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Atmospheric Slant Path Analysis Model (ASPAM) Quick Reference Users Handbook

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INTRODUCTION

This users handbook serves as a quick reference guide for reading Atmospheric Slant Path Analysis Model (ASPAM) Point Analysis (PA) products. For additional information, please refer to Chapter 3 of the *Improved Point Analysis Model (IPAM) User's Guide* (AFGWC/TN—91/001). IPAM was renamed ASPAM in 1992.

Point analysis products give a numerical description of weather at a given instant and indicate weather from one point (site) to another in either a vertical or horizontal direction. Vertical PA elevation angles range between 10 and 90 degrees. When slanted, PAs indicate weather in a direction between 001 and 360 (due north).

Two types of PAs exist: Radiosonde Vertical Profile (RAOBVP) and Optimum Interpolation Vertical Profile (OIVP). The RAOBVP uses radiosonde data while the OIVP employs a combination of available surface and upper-air (balloons, radiosonde, rocketsonde, satellite) observations and the High Resolution Analysis System (HIRAS).

The ASPAM output format is based on sequential paragraphs labeled A through K. The content of each paragraph depends on the options selected by the customer, for example, RAOB PAs usually come with Paragraph F.

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ATMOSPHERIC SLANT PATH ANALYSIS MODEL (ASPAM)
QUICK REFERENCE GUIDE

CHAPTER 1

POINT ANALYSIS (PA) OUTPUT CONTENT

1.1 General. The following paragraphs serve as a quick reference guide for information contained in PA products. The paragraphs are explained sequentially, A through K, as in the ASPAM output.

1.2 Paragraph A - Point Analysis Site Identification. Paragraph A of the ASPAM product identifies the site or location of the PA. The latitude and longitude are in degrees and hundredths of a degree. A minus (-) sign indicates the Southern and Western Hemispheres. The example below represents 65.28°N, 126.80°W.

Format: sXXX.XX sYYY.YYY

SITE IDENTIFICATION EXAMPLE

A. SITE 65.28 -126.80

1.3 Paragraph B - Date and Time. Paragraph B specifies the time and date of the event for which the PA is provided. The time is in universal coordinated time.

Format: TTTTZ DD MMM YY

DATES/TIME EXAMPLE

B. TIME 1200Z 11 APR 92

NOTE: The customer determines site and time. When the customer requests sanitation, the locations and times are omitted.

1.4 Paragraph C - Cloud Cover. Cloud cover is obtained from the synoptic Real Time Nephanalysis (RTNEPH) closest to the event time. The time and date of RTNEPH data is shown above the cloud grid. The time will be the 3- or 6-hourly (00Z, 03Z, 06Z, 09Z, and so forth) report nearest the PA time. Each grid point shows a cloud description, High (H), Middle (M), and Low (L) cloud layer amounts, and the Total (T) cloud amount in eighths of sky coverage. The grid contains a minimum radius of 75 nm surrounding the location site. The example below represents 4/8s sky coverage of high clouds, 3/8s coverage of middle clouds, 2/8s coverage of low clouds, and a total for all the cloud layers of 6/8s. The total is not necessarily the sum of the three layers, due to possible overlapping of cloud layers. The number of lines in the cloud depiction is shown in the parentheses, for example 0048 indicates 48 lines. The PA point is located in the center of Paragraph C.

CLOUD COVER EXAMPLE

C. CLOUD COVER - (0048)

RTNEPH for 1200Z 01/07/89 USED IN CLOUD DEPICTION

| | | |
|---|---|-----------|
| 4 | | FORMAT: H |
| 3 | 6 | M T |
| 2 | | L |

CHAPTER 1

1.5. Paragraph D - Pseudo-Surface Observation (Weather at Site). The output format for the pseudo-observation is as follows:

Format: VSBY vv.vv NM x/8 ct bbb/ttt x/8 ct bbb/ttt x/8 ct bbb/ttt x/8 ct bbb/ttt
TOTAL CLOUD COVERAGE T/8
WIND dddfffGfff PRESENT WEATHER REMARK

Where:

- vv.vv = surface visibility in nautical miles (to the nearest hundredth)
- x/8 = amount of cloud layer in eighths
- ct = the cloud type (See table)
- bbb = base of cloud layer in hundreds of feet/AGL
- ttt = top of cloud layer in hundreds of feet/AGL
- x/8 = total cloud cover in eighths
- ddd = direction in whole degrees true (000 indicates calm)
- fff = speed in knots
- Gfff = gust speed in knots (when it exists)
- RMK = Plain language remark on cloud coverage tendency, for example CLD INCRSG, CLD DCRSG , OR CLD SAME. A remark is not always included.

In the example below, visibility is 10.00 nm with 2/8s of stratocumulus. The base of the cloud is at 2,000 feet AGL and the top is at 4,000 feet. There are also 3/8s of altocumulus with a base at 11,000 feet, a top at 14,000 feet and 5/8s of cirrostratus with base at 28,000 feet and top at 35,000 feet. From the observation point, 7/8s of the sky is covered. The wind direction is from 240 degrees, the speed is 20 knots with gusts to 26 knots. There has been no change in cloud coverage over the past 3 hours.

