

CHAPTER 2 - WIND

ADDITIONAL MATERIAL TO STUDY: Chapter 9, paragraphs 9.2.1a & f, wind criteria for SPECI.

2.1 Introduction

Wind is measured in terms of velocity, a vector that includes direction and speed. The absence of apparent motion of the air is termed “CALM.” The direction and speed of the wind should be measured in an unsheltered area.

2.2 Wind Direction

Is considered to be the direction from which the wind is blowing. The wind direction shall be determined by averaging the observed direction over a 2-minute interval when direct-reading dials or recorders are used.

Wind direction shall be reported in all observations (except single-element SPECIs). Direction shall be reported in tens of degrees (see Table 2-1) with reference to true north using three digits with the last digit always being a zero or the direction may be reported as VRB (variable) if the speed is 6 knots or less and a direction can not be determined.

WIND DIRECTION IN TENS OF DEGREES (TRUE)			
8 Points of Compass	Tens of Degrees	8 Points of Compass	Tens of Degrees
N	360	S	180
N	010	S	190
N	020	S	200
NE	030	SW	210
NE	040	SW	220
NE	050	SW	230
NE	060	SW	240
E	070	W	250
E	080	W	260
E	090	W	270
E	100	W	280
E	110	W	290
SE	120	NW	300
SE	130	NW	310
SE	140	NW	320
SE	150	NW	330
S	160	N	340
S	170	N	350

Table 2-1. Wind Direction in Tens of Degrees.

2.2.1 Estimating Wind Direction

Though winds can be estimated, there is no way to indicate that wind direction or speed has been estimated in the coded transmitted report. If the wind direction indicator is inoperable, estimate the direction by observing the wind cone or tee, movement of twigs, leaves, smoke, etc., or by facing into the wind in an unsheltered area. When estimating wind direction, note that even small obstacles may cause variations in the wind direction. Do not use the movement of clouds, regardless of how low the clouds are, in estimating the surface wind direction.

2.2.2 Conversion of True and Magnetic Winds

Even though an observer is required to report wind direction with reference to true north, there are times when the observer will either need to convert the true reading to magnetic; when reporting wind direction to an aircraft; or convert a magnetic reading to true; when a magnetic compass is used to estimate the wind direction.

Obtain the local variation from an aeronautical chart and proceed as follows:

- a. To convert from true to magnetic wind:
 - (1) Add westerly variation to true direction.
 - (2) Subtract easterly variation from true direction.
- b. To convert from magnetic to true direction:
 - (1) Add easterly variation to magnetic direction.
 - (2) Subtract westerly variation from magnetic direction.

2.3 Wind Speed

Is the horizontal speed of air past a given point. If possible, the average wind speed should not be determined during a peak or a lull in gusty winds or squalls. The wind speed shall be determined by averaging the speed to the nearest whole knot over a 2-minute period. Where direct-reading dials or recorders are used, determine the speed by averaging the observed values.

Wind speed shall be reported in all observations (except single-element SPECIs). Wind speed is always reported in surface observations in knots. Wind speed is reported using two digits or three when necessary.

2.3.1 Estimating Wind Speed

Do not use the movement of clouds, regardless of how low the clouds are, in estimating the surface wind speed. Use the Beaufort scale, Table 2-2, to estimate wind speeds if instruments are out of service or if the wind speed is below the starting speed of the anemometer in use. Gusts and squalls are not to be estimated.

WIND EQUIVALENT -- BEAUFORT SCALE				
Beaufort #	MPH	KTS	International Description	Specifications
0	<1	<1	Calm	Calm; smoke rises vertically.
1	1-3	1-3	Light Air	Direction of wind shown by smoke drift, not by wind vanes.
2	4-7	4-6	Light Breeze	Wind felt on face; leaves rustle; vanes moved by wind.
3	8-12	7-10	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	11-16	Moderate	Raises dust, loose paper; small branches moved.
5	19-24	17-21	Fresh	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25-31	22-27	Strong	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32-38	28-33	Near Gale	Whole trees in motion; inconvenience felt walking against the wind.
8	39-46	34-40	Gale	Breaks twigs off trees; impedes progress.
9	47-54	41-47	Strong Gale	Slight structural damage occurs.
10	55-63	48-55	Storm	Trees uprooted; considerable damage occurs.
11	64-72	56-63	Violent Storm	Widespread damage.
12	73-82	64-71	Hurricane	

Table 2-2. Estimating Wind Speed

2.4 Calm Wind

When no motion of the air is detected, the wind shall be reported as calm. A calm wind is coded with 5 zeros, e.g., 00000KT. On the MF1M-10C form, 3 zeros are recorded in column 3 Wind Direction, 2 zeros are recorded in column 4 Wind Speed, the “KT” is not recorded.

