

AVIATION WEATHER SERVICES

IN-FLIGHT WEATHER ADVISORIES

1. The Hazardous Inflight Weather Advisory Service (HIWAS) is a continuous broadcast over selected VORs of in-flight weather advisories, i.e., SIGMETs, convective SIGMETs, AIRMETs, severe weather forecast alerts (AWW), and center weather advisories.
2. AIRMETs are issued on a scheduled basis every 6 hr., with unscheduled amendments issued as required.
 - a. An AIRMET is valid for 6 hr.
3. A SIGMET advises of nonconvective activity that is potentially hazardous to all aircraft.
4. SIGMETs are issued when the following phenomena occur or are expected to occur:
 - a. Severe icing not associated with thunderstorms
 - b. Severe or extreme turbulence or clear air turbulence (CAT) not associated with thunderstorms
 - c. Duststorms, sandstorms, or volcanic ash lowering surface or in-flight visibilities to below 3 SM
 - d. Volcanic eruption
5. Pilots of IFR flights seeking ATC in-flight weather avoidance assistance should keep in mind that ATC radar limitations and frequency congestion may limit the controller's capability to provide this service.

AVIATION ROUTINE WEATHER REPORT (METAR)

1. Aviation routine weather reports (METARs) are actual weather observations at the time indicated on the report. There are two types of reports.
 - a. METAR is an hourly routine observation (scheduled).
 - b. SPECI is a special METAR observation (unscheduled).
2. Following the type of report are the elements listed below:
 - a. The four-letter ICAO station identifier.
 - b. Date and time of report. It is appended with a "Z" to denote Coordinated Universal Time (UTC).
 - c. Modifier (as required).
 - d. Wind.
 - e. Visibility.
 - f. Runway visual range (as required).
 - g. Weather phenomena.

h. Sky conditions.

1) The ceiling is the lowest broken or overcast layer, or vertical visibility into an obscuration.

2) Cloud bases are reported with three digits in hundreds of feet AGL.

a) EXAMPLE: OVC007 means overcast cloud layer at 700 ft. AGL.

3) Total obscurations are reported in the format "VVhhh" with "VV" meaning vertical visibility and "hhh" being the vertical visibility in hundreds of feet.

a) EXAMPLE: VV008 means vertical visibility of 800 ft.

i. Temperature-dew point.

j. Altimeter.

k. Remarks (RMK).

1) RAE42SNB42 means rain ended at 42 min. past the hour and snow began at 42 min. past the hour.

3. EXAMPLE: METAR KAUS 301651Z 12008KT 4SM -RA HZ BKN010 BKN023 OVC160 21/17 A3005 RMK RAB25

a. METAR is a routine weather observation.

b. KAUS is Austin, TX.

c. 301651Z means the observation was taken on the 30th day at 1651 UTC (or Zulu).

d. 12008KT means the wind is from 1200 true at 8 kt.

e. 4SM means the visibility is 4 statute miles.

f. -RA HZ means light rain and haze.

g. BKN010 BKN023 OVC160 means broken cloud layers at 1,000 ft. and 2,300 ft. and an overcast cloud layer at 16,000 ft.

h. 21/17 means the temperature is 21°C and the dew point is 17°C.

i. A3005 means the altimeter setting is 30.05 in. of Hg.

j. RMK RAB25 means remarks, rain began at 25 min. past the hour.

PILOT WEATHER REPORTS (PIREPs)

1. PIREPs are transmitted in the format illustrated below.

	PIREP ELEMENT	PIREP CODE	CONTENTS
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomenon
2.	Report type	UA or UUA	Routine or Urgent PIREP
3.	Location	/OV	In relation to a VOR
4.	Time	/TM	Coordinated Universal Time
5.	Altitude	/FL	Essential for turbulence and icing reports
6.	Type Aircraft	/TP	Essential for turbulence and icing reports
7.	Sky cover	/SK	Cloud height and coverage (sky clear, few, scattered, broken, or overcast)
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
9.	Temperature	/TA	Degrees Celsius
10.	Wind	/WV	Direction in degrees magnetic north and speed in knots
11.	Turbulence	/TB	See AIM paragraph 7-1-22
12.	Icing	/IC	See AIM paragraph 7-1-20
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

2. EXAMPLE: UA /OV OKC 063064/TM 1522/FLOSO/TP C172/TA -04/WV 245040/TB LGTI RM IN CLR.

DECODED: Pilot report, 64 NM on the 063° radial from Oklahoma City VOR at 1522 UTC (or Z), flight level 5,000ft., type of aircraft is a Cessna 172, outside air temperature is -4°C, wind 245° at 40 kt., light turbulence, remarks are that the pilot is in clear skies.