Example of PA paragraph D output

D. WEATHER AT SITE
VSBY 10.00 NM 2/8 SC 020/040 3/8 AC 110/140 5/8 CS 280/350 0/8 ** ***/***
TOTAL CLOUD COVERAGE 7/8
WIND 240020G026 CLD SAME

NOTE: An asterisk (*) indicates no data, an entry of UN indicates missing data.

| CLOUD TYPES FOR ASPAM PARAGRAPH D OUTPUT | |
|--|-------------------|
| <u>Abbreviation</u> | <u>Cloud Type</u> |
| CB | Cumulonimbus |
| ST | Stratus |
| SC | Stratocumulus |
| CU | Cumulus |
| AS | Altostratus |
| NS | Nimbostratus |
| AC | Altocumulus |
| CS | Cirrostratus |
| CC | Cirrocumulus |
| CI | Cirrus |
| UN | Unknown |

1.6 PARAGRAPH E - PRECIPITABLE WATER. Paragraph E provides precipitable water amounts expressed in centimeters for specified layers at the PA site. The calculated value for precipitable water is written as follows:

Format: X.XXEstu

where:

X.XX = precipitable water amounts expressed in centimeters (cm).

E = exponential value to the base 10.

s = a sign for (+) or (-)

t = the tens value of the exponent

u = the unit value of the exponent

The following example indicates .471 cm of precipitable water (possible precipitation) between the surface and 1,000 feet above ground level (AGL). M represents a factor of 1000 (Roman numerals).

EXAMPLE OF PRECIPITABLE WATER

E. PRECIPITABLE WATER (CM) -

| | | |
|--------------------|-----------------------|--------------------|
| SFC-1M FT 4.71E-01 | 10M - 12M FT 2.54E-01 | 40M - 45M 5.28E-04 |
| 1M- 2M FT 1.58E-01 | 12M - 14M FT 1.03E-01 | 45M - 50M 9.83E-05 |
| 2M- 3M FT 1.34E-02 | 14M - 16M FT 1.54E-01 | 50M - 60M 8.75E-04 |

1.7 PARAGRAPH F - WINDS, TEMPERATURE, ABSOLUTE HUMIDITY, DENSITY, PRESSURE. Paragraph F provides analytic data at a specified height AGL/mean sea level (MSL) at the ASPAM point. The format and parameters are as follows:

Format: hhhM ddd sss sTTT g.gggEstu d.dddEstu ppp.pp

where:

hhhM = height of the level

Note: The customer selects height in thousands of feet indicated by M or hundreds of meters indicated by H.

ddd = wind direction in degrees true

sss = wind speed in meters per second

sTTT = temperature in degrees Celsius

Note: A negative (-) symbol (s) indicates the temperature (s) is below freezing.

CHAPTER 1

- g.ggg = absolute humidity in grams per cubic meter
- E = Exponential value to the base 10
- s = a sign for (+) or (-)
- t = the tens value of the exponent
- u = the unit value of the exponent
- d.ddd = density value in grams per cubic centimeter
- E = exponential value to the base 10
- s = a sign for (+) or (-)
- t = the tens value of the exponent
- u = the unit value of the exponent
- ppp.pp = pressure in millibars for this level (not corrected for Sea Level)

Note: An asterisk (*) indicates data is not available

In the following example, surface (SFC) winds are from 179 degrees at 3 meters per second (approximately 6 kts), the temperature is 15 degrees Celsius, the absolute humidity is 10.23 grams per cubic meter, the density is .001186 grams per cubic centimeter and the pressure is 987.00 millibars. Paragraph F is usually chosen with a RAOB PA.

EXAMPLE OF PA PARAGRAPH F

F. WINDS, TEMPERATURE, ABS HUMIDITY, DENSITY, PRESSURE

| HEIGHT | DIR | SPEED | TEMP | ABS HUM | DEN | PRES |
|--------|-------|---------|---------|-----------|-----------|--------|
| F AGL | (DEG) | (M/SEC) | (DEG C) | (GM/M3) | (GM/CM3) | (MB) |
| SFC | 179. | 3. | 15. | 1.023E+01 | 1.186E-03 | 987.00 |
| 1M | 196. | 6. | 21. | 1.099E+01 | 1.119E-03 | 952.00 |
| 2M | 216. | 10. | 21. | 1.153E+01 | 1.081E-03 | 917.00 |
| 3M | 226. | 10. | 18. | 9.689E+00 | 1.054E-03 | 887.00 |

1.8 PARAGRAPH G, REMARKS: SELF-EXPLANATORY.

EXAMPLE OF PA PARAGRAPH G.

G. REMARKS - (0038) PA SURFACE ELEVATION 0 METERS
 DISTANCE AND BEARING TO NEAREST RAOB -- 15.0 NM AT 178.0 DEG
 RAOB STATION NUMBER -- 725530 (WMO BLOCK STATION NUMBER)
 RAOB SITE ELEVATION -- 1312 FT
 EVENT SITE ELEVATION -- 675 FT (USER SUPPLIED)
 SOME ANALYSIS FIELDS DATA USED TO FILL IN 15 STANDARD PRESSURE LEVELS
 NO HIRAS ANALYSIS USED ABOVE HIGHEST RAOB LEVEL.
 RAOB BASE TIME -- 12 Oct 92 1200Z

NOTE: RAOB information is only available with RAOB PAs.