2.5 Gusts

Rapid fluctuations in wind speed with a variation of 10 knots or more between peaks and lulls. The existence of gusts is indicated on direct-reading wind speed indicators by fluctuation and sudden increases and decreases of wind speed. If the criteria given is met, the speed of the gust is the maximum instantaneous speed observed.

When a gust is detected within 10 minutes prior to an observation that includes wind, the gust shall be reported in the body of the observation.

2.6 Coding and Entering Wind Direction, Speed, and Gust

The transmitted coded group ends with the letters “**KT**” to indicate the unit of measurement is in knots, however, it is not recorded on MF1M-10C.

Examples of Transmitted/Coded Data: 31015KT VRB04KT 040112KT 00000KT

If the wind group contains a gust the letter indicator “**G**” is placed right before the wind gust speed in the transmitted coded report, however, it is not recorded in column 5 of MF1M-10.

Examples of Transmitted/Coded Data: 31015G25KT 090115G125KT

Estimated wind data is reported in the normal manner, but annotate in column 65 that the wind data is estimated and the reason for the estimation, e.g., WIND DATA ESTIMATED - EQUIPMENT INOPERATIVE.

Wind direction, speed, gusts, and shifts shall be determined at all stations.

2.7 Variable Wind Direction

The wind direction may be considered variable if (Condition #1), during the 2-minute evaluation period, the wind speed is 6 knots or less and the direction varies so it can not be determined. Also, the wind direction shall be considered variable if (Condition #2), during the 2-minute evaluation period, it varies or fluctuates by 60 degrees or more when the average wind speed is greater than 6 knots.

Condition #1 (Light and Variable):

Direction is variable and the wind speed is 6 knots or less, the speed is appended to the VRB, e.g., VRB05. (VRB is reported as the direction in column 3), e.g., VRB04. When this type of variable wind direction is used the extremes of variation (column 6) is never reported.

However, VRB should only be used if a wind direction can not be determined, e.g., 14004.

Condition #2:

If the wind direction varies by 60 degrees or more and wind speed is greater than 6 knots, a variable wind group (column 6 of MF1M-10C) is also reported. The extreme values are coded using three digits for each direction (Remember: tens of degrees, last digit is always a zero). A “**V**” separates the two extreme values. The directional variation shall be coded in a clockwise direction and remember it can vary by more than 60 degrees.

Example: The wind is variable from 180 degrees to 250 degrees at 10 knots, it would be coded as:

21010KT 180V250

Remember: This type of wind variability is reported when 1) during the 2-minute evaluation period the direction varies by 60° or more and 2) the 2-minute average wind speed (column 4) is greater than 6 knots. Gusts are not an average wind speed reading, they are an instantaneous reading.

3.8 Wind Shift

A wind shift is indicated by a change in wind direction of 45 degrees or more over a less than 15-minute period with sustained wind speeds of 10 knots or more. Wind shifts are normally associated with some or all of the following phenomena:

- a. Gusty winds shifting in a clockwise manner in the Northern Hemisphere;

- b. Rapid drop in dew-point;
- c. Rapid drop in temperature;
- d. Rapid rise in pressure;
- e. In summer: Lightning, thunder, heavy rain, and hail;
- f. In winter: Frequent rain or snow showers.

A wind shift shall always be reported when it occurs and are reported in the remarks section of METAR and SPECI reports. A special (SPECI) observation shall be taken immediately after a wind shift occurrence, and a remark, reporting the wind shift and the time it occurred, shall be included. The time reported is the time the shift began. Only the minutes are required if the hour can be inferred from the report time. When the shift is believed to be associated with a frontal passage, report "FROPA" in remarks immediately after the time the shift began. When a SPECI containing a wind shift is not given long-line dissemination, include the wind shift data in the remarks of the next transmitted report.