WEATHER DEPICTION CHART

1. The weather depiction chart is computer-prepared from both manual and automated METARS.

- a. A reporting station is depicted on the chart by a circle called a station circle.
- b. Automated stations are identified by a bracket (]) to the right of the station circle.

2. Station circle data

- a. Total sky cover is shown by the amount of shading of the station circle.
- b. Cloud height above ground level (AGL) is entered under the station circle in hundreds of feet.
 - 1) If the total sky cover is broken, overcast, or obscured, the cloud height is the ceiling.
- c. Weather and obstruction-to-vision symbols are entered to the left of the station circle.
 - 1) Some may be entered above the station circle for readability.

d. When visibility is 5 SM or less, it is entered to the left of the weather or obstructions to visibility.

e. EXAMPLES:



5 means overcast sky, ceiling 500 ft., continuous rain (slight at time of 5 observation), and visibility greater than 6 SM.



1/2 15 means overcast sky, ceiling 1,500 ft., continuous rain (heavy at time of 1/2 observation), and visibility 1/2 SM.

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

a. IFR -- Ceilings less than 1,000 ft. and/or visibility less than 3 SM is shown by a hatched area outlined by a smooth line.

b. MVFR (marginal VFR) -- Ceilings 1,000 to 3,000 ft. inclusive and/or visibility 3 to 5 SM inclusive is shown by a nonhatched area outlined by a smooth line.

c. VFR -- Ceilings greater than 3,000 ft. and visibility greater than 5 SM are not outlined.

TERMINAL AERODROME FORECAST (TAF)

1. Terminal aerodrome forecasts (TAFs) are weather forecasts for selected airports throughout the country. They are a source of weather to expect at your destination airport at your ETA.

a. The forecast is for a geographical area within a 5-SM radius of the airport's center.

1) **VC** (vicinity) is used to refer to weather expected to occur between a 5- to 10-SM radius of the airport.

2. The elements of a TAF are listed below:

a. Type of report

1) TAF is a routine forecast.

2) TAF AMD is an amended forecast.

b. ICAO station identifier

c. Date and time the forecast is actually prepared

d. Valid period of the forecast

e. Forecast meteorological conditions. This is the body of the forecast and includes the following:

1) Wind

a) **VRB** means that the wind direction is forecast to fluctuate due to convective activity or low wind speeds (3 kt. or less).

2) Visibility

a) **P6SM** means the forecast visibility is greater than 6 SM.

3) Weather

4) Sky condition

5) Optional data (wind shear)

a) Wind shear in a TAF is a forecast of nonconvective low-level wind shear (up to 2,000 ft. AGL) and is forecast only when wind shear is expected.

b) EXAMPLE: **WS005/27050KT** means low-level wind shear at 500 ft. AGL, wind 2700 true at 50 kt.

AVIATION AREA FORECAST (FA)

1. The VFR Clouds and Weather (VFR CLDS/WX) section of the aviation area forecast (FA) contains a 12-hr. specific forecast followed by a 6-hr. categorical outlook, which gives a total forecast period of 18 hr.

a. The VFR CLDS/wX section is usually several paragraphs long and is broken down by states or well-known geographical areas.

b. The specific forecast section covers an area the size of several states (an area greater than 3,000 sq. mi.) and gives a general description of clouds and weather that are significant to VFR flight operations.

2. In the categorical outlook of an FA, the contraction "WND" is included if the sustained surface wind is expected to be 20 knots or more or surface wind gusts are expected to be 25 knots or more during the majority of the 6-hour outlook period.