Example of PA Paragraph G.

| | | |
|-------------------------|-------------------------|--------|
| SURFACE OBSERVATIONS | 1 | 2 |
| BLOCK/STATION NUMBER | 72549 | 72553 |
| CALL LETTERS | FOD | OVN |
| ZULU TIME | 1200Z | 1200Z |
| BEARING (DEG) | 55 | 178 |
| DISTANCE (NM) | 99 | 15 |
| WIND DIRECTION (DEG) | 130 | 160 |
| WIND SPEED (KTS) | 9 | 9 |
| SEA LEVEL PRESSURE (MB) | 1010.2 | 1010.2 |
| 3-HRLY PRES CHANGE (MB) | + 0.2 | |
| ALTIMETER SETTING (IN) | 29.86 | |
| VISIBILITY (NM) | 10.3 | |
| 6-HR PRECIPITATION (IN) | | .5 |
| TEMPERATURE (DEG C) | 18 | 19 |
| DEW POINT (DEG C) | 7 | 11 |
| PRESENT WEATHER | | |
| CLOUDS: | | |
| LOW, MID, HIGH TYPES | MIS, MIS, MIS 0, 0, CS8 | |
| REPORT CLOUD LAYERS | | |
| (COVER, TYPE, X100 FT) | | |
| TOTAL COVERAGE | 6/8 | |
| CEILING (X 100 FT) | | |

MF =116. F=102. A= 29.

| | |
|---------------------------|---------|
| MOISTURE QUALITY INDEX | = 4.81 |
| TEMPERATURE QUALITY INDEX | = 3.44 |
| SLANT PATH AZIMUTH | = 135.0 |
| SLANT PATH ELEVATION | = 45.0 |

Space Environmental Support System (SESS) data is always included in Paragraph G. ASPAM uses SESS variables to determine the temperature structure of the upper atmosphere to 400,000 feet MSL. Variables include the 90-day mean flux (MF), the daily flux (F), and the planetary geomagnetic index (A). The model uses default values of MF = 120, F = 120, and A = 10 if the data is missing from ASPAM input tables. The 50th Weather Squadron, the Air Force's Space Forecast Center at Falcon AFB, Colorado, collects SESS data. The values are MF = 116, F = 102, A = 29 in the above example. The moisture quality index is based on specific humidity errors. The temperature quality index is based on the temperature errors. When either quality index is less than 1.5, the profile is questionable.

Radiosonde data is the basis of RAOBVP PAs. The remarks section will indicate the RAOB used, and the bearing and distance from the requested site. OIVP PAs employ a combination of available surface observations, upper air and a high resolution analysis system (HIRAS). A data source table may be requested when the PA is OIVP.

Possible data sources

PBL - Pibal, upper-air balloons
 AIR - Aircraft
 SFC - Surface observations
 GOE - GOES satellite winds

RAB - RAOB, Radiosonde
 SAT - Satellite
 ROC - ROCOB, Rocketsonde

EXAMPLE OF ASPAM PARAGRAPH G DATA SOURCE OUTPUT

DATA SOURCE WEIGHT TABLE:

| LEVEL | WIND | TEMP | ABS HUM | HGT |
|---------|---------------|---------------|---------------|---------------|
| FT/AGL | SRC/WGT/CORR | SRC/WGT/CORR | SRC/WGT/CORR | SRC/WGT/CORR |
| SFC | SFC/0.05/0.95 | SFC/0.07/0.91 | SFC/0.10/0.97 | SFC/0.06/0.95 |
| 0.750 | PBL/0.34/0.76 | SFC/0.22/0.82 | SFC/0.44/0.51 | SFC/0.35/0.47 |
| 1.008 | PBL/0.43/0.82 | RAB/0.28/0.64 | RAB/0.35/0.74 | RAB/0.22/0.14 |
| 1.764 | SAT/0.27/0.64 | RAB/0.33/0.93 | SAT/0.50/0.34 | RAB/0.54/0.90 |
| | | | | |
| | | | | |
| 100.350 | SAT/0.32/0.42 | - /0.00/0.00 | - /0.00/0.00 | SAT/0.32/0.81 |

Height can be in feet or meters / AGL or MSL (as requested). Feet are in 1,000-foot increments and meters are in 1,000-meter increments.

SRC = Source of data. A dash (-) in this column indicates no data available, so "first guess" (analysis) data is used to fill in.

WGT = the weighting factor in percent that the ASPAM program assigns each source of data at that particular level. Values range from a low of 0 to a high of 1.0.

CORR = correlation coefficient calculated by ASPAM program. Values range from a low of 0 to a high of 1.

1.9 PARAGRAPH H - AEROSOL PARAMETERS AND VERTICAL PROFILE INFORMATION

Format: VERTICAL PROFILE INFORMATION LLHCCSV_vvM₃QQ_v_a H_a C_a C_a

where:

- LL = number of levels
- H = primary boundary layer aerosol parameter
 1, 2, or 5 indicates land (1 is rural, 2 is urban, 5 is tropospheric)
 3 or 4 indicates Maritime (3 is open ocean, 4 is coastal)
 6 indicates fog
- CC = air parcel type, this reflects the amount of time since the airmass was over dry land, only included if H is 3 (the airmass is over open ocean)
- S = seasonal dependence
 1 indicates spring/summer, March - August or latitude is less than 20 degrees
 2 indicates fall/winter September - February or latitude is greater than 70 degrees
- V = profile and extinction type for stratospheric aerosols
 1 = background stratospheric aerosol (small amount)
 2 = moderate concentration of volcanic aerosol (aged profile)
 3 = high concentration of volcanic aerosol (fresh profile)
 4 = high concentration of volcanic aerosol (aged profile)
 5 = moderate concentration of volcanic aerosol (fresh profile)
 9 = missing

POINT ANALYSIS (PA) OUTPUT CONTENT

vv = surface visibility range, a function of the atmospheric extinction coefficient, the albedo, visual angle, and the observer's threshold contrast at the moment of observation

