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Upper-Air Meteorological Support for ARB's 1995 Mojave Desert Ozone Transport Study

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD
Research Division

Upper-Air Meteorological Support for ARB's 1995 Mojave Desert Ozone Transport Study

Final Report

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Prepared For:

California Air Resources Board
Research Division
2020 L Street
Sacramento, CA 95814

Prepared By:

Daniel E. Wolfe
Environmental Technology Laboratory
Environmental Research Laboratories
National Oceanic and Atmospheric Administration
325 Broadway
Boulder, Colorado 80303

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ABSTRACT

The National Oceanic and Atmospheric Administration's (NOAA) Environmental Technology Laboratory (ETL) System Demonstration and Integration Division was contracted for use of it's newly developed 449 MHz wind profiler/RASS (profiler) in support of the 1995 Mojave Desert Ozone Transport Study. The profiler operated in conjunction with an ozone lidar operated by NOAA's ETL Atmospheric Lidar Division. Both systems were located at George Air Force Base and operated for 2 weeks in early August (near the city of Victorville, CA in the Mojave desert). The profiler continuously monitored the winds from near ground level to a maximum height of 3.5 km above ground level (AGL) and the virtual temperature to a maximum height of 2.5 km AGL. High spatial and temporal resolution wind profiles are available to combine with lidar ozone profiles to calculate ozone flux/transport profiles. Virtual temperature profiles from the RASS are available to help determine the mixing depth. Surface measurements of temperature, relative humidity, pressure and wind speed and direction were also made to supplement the profiler data in the lowest levels.

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I. INTRODUCTION:

The study described in this report represents the first field operations of NOAA's prototype 449-MHz wind profiler with radio acoustic sounding system (RASS). In this study the overall objectives were:

> **To test NOAA's prototype 449-MHz profiler/RASS under strong radio frequency (RF) interference conditions.**
>
> **To deploy the 449-MHz profiler at George Air Force Base near Victorville, California**
>
> **To collect wind and temperature profiles in conjunction with NOAA's ozone lidar.**
>
> **To quality control these data through post-processing and provide them to CARB.**
>
> **To provide quality controlled wind profiles to be used in conjunction with ozone profiles for calculating ozone flux profiles.**

Because of the conflict between the operating RF of the U.S. Air Force Search and Rescue (SAR) satellites and the 404-MHz NOAA Profiler Network (NPN), the Systems Demonstration and Integration Division designed and built a prototype portable 449-MHz wind profiler with Radio Acoustic Sounding System (RASS) capabilities to test the feasibility of operation at this new frequency. The 449-MHz system coincides with an operating frequency of civilian amateur radio operators. Preliminary tests of the 449-MHz system were carried out to determine if the amateur radio activity would interfere with the 449-MHz profiler significantly enough to produce erroneous winds. These tests showed that high quality winds could be measured in the presence of RF interference. Experience also suggested that siting of the profiler antenna with the intention of blocking the strongest direct interference should be a priority. At George Air Force Base less than 5 km to the NNW of Victorville, CA, (location shown in Fig. 1a) measurements were made of local RF signals near 449-MHz prior to deployment. The area of strongest RF signals to the east was blocked by the placing the profiler antenna to the west of a concrete berm (shown in Fig. 1b&c). Other possible sources of contamination the profiler included mainly power lines (Fig. 1c). Limited contamination from these sources was confined to the lowest 2 gates of the profiler (below 0.3 km) and only during periods of strong winds.

The 449-MHz profiler is a five-beam phased array system with an electronically steerable antenna. This feature enhances the potential data quality when operated in a five-beam mode; one vertical and two pairs of orthogonal oblique pointing beams. In this mode one can then make use of existing quality-control (QC) algorithms (Weber et al., 1993; Weber and Wuertz, 1991; Wolfe et al., 1995) that test for consistency between opposite pointing beams. This can be important when operating in highly convective or variable conditions, since each beam samples a different volume at a different time. This prototype system uses the Profiler On Line Program (POP 4.13) and was set up to collect a 30-sec sample from each beam in succession. It took approximately 2.5 minutes to cycle through all five beams. Figure 2 is a plot of 15 minute consensus-averaged winds produced in the field by POP. Each 15-minute profile is a consensus of approximately six 2.5 minute cycles. Comparing these data to the 15-minute and 60 minute QC'd data, presented later in this report, illustrates the effect of the QC and temporal smoothing. The 15- and 60-minute QC'd data are different from the standard consensus winds because the continuity algorithm (Weber et al., 1993) was applied to the raw radial velocities before averaging . The continuity algorithm employs a pattern recognition technique that attempts to distinguish continuous features of radial velocity over time and height from those features that are discontinuous. Quality control flags are set to "GOOD" for continuous features, and set to "BAD" for those that are discontinuous. The time-averaged radials (15 or 60 minute) are also passed through the same continuity algorithm as a final quality control step prior to combining the radials and calculating the wind speed and direction. The RASS acoustic and atmospheric radial velocities are processed in a similar manner.

The final products (15/60-minute average-wind and temperature data) are all contained in daily ASCII files. The validation level for these data is 23. This code means that the raw moment level radials were passed once through the continuity algorithm (Table IIIa) and then the averaged radial velocities were passed through a second time (Table IIIb) over an entire 24-hr period prior to calculation of the winds or temperature. Within each file is a QC value representing either "GOOD'" "SUSPECT'" or "BAD" data. All original data are retained and have not been flagged. The wind data are of a high quality with little or no further editing needed. The temperature data are not as clean as the wind data due to RF interference. Further quality control is needed on these data, primarily at the upper gates where the atmospheric signal is weak and the RF interference dominates.

Appendix A is a summary of some of the more important entries taken from the profiler log book. Appendix B contains short lists of the profiler wind, temperature and surface meteorological data file formats. Appendix C contains all the figures including daily wind barb and temperature vertical profiles during 2-13 August (JD 214-225), 1995.

II. DATA QUALITY CONTROL

Tests were performed to determine what effect RF interference might have on the 449-MHz profiler. Intercomparisons were made between the NOAA 404-MHz and 449-MHz profilers, both located at Platteville, CO. These results shown in Figs. 3a&b by the solid circles confirm that the RF interference at this location did not compromise the utility of the 449-MHz profiler data. The Platteville data were QC'd and then processed to match the spatial (250m vertical resolution) and temporal (hourly averages) sampling of the 404-MHz profiler. The comparison height of 3270 m MSL was chosen as a height well above any potential ground clutter interference, but still within the region of strong signals and varying winds. Means, standard deviations, and correlations of the meteorological U and V wind components indicate RF interference was not a problem in this data set. The few outliers seen (Figs. 3a&b) that made it through the QC, are believed to be the result of RF interference.

No independent auditing of the data was performed while in Victorville, but several opportunities arose where wind and temperature profiles were available for comparison from independent measurements. Personal communication with J.J. Carroll of University of California at Davis has confirmed that aircraft profiles, taken near the profiler, of computed virtual temperature compared well with the unedited consensus RASS profiles. Similar comparisons of wind speed and direction were also encouraging.

Figures 3a&b also contain comparisons (open circles) of the hourly 449-MHz profiler winds with hourly-consensus data from a 915-MHz boundary layer profiler (operated by CARB) over the entire experiment. This profiler was located near the Apple Valley Airport approximately 15 km to the ESE of George AFB. Complex topography, including the Bell Mountain Range, separates these two sites. The comparison height of ~2500m MSL was chosen to reduce the effects of the complex terrain. Means, standard deviations, and correlations calculated over the entire 12 days again show good agreement, with no indication that RF interference was a problem. The increased scatter seen in the data compared to Platteville is a result of the larger spatial separation between these two sites. Despite the increased scatter, there are no obvious outliers to suggest that some data contaminated by RF made it through the QC process. It should be noted that all Victorville data flagged as suspect were removed for these comparisons.

Following the CARB experiment the profiler was moved to Point Loma, CA, for a special experiment in conjunction with the U.S. Navy. During this experiment 20 rawinsondes were launched for comparison with the high temporal resolution profiler/RASS data. Figure 4 shows two such virtual temperature comparisons. Both RASS profiles represent the closest single unedited RASS profile corresponding in time to the rawinsonde launch. These absolute differences are much less than the reported 1°C accuracy of standard RASS systems (May et al., 1989, Wuertz et al., 1991). The similarity in the detail of the vertical structure is also remarkably good.

All profiler data have been QC'd using a continuity algorithm (Weber and Wuertz 1991). Tables I, II, and III describe the profiler/ RASS specifications, Profiler On-Line Program parameters and continuity algorithm parameters. These tables are presented primarily to maintain a record of how the 449-MHz profiler was operated and the data were processed during this experiment. This information is also necessary in understanding the final data and its quality. A 15-min consensus period was set in the POP parameters; this controls how often RASS is turned on. The pulse width and gate spacing for the winds were set to 75 meters. The RASS pulse width and gate spacing were set to 150 m and 120 m respectively. The increased pulse width for the RASS was made in an attempt to increase the output power and consequently the height range.

Figures 5a-e are time-height plots of the signal-to-noise ratio (SNR) for all five beams on 5 Aug (Julian Date 217). Local time equals UTC-7 hrs; ie. 1900 UTC equals 1200 local time. The top plot is the raw unedited data and the bottom plot the QC/edited data. The minimum and maximum SNR threshold values used in the QC algorithm (Table IIIa) were chosen based on these types of plots from preliminary QC runs. Thresholding permits the user to eliminate noise and some RF interference in the data.

Figures 6a-e are the corresponding radial velocities for all five beams. Periods of RF interference (vertical stripes in Fig. 6c) standout here more than in Fig. 5. Also depicted in these figures is how the continuity algorithm handles the RF interference and/or low SNR. As the name implies this algorithm looks for consistent patterns. Various parameters in Table IIIa such as the minimum pattern size and the neighborhood parameters allow one to try to adjust the algorithm to maximize the amount of bad data eliminated while retaining as much good data as possible. The size of the QC interval period also determines what passes or fails the QC. As can be seen in Figure 6b for beam 1, the RF interference (~2100 UTC) was not identified as a continuous pattern and failed the QC. In contrast for beam 2 (Fig. 6c) the RF interference (~2100 UTC) was identified as a continuous pattern and passed the QC. Processing parameters were identical for all days during the experiment. Weak signal in the upper gates may be locked onto by the algorithm if it is a large enough pattern or is identified as connecting to a pattern in the lower gates. A majority of the averaged winds computed with such data are later flagged as suspect when the averaged radial velocities are passed through the QC algorithm. Several points to notice in these data plots are:

1) The complex structure with multiple layers, especially at night (Figs. 5a-c).
2) The bird point targets beginning ~0400 UTC (speckling Figs. 5b and 6b).
3) The growth of the convective boundary layer (CBL) ~ 1600 UTC (0900 local time; Fig. 5c).
4) The RF interference in all beams (Figs. 6a-e ~2000 UTC) producing erroneous radial velocities.
5) A strong, nearly continuous layer of high SNR (horizontal band) at ~.25 km, probably ground clutter.
6) The vertical white stripes representing RASS sampling periods every 15 minutes.

Birds only appear in the north/south pointing radial velocities (Figs. 6b&c) even though they are evident in the SNR for all oblique beams (Figs. 5b-e). This fact and the positive radial velocities in the north-pointing beam (positive is towards the profiler) suggest that these are migrating birds traveling north to south. Note that the QC algorithm is able to identify these data as a discontinuity, therefore eliminating the contaminated data within the radial velocities (Figs. 6b-e). Bird contamination has been identified before in profiler data and is described in detail by Wilczak et al. (1995) and Merritt (1995).