WINDS AND TEMPERATURES ALOFT FORECAST (FB)

1. Forecast winds and temperatures, provided at specified altitudes for specific locations in the United States, are presented in table form.

2. A four-digit group (used when temperatures are not forecast) shows wind direction with reference to **true** north and the wind speed in **knots**.

a. The first two digits indicate wind direction after a zero is added.

- b. The next two digits indicate the wind speed.
3. A six-digit group includes the forecast temperature aloft.
- a. The last two digits indicate the temperature in degrees Celsius.
 - b. Plus or minus is indicated before the temperature, except at higher altitudes (above 24,000 ft. MSL) where it is always below freezing.
 - c. The ISA (International Standard Atmosphere) temperature is 15°C at the surface with a standard lapse rate of 2°C per 1,000 ft.
4. When the wind speed is less than 5 kt., the forecast is coded **9900**, which means that the wind is light and variable.
5. Note that at some of the lower levels the wind and temperature information is omitted.
- a. Winds aloft are not forecast for levels within 1,500 ft. of the station elevation.
 - b. No temperatures are forecast for the 3,000-ft. level or for a level within 2,500 ft. of the station elevation.
6. If the wind speed is forecast to be 100 to 199 kt., the forecaster adds 50 to the direction and subtracts 100 from the speed. To decode, you must do the reverse: subtract 50 from the direction and add 100 to the speed.
- a. EXAMPLE: If the forecast for the 39,000-ft. level appears as **731960**, subtract 50 from 73 and add 100 to 19. The wind would be 230° at 119 kt. with a temperature of -60°C (above 24,000 ft.).
 - b. It is easy to know when the coded direction has been increased by 50. Coded direction (in tens of degrees) normally ranges from 01 (010) to 36 (360°). Any coded direction with a numerical value greater than 36 indicates a wind of 100 kt. or greater. The coded direction for winds of 100 to 199 kt. thus ranges from 51 to 86.
7. If the wind speed is forecast to be 199 kt. or more, the wind group is coded as 199 kt.; e.g., **7799** is decoded 270° at 199 kt. or more.
8. EXAMPLES: Decode these FB winds and temperatures:

<u>Coded</u>	<u>Decoded</u>
9900+00	Winds light and variable, temperature 0°C
2707	270° at 7 kt.
850552	85 – 50 = 35; 05 + 100 = 105 350° at 105 kt., temperature –52°C

LOW-LEVEL SIGNIFICANT WEATHER PROG

1. Low-level prognostic charts contain four charts (panels) of conditions forecast to exist at a valid time shown on the chart.