Example: A wind shift occurring at 15 minutes after the hour would be reported in remarks as:

WSHFT 15

If this wind shift was associated with a frontal passage it would be reported as:

WSHFT 15 FROPA

2.9 Squalls

Squalls (SQ) are reported in Present Weather (column 9) and are also part of what makes up the wind character. A Squall is a sudden increase in average wind speed of at least 16 knots and sustained at 22 knots or more and lasting for at least 1 minute. The difference between Gust and Squall is duration and intensity of the increase. Squalls are reported only if they have occurred within 10 minutes prior to the time of the observation.

2.10 Peak Wind Speed

The maximum instantaneous wind speed recorded that exceeds 25 knots.

Peak wind is the highest instantaneous speed recorded that is greater than 25 knots since the last routine METAR. Only designated stations record peak wind data. These stations are equipped with an instantaneous wind speed recorder. Observers determine peak wind data for entry in the remark section of the METAR observation by evaluating the wind speed recorder record.

TYPE M/S	TIME G LST G UTC	WIND				VISIBILITY			PRESENT WEATHER	SKY CONDITION	TEMP. (°C)	DEW POINT (°C)	ALTIMETER SETTING (In.)	REMARKS AND SUPPLEMENTAL CODED DATA	TOTAL SKY COVER (0-8)
		DIREC- TION (True)	SPEED (Knots)	GUST (Knots)	VARIABILITY (True)	SUR- FACE	TOWER	RUNWAY VISUAL RANGE (Feet)							
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(17)

Direction

Speed

Gust

Variability

Present Weather

WIND DIRECTION IN TENS OF DEGREES (TRUE)			
Degrees Observed	Degrees Entered	Degrees Observed	Degrees Entered
355-004	360	175-184	180
005-014	010	185-194	190
015-024	020	195-204	200
025-034	030	205-214	210
035-44	040	215-224	220
045-054	050	225-234	230
055-064	060	235-244	240
065-074	070	245-254	250
075-084	080	255-264	260
085-094	090	265-274	270
095-104	100	275-284	280
105-114	110	285-294	290
115-124	120	295-304	300
125-134	130	305-314	310
135-144	140	315-324	320
145-154	150	325-334	330
155-164	160	335-344	340
165-174	170	345-354	350

If the direction was determined to be variable and the wind speed is 6 knots or less, enter VRB for direction

Report squalls (SQ) in Present Weather if there is a sudden increase in the average wind speed by at least 16 knots and sustained at 22 knots or more and continues for at least 1 minute during the 10 minutes prior to the time of observation.

If the wind direction varies by 60° or more during the observation and the speed (column 4) is greater than 6 knots, enter the extreme values using three digits for each direction, separating the directions with a V; e.g., 270V330. Remember : Direction is entered in tens of degrees, which makes the last digit always zero.

Enter speed of maximum gusts observed in the ten minutes preceding the observation. Enter speed in whole knots using two digits or three when necessary. If no gusts are observed, omit this entry.

Enter speed in whole knots using two digits or three when necessary.

Report wind shifts whenever the wind direction changes by 45° degrees or more in less than 15 minutes with sustained winds of 10 knots or more. Enter WSHFT followed by a space and minutes past the hour when the shift began; e.g., WSHFT 33

REVIEW QUESTIONS

1. Wind direction and wind speed are determined by averaging over a _____ period.
 - a. 1-minute
 - b. 2-minute
 - c. 5-minute
 - d. 10-minute

2. Wind shifts are reported:
 - a. in the body of METAR
 - b. in the remarks section of METAR and SPECI reports
 - c. only in METAR, but not in SPECI
 - d. in metric units

3. What is the appropriate unit of measure and resolution for wind reports in an aviation weather report?
 - a. nearest degree and knots
 - b. nearest degree and miles per hour
 - c. tens of degrees and knots
 - d. tens of degree and miles per hour