Figure 7 is a time-height plot of the SNR for the RASS acoustic beam on 5 Aug (JD 217). The darker vertical stripes represent the actual amount of time, three minutes, that RASS was turned on out of every 15-minute consensus period. There are six temperature profiles sampled within each 3-minute RASS mode. The white spacing is the wind-sampling period (12 minute). Plotting these data at the times they were actually sampled (Fig. 7) makes it difficult to extract information. Therefore, Figs. 8a&b are the RASS SNR and radial acoustic velocity on 5 Aug depicted as if they were uniformly sampled in time across a 15-minute period. The vertical white stripes are placed in the plot every 15 minutes to denote a break in the sampling. Note the regions of interference that appear as nearly continuous vertical stripes (Fig 8b, 1900 UTC). The continuity algorithm works on the RASS data in the same manner as the profiler wind data looking for consistency in time and height. Interference such as that found around 2000 UTC will pass the QC regardless of its meteorological truth unless the velocity resolution (or shear) parameter detects a discontinuity or it forms an isolated pattern that is less than the minimum pattern size. Figures 9a&b are the corresponding RASS atmospheric SNR and radial velocity sampled simultaneous with the acoustic velocity (Fig. 8). These velocities are normally used to correct the acoustic velocities where large up- and downward motion of the atmosphere tends to bias the true acoustic velocity and therefore the virtual temperature. During periods of precipitation, which are seen as downward (positive) vertical velocities in the profiler data, one would not want to correct the acoustic velocities. Previous work (personal communication with Earl Gossard, 1996) concludes that unwanted variability in the virtual temperatures is introduced when the POP consensus-averaged vertical velocities are used to correct the acoustic velocities. As can be seen in the edited atmospheric vertical velocities (Fig 9b) there is variability on the order of 1 to 2 ms^{-1}, which translates into a 1.6 to 3.2°C temperature correction. All virtual temperature data shown in this report have not been corrected for vertical velocity, although both the vertical velocities and a corrected temperature are available in the data files in addition to the uncorrected temperatures.

It should be noted at this time that raw spectral data were saved in addition to the moment data. Spectral data were used to help identify periods of RF interference and confirm the how the quality control algorithms were functioning on moment data within these contaminated periods. These data are available to anyone who wishes, for more in-depth analysis.

III. DATA DISCUSSION

IIIa. Surface Instrumentation

Surface meteorological instrumentation was collocated with the profiler and mounted on a three-meter tripod (Fig. 10). The tripod was placed on top of an ~4-meter berm surrounding the profiler site. In order to keep the surface measurements close to the profiler, this site was the best possible. Effects of the berm, which was oriented north-south, are believed to be negligible and are not evident even in the 5-minute average data shown in this report. Instrumentation included an R.M. Young Model 05103-5 anemometer, Vaisala Model HMP35C Temperature/RH probe, and a Setra Model 270 pressure sensor. Data were recorded using a Campbell Scientific Model CR10 data logger sampling at .1 Hz. and internally averaged to 5-minute values. Data were continually downloaded from the data logger to a PC. All instrumentation was new with factory direct calibrations. Intercomparisons were made to secondary standards after the study and all instruments were found to be within manufacturer specifications.

IIIb. Surface Meteorology

Surface temperatures (Fig. 11a) over the 12-day period from 2-13 August show a strong diurnal heating trend with daytime maximums ranging from 36-40°C, minimums 18-23°C and a diurnal range on the order of 15°C. The period of maximum heating occurred around 1500-1600 hrs. and the minimum heating around 0500-0700 hrs. local time each day. There is no indication in the temperature data of any significant change in air mass or cloud cover that altered the diurnal heating cycle.

Surface pressure measurements (Fig. 11b) show both the diurnal heating effects along with the large scale synoptic pattern. The passage of a single surface low pressure system is evident in the data on 10 Aug (JD 222).

Surface wind speeds (Fig.11c) range from 0-10 ms^{-1} and show a very consistent diurnal cycle. The strongest winds occurred 1500-1700 hrs. local time each day in phase with the maximum heating. Minimum winds occurred 0500-0700 hrs. local time each day. Corresponding wind directions (Fig. 11d) are from three dominant directions and correlate with the wind speed. For speeds less than 4 ms^{-1}, winds are from ESE, speeds of 4-7ms^{-1}, winds from directions around SSW, and speeds greater than 7 ms^{-1}, winds from WNW.

Relative humidity (Fig. 11e) was low, as expected for this site and this time of year. Data range from 10-48%, and show a consistent diurnal pattern tied to the temperature variation. Analyzing a conservative moisture parameter such as the mixing ratio (Fig. 11f) calculated from the temperature, RH, and pressure, there is significantly more variability (1-10 gkg^{-1}) and less of a discernable diurnal pattern. There is no known local surface moisture source and it is believed that this variability is a direct result of moisture advection. Comparing these data to the other surface parameters, one sees some evidence of a correlation between southwesterly flow and increased mixing ratios. This is consistent with marine air from the Los Angles basin entering through Cajon Pass which lies to the southwest of Victorville (Fig. 1a). In contrast, northwesterly flow off the high desert correlates with drier periods. Even though the mixing ratios are low, they appear to be an excellent indicator of variation in the air mass. These results are consistent with previous work reported by Russell (1995).

Table IV lists some basic statistics calculated from the 5-minute surface meteorological data. Appendix C contains a short listing of the surface meteorological data file. Time (UTC) has been converted to decimal Julian day and represents the end of the 5-minute averaging period reported by the data logger.

IIIc. Profiler Winds

All profiler winds shown here have been generated by post-processing the raw moment data using the continuity algorithm for QC. It should be reiterated here that this algorithm is applied to the radial velocities from each antenna beam independently. A further requirement that opposite-pointing oblique beam measurements must agree was not imposed on these data. Normally this cross-beam check has proven useful, especially for convective conditions, in identifying periods where there is no horizontal homogeneity between the different volumes sampled by the various beams during the sampling cycle (Weber et al., 1993). This method was applied to these data at first, but too much good data were thrown out. It is believed that the variability of the RF interference between opposite pointing beams, as seen in Figs. 5&6, was the major cause for this.

Figures 12a-l are daily plots of the hourly QC'd wind barbs for the period from 2-13 Aug (JD 214-225). Suspect data are plotted in these figures. Hourly winds were calculated using a complete hours worth of QC'd moment data. Wind barb and QC keys are listed on the right-hand side of the plot.

Times represent the end of the averaging period and heights identify the middle of that layer. The lowest row of wind barbs is the surface winds merged with the profiler data in these plots for initial comparison purposes only. The surface data are hourly averages calculated from the 5-minute data. Suspect data are identified by the large circles at the origin of the wind barb. This is indicated by a code of "7" in the data files as determined by the QC algorithm. This flag corresponds to all five profiler beams failing to pass the radial velocity QC at either the 15 or 60-minute averaged level. For the most part suspect data do not fit the overall pattern and are confined to the upper gates or entire profiles where RF interference was detected (Fig 12).

Preliminary review of the data shows good agreement between surface winds and the lowest profiler data. Exceptions to this are in the evening with light winds and periods when one would expect the formation of the nocturnal inversion to decouple the surface from upper levels. Overall winds are consistent with the large-scale synoptic weather patterns in this region producing predominantly westerly flow. Because the data are processed in daily blocks, edge effects are possible between days. In perusing these 12 days one case is seen in which the profiles on two consecutive days appear suspect. This occurs between JD 217-218 (Figs 13d&e) when a typical increase in wind speeds occurred between the last hour on JD 217 and the first hour on JD 218. More detailed analysis of the radial data (not shown) and 15-minute wind barb plots (Figs 13 a-l), indicates this change in the wind was real.

Figures 13a-l are the 15-minute averaged QC'd data. Suspect data are not plotted in these figures. Fifteen-minute winds are calculated using a full 15-minutes worth of moment data. Data identified as suspect during the QC have been intentionally omitted from these plots. The lowest level winds again are surface data and represent the 5-minute average surface value closest in time to each 15-minute period. Note the differences and similarities between the consensus winds generated by POP (Fig. 2) and the post-processed wind data (Fig. 13e). These data and moment level data (Figs 5&6) show a good picture of the variability that the QC algorithm must deal with. Figure 14 shows the same data as Fig. 13d with the suspect data included. Figure 15 is an enlarged plot of the period from 1900-2200 in Fig. 14 showing what data have been flagged as suspect. This day was chosen to test some of the QC parameter settings. Lowering the time neighborhood size (Table IIIa) in this case caused more of the bad data to be left in while raising it caused some of the good data on each side of the obviously bad profiles to be flagged. In reviewing all of Figs. 13 a-l one sees that there are still some questionable data that passed through the QC algorithm. With considerable effort, time, and probably at the expense of good data, more bad data could be eliminated. In general, the 15-minute winds show consistency from 15- to 15-minute period and also between days. Surface winds track the lowest-level profiler winds and show similar variability during light wind periods.

Appendix C contains a sample of a wind file. This format is the Sonoma Technology Inc. (STI) common data format adapted for use in this report. The wind components (u,v,w) are standard meteorological convention. It should be noted that the w component is calculated from the pair of co-planar oblique beams and is not the directly measured vertical velocity. Weber et al. (1993) discuss the advantages of using the calculated over the measured vertical velocity.

IIId. RASS Temperatures

Figures 16a-l are the hourly QC'd virtual temperature profiles for each day. Slanted dashed lines represent the dry adiabatic lapse rate. Quality control of the temperature data is similar to wind QC. Suspect data points are signified by squares. The acoustic and atmospheric radial velocities sampled on the vertical beam during the RASS mode are run through the continuity algorithm. Since the profiler operated in a 15-minute consensus mode (Table I), RASS was turned on for three continuous minutes of every 15 minutes. This generates approximately 6-7 individual moment temperature profiles within each 3 minute sample period. For the RASS QC parameter set in Table IIIa this means that in a 1-hr QC interval there were 4 three-minute RASS sample periods input into the QC algorithm. Weber et al. (1993) discuss the potential errors one might expect with this type of sampling.

The virtual temperatures shown in Figs. 16a-l are not corrected for vertical velocity. The ASCII data files contain both the corrected and uncorrected virtual temperatures along with the vertical velocity. No quality control of the data has been performed to test for reasonable lapse rates. Good data don't normally extend above 2150 m MSL. The obviously incorrect profiles extending above this height are due primarily to bands of RF interference with SNR that fall within the preset threshold region (Figs. 8&9). Examining Figs. 16a-l we see fairly consistent profiles from hour to hour. Daytime warming and growth of the convective boundary layer are visible on most days. The formation of a nocturnal inversion can be seen at times.

Figures 17a-f are the 15-minute virtual temperature profiles on 5 Aug in 4-hr blocks. These profiles show more detail and variability than the hourly profiles. For the most part these profiles are consistent between each 15-minute period. The most variability is seen in the profiles from 2000-2345 UTC (Fig f). This coincides with the period of strongest daily heating and thermal plumes.

Appendix C contains a sample of a temperature file. This format is the STI common data format for temperatures. Averaged (15/60 minute) vertical velocities (w) and corrected virtual temperatures (CT) are reported for all heights, with an indicator that signifies whether each point was considered good or suspect by the QC algorithm.

IV. SUMMARY AND CONCLUSIONS

The NOAA 449-MHz wind profiler with RASS operated continuously from 2 August through 13 August 1995 in conjunction with ETL's ozone lidar. These efforts were in support of the 1995 Mojave Desert Ozone Transport Study. The profiler provided high spatial and temporal resolution wind profiles, which when combined with lidar ozone profiles will be used to calculate ozone flux/transport profiles. Virtual temperature profiles from the RASS can be used to help determine the mixing depth. Both systems were located at George Air Force Base near the city of Victorville, CA, in the Mojave desert. The profiler continuously monitored the winds from near ground level to a maximum height of 3.5 km AGL and the virtual temperature to a maximum height of 2.5 km AGL.

Surface measurements of temperature, relative humidity, pressure, and wind speed and direction were also made to supplement the profiler data in the lowest levels.

Results show that high-quality winds and temperatures can be measured by the 449-MHz profiler in the presence of RF interference. These data collected near Victorville show consistent periods of southwesterly flow, indicating frequent potential for ozone transport through the Cajon Pass from the Los Angeles basin.