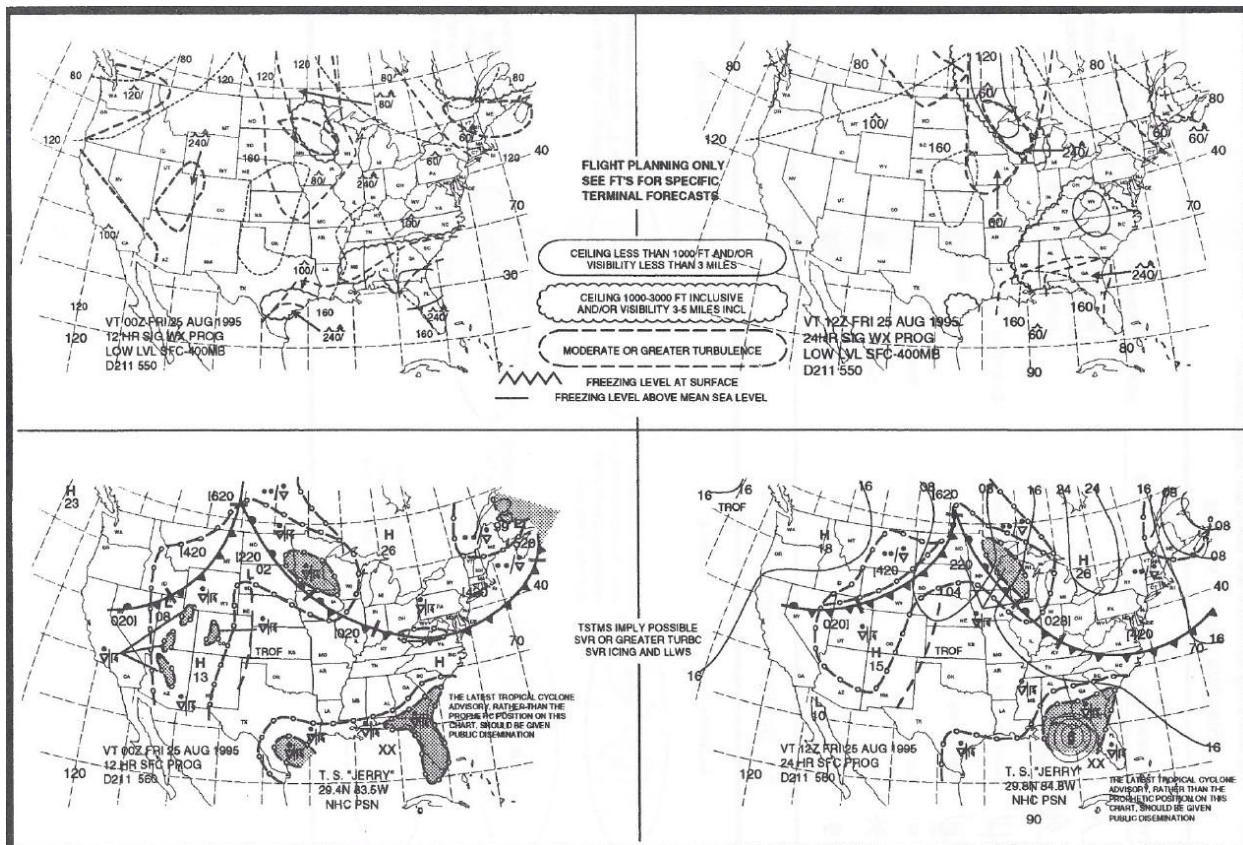
- a. The two upper panels forecast significant weather from the surface up to 24,000 ft.: one for 12 hr. and the other for 24 hr. from the time of issuance.
- b. The two lower panels forecast surface conditions: one for 12 hr. and the other for 24 hr. from the time of issuance.
- c. See Figure on the next page.

2. The top panels show

- a. Ceilings less than 1,000 ft. and/or visibility less than 3 SM (IFR) indicated by a solid line around the area
- b. Ceilings 1,000 to 3,000 ft. and/or visibility 3 to 5 SM (MVFR) indicated by a scalloped line around the area
- c. Moderate or greater turbulence indicated by a broken line around the area
 - 1) Altitudes "up to" are above a line; e.g., 120 is up to 12,000 ft.
 - 2) Altitudes "down to" are below a line; e.g., 90 is down to 9,000 ft.
- d. Freezing levels indicated by a dashed line corresponding to the height of the freezing level

3. The bottom panels show location of

- a. Highs, lows, fronts
- b. Other areas of significant weather



4. The following symbols are used on "prog" charts:
 a. Standard weather symbols

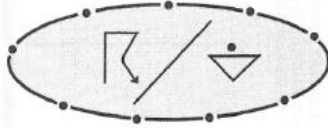
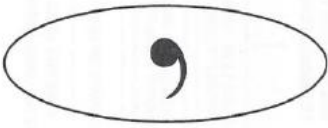
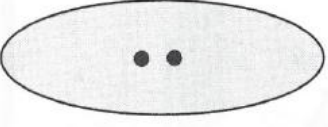
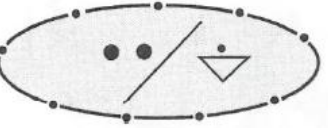
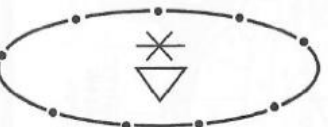
SYMBOL	MEANING	SYMBOL	MEANING
	Moderate turbulence		Rain shower
	Severe turbulence		Snow shower
	Moderate icing		Thunderstorms
	Severe icing		Freezing rain
	Rain		Tropical storm
	Snow		Hurricane (typhoon)
	Drizzle		

NOTE: Character of stable precipitation is the manner in which it occurs. It may be intermittent or continuous. A single symbol denotes intermittent and a pair of symbols denotes continuous.