M₃ = ozone profile. Represents a climatological component profile of ozone.
 1 indicates latitude is less than 20 degrees
 2 indicates latitude is between 20 degrees - 70 degrees (summer)
 3 indicates latitude is between 20 degrees - 70 degrees (winter)
 4 indicates latitude is greater than 70 degrees (summer)
 5 indicates latitude is greater than 70 degrees (winter)
 6 indicates profile is US standard

QQ = boundary layer parameter quality index

V_aV_a = alternate surface visibility range

H = alternate boundary layer aerosol parameter.
 Same values as H (primary boundary layer)

C_aC_a = alternate air parcel type (only included if H = 3)

The rest of the paragraph has the following format:

hhhhh pppp sTTTT qqqq AHAZ sT_aT_aT_a q_aq_aq_a AHAZ sXXXXYYYYY Z.ZZZ

where:

hhhhh = height in hundredths of kilometers MSL. A negative value indicates the site elevation is below sea level.

pppp = pressure to tenths of a millibar

sTTTT = temperature in Celsius e.g. 125 = 12.5°C. Negative if minus (-) sign is included.

qqqq = water vapor density in g/m³

AHAZ = *** Not used

sT_aT_aT_a = alternate temperature in Celsius, negative when a minus (-) sign is included

q_aq_aq_a = alternate water vapor density in hundredths of a gram per cubic meter

AHAZ = *** Not used

sXXXX = latitude in hundredths of a degree, negative (-) indicates south (e.g., 4162 = 41.62)

YYYYY = longitude in hundredths of a degree

Note: The frame of reference for longitude is 0 degrees, the prime meridian. Values 180 degrees and less are east, for example, 09000 is 90° E. Values greater than 180 are west, for example, 26397 is 96.03° W (360 - 263.97 = 96.03° W).

Z.ZZZ = ozone day-night ratio in parts per million.

EXAMPLE OF ASPAM PARAGRAPH H

H. AEROSOL PARAMETERS

VERTICAL PROFILE INFORMATION 351 11193 9 62

| | | | | | | | |
|-----|------|-----|------|-----|------|-----------|-------|
| 20 | 9870 | 153 | 1023 | 164 | 917 | 416226397 | 0.025 |
| 25 | 9813 | 152 | 992 | 161 | 912 | 416226397 | 0.025 |
| 50 | 9523 | 213 | 1093 | 222 | 1005 | 416226397 | 0.027 |
| 75 | 9242 | 206 | 1183 | 214 | 1110 | 416226397 | 0.025 |
| 100 | 8984 | 184 | 1020 | 195 | 919 | 416226397 | 0.025 |
| 125 | 8730 | 179 | 920 | 191 | 794 | 416226397 | 0.027 |

The example LL is 35 indicating 35 levels. The primary boundary layer aerosol type "1" indicates the air mass is over land, and rural. The air parcel type (CC) is omitted. The season "1" is spring/summer with background stratospheric aerosol content "1" which indicates normal. The surface visibility range is 19. The composite ozone profile latitude "3" is for between 20° and 70°, winter. The boundary layer quality index is 9. The alternate surface visibility range is 6. The alternate boundary layer aerosol parameter is "2" which indicates a land, urban air mass.

The third line of the above example shows a height of 0.2 km MSL, the pressure is 987.0 mb, the temperature is 15.3° C, the water vapor density is 10.23 gm/m³. There is an alternate profile temperature of 16.4° C and an alternate water vapor density of 9.17 gm/m³. The location is 41.62° N and 96.03°W (360 - 263.97 = 96.03).

EXAMPLE OF ASPAM PARAGRAPH H WITH SLANTPATH

H. AEROSOL PARAMETERS

VERTICAL PROFILE INFORMATION 352 22 63 7 42

| | | | | | | | |
|-----|------|-----|-----|-----|-----|-----------|-------|
| 20 | 9967 | -16 | 403 | -10 | 389 | 4825 1637 | 0.025 |
| 25 | 9905 | -15 | 400 | -8 | 387 | 4825 1637 | 0.025 |
| 50 | 9601 | -8 | 397 | -2 | 385 | 4825 1637 | 0.027 |
| 75 | 9306 | -4 | 403 | 3 | 391 | 4825 1638 | 0.029 |
| 100 | 9021 | -9 | 369 | -2 | 358 | 4826 1638 | 0.031 |
| 125 | 8744 | -15 | 332 | -8 | 320 | 4826 1638 | 0.033 |

A slant path profile indicates different subpoints along the path in the latitude and longitude (XXXX, YYYY).

1.10 PARAGRAPH I - WINDS, TEMPERATURE, ABSOLUTE HUMIDITY, DENSITY, PRESSURE. This paragraph is used with OIVP PAs. The customer has the option of moving the information to paragraph F. The format is the same as paragraph F.

EXAMPLE OF PA PARAGRAPH I OUTPUT

I. WINDS, TEMPERATURE, ABS HUMIDITY, DENSITY, PRESSURE -

| HEIGHT | DIR | SPEED | TEMP | ABS HUM | DEN | PRES |
|--------|-------|---------|---------|-----------|-----------|--------|
| FAGL | (DEG) | (M/SEC) | (DEG C) | (GM/M3) | (GM/CM3) | (MB) |
| SFC | 179. | 3. | 15. | 1.023E+01 | 1.186E-03 | 987.00 |
| 1M | 196. | 6. | 21. | 1.099E+01 | 1.119E-03 | 952.00 |
| 2M | 216. | 10. | 21. | 1.153E+01 | 1.081E-03 | 917.00 |
| 3M | 226. | 10. | 18. | 9.689E+00 | 1.054E-03 | 887.00 |

1.11 PARAGRAPH J - 24-HOUR SURFACE WEATHER HISTORY. This paragraph provides a 24-hour coded weather history for the event site.