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TABLE Ia. Victorville Profiler Operating Characteristics

Radar frequency	449-MHz
Bandwidth	2 MHz
Peak Power	1.2 kW
Average Power	100 W (max)
Antenna aperture	4.25 m x 4.25 m COCO array 5.5 m x 5.5 m platform
Beamwidth (3 dB one way)	9.5°
Gain	27 dB
Antenna pointing	6 beams 2 zenith (both polarizations) 4 oblique, 75° elevation (356°, 266°, 176°, 86°)

TABLE Ib. Victorville RASS Operating Characteristics

RASS acoustic frequency	900 - 1050 Hz
Acoustic sources	4 vertically pointing 1.2m dia dishes shielded in acoustic foam enclousures JBL-2445J acoustic dirvers (100W max, ea)
Acoustic power (CW)	30W total, acoustic w/ 4 drivers
Audio electric drive	20 VAC (RMS) 16 ohm voice coil
Temperature range Acoustic velocity range	5 to 42°C -334.4 to -355.7ms^{-1}

TABLE II. Profiler On-Line Program Parameters (POP 4.13)

Parameter	WIND	RASS
IPP (ns)	30000	30000
PW (ns)	700	1200
PULSE CODE	0	0
No. of Heights	46	25
DELAY (ns)	2800	2800
GATE SPACING (ns)	500	800
COH	440	15
SPECTRAL AVERAGES	32	17
FFT	64	2048
DWELL	30	31
FIRST GATE (km AGL)	.15	.15
LAST GATE (km AGL)	3.53	3.03
IPP (km AGL)	4.13	4.05
NYQUIST VELOCITY	+/-12.6 ms^{-1}	+/-5.4 ms^{-1} (atmospheric) 5-42°C (acoustic)
SPECTRAL RESOLUTION	.39 ms^{-1}	.35 ms^{-1} (atmospheric) .63°C (acoustic)
SPECIAL SETTINGS	MEAN MODE	NONE
CONSENSUS PERIOD	15 min	15 min

IPP = Inter Pulse Period, PW = Pulse Width, COH = Coherent Integration or Time Domain Averaging, FFT = No. of Fast Fourier Transform pts, Pulse Code 0 = off, IPP (km AGL) = maximum (unaliased) height.
Profiler was run in the mean mode (bird algorithm not activated)

For more information on radar terminology see:

Introduction to Radar Systems, Skolnik, M.L. McGraw-Hill, 1980.

Beam sampling sequence V-N-S-E-W

V-vertically pointed beam

Site Elevation 872 m Lat. 34.58 N Lon 117.35 W TABLE IIIa. Profiler Quality Control

Processing Parameters (moments)

QC Parameters	WIND	RASS
QC MODE	0	0
QC INTERVAL (sec)	3600	3600
SNR_{max} Threshold (dB)	-20	-25
SNR_{min} Threshold (dB)	35	10
Minimum Pattern Size	16	32
Time Neighborhood	2.5	2.5
Height Neighborhood	2.5	2.5
Velocity Resolution (ms^{-1})	2	2
Unfolding Range (nyquist)	10%	0%

TABLE IIIb. Profiler Quality Control Processing Parameters (averaged radials)

QC Parameters	WIND	RASS
QC INTERVAL (hours)	24	24
Minimum Pattern Size	32	32
Time Neighborhood	2.5	1.5
Height Neighborhood	2.5	1.5
Velocity Resolution (ms^{-1})	2	1
Time Average (min)	15/60	15/60
Height Average (m)	75	120

QC mode = 1 when beams are QC'd combined. 0 = if QC'd individually prior to combining
QC Interval = Time of QC period, data are QC'd in blocks of this length
SNR threshold = minimum and maximum range of SNR passed through to QC routine
Minimum pattern = minimum number of points required to make a pattern
Time neighborhood = temporal window included in pattern (index)
Height neighborhood = height window included in pattern (index)
Velocity resolution = max delta radial velocity allowed between neighbors
Unfolding Range = percent of nyquist velocity used to test for unfolding of high of winds

TABLE IV. Surface Meteorological Statistics

STATISTICS	Minimum	Maximum	Mean	Sigma
Temp (C)	18.5	39.3	29.7	5.5
RH (%)	4.3	47.8	19.9	9.3
Pressure (mb)	904.6	913.4	910.0	1.9
Wind Spd (ms^{-1})	0.0	9.99	2.93	1.8
Wind Dir (True)	0	359.7	N/A	60.
Mixing Ratio (gkg^{-1})	1.76	10.18	5.3	1.6
Dew Point (C)	-26.2	-23.8	-25.2	.4
Virtual Temp (C)	18.5	39.3	29.7	5.5

GLOSSARY OF TERMS, ABBREVIATIONS, AND SYMBOLS

ETL	Environmental Technology Laboratory
ERL	Environmental Research Laboratory
NOAA	National Oceanic and Atmospheric Administration
SDID	System Demonstration and Integration Division
RASS	Radio Acoustic Sounding System
AGL	Above Ground Level
RF	Radio frequency
POP	Profiler On-Line Program
QC	Quality Control
SNR	Signal-to-Noise Ratio
NPN	NOAA Profiler Network
SAR	Search And Rescue
CBL	Convective Boundary Layer
UTC	Universal Time Coordinate
AFB	Air Force Base
JD	Julian Date
STI	Sonoma Technologies Inc.
STD	Standard deviation
CW	Continuous Wave
MSL	Mean Sea Level
CARB	California Air Resource Board
U	East/West meteorological wind component (+ from West)
V	North/South meteorological wind component (+ from South)

Nyquist velocity- The highest velocity which can be determined in a Fourier analysis of a discrete sampling of data.

Unaliased height- The maximum height a transmitted pulse reaches before the next pulse is transmitted.

APPENDIX A:

July 28, 1995 (JD 209)

Arrived Victorville, CA, George AFB
Setup profiler and collected first test data (surface meteorological data also)
Radar antenna leveled and aligned using digital level and compass to true north
Surface wind direction sensor aligned using digital compass to true north
Lidar arrived late afternoon
Grass fire to the southwest near Cajon Pass (smoke plume see Fig 18)

July 29, 1995 (JD 210)

Continued system check-out

July 30, 1995 (JD 211)

Strong winds at site damage RASS antenna (~2300)
Power off to entire base (no data)
Suspected tornado due to damage reported around George AFB
trees uprooted, roofs blown off (see Figs. 19 a,b)

July 31, 1995 (JD 212)

Power restored ~ 1900 UTC
Repaired damaged RASS antenna
Re-checked radar antenna alignment
Collecting data again 1910 UTC
Still testing system and checking data
Another grass fire near Cajon Pass

August 1, 1995 (JD 213)

Testing 3 and 5 beam modes along with varying consensus periods

August 2, 1995 (JD 214)

Lidar not running
15 minute winds from last night look consistent
Surface meteorological data logger changed to include wind spd/dir averaging routine (1950 UTC)

August 4, 1995 (JD 216)

Ran some power/noise tests near the end of the day collecting spectra
SDID crew returning to Boulder; Lidar crew instructed on how to backup data
Profiler to run continuously unattended (15-minute consensus winds and temps w/spectra)

August 6, 8, 10, 1995 (JD 218, 220, 222)

Profiler files backed up to tape, surface meteorological data backed up to floppy disk

August 13, 1995 (JD 225)

Profiler files backed-up to tape, surface met backed-up to floppy disk
Shut-down radar
Re-checked leveling and alignment of all instrumentation
EXPERIMENT completed. (~2000 UTC)

APPENDIX B

This is a list of the files on each floppy.

The .zip files were packed using PKZIP VER 2.04g
The cns data are files were generated directly by POP 4.13 in the field and
are a 15 minute consensus.
The files on floppy 2 are all in the STI common data format.
The vicapp.zip file contains the Apple Valley and 449 time series and GRAPHER
plotting files.

Floppy 1 of 3

VICTCNS.ZIP	283,785	04-30-96	6:22a	VICTCNS.ZIP
VICTSFC.MET	368,404	04-30-96	8:45a	victsfc.met
VICAPP.ZIP	112,243	04-19-96	10:16a	VICAPP.ZIP
PKUNZIP.EXE	29,378	04-09-95	5:28p	PKUNZIP.EXE
PKZIP.EXE	42,166	04-09-95	5:28p	PKZIP.EXE

Floppy 2 of 3

VIC60W.ZIP	216,901	04-22-96	5:45a	VIC60W.ZIP
VIC60T.ZIP	57,282	04-30-96	6:16a	VIC60T.ZIP
VIC15T.ZIP	160,221	04-30-96	6:17a	VIC15T.ZIP
VIC15W.ZIP	628,068	04-22-96	5:46a	VIC15W.ZIP

Floppy 3 of 3

VICWCNS.ZIP	1,277,146	03-19-96	11:52a	VICWCNS.ZIP

These are the 60 minute QC'd wind files packed in vic60w.zip

Note that the naming convention for the daily 15/60 min QC'd files will be the same. Therefore, anytime these files are unpacked they will write over each other unless renamed or placed in a unique directory.

VIC95210.W23	82,782	04-18-96	6:49a	VIC95210.W23
VIC95211.W23	86,315	04-18-96	6:49a	VIC95211.W23
VIC95212.W23	19,188	04-18-96	6:49a	VIC95212.W23
VIC95213.W23	33,320	04-18-96	6:49a	VIC95213.W23
VIC95214.W23	86,315	04-18-96	6:49a	VIC95214.W23
VIC95215.W23	86,315	04-18-96	6:50a	VIC95215.W23
VIC95216.W23	68,650	04-18-96	6:50a	VIC95216.W23
VIC95217.W23	86,315	04-18-96	6:50a	VIC95217.W23
VIC95218.W23	86,315	04-18-96	6:50a	VIC95218.W23
VIC95219.W23	86,315	04-18-96	7:03a	VIC95219.W23
VIC95220.W23	82,782	04-18-96	7:03a	VIC95220.W23
VIC95221.W23	86,315	04-18-96	7:03a	VIC95221.W23
VIC95222.W23	86,315	04-22-96	5:39a	VIC95222.W23
VIC95223.W23	82,782	04-18-96	7:03a	VIC95223.W23
VIC95224.W23	86,315	04-18-96	7:03a	VIC95224.W23
VIC95225.W23	79,249	04-18-96	7:03a	VIC95225.W23

Sample of wind output file (15 minute) ASCII STI common data format

CDF Type: Wind Program: WWWW Version: 0.0
CARB

Station: victorville
Date: 08/05/95 Julian Day: 217
Filename: vic95217.w23 Validation Level: 2.3
Created by: WINPRO 1.00 Created on: 04/17/96 1338
Elev. (m msl): 0872 Elev. (ft msl): 02860
Lat (dec deg): 34.58000 N Long (dec deg): 117.35000 W
UTMN (km): 0000.000 UTME (km): 000.000
Time Zone: UTC Diff. to UTC (hr): 00
Mode Number: 1 Mode Title: 075m

Avg. Int. (min): 15 Time Convention: End
Pulse Len. (m): 0104 Spacing (m): 0075
Max. Samples: 001 001 001 Req. Samples: 001 001 001
Ant. Azimuth (deg): 356 356 176 Ant. Elev. (deg): 000 000 000

QC Code Definition: 0=Valid, 1=Estimated, 7=Suspect, 8=Invalid
Data Code Definition: -940=Failed QC, -950=Failed Consensus
-960=Exceeded Nyquist Vel., -980=Flagged by Reviewer
-999=Missing or Not Reported

Time # of Gates Radar Parameter Changes
HHMM NNN N
0015 45 0

QC Code	Height (m msl)	WS (m/s)	WD (deg)	u (m/s)	v (m/s)	w (m/s)	No. in Cns SE	No. in Cns SW	No. in Cns V	SNR (db) SE	SNR (db) SW	SNR (db) V
0	1022	1.1	128	-0.90	0.70	-0.36	0	0	0	0	0	0
0	1097	2.0	173	-0.24	1.97	-0.49	0	0	0	0	0	0
0	1172	0.8	185	0.07	0.82	-0.12	0	0	0	0	0	0
0	1247	0.4	238	0.37	0.23	-0.04	0	0	0	0	0	0
0	1322	2.1	245	1.91	0.90	0.02	0	0	0	0	0	0
0	1397	1.3	246	1.24	0.54	-0.13	0	0	0	0	0	0
0	1472	3.4	263	3.40	0.40	-0.04	0	0	0	0	0	0
0	1547	4.5	260	4.45	0.76	-0.17	0	0	0	0	0	0
0	1622	4.8	263	4.78	0.61	-0.27	0	0	0	0	0	0
0	1697	5.6	256	5.45	1.35	-0.25	0	0	0	0	0	0
0	1772	6.5	257	6.33	1.43	-0.27	0	0	0	0	0	0
0	1847	6.9	265	6.84	0.58	-0.16	0	0	0	0	0	0
0	1922	7.2	268	7.24	0.25	-0.14	0	0	0	0	0	0
0	1997	8.0	273	7.96	-0.38	-0.21	0	0	0	0	0	0
0	2072	8.3	270	8.32	0.03	-0.30	0	0	0	0	0	0
0	2147	8.1	267	8.11	0.40	-0.42	0	0	0	0	0	0
0	2222	8.0	271	8.00	-0.11	-0.29	0	0	0	0	0	0
0	2297	8.8	279	8.75	-1.32	-0.45	0	0	0	0	0	0
0	2372	8.6	276	8.60	-0.87	-0.40	0	0	0	0	0	0
0	2447	8.8	279	8.71	-1.39	-0.41	0	0	0	0	0	0
0	2522	9.1	276	9.05	-1.01	-0.46	0	0	0	0	0	0
0	2597	9.1	276	9.09	-0.92	-0.37	0	0	0	0	0	0
0	2672	8.6	273	8.59	-0.48	-0.14	0	0	0	0	0	0
0	2747	7.9	270	7.86	-0.04	-0.01	0	0	0	0	0	0
0	2822	7.4	265	7.36	0.59	0.08	0	0	0	0	0	0
0	2897	6.8	259	6.68	1.29	-0.01	0	0	0	0	0	0
0	2972	7.4	248	6.90	2.78	-0.14	0	0	0	0	0	0