Examples:

	Intermittent	Continuous
Rain		
Drizzle		
Snow		

b. Significant weather symbols

Depiction	Meaning	Depiction	Meaning
	Showery precipitation (e.g., thunderstorms/rain showers) covering half or more of the area		Intermittent precipitation (e.g., drizzle) covering less than half of the area
	Continuous precipitation (e.g., rain) covering half or more of the area		Showery precipitation (e.g., rain showers) embedded in an area of continuous rain covering half or more of the area
	Showery precipitation (e.g., snow showers) covering less than half of the area		

SEVERE WEATHER OUTLOOK CHART

1. The severe weather outlook chart is a 48-hr. outlook for thunderstorm activity presented in two panels.
2. The left-hand panel covers the first 24-hr. period beginning at 1200Z (12Z) and depicts areas of possible general and severe thunderstorm activity in the continental U.S.
 - a. A line with an arrowhead delineates an area of probable thunderstorm activity located to the right of the line when facing in the direction of the arrow.
 - b. If severe thunderstorm activity is expected in an area, that area is labeled with a risk category.
 - 1) **SLGT** means that there is a slight risk of severe thunderstorms; they are expected to cover 2% to 5% of the area.
 - 2) **MDT** means that there is a moderate risk of severe thunderstorms; they are expected to cover 6% to 10% of the area.
 - 3) **HIGH** means that there is a high risk of severe thunderstorms; they are expected to cover more than 10% of the area.
 - c. If general (i.e., non-severe) thunderstorm activity is expected in an area, that area is not labeled with a risk category.
 - 1) **NO SVR TSTMS FCST** means that the chart depicts no forecast areas of severe thunderstorms.
3. The right-hand panel covers the following day beginning at 1200Z and is similar to the left-hand panel, except that it is issued less frequently.

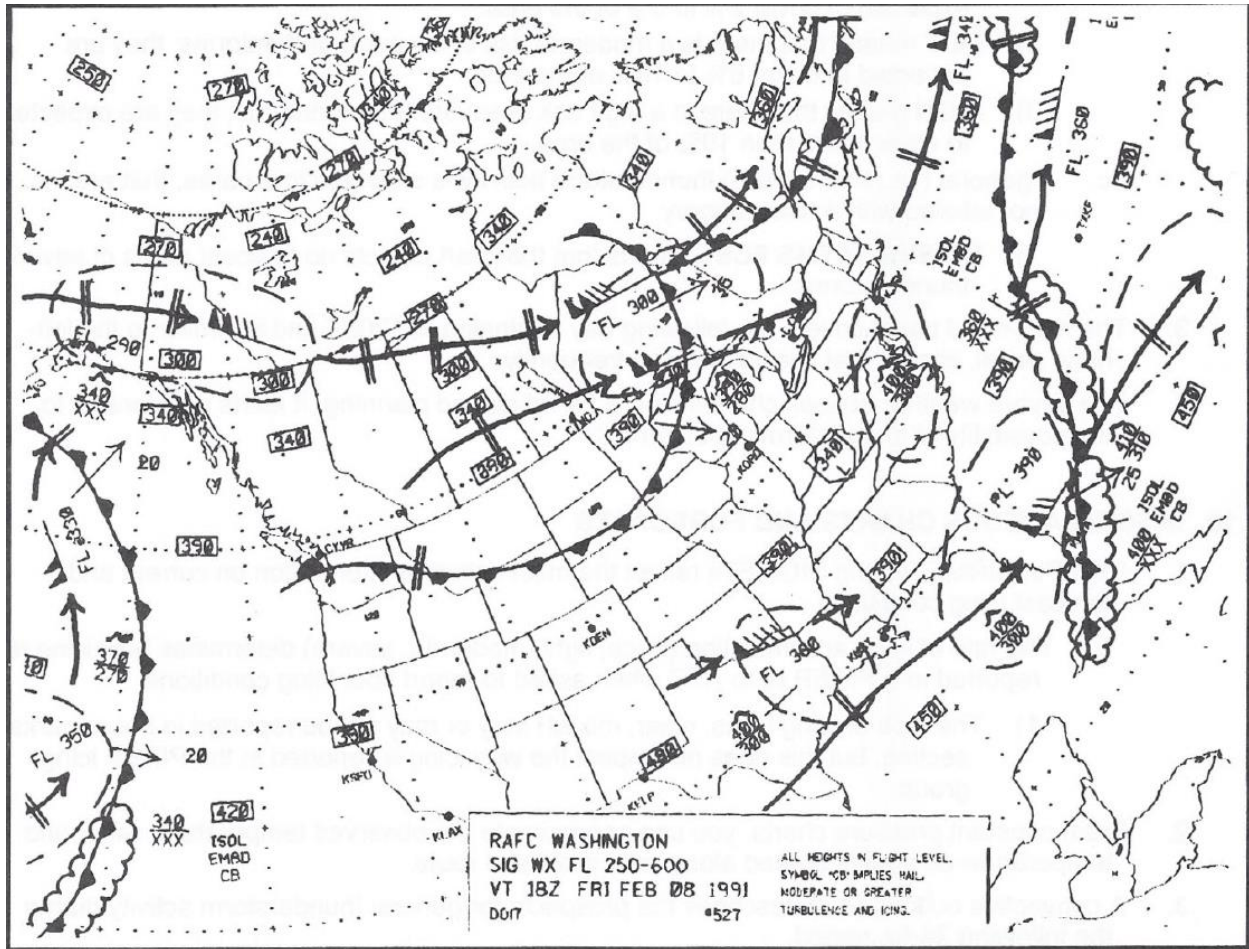
4. The severe weather outlook chart is strictly for advanced planning. It alerts all interests to the possibility of future storm development.


