Cheyenne, WY
DAX Sacramento, CA
DDC Dodge City, KS
DFX Del Rio/Laughlin AFB, TX
DIX Philadelphia, PA/Fort Dix, NJ
DLH Duluth, MN
DMX Des Moines/Johnston, IA
DOX Dover AFB , DE
DTX Detroit-Pontiac/White Lake, MI
DVN Quad Cities/Davenport, IA
DYX Abilene/Dyess AFB, TX
EAX Kansas City/Pleasant Hill, MO
EMX Tucson/Pima County, AZ
ENX Albany/East Berne, NY
EOX Fort Rucker, AL
EPZ El Paso, TX/Santa Teresa, NM
ESX Las Vegas/Nelson, NV
EVX Red Bay/Eglin AFB, FL
EWX Austin-San Antonio/New Braunfels, TX
EYX Edwards AFB, CA
FCX Roanoke/Coles Knob, VA
FDR Frederick/Altus AFB, OK
FDX Clovis/Cannon AFB, NM
FFC Atlanta/Peachtree City, GA
FSD Sioux Falls, SD
FSX Flagstaff/Coconino, AZ
FTG Denver/Boulder, CO
FWS Dallas/Fort Worth, TX
GGW Glasgow, MT
GJX Grand Junction/Mesa, CO
GLD Goodland, KS
GRB Green Bay/Ashwaubenon, WI
GRK Killeen/Fort hood, TX
GRR Grand Rapids, MI
GSP Greenville-Spartanburg/Greer, SC
GUA Agana, GU
GWX Columbus AFB, MS
GYX Portland/Gray, ME
HDX Alamogordo/Holloman AFB, NM
HGX Houston-Galveston/Dickinson, TX
HKI South Kauai/Numila, HI
HKM Kamuela/Puu Mala, HI
HMO Molokai/Kukui, HI
HNX San Joaquin Valley/Hanford, CA
HPX Fort Campbell, KY
HTX Hytop, AL
HWA South Hawaii/Naalehu, HI
ICT Wichita, KS
ICX Cedar City, UT
ILN Cincinnati/Wilmington, OH
ILX Lincoln, IL
IND Indianapolis, IN
INX Tulsa/Inola, OK
IWA Phoenix/Mesa, AZ
IWX North Webster, IN
JAN Jackson, MS
JAX Jacksonville, FL
JGX Warner Robins/Robins AFB, GA
JKL Jackson/Noctor, KY
JUA San Juan/Cayey, PR
LBB LUBBOCK, TX
LCH Lake Charles, LA
LIX New Orleans-Baton Rouge/Slidell, LA
LNX North Platte/Thedford, NE
LOT Chicago/Romeoville, IL
LRX Elko/Sheep Creek Mountain, NV

LSX ST. Louis/Research Park, MO
LTX Wilmington/Shallotte, NC
LVX Louisville/Fort Knox, KY
LWX Baltimore, MD-Washington, DC/Sterling, VA
LZK North Little Rock, AR
MAF Midland/Odessa, TX
MAX Medford/Mount Ashland, OR
MBX Minot AFB, ND
MHX Morehead City/Newport, NC
MKX Milwaukee/Dousman, WI
MLB Melbourne, FL
MOB Mobile, AL
MPX Minneapolis/Chanhassen, MN
MQT Marquette/Negaunee, MI
MRX Knoxville-Cities/Morristown, TN
MSX Missoula/Point Six Mountain, MT
MTX Salt Lake City/Promontory Point, UT
MUX San Francisco/Mount Umunhum, CA
MVX Fargo-Grand Forks/Mayville, ND
MXX Carrville/Maxwell AFB, AL
NKX San Diego/Miramar Nas, CA
NQA Memphis/Millington, TN
OAX Omaha/Valley, NE
OHX Nashville/Old Hickory, TN
OKX New York City/Upton, NY
OTX Spokane, WA
PAH Paducah, KY
PBZ Pittsburgh/Coraopolis, PA
PDT Pendleton, OR
POE Fort Polk, LA
PUX Pueblo, CO
RAX Raleigh-Durham/Clayton, NC
RGX Reno/Virginia Peak, NV
RIW Riverton, WY
RLX Charleston/Ruthdale, WV
RMX Rome/Griffiss AFB, NY
RTX Portland/Scappoose, OR
SFX Pocatello-Idaho Falls/Springfield, ID
SGF Springfield, MO
SHV Shreveport, LA
SJT San Angelo, TX
SOX Santa Ana Mountains/Orange County, CA
SRX Slatington Mountain, AR
TBW Tampa/Ruskin, FL
TFX Great Falls, MT
TLH Tallahassee, FL
TLX Oklahoma City/Norman, OK
TWX Topeka/Alma, KS
TYX Fort Drum, NY
UDX Rapid City/New Underwood, SD
UEX Hastings/Blue Hill, NE
VAX Valdosta/Moody AFB, GA
VBX Lompoc/Vandenberg AFB, CA
VNX Enid/Vance AFB, OK
VTX Los Angeles/Sulphur Mountain, CA
YUX Yuma, AZ

INTERNET ADDRESSES

NATIONAL WEATHER SERVICE HOME PAGE

http://www.nws.noaa.gov

INTERACTIVE WEATHER INFORMATION NETWORK (IWIN)

http://weather.gov

WEATHER CHARTS

http://weather.noaa.gov/fax/graph.shtml
or
http://weather.noaa.gov/fax/nwsfax.shtml

AVIATION DIGITAL DATA SERVICE

http://adds.awc-kc.noaa.gov

NWS NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION

http://www.ncep.noaa.gov

AVIATION WEATHER CENTER

http://www.awc-kc.noaa.gov

NWS LINKS

http://nimbo.wrh.noaa.gov/wrhq/nwspage.html
or
http://www.nws.noaa.gov/regions.shtml

ALASKAN AVIATION WEATHER UNIT

http://www.alaska.net/~aawu/