0	3047	7.0	243	6.20	3.14	-0.07	0	0	0	0	0	0
0	3122	7.0	240	6.04	3.49	-0.19	0	0	0	0	0	0
0	3197	7.6	231	5.90	4.75	-0.23	0	0	0	0	0	0
0	3272	9.0	228	6.74	5.98	-0.21	0	0	0	0	0	0
0	3347	11.0	227	8.07	7.54	-0.21	0	0	0	0	0	0
0	3422	9.9	227	7.26	6.73	-0.23	0	0	0	0	0	0
0	3497	10.9	223	7.40	7.97	-0.30	0	0	0	0	0	0
0	3572	11.2	230	8.62	7.13	-0.23	0	0	0	0	0	0
0	3647	11.1	231	8.64	6.95	-0.20	0	0	0	0	0	0
0	3722	11.2	233	8.96	6.73	-0.26	0	0	0	0	0	0
8	3797	-999.0	-998	8.43	4.15	0.17	0	0	0	0	0	0
8	3872	-999.0	-998	9.01	3.54	0.13	0	0	0	0	0	0
8	3947	-999.0	-998	7.81	3.60	0.42	0	0	0	0	0	0
8	4022	-999.0	-998	9.16	3.70	0.25	0	0	0	0	0	0
8	4097	-999.0	-998	8.35	3.60	0.57	0	0	0	0	0	0
8	4172	-999.0	-998	8.86	3.67	0.45	0	0	0	0	0	0
8	4247	-999.0	-998	6.79	3.31	0.69	0	0	0	0	0	0
8	4322	-999.0	-998	0.00	0.00	0.00	0	0	0	0	0	0
0030	45	0										
0	1022	0.9	141	-0.56	0.68	-0.24	0	0	0	0	0	0
0	1097	2.0	233	1.59	1.18	-0.40	0	0	0	0	0	0
0	1172	1.5	258	1.51	0.31	-0.08	0	0	0	0	0	0
0	1247	1.9	261	1.91	0.29	0.05	0	0	0	0	0	0
0	1322	2.5	250	2.38	0.89	0.03	0	0	0	0	0	0
0	1397	1.4	252	1.36	0.45	0.06	0	0	0	0	0	0
0	1472	3.1	258	3.04	0.64	0.10	0	0	0	0	0	0
0	1547	3.8	250	3.60	1.33	0.14	0	0	0	0	0	0
0	1622	5.7	243	5.08	2.61	0.12	0	0	0	0	0	0
0	1697	5.7	250	5.39	1.99	0.20	0	0	0	0	0	0
0	1772	6.1	261	5.97	0.98	0.23	0	0	0	0	0	0
0	1847	6.5	263	6.42	0.84	0.02	0	0	0	0	0	0
0	1922	7.0	266	7.03	0.48	0.02	0	0	0	0	0	0
0	1997	7.7	268	7.69	0.28	-0.04	0	0	0	0	0	0
0	2072	7.0	275	6.98	-0.59	-0.15	0	0	0	0	0	0
0	2147	7.1	273	7.13	-0.42	-0.29	0	0	0	0	0	0
0	2222	7.9	281	7.76	-1.48	-0.12	0	0	0	0	0	0
0	2297	9.2	283	8.99	-1.99	-0.22	0	0	0	0	0	0
0	2372	8.6	278	8.55	-1.16	-0.22	0	0	0	0	0	0
0	2447	8.0	283	7.83	-1.75	-0.17	0	0	0	0	0	0
0	2522	9.5	276	9.47	-1.07	-0.10	0	0	0	0	0	0
0	2597	8.6	269	8.55	0.20	-0.03	0	0	0	0	0	0
0	2672	8.4	264	8.35	0.84	0.19	0	0	0	0	0	0
0	2747	7.7	255	7.42	1.96	0.16	0	0	0	0	0	0
0	2822	7.8	247	7.17	3.01	0.11	0	0	0	0	0	0
0	2897	7.3	241	6.38	3.51	-0.04	0	0	0	0	0	0
0	2972	6.7	232	5.27	4.14	-0.12	0	0	0	0	0	0
0	3047	7.2	226	5.24	5.00	-0.07	0	0	0	0	0	0
0	3122	8.0	222	5.39	5.93	-0.09	0	0	0	0	0	0
0	3197	8.8	219	5.58	6.82	-0.11	0	0	0	0	0	0
0	3272	10.2	221	6.71	7.70	-0.14	0	0	0	0	0	0
0	3347	11.1	214	6.30	9.17	-0.06	0	0	0	0	0	0
0	3422	11.5	204	4.68	10.46	0.07	0	0	0	0	0	0
0	3497	10.2	207	4.62	9.07	0.10	0	0	0	0	0	0
0	3572	11.9	213	6.51	10.00	-0.20	0	0	0	0	0	0
0	3647	14.6	212	7.81	12.37	-0.77	0	0	0	0	0	0
0	3722	13.5	218	8.31	10.62	-0.60	0	0	0	0	0	0
8	3797	-999.0	-998	7.77	4.12	0.35	0	0	0	0	0	0
8	3872	-999.0	-998	8.46	4.48	0.23	0	0	0	0	0	0
8	3947	-999.0	-998	6.84	4.10	0.44	0	0	0	0	0	0
8	4022	-999.0	-998	7.42	4.35	0.43	0	0	0	0	0	0
8	4097	-999.0	-998	6.60	3.72	0.51	0	0	0	0	0	0
8	4172	-999.0	-998	6.59	4.18	0.59	0	0	0	0	0	0
8	4247	-999.0	-998	6.31	4.01	0.68	0	0	0	0	0	0
8	4322	-999.0	-998	0.00	0.00	0.00	0	0	0	0	0	0

Sample of RASS temperature output file in STI common data format

```
CDF Type: Temp        Program:  WWWW          Version: 0.0
CARB


Station:        victorville
Date:           08/05/95        Julian Day:     217
Filename:       vic95217.t23    Validation Level: 2.3
Created by:     WINPRO   1.00   Created on:     04/30/96 0627
Elev. (m msl):  0872            Elev. (ft msl):  02860
Lat (dec deg):  34.58000  N     Long (dec deg):  117.35000  W
UTMN (km):      0000.000        UTME (km):      000.000
Time Zone:      UTC             Diff. to UTC (hr): 00
Mode Number:    1               Mode Title:     120m


Avg. Int. (min):  60            Time Convention:  End
Pulse Len. (m):   0104          Spacing (m):      0120
Max. Samples:     001 001 001   Req. Samples:     001 001 001
Ant. Azimuth (deg): 356 356 000   Ant. Elev. (deg): 000 000 000


QC Code Definition:  0=Valid, 1=Estimated, 7=Suspect, 8=Invalid
Data Code Definition: -940=Failed QC, -950=Failed Consensus
              -960=Exceeded Nyquist Vel., -980=Flagged by Reviewer
              -999=Missing or Not Reported




Time   # of Gates  Radar Parameter Changes
HHMM   NNN         N
QC  Height   Tv    w    CT  Cw  SNT  SNw
Code (m msl) ©  (m/s)       (dB) (dB)
0000   20     0
7  1022   27.3   .33  27.97   .00   .00  0  0  0  0  0  0
8  1142   28.7 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1262   27.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1382   27.6 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1502   25.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1622   24.9 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1742   24.0 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  1862   22.6 -94.00 -940.00   .00   .00  0  0  0  0  0  0
7  1982   20.3  -.03  20.27   .00   .00  0  0  0  0  0  0
7  2102   17.1   .15  17.38   .00   .00  0  0  0  0  0  0
7  2222   10.8   .09  11.04   .00   .00  0  0  0  0  0  0
8  2342   10.7 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  2462   10.7 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  2582   10.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  2702   10.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  2822   10.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  2942   10.8 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  3062   10.9 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  3182   10.9 -94.00 -940.00   .00   .00  0  0  0  0  0  0
8  3302   10.9 -94.00 -940.00   .00   .00  0  0  0  0  0  0
0100   20     0
0  1022   32.2   .51  33.16   .00   .00  0  0  0  0  0  0
0  1142   31.6   .32  32.24   .00   .00  0  0  0  0  0  0
0  1262   30.8   .09  31.00   .00   .00  0  0  0  0  0  0
0  1382   29.8   .06  29.94   .00   .00  0  0  0  0  0  0
0  1502   28.9   .07  29.07   .00   .00  0  0  0  0  0  0
```

Sample of Surface meteorological data file:

yr,jd,jjd,t,rh,p,ws,wd,mr,tv,dp

1995	214	214.833	38.01	10.44	911.19	2.09	304.05	4.77	38.02	-25.13
1995	214	214.837	38.22	10.37	911.18	2.18	239.17	4.79	38.23	-25.13
1995	214	214.840	38.05	10.49	911.13	2.53	269.79	4.80	38.06	-25.14
1995	214	214.844	38.19	10.61	911.04	1.17	94.00	4.90	38.20	-25.16
1995	214	214.847	38.65	10.31	910.96	1.79	113.45	4.88	38.66	-25.16
1995	214	214.851	38.58	10.30	910.91	2.31	123.95	4.86	38.59	-25.15
1995	214	214.854	38.23	10.49	910.84	2.70	190.13	4.85	38.24	-25.15
1995	214	214.858	38.37	10.45	910.82	1.08	34.12	4.87	38.38	-25.16
1995	214	214.861	38.83	9.98	910.76	1.84	308.16	4.77	38.84	-25.13
1995	214	214.865	38.81	9.93	910.72	2.75	256.40	4.74	38.82	-25.12
1995	214	214.868	38.65	10.02	910.59	2.60	324.76	4.74	38.66	-25.12
1995	214	214.872	39.08	10.57	910.55	2.85	194.92	5.12	39.09	-25.23
1995	214	214.875	39.12	10.62	910.47	4.67	162.79	5.16	39.13	-25.24
1995	214	214.878	38.39	11.75	910.47	4.03	190.21	5.49	38.40	-25.33
1995	214	214.882	38.33	11.90	910.38	5.51	181.23	5.54	38.34	-25.34
1995	214	214.885	38.27	11.62	910.35	4.31	181.25	5.40	38.28	-25.30
1995	214	214.889	38.55	11.54	910.37	4.59	186.91	5.44	38.56	-25.31
1995	214	214.892	38.56	12.10	910.29	5.36	146.76	5.71	38.57	-25.38
1995	214	214.896	38.51	11.82	910.31	4.08	180.76	5.56	38.52	-25.34
1995	214	214.899	38.58	12.27	910.20	5.15	157.45	5.80	38.59	-25.40
1995	214	214.903	38.72	12.16	910.21	4.19	173.28	5.79	38.73	-25.40
1995	214	214.906	38.76	12.17	910.12	3.64	182.52	5.81	38.77	-25.41
1995	214	214.910	38.89	12.64	910.00	5.81	158.97	6.08	38.90	-25.47
1995	214	214.913	38.62	12.88	910.07	5.24	158.04	6.10	38.63	-25.48
1995	214	214.917	38.94	12.33	909.99	4.66	185.08	5.94	38.95	-25.44
1995	214	214.920	38.81	12.46	909.95	4.89	182.35	5.96	38.82	-25.45
1995	214	214.924	39.08	12.31	909.93	4.29	176.49	5.98	39.09	-25.45
1995	214	214.927	39.31	12.35	909.87	4.34	176.52	6.08	39.32	-25.47
1995	214	214.931	38.86	12.78	909.89	5.58	201.66	6.14	38.87	-25.49
1995	214	214.934	38.70	12.67	909.88	4.84	202.60	6.03	38.71	-25.46
1995	214	214.937	38.65	12.68	909.90	4.10	195.51	6.02	38.66	-25.46
1995	214	214.941	38.08	13.03	909.90	4.48	197.88	6.00	38.09	-25.45
1995	214	214.944	37.97	13.16	909.92	2.82	177.99	6.02	37.98	-25.46
1995	214	214.948	37.77	13.24	909.87	3.81	166.39	5.99	37.78	-25.45
1995	214	214.951	37.77	13.48	909.84	4.24	176.81	6.10	37.78	-25.48
1995	214	214.955	38.25	13.15	909.82	3.59	197.02	6.11	38.26	-25.48
1995	214	214.958	38.65	12.78	909.77	3.36	208.82	6.07	38.66	-25.47
1995	214	214.962	38.68	13.34	909.69	4.68	185.50	6.35	38.69	-25.54
1995	214	214.965	38.83	13.67	909.74	5.20	247.02	6.56	38.85	-25.58
1995	214	214.969	38.87	13.18	909.70	2.82	177.48	6.34	38.89	-25.53
1995	214	214.972	38.76	13.05	909.77	5.23	235.03	6.23	38.77	-25.51
1995	214	214.976	38.56	13.04	909.83	5.47	230.93	6.16	38.57	-25.49
1995	214	214.979	38.86	12.51	909.83	3.38	238.11	6.01	38.87	-25.46
1995	214	214.983	38.99	12.36	909.74	2.64	200.83	5.98	39.00	-25.45
1995	214	214.986	38.59	13.99	909.62	3.55	247.14	6.63	38.61	-25.60
1995	214	214.990	38.71	11.55	909.52	4.86	341.62	5.50	38.72	-25.33
1995	214	214.993	38.82	12.07	909.33	7.45	218.06	5.78	38.83	-25.40
1995	214	214.997	38.66	11.99	909.36	7.01	209.60	5.69	38.67	-25.38
1995	215	215.000	38.63	11.09	909.67	5.04	250.42	5.25	38.64	-25.26
1995	215	215.003	38.60	11.47	909.62	3.79	213.47	5.43	38.61	-25.31
1995	215	215.007	38.40	11.28	909.60	3.87	278.52	5.28	38.41	-25.27
1995	215	215.010	38.90	10.42	909.59	4.13	250.79	5.01	38.91	-25.19
1995	215	215.014	39.04	10.43	909.55	4.26	246.50	5.05	39.05	-25.20
1995	215	215.017	38.89	10.76	909.60	3.57	242.50	5.17	38.90	-25.24
1995	215	215.021	38.65	10.32	909.60	4.10	262.59	4.89	38.66	-25.16
1995	215	215.024	38.30	12.10	909.52	4.34	278.76	5.63	38.31	-25.36
1995	215	215.028	37.97	13.22	909.56	4.85	209.59	6.05	37.98	-25.47
1995	215	215.031	37.65	13.86	909.58	5.55	221.34	6.24	37.66	-25.51
1995	215	215.035	37.40	13.60	909.59	4.97	202.34	6.03	37.41	-25.46
1995	215	215.038	37.36	13.65	909.57	5.67	209.70	6.04	37.37	-25.46
1995	215	215.042	37.22	13.59	909.62	5.98	214.61	5.97	37.23	-25.45
1995	215	215.045	37.10	13.85	909.64	5.98	219.56	6.04	37.11	-25.46

APPENDIX C

FIGURES

Figure 1a; Map of southern California. Victorville is located near the center to the northeast of Los Angeles.

Figure 1b: 449-MHz profiler/RASS as set-up at George AFB Victorville, CA looking to the east. Profiler antenna, RASS sources, and electronics van.

Figure 1c: Lidar van, surface meteorological tower; and 449-MHz profiler looking to the north.

Figure 2: Victorville 15-minute real-time consensus winds on 6 August 1995 (JD 218) generated by POP 4.13. Converted to Sonoma Technology Inc. common data format for display.

Figure 3a&b: Scatter plots comparing hourly U and V meteorological wind components. Solid circles represent the Platteville 449/404-MHz profiler comparison at 3270 m. Open circles represent the Victorville 449-MHz and the CARB Apple Valley 915-MHz profiler comparison at 2500 m MSL.

Figure 4: Comparison of RASS virtual temperature profiles vs balloon soundings taken by the Naval Research and Development Lab at Pt. Loma, CA, 21 Sept 1995.

Figure 5a-e: SNR for all five antenna beams on 5 Aug (JD 217). Top plot is raw unedited data, and bottom plot is after QC. Vertical white stripes are RASS sampling periods.

Figure 6a-e: Radial velocities (1st moment) for all five antenna beams on 5 Aug (JD 217). Top plot is raw unedited data and bottom plot is after QC. Vertical white stripes are RASS sampling periods. Black regions in edited plots are data flagged as bad or missing.

Figure 7: SNR for the RASS acoustic beam on 5 Aug (JD 217) as sampled in time.

Figures 8a&b: SNR and radial velocity of the RASS acoustic beam depicted as if sampled uniformly in time on 5 Aug (JD 217). Vertical white stripes represent breaks in RASS sampling.

Figures 9a&b: SNR and radial velocity of the vertical wind component measured during the RASS mode and depicted as if sampled uniformly in time on 5 Aug (JD 217). Vertical white stripes represent breaks in RASS sampling.

Figure 10: Surface meteorological 3-meter tower with the temperature, RH, pressure, wind speed and direction sensors; looking to the north

Figure 11a-f: Surface meteorological tower time series of 5-minute average data; (a) temperature, (b) pressure, (c) wind speed, (d) wind direction, (e) RH, (f) mixing ratio 2-13 Aug 1995.

Figure 12a-l QC'd hourly winds for each day from 2-13 Aug 1995. Times are UTC and represent the end of the averaging period. Lowest level data are hourly averaged surface winds from the 5 minute data.

Figure 13a-l: QC'd 15-minute winds for each day from 2-13 Aug 1995. Times are UTC and represent the end of the averaging period. Lowest level data are surface winds from a single 5-minute average point closest in time to each 15-minute period.

Figure 14: Same as Fig. 13d with the addition of suspect data plotted. The suspect data are indicated by circles at the origin of the wind barbs.

Figure 15: Enlargement of Fig. 14 for the period from 1900-2200 UTC showing flagged suspect data.

Figure 16a-l: Daily profiles of hourly QC'd virtual temperatures from 2-13 Aug 1995.

Figure 17a-f: Quality controlled 15-minute average virtual temperature profiles on 5 Aug (JD 217) in blocks of 4 hrs each (a) 0000-0345, (b) 0400-0745, (c) 0800-1145, (d) 1200-1545, (e) 1600-1945, (f) 2000-2345.

Figure 18: Smoke plume on 28 July from nearby Cajon Pass (looking south). Plume moving from the SW to the NE (right to left in figure)

Figure 19a: Tree (500 yds to west of profiler) blown down by strong winds on 30 Jul prior to start of the experiment.

Figure 19b: Sections of roofs from George AFB buildings blown off by strong winds on 30 Jul prior to start of the experiment.

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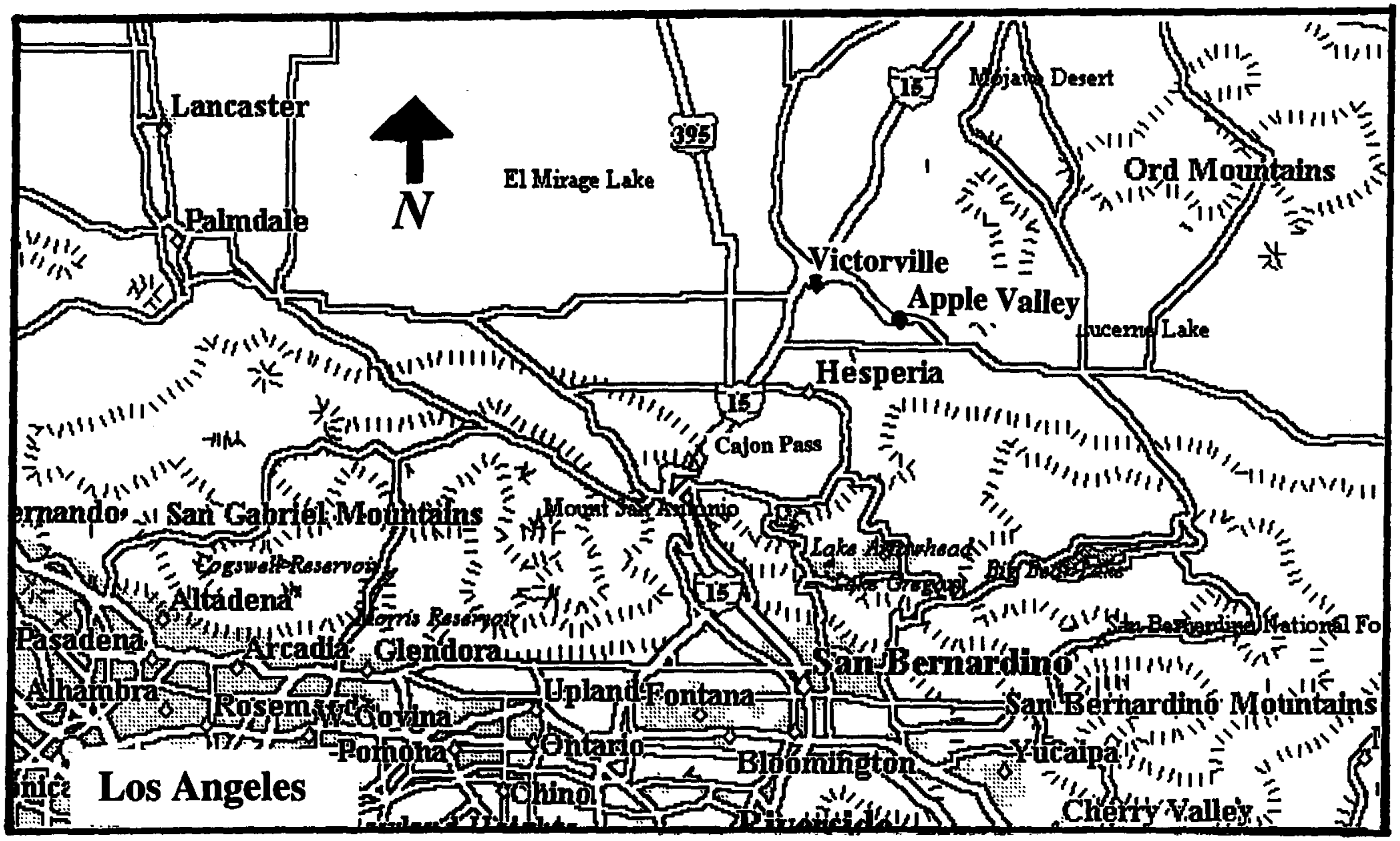


Figure 1a: Map of southern California. Victorville is located near the center to the northeast of Los Angeles.