MISCELLANEOUS CHARTS AND FORECASTS

1. PIREPs, AIRMETs, and SIGMETs reflect the most accurate information on current and forecast icing conditions.
 - a. The rate of icing accumulation (trace, light, moderate, severe) determines how icing is reported in a PIREP or to ATC when asked to report your icing conditions.
 - 1) The type of icing (rime, clear, mixed) may or may not be reported in the remarks section, but this does not impact the way icing is reported in the PIREP icing group.
2. From constant pressure charts, you can approximate the observed temperature, wind, and temperature-dew point spread along your proposed route.
3. A convective outlook (AC) describes the prospects for general thunderstorm activity during the following 24-hr. period.
 - a. Areas in which there is a high, moderate, or slight risk of severe thunderstorms are included as well as areas where thunderstorms may approach severe limits.
4. The surface analysis chart depicts actual frontal positions, pressure patterns, temperature, dew point, wind, weather, and obstructions to vision at the valid time of the chart.
5. A severe weather watch bulletin (WW) is unscheduled and is issued as required.

HIGH-LEVEL SIGNIFICANT WEATHER PROG

1. The U.S. High-Level Significant Weather Prognostic Chart encompasses airspace from above 24,000 ft. to 60,000 ft. pressure altitude (FL 240 to FL 600).
2. Tropopause heights are depicted in hundreds of feet MSL, which may be presented by a five-sided polygon or a small rectangular block.
 - a. The five-sided polygon indicates areas of high and low tropopause heights.
 - b. The rectangular block indicates the tropopause height in areas that have a very flat tropopause slope.
 - c. Note that, in Figure 20 below, which is out of date, all heights are given as flight levels, not hundreds of feet MSL.



3. The height and maximum wind speed of jet streams having a core speed of 80 kt. or greater are shown as a solid line with arrowheads indicating the flow direction.
 - a. The height is given as a flight level (FL).
 - b. The maximum core wind velocity is depicted by a shaft with a pennant equal to 50 kt. and a feather, or barb, equal to 10 kt.
 - 1) EXAMPLE:  means a maximum core speed of 130 kt.
4. Areas of forecast moderate or greater turbulence are enclosed by bold, dashed lines.
 - a. The enclosed area includes all turbulence not caused by thunderstorms or convective activity (thunderstorms imply turbulence).
 - b. Areas are labeled with the appropriate turbulence symbol(s) and the vertical extent in hundreds of feet MSL.
5. Small scalloped lines enclose areas of expected cumulonimbus development. "CB" denotes cumulonimbus.