Format: YYJJJhhmmbbb_xcv_xth_xbbb_xcv_xth_xbbb_xcv_xth_xtcvpto pppp sTT sDDddssaaa

Note: subscript “_x” is not printed. It is used to indicate separate layers. The group “bbb_xcv_xth_x” is repeated four times. An entry of 999 means the data is missing.

Where:

YY = year, (e.g. 88 is 1988)

JJJ = Julian day (e.g. 139 is 18 May)

hh = hour UTC (e.g. 12 is 12Z)

mm = minutes

Note: Information starts at the time of the PA. The next line is valid at the nearest previous 3-hourly observation (00, 03, 06, 09, 12, 15, 18 21Z). Each subsequent line is valid 3 hours early, eight lines describe a 24-hour history.

bbb = cloud base in hundreds of meters AGL.

cv_x = cloud coverage, to the nearest ten percent.

th_x = cloud layer thickness in hundreds of meters.

tc = total cloud cover in percent

vv = visibility in kilometers

pt = precipitation type

R = rain or drizzle

S = snow

RS = rain & snow

ZR = freezing rain

RW = rain shower

SW = snow shower

A = hail

IP = ice pellets

IC = ice crystals

O = obscuration to visibility

K = smoke

F = fog

H = haze

I = fog depositing rime ice

D = dust/sand

BS = blowing snow

pppp = pressure in tenths of millibars (e.g. 9870 is 987.0 MB)

sTT = temperature in degrees Celsius (If negative, a minus (-) is included)

sDD = Dewpoint in degrees Celsius

ddsss = wind direction in tens of degrees (e.g., 18 = 180°) and speed in meters/sec.

aaa = alternate wind speed in meters/sec

Following the surface weather history are three values:

Format: T_hT_h T_lT_l SSS

Example: 29 15 0

T_hT_h = maximum 24-hour temperature in degrees Celsius, for example, 29 = 29°C

T_lT_l = minimum 24-hour temperature in degrees Celsius

SSS = snow depth in inches

- rrr = relative humidity (converted from absolute humidity)
- RRR.R = the radio index (computed using a formula) ranges from Gamma rays to very high frequency.
- o.000000 = the optical index (computed using a formula) ranges from violet to red.
- DDD.DDDD = the difference between the radio indices at the level and the next level.
- AAAAAA = the refractive condition (determined by the size of delta) range from subrefractive to normal to super refractive to trapping.

EXAMPLE OF ASPAM PARAGRAPH K

K. REFRACTIVE INDEX PROFILE

| PRESS | HGT | WD | WS | TEMP | RH | RADIO | OPTICAL | REFRC |
|--------|------|-----|-----|-------|------|-------|----------|-----------------|
| MB | FT | DG | M/S | DG C | PRCT | INDEX | INDEX | DELTA COND |
| 1020.0 | 0 | 320 | 2 | 4.24 | 90 | | | |
| 983.0 | 1000 | 356 | 2 | 10.11 | 25 | 305.2 | 1.000305 | -27.2009 SUPER |
| 947.7 | 2000 | 70 | 1 | 9.42 | 14 | 278.0 | 1.000278 | -10.7483 NORMAL |
| 913.4 | 3000 | 200 | 1 | 8.16 | 10 | 267.3 | 1.000267 | -7.3337 NORMAL |
| 879.7 | 4000 | 230 | 4 | 6.22 | 10 | 259.9 | 1.000254 | -2.8748 NORMAL |

The second line of the example indicates a pressure of 983.0 MB at 1000 feet. The wind has a direction of 356 and a speed of 2 meters per second. The temperature is 10.11 C, the relative humidity is 25 percent.

CHAPTER 2

D. WEATHER AT SITE

VSBY 03.24 NM 0/8 ** ***/***, 0/8 ** ***/***, 2/8 ST 024/034, 8/8 ST 058/068
 TOTAL CLOUD COVERAGE 8/8
 WIND 305015G*** LGT CON SNOW

E. PRECIPITABLE WATER (CM) -

| | | |
|----------------------|-----------------------|------------------------|
| SFC - 1M FT 9.64E-01 | 10M - 12M FT 3.81E-01 | 40M - 45M FT 9.69E-04 |
| 1M - 2M FT 8.74E-01 | 12M - 14M FT 2.53E-01 | 45M - 50M FT 7.80E-04 |
| 2M - 3M FT 7.79E-01 | 14M - 16M FT 1.63E-01 | 50M - 60M FT 1.12E-03 |
| 3M - 4M FT 6.93E-01 | 16M - 18M FT 1.05E-01 | 60M - 70M FT 7.03E-04 |
| 4M - 5M FT 6.07E-01 | 18M - 20M FT 6.76E-02 | 70M - 80M FT 4.38E-04 |
| 5M - 6M FT 5.20E-01 | 20M - 25M FT 8.43E-02 | 80M - 90M FT 2.68E-04 |
| 6M - 7M FT 4.30E-01 | 25M - 30M FT 1.70E-02 | 90M - 100M FT 1.71E-04 |
| 7M - 8M FT 3.50E-01 | 30M - 35M FT 1.52E-03 | |
| 8M - 10M FT 5.33E-01 | 35M - 40M FT 1.21E-03 | |