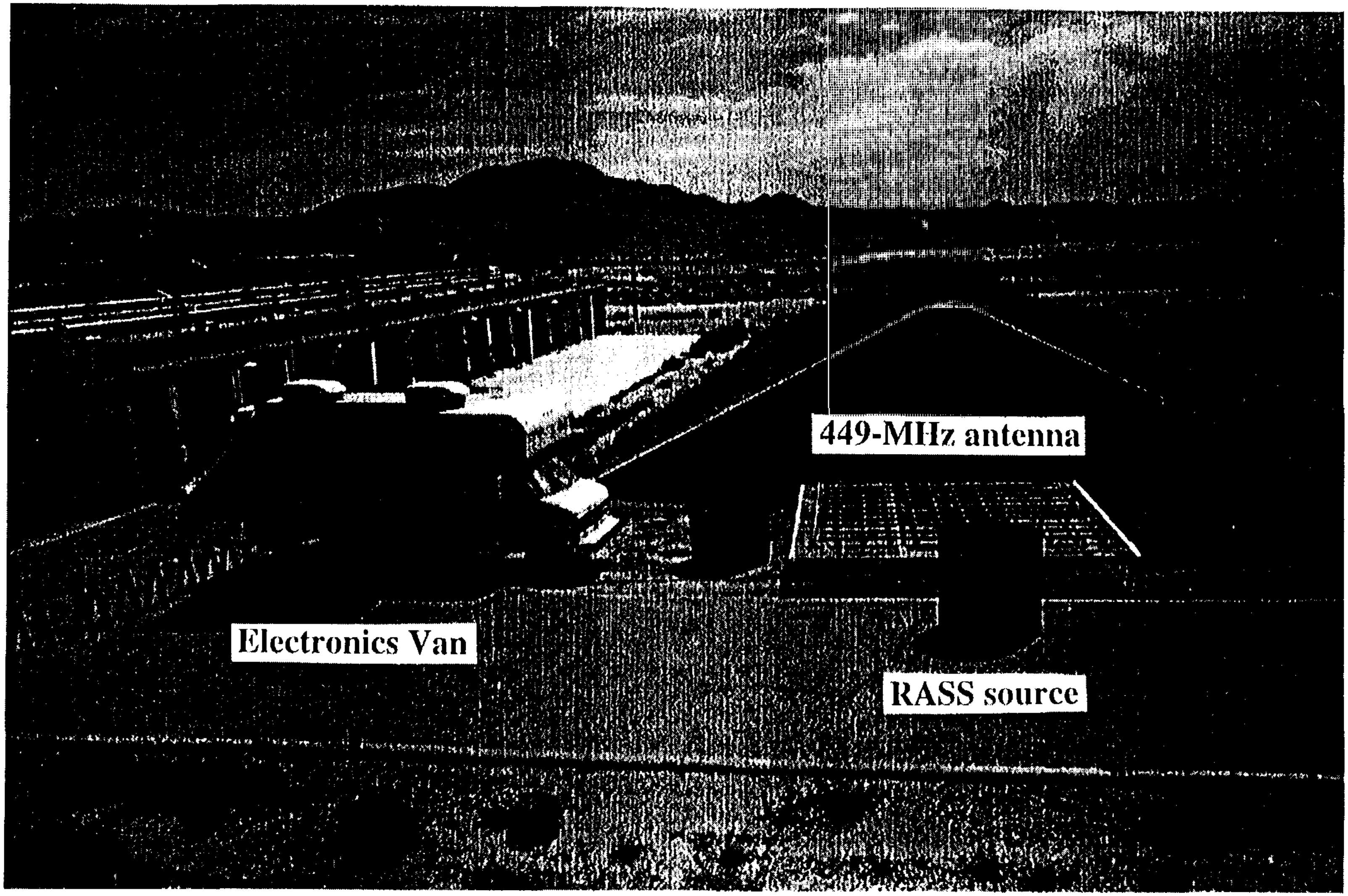


Figure 1b: 449-MHz profiler/RASS as set-up at George AFB Victorville, CA looking to the east. Profiler antenna, RASS sources, and electronics van.

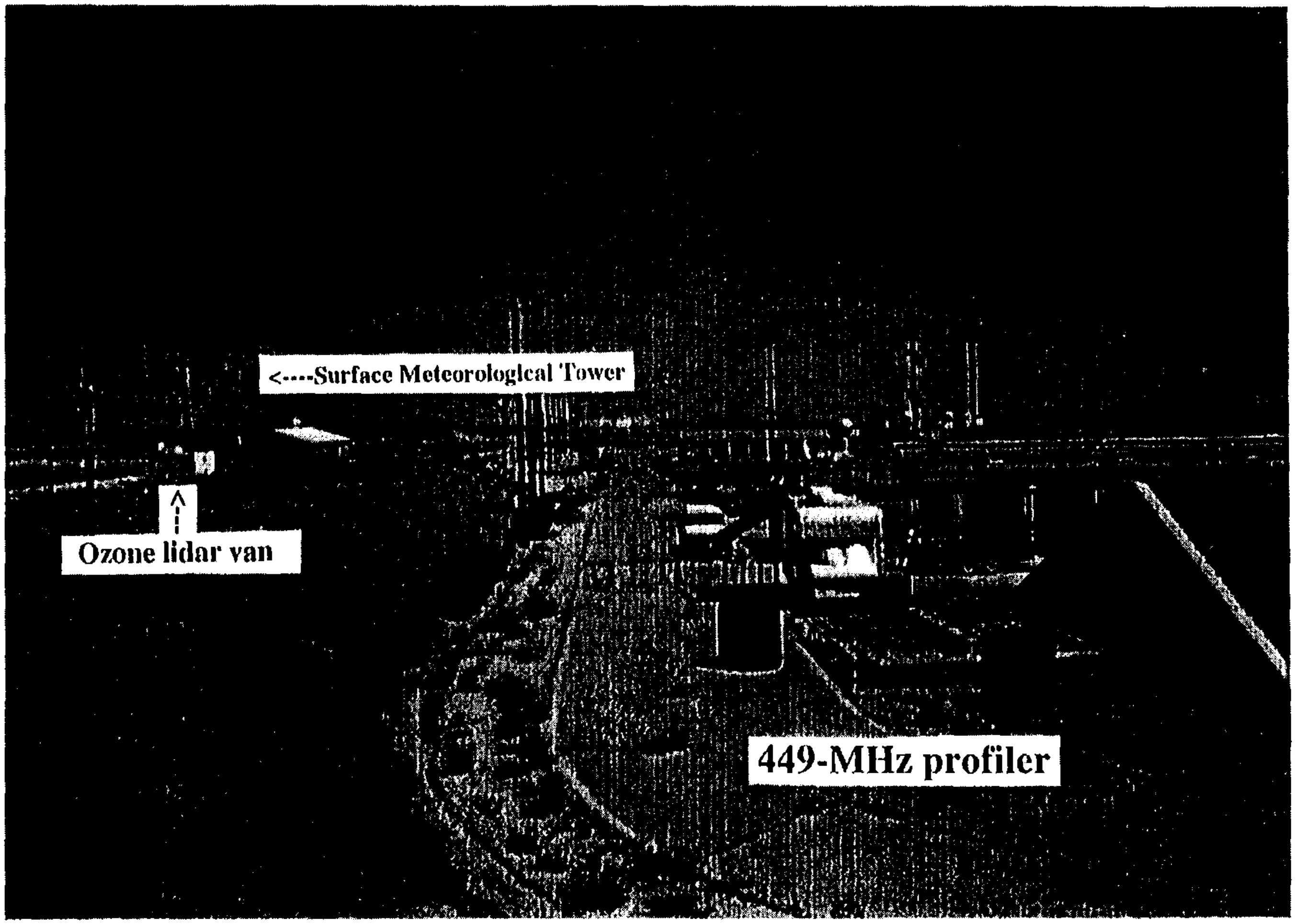


Figure 1c: Lidar van, surface meteorological tower: and 449-MHz profiler looking to the north.

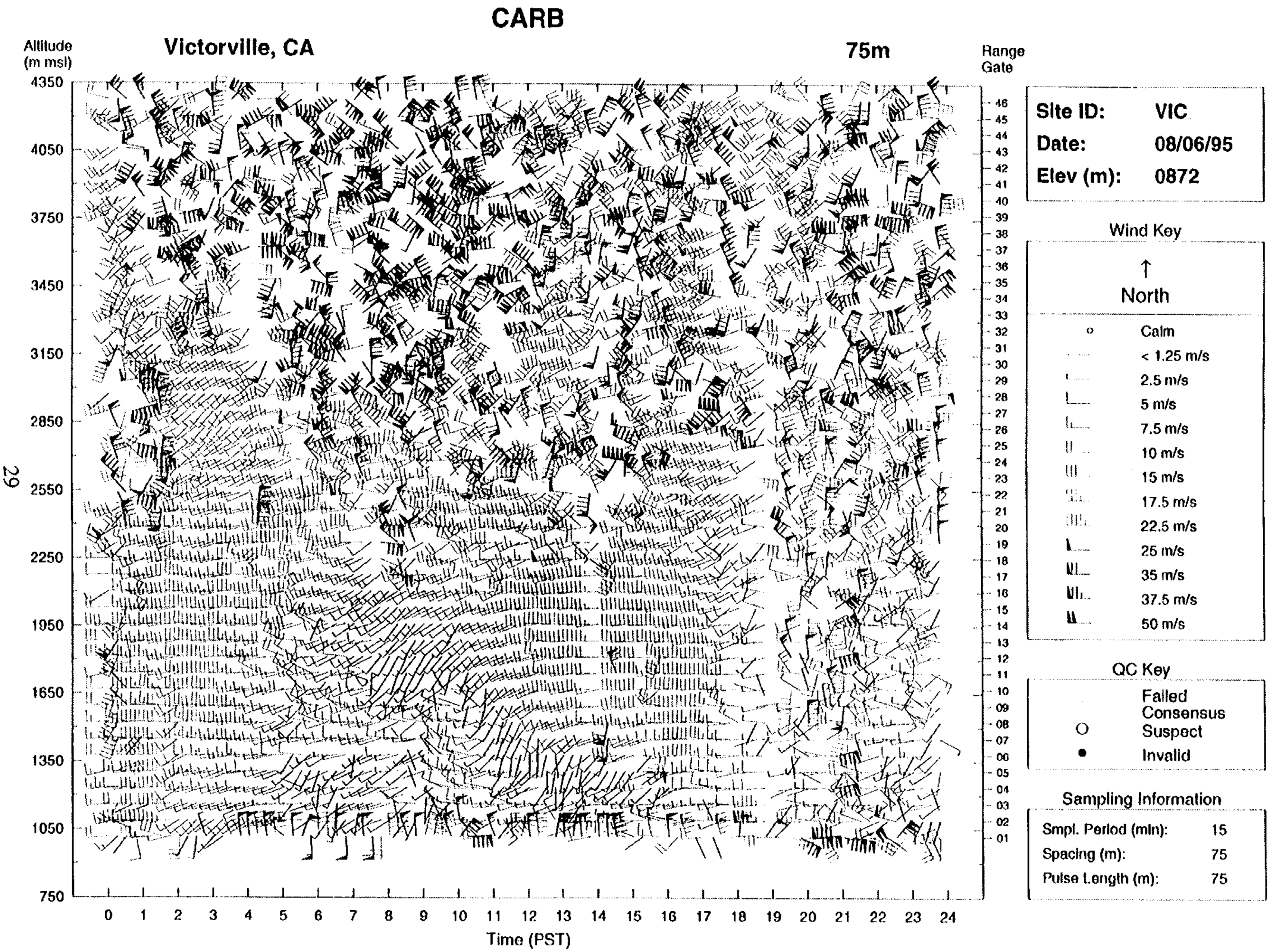


Figure 2: Victorville 15-minute real-time consensus winds on 6 August 1995 (JD 218) generated by POP 4.13. Converted to Sonoma Technology Inc. common data format for display.