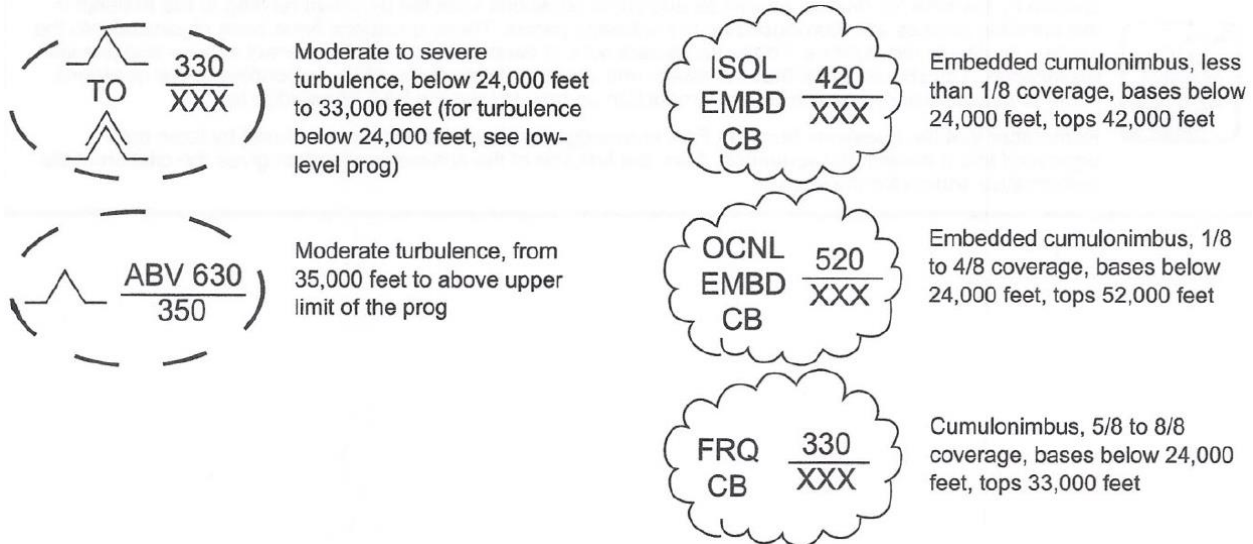
a. CB refers to the occurrence or expected occurrence of an area of widespread cumulonimbus clouds or cumulonimbus clouds along a line with little or no space between the individual clouds, or cumulonimbus clouds embedded in cloud layers or concealed by haze or dust.

b. CB bases below 24,000 ft. (FL 240) are shown as XXX.

1) CB tops are expressed in hundreds of feet MSL.

2) The term "below 24,000 ft." (FL 240) is used because phenomena that extend beyond the lower limit of the High-Level Significant Weather Prognostic Chart are found on the Low-Level Significant Weather Prognostic Chart, the upper limit of which is 24,000 ft. pressure altitude (FL 240).

6. EXAMPLES:



OBSERVED WINDS ALOFT CHART

1. Arrows with pennants and barbs show wind direction and speed.

a. Wind direction is drawn to the nearest 10°, with the second digit of the coded direction entered at the outer end of the arrow.


1) To determine wind direction, obtain the general direction from the arrow and then use the digit to determine the direction to the nearest 10°.


2) For example, wind from the northwest with a digit of "3" at the end of the arrow indicates 330°.

b. Wind speed is indicated by the sum of three symbols: A half barb is 5 kt., a full barb is 10 kt., and a pennant is 50 kt.

2. Temperature is in whole degrees Celsius for each forecast point and is entered above and to the right of the station circle.

3. EXAMPLES:

 wind 2900 at 50 kt. (represented by one pennant), temperature -48 C

 wind 2300 at 35 kt. (represented by three and one-half barbs), temperature -47 C