F. WINDS, TEMPERATURE, ABS HUMIDITY, DENSITY, PRESSURE -

G. REMARKS - (0067) PA SURFACE ELEVATION IS 138 METERS

| | 1 | 2 | 3 | 4 |
|-------------------------|---|---------|----------|----------------|
| SURFACE OBSERVATIONS | I | I | I | I |
| BLOCK/STATION NUMBER | I 72433 | I 72433 | I 72445 | I 72434 |
| CALL LETTERS | I BLV | I MVN | I VIH | I STL |
| ZULU TIME | I 1200Z | I 1200Z | I 1200Z | I 1200Z |
| BEARING (DEG) | I 0 | I 106 | I 255 | I 297 |
| DISTANCE (NM) | I 1 | I 48 | I 94 | I 27 |
| WIND DIRECTION (DEG) | I 320 | I 300 | I 300 | I 320 |
| WIND SPEED (KTS) | I 25 | I 9 | I 16 | I 25 |
| SEA LEVEL PRESSURE (MB) | I 1008.5 | I | I 1013.3 | I 1009.5 |
| 3-HRLY PRES CHANGE (MB) | I + 3.9 | I | I | I + 4.7 |
| ALTIMETER SETTING (IN) | I 29.77 | I 29.71 | I 29.89 | I 29.80 |
| VISIBILITY (NM) | I 6.1 | I 8.7 | I 13.0 | I 4.9 |
| 6-HR PRECIPITATION (IN) | I | I | I | I TRACE |
| TEMPERATURE (DEG C) | I -1 | I -1 | I -3 | I -2 |
| DEWPOINT (DEG C) | I -5 | I -6 | I -6 | I -5 |
| PRESENT WEATHER | I LGT CON SNOW | | I | I LGT CON SNOW |
| PAST WEATHER | I | I | I | I SNOW |
| CLOUDS: | I | I | I | I |
| LOW, MID, HIGH TYPES | I ISF7,AS2,MIS IMIS,MIS,MIS ISC5,MIS,MIS ISC5,AS2,MIS | | I | I |
| REPORT CLOUD LAYERS | I | I | I | I |
| (COVER,TYPE,X100 FT) | I | I | I | I |
| TOTAL COVERAGE | I 8/8 | I 8/8 | I 8/8 | I 8/8 |
| CEILING (X100 FT) | I M025 | I M016 | I E015 | I 050 |

MF= 99. F=119. A= 12.

DATA SOURCE WEIGHT TABLE:

| LEVEL | WIND | TEMP | ABS HUM | HGT |
|--------|---------------|---------------|----------------|----------------|
| MT/MSL | SRC/ WGT/CORR | SRC/ WGT/CORR | SRC/ WGT/CORR | SRC/ WGT/CORR |
| SFC | PBL/0.28/0.88 | RAB/0.23/0.88 | RAB/0.27/0.89 | RAB/0.27/0.89 |
| 0.239 | PBL/0.26/0.84 | RAB/0.20/0.88 | RAB/0.25/0.89 | RAB/0.23/0.89 |
| 0.486 | PBL/0.22/0.84 | RAB/0.13/0.88 | RAB/0.19/0.8 | RAB/0.19/0.89 |
| 0.738 | PBL/0.20/0.89 | SFC/0.20/0.6 | 8RAB/0.15/0.88 | RABB/0.23/0.89 |
| 0.993 | PBL/0.19/0.84 | RAB/0.14/0.89 | SFC/0.11/0.72 | RAB/0.17/0.89 |
| 1.247 | PBL/0.19/0.83 | SFC/0.10/0.68 | SFC/0.11/0.71 | RAB/0.12/0.88 |
| 1.496 | PBL/0.22/0.89 | RAB/0.10/0.89 | RAB/0.09/0.89 | RAB/0.10/0.73 |
| 1.744 | PBL/0.23/0.88 | RAB/0.12/0.90 | RAB/0.11/0.90 | RAB/0.11/0.87 |
| 1.993 | PBL/0.23/0.85 | RAB/0.12/0.90 | RAB/0.13/0.90 | RAB/0.12/0.88 |
| 2.244 | PBL/0.21/0.82 | RAB/0.12/0.87 | RAB/0.14/0.87 | RAB/0.12/0.88 |
| 2.496 | PBL/0.15/0.90 | RAB/0.15/0.89 | RAB/0.10/0.89 | RAB/0.15/0.89 |
| 2.996 | PBL/0.13/0.88 | RAB/0.18/0.89 | RAB/0.12/0.89 | RAB/0.19/0.90 |
| 3.489 | PBL/0.11/0.82 | RAB/0.17/0.86 | RAB/0.12/0.90 | RAB/0.18/0.86 |
| 3.987 | PBL/0.12/0.89 | RAB/0.17/0.68 | RAB/0.13/0.89 | RAB/0.17/0.88 |
| 4.490 | PBL/0.08/0.89 | RAB/0.13/0.89 | RAB/0.12/0.90 | RAB/0.15/0.89 |
| 4.996 | AIR/0.09/0.84 | RAB/0.13/0.69 | RAB/0.12/0.90 | RAB/0.13/0.89 |
| 5.988 | PBL/0.08/0.78 | RAB/0.13/0.89 | RAB/0.13/0.89 | RAB/0.18/0.89 |
| 6.995 | PBL/0.09/0.88 | RAB/0.10/0.90 | RAB/0.12/0.90 | RAB/0.16/0.90 |
| 7.840 | PBL/0.13/0.74 | RAB/0.18/0.89 | RAB/0.12/0.89 | RAB/0.19/0.89 |
| 7.987 | PBL/0.11/0.74 | RAB/0.15/0.89 | RAB/0.12/0.9 | RAB/0.16/0.89 |
| 8.996 | AIR/0.07/0.89 | SAT/0.42/0.93 | -/0.00/0.0 | RAB/0.12/0.92 |
| 9.999 | PBL/0.08/0.77 | AIR/0.12/0.90 | -/0.00/0.00 | RAB/0.16/0.90 |
| 12.497 | PBL/0.12/0.88 | RAB/0.10/0.88 | -/0.00/0.00 | RAB/0.18/0.83 |
| 14.994 | PBL/0.10/0.88 | RAB/0.10/0.93 | -/0.00/0.00 | RAB/0.19/0.93 |
| 17.497 | PBL/0.18/0.91 | RAB/0.12/0.83 | -/0.00/0.00 | RAB/0.18/0.92 |
| 20.002 | PBL/0.17/0.92 | SAT/0.09/0.93 | -/0.00/0.00 | RAB/0.12/0.92 |
| 22.513 | PBL/0.16/0.92 | RAB/0.11/0.90 | -/0.00/0.00 | RAB/0.19/0.90 |
| 25.033 | PBL/0.16/0.78 | SAT/0.08/0.83 | -/0.00/0.00 | RAB/0.21/0.83 |
| 27.569 | PBL/0.29/0.92 | RAB/0.21/0.90 | -/0.00/0.00 | RAB/0.33/0.78 |
| 29.957 | PBL/0.48/0.68 | SAT/0.13/0.86 | -/0.00/0.00 | SAT/0.13/0.89 |