Validation Lvl: 0.0
Filename: VIC50806.CNS
Plotted: 12/16/96 07:20

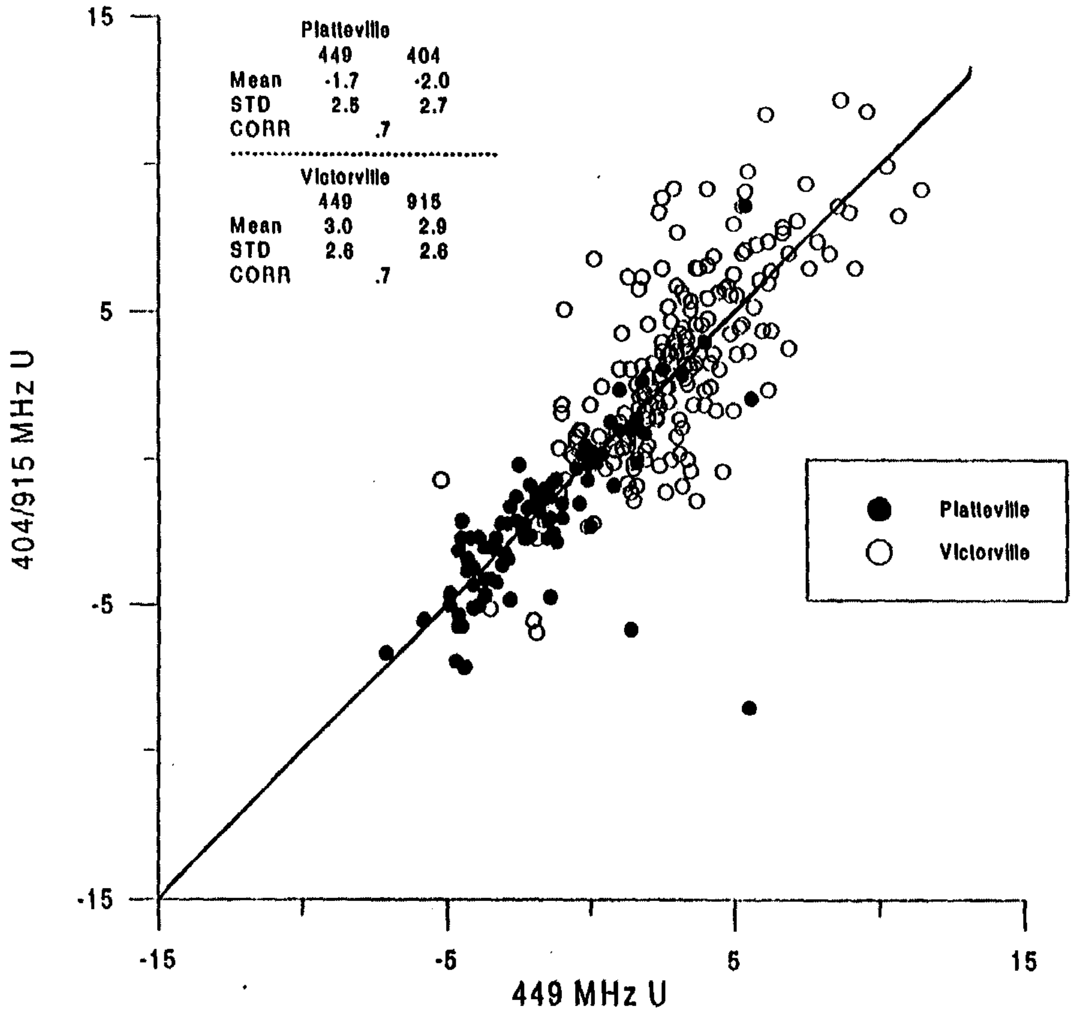


Figure 3a: Scatter plots comparing hourly U meteorological wind componnent. Solid circles represent the Platteville 449/404-MHz profiler comparison at 3270 m. Open circles represent the Victorville 449-MHz and the CARB Apple Valley 915-MHz profiler comparison at 2500 m

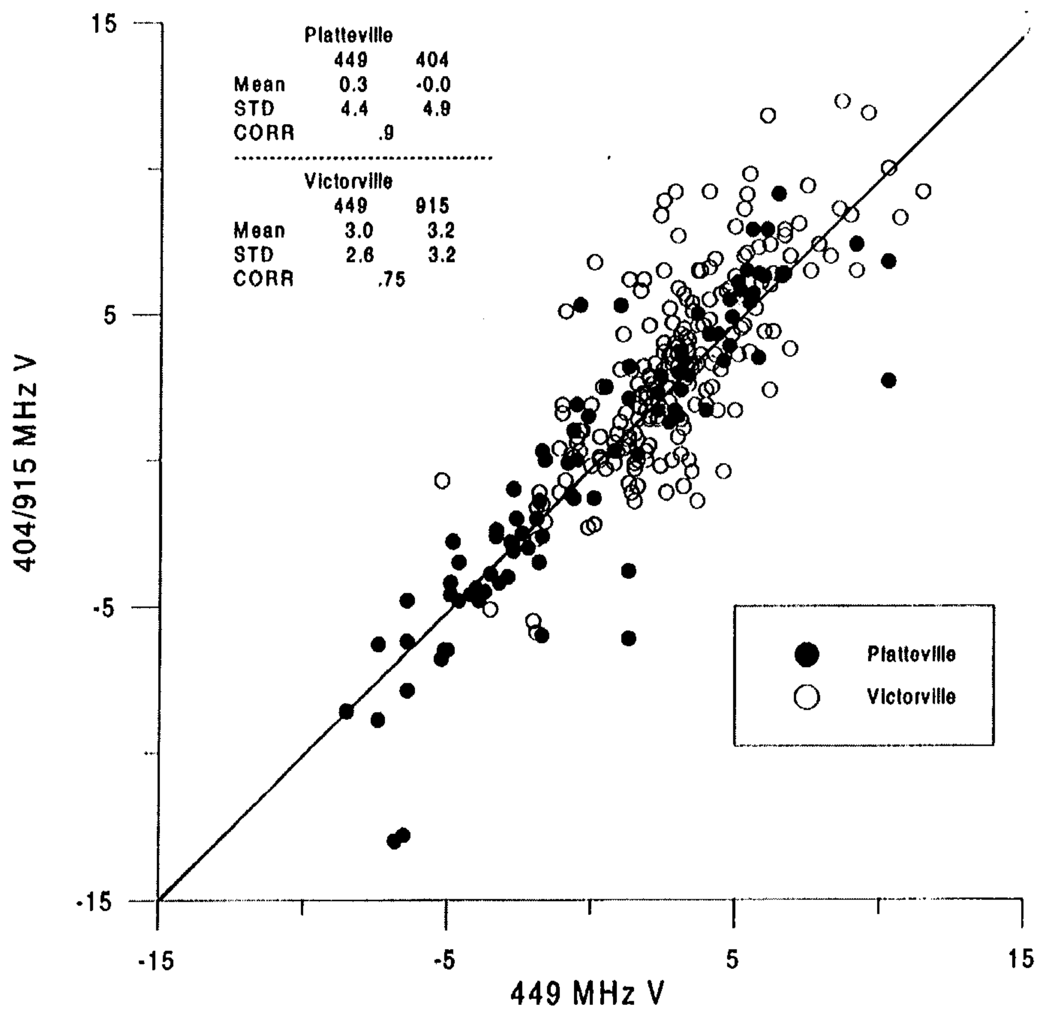


Figure 3b: Scatter plots comparing hourly V meteorological wind componnent. Solid circles represent the Platteville 449/404-MHz profiler comparison at 3270 m. Open circles represent the Victorville 449-MHz and the CARB Apple Valley 915-MHz profiler comparison at 2500 m MSL

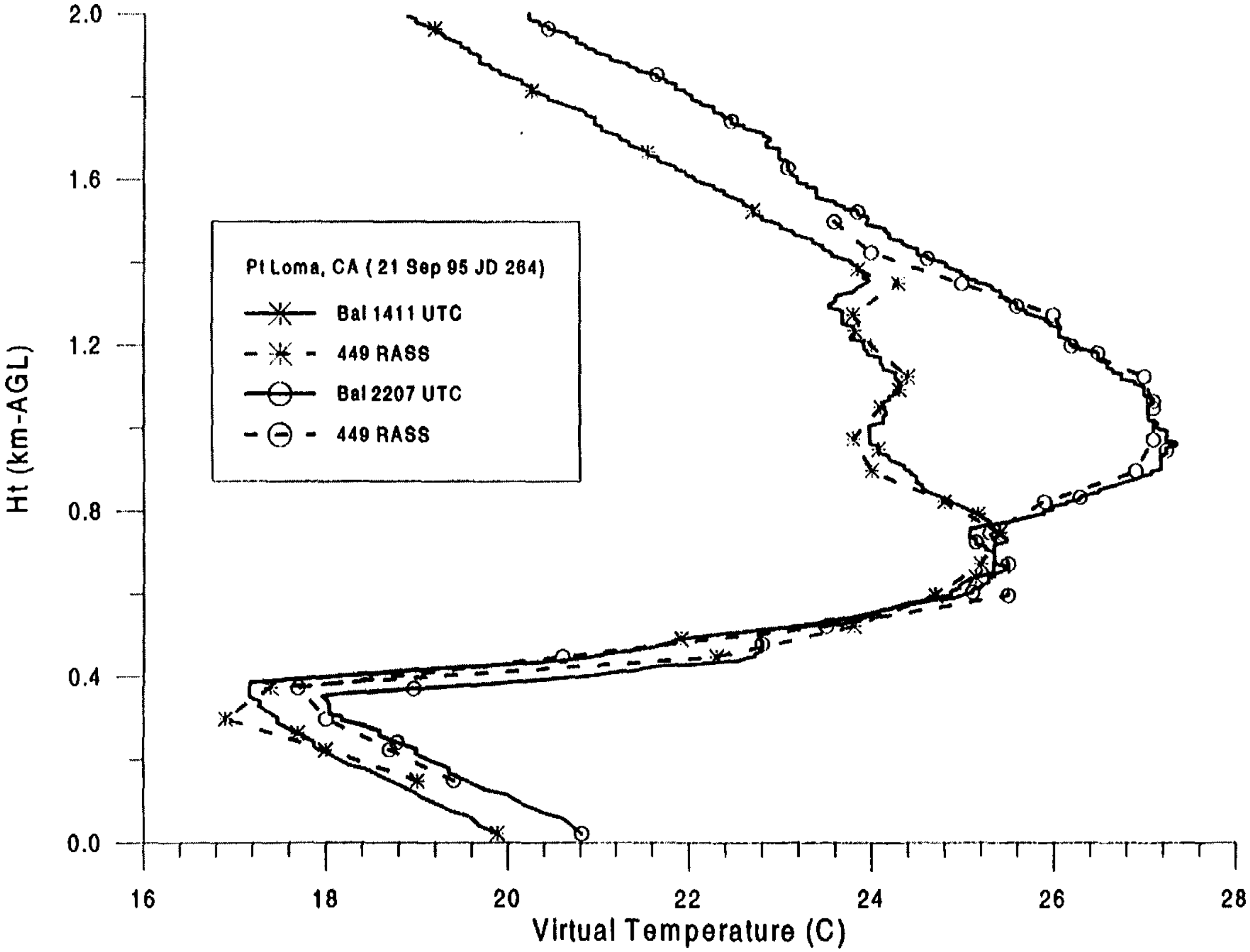


FIGURE 4. Comparison of RASS virtual temperature profiles vs balloon soundings taken by the Naval Research and Development Laboratory at Pt. Loma, California, on September 21, 1995.

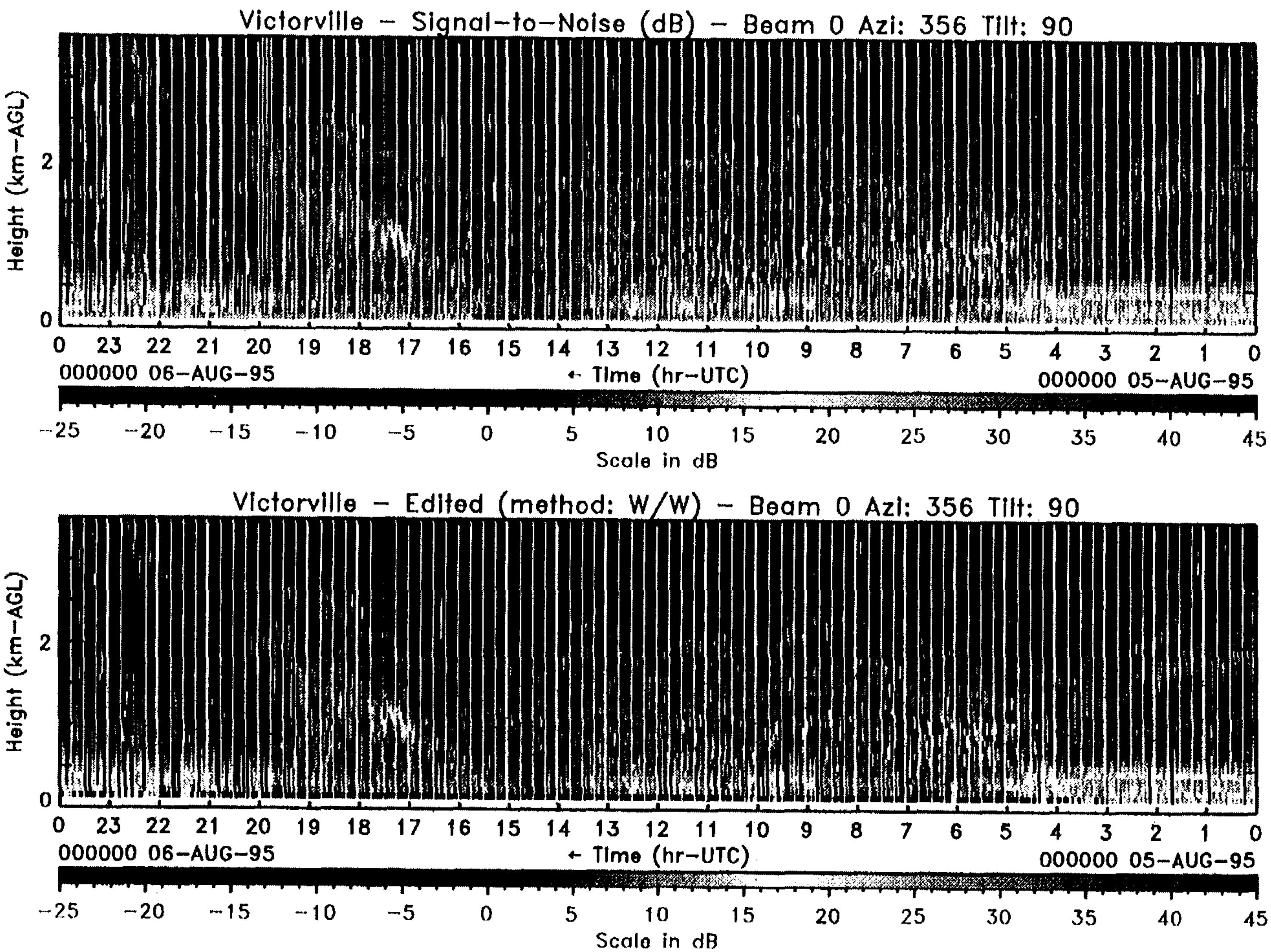


Figure 5a: SNR for antenna beam 0, azimuth 356°, and tilt 90° on 5 Aug (JD 217). Top plot is raw unedited data and bottom plot is after quality control. Vertical stripes are RASS sampling periods. Black regions in edited plots are data flagged as bad or missing.