4. How would you report that an average wind speed of 25 knots was varying rapidly between 20 and 30 knots?
 - a. 25
 - b. 25 and the remark, WND 20V30
 - c. 25G30
 - d. 20G30

5. If the wind is from true north at 8 knots and the magnetic declination is plus 10 degrees, the wind direction and speed would be coded as:
 - a. 35008KT
 - b. 36008KT
 - c. 00008KT
 - d. 01008KT

6. Which of the following wind parameters is not included in the body of the METAR/SPECI wind element?
 - a. direction
 - b. speed
 - c. squalls
 - d. variable

REVIEW QUESTIONS

7. A strong wind suddenly increases from 270 degrees at 15 knots to 32 knots with gusts to 44 knots and persists for 3 minutes before subsiding. This is reported as:
- 27032G44KT
 - 27044KT SQ (in present weather)
 - 27015G44KT SQ (in present weather)
 - 27032G44KT SQ (in present weather)
8. Calm wind is coded in the body of the report as:
- 00000KT
 - VRB00KT
 - 0000KT
 - blank (no entry for wind)
9. The wind direction is from 240° at 9 knots and the direction is varying from 210° to 260°. How would this be formatted for transmission?
- 24009KT
 - 24009KT 210V260
 - 24009KT 210V260KT
 - VRB09KT
10. If a wind shift is accompanied by a cold frontal passage that began at 30 minutes after the hour, the remark would be coded as:
- FROPA 30
 - COLD FROPA 30
 - FROPA WSHFT 30
 - WSHFT 30 FROPA
11. The essential difference between gusts and squalls is:
- the intensity of precipitation with which they are associated.
 - the variation between peaks and lulls.
 - the duration of the increased wind speed.
 - their peak speed.
12. A variable wind direction and a speed of 4 knots would be coded as:
- 00004KT
 - 99904KT
 - VRB04KT
 - /04KT

REVIEW QUESTIONS

13. Which of the following is a good method for estimating low surface wind speed?
- movement of very low clouds
 - pilot reports
 - a non-moving wind vane
 - none of the above
14. The sudden onset of strong winds with speeds increasing by at least 16 knots and sustained at 22 or more knots for at least 1 minute is reported as a
- Squall
 - Gust
 - Funnel Cloud
 - Dust Storm
15. The station anemometer is not in operation. However, the observer estimates that the wind speed is 10 knots. The wind speed will be reported as:
- M
 - /M
 - E10
 - 10
16. At the time of a METAR observation, the anemometer cups, whose starting speed is 3 knots, are not moving. Smoke near the surface is observed to be drifting to the south. The wind should be reported as
- 00000
 - 36002
 - 18002
 - VRB02
17. Before the wind is characterized as gusty, variation between peaks and lull must be at least how many knots?
- 10
 - 15
 - 20
 - 25
18. Wind direction is varying from 180⁰ to 240⁰ at 10 knots. The correct entry in the body of the METAR observation is
- 18010 V240
 - 21010 180V240
 - 21010 180V210
 - VRB10 180V240

REVIEW QUESTIONS

19. Squalls are reported only if they have been observed within the last ____ minutes.
- 10
 - 15
 - 20
 - 16
20. The wind is from 360° at 125 knots. What would be the correct entry in Column 4 (Speed), of MF1M-10C?
- 25
 - 125
 - 36025
 - 36125
21. The wind shifted at 1030CST from 180° at 15 knots to 270° at 40 knots with gusts to 50 knots. The correct remark in column 14 for the 1050CST observation would be
- WSHFT 1030C FM 18015KT
 - WSHFT 30
 - WSHFT 30 to 27040G50
 - WSHFT 1630UTC
22. The wind suddenly increases from 180 degrees at 05 knots to 150 degrees at 21 knots with gusts to 35 knots and persists for 3 minutes before subsiding. This is reported as:
- 15021G35KT
 - 18035KT
 - 18021G35KT SQ (in present weather)
 - 15021G35KT SQ (in present weather)
23. A wind shift is reported if there is a change in direction of ____ degrees or more that takes place in less than ____ minutes and has sustained winds of ____ knots or more throughout the wind shift.
- 60, 10, 10
 - 60, 15, 10
 - 45, 15, 6
 - 45, 15, 10