MOISTURE QUALITY INDEX = 4.85
 TEMPERATURE QUALITY INDEX= 4.10

SLANT PATH AZIMUTH = 45.0
 SLANT PATH ELEVATION ANGLE = 4.5

CHAPTER 2

H. AEROSOL PARAMETERS

36

VERTICAL PROFILE INFORMATION 351 22143 9121

| | | | | | | | |
|------|------|------|-----|------|-----|-----------|-------|
| 14 | 9917 | -15 | 367 | -5 | 350 | 385527015 | 0.030 |
| 25 | 9763 | -23 | 354 | -13 | 340 | 385627016 | 0.030 |
| 50 | 9456 | -39 | 331 | -29 | 320 | 385827019 | 0.032 |
| 75 | 9161 | -56 | 308 | -47 | 300 | 386027021 | 0.034 |
| 100 | 8876 | -73 | 280 | -65 | 280 | 386227024 | 0.035 |
| 125 | 8598 | -90 | 254 | -82 | 254 | 386427026 | 0.037 |
| 150 | 8322 | -107 | 223 | -99 | 223 | 386627029 | 0.039 |
| 175 | 8053 | -122 | 199 | -114 | 197 | 386827031 | 0.041 |
| 200 | 7792 | -135 | 169 | -127 | 165 | 387027034 | 0.042 |
| 225 | 7539 | -149 | 147 | -141 | 142 | 387227036 | 0.044 |
| 250 | 7295 | -163 | 122 | -154 | 118 | 387427039 | 0.045 |
| 300 | 6822 | -189 | 91 | -181 | 87 | 387727044 | 0.046 |
| 350 | 6370 | -222 | 69 | -213 | 67 | 388127048 | 0.047 |
| 400 | 5948 | -257 | 50 | -248 | 48 | 388527053 | 0.048 |
| 450 | 5551 | -288 | 35 | -279 | 34 | 388827058 | 0.050 |
| 500 | 5177 | -320 | 24 | -311 | 23 | 389227063 | 0.051 |
| 600 | 4481 | -379 | 12 | -369 | 11 | 389927072 | 0.054 |
| 700 | 3870 | -439 | 6 | -430 | 5 | 390627081 | 0.059 |
| 800 | 3326 | -481 | 3 | -471 | 3 | 391327090 | 0.103 |
| 900 | 2859 | -490 | 0 | -482 | 0 | 392027099 | 0.204 |
| 1000 | 2459 | -459 | 0 | -451 | 0 | 392627107 | 0.354 |
| 1250 | 1691 | -464 | 0 | -455 | 0 | 394227128 | 0.915 |
| 1500 | 1156 | -510 | 0 | -500 | 0 | 395727149 | 1.677 |
| 1750 | 786 | -532 | 0 | -522 | 0 | 397227169 | 2.563 |
| 2000 | 533 | -556 | 0 | -546 | 0 | 398627188 | 3.494 |
| 2250 | 360 | -561 | 0 | -549 | 0 | 400027206 | 4.392 |
| 2500 | 244 | -559 | 0 | -546 | 0 | 401327224 | 5.180 |
| 2750 | 166 | -566 | 0 | -549 | 0 | 402627242 | 5.776 |
| 3000 | 112 | -591 | 0 | -579 | 0 | 403827259 | 6.326 |
| 3500 | 59 | -431 | 0 | -412 | 0 | 406227293 | 7.122 |
| 4000 | 41 | -216 | 0 | -188 | 0 | 408527325 | 6.941 |
| 4500 | 16 | -86 | 0 | -45 | 0 | 410727356 | 4.863 |
| 5000 | 8 | -132 | 0 | -89 | 0 | 412827385 | 2.970 |
| 7500 | 1 | -549 | 0 | -480 | 0 | 422127523 | 2.342 |

I. WINDS, TEMPERATURE, ABS HUMIDITY, DENSITY, PRESSURE -

J. SURFACE WEATHER HISTORY

24 HOUR SURFACE WEATHER HISTORY

| | | | | |
|---|---------|------|------------|------------|
| 9335912000090303019100300000000000000009906 | S0 | 9917 | -1 | -431008010 |
| 93359090001608030000000000000000000007511 | S0 | 9859 | 7 | 432009011 |
| 93359060000503030131003000000000000000990900F | 9833 | 3 | 028006007 | |
| 933590300004030300910220260818000000009903 | S0 | 9871 | 1 | -326005006 |
| 933590000009030301310030000000000000009906 | S0 | 9909 | -1 | -625004005 |
| 933582100010030303110090000000000000009911000 | 9952 | -1 | -726005006 | |
| 933581800010030304610090000000000000009911000 | 9994 | -2 | -826005006 | |
| 933581500007030301303030251009000000009906 | S010009 | -2 | -628004005 | |
| 93358120001310030000000000000000000009906 | S010024 | -2 | -431004005 | |

7 -2 2

K. REFRACTIVE INDEX

| PRESS MB | HGT FT | WD DG | WS M/S | TEMP DG | RH PRCT | RADIO INDEX | OPTICAL INDEX | DELTA | REFRAC COND |
|-------------|-----------|----------|-----------|------------|------------|----------------|------------------|----------|----------------|
| 991.7 | 424. | 305. | 7.5 | 271.66 | 83.9 | | | | |
| 972.4 | 924. | 305. | 8.7 | 270.66 | 87.1 | 303.9 | 1.000303 | -10.5757 | NORMAL |
| 953.7 | 1424. | 306. | 9.9 | 269.70 | 89.2 | 298.6 | 1.000299 | -10.3315 | NORMAL |
| 935.3 | 1924. | 307. | 11.2 | 268.70 | 91.6 | 293.4 | 1.000293 | -10.0845 | NORMAL |
| 917.4 | 2424. | 308. | 12.4 | 267.68 | 94.2 | 288.4 | 1.000288 | -10.0918 | NORMAL |
| 899.8 | 2924. | 310. | 12.9 | 266.61 | 95.9 | 283.3 | 1.000283 | -10.0977 | NORMAL |
| 882.7 | 3424. | 311. | 13.3 | 265.56 | 97.6 | 278.3 | 1.000278 | -9.8911 | NORMAL |
| 865.7 | 3924. | 311. | 13.9 | 264.52 | 99.9 | 273.3 | 1.000273 | -9.9629 | NORMAL |
| 848.9 | 4424. | 311. | 14.4 | 263.48 | 99.9 | 268.3 | 1.000268 | -10.1396 | NORMAL |
| 832.2 | 4924. | 311. | 15.0 | 262.41 | 99.9 | 263.3 | 1.000263 | -10.0952 | NORMAL |
| 815.7 | 5424. | 311. | 15.3 | 261.53 | 99.9 | 258.2 | 1.000257 | -10.0754 | NORMAL |
| 799.4 | 5924. | 312. | 15.7 | 260.68 | 98.1 | 253.2 | 1.000253 | -10.2206 | NORMAL |
| 783.5 | 6424. | 312. | 16.0 | 259.89 | 94.8 | 248.1 | 1.000248 | -10.0128 | NORMAL |
| 768.0 | 6924. | 313. | 16.3 | 259.04 | 92.6 | 243.1 | 1.000242 | -9.5830 | NORMAL |
| 752.7 | 7424. | 313. | 16.5 | 258.18 | 90.6 | 238.3 | 1.000237 | -9.5142 | NORMAL |
| 737.7 | 7924. | 313. | 16.2 | 257.36 | 86.1 | 233.5 | 1.000233 | -9.3594 | NORMAL |
| 723.0 | 8424. | 313. | 16.0 | 256.54 | 82.9 | 228.8 | 1.000228 | -8.9391 | NORMAL |
| 708.4 | 8924. | 314. | 16.1 | 255.73 | 80.9 | 224.4 | 1.000224 | -8.6542 | NORMAL |
| 694.1 | 9424. | 314. | 16.1 | 254.91 | 78.9 | 220.0 | 1.000219 | -8.4240 | NORMAL |
| 680.0 | 9924. | 314. | 16.2 | 254.06 | 77.3 | 215.8 | 1.000216 | -8.0346 | NORMAL |
| 666.1 | 10424. | 314. | 16.4 | 253.07 | 77.4 | 211.8 | 1.000212 | -7.7377 | NORMAL |
| 652.3 | 10924. | 314. | 16.5 | 252.07 | 77.5 | 207.9 | 1.000208 | -7.6585 | NORMAL |
| 638.6 | 11424. | 314. | 16.7 | 251.05 | 77.8 | 204.1 | 1.000204 | -7.4963 | NORMAL |
| 625.5 | 11924. | 313. | 17.0 | 250.00 | 76.9 | 200.4 | 1.000200 | -7.2922 | NORMAL |
| 612.5 | 12424. | 313. | 17.3 | 248.94 | 76.1 | 196.7 | 1.000196 | -7.1381 | NORMAL |
| 599.8 | 12924. | 313. | 17.7 | 247.87 | 75.3 | 193.1 | 1.000193 | -7.0471 | NORMAL |
| 587.3 | 13424. | 314. | 17.5 | 246.88 | 74.0 | 189.6 | 1.000189 | -6.9756 | NORMAL |