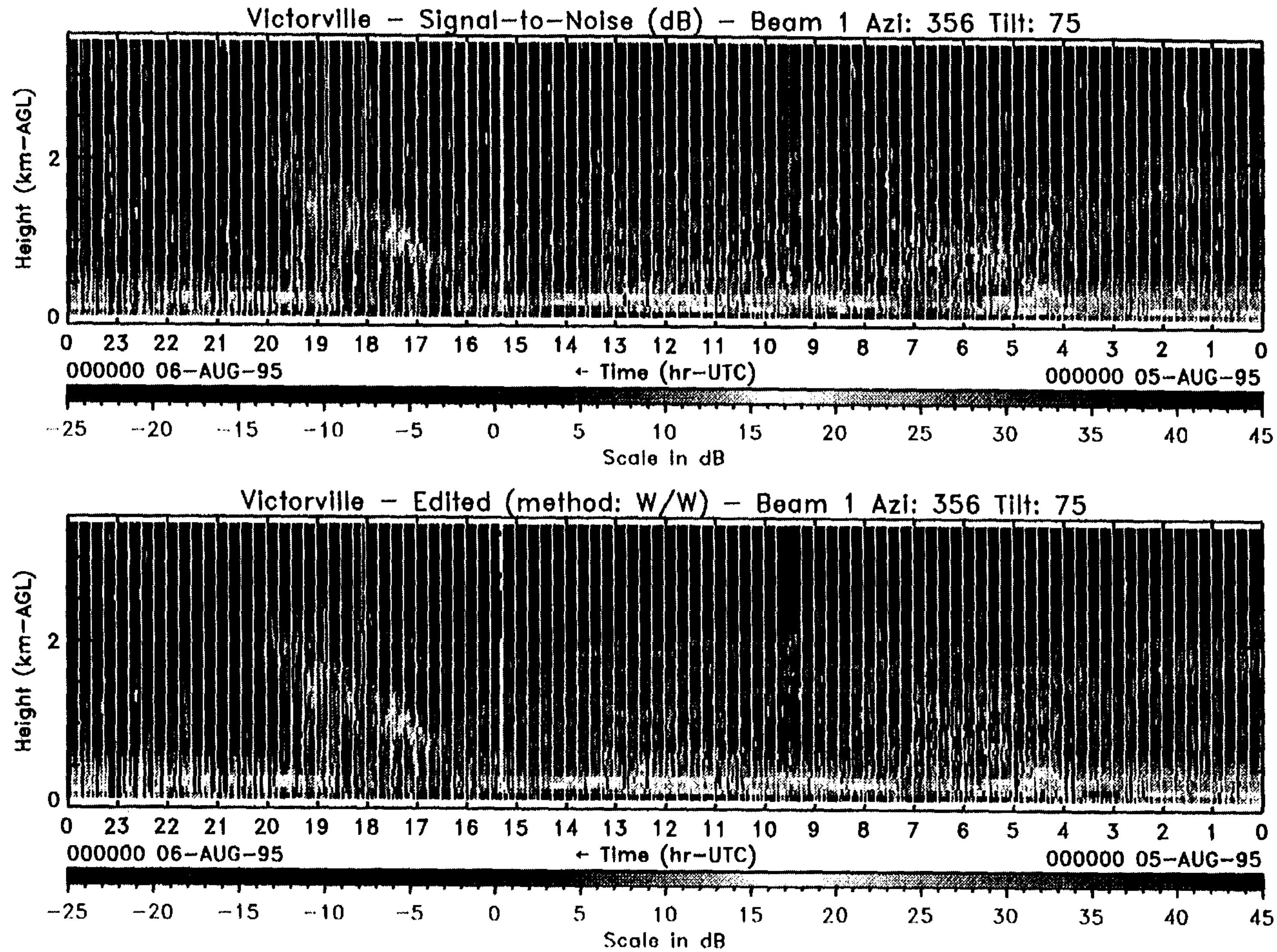

Victorville - Signal-to-Noise (dB) - Beam 1 Azi: 356 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB
Victorville - Edited (method: W/W) - Beam 1 Azi: 356 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB

Figure 5b:

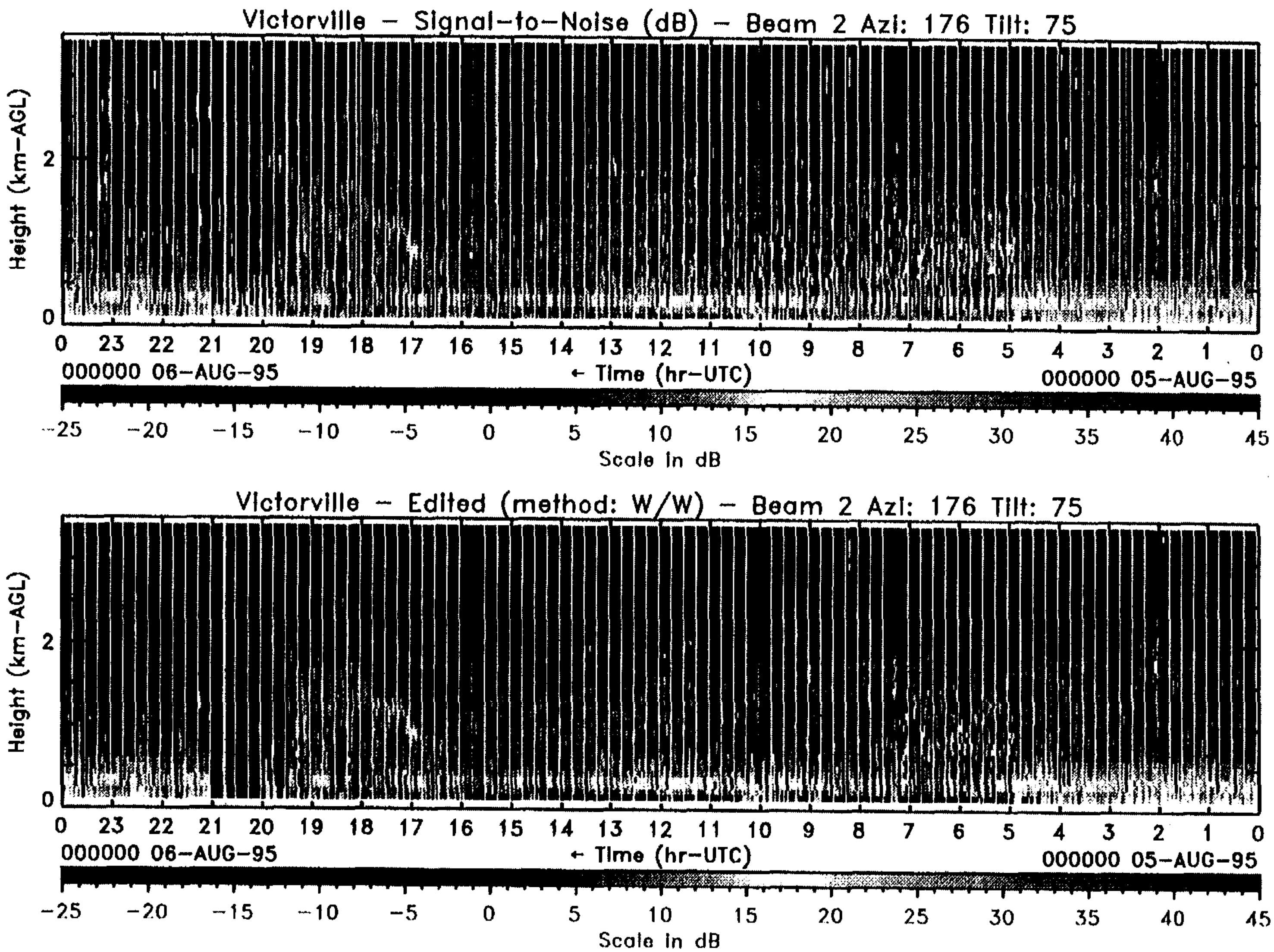
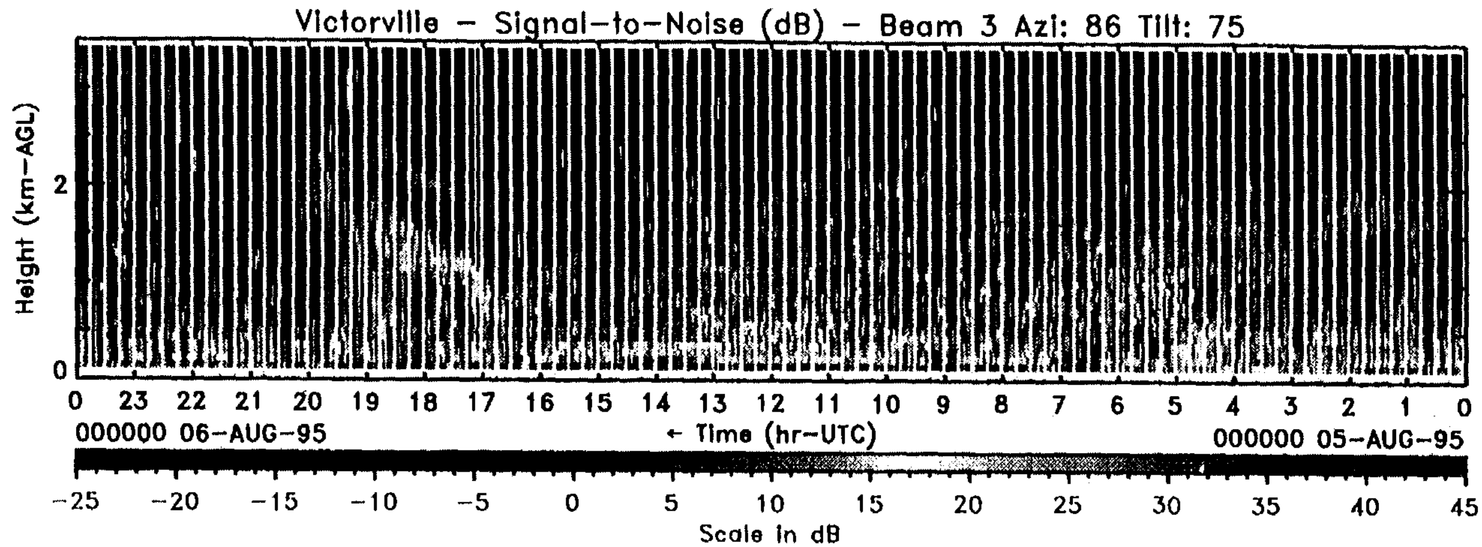

Victorville - Signal-to-Noise (dB) - Beam 2 Azi: 176 Tilt: 75
Height (km-AGL)
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB
Victorville - Edited (method: W/W) - Beam 2 Azi: 176 Tilt: 75
Height (km-AGL)
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB

Figure 5c:


Victorville – Signal–to–Noise (dB) – Beam 3 Azi: 86 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–25 –20 –15 –10 –5 0 5 10 15 20 25 30 35 40 45
Scale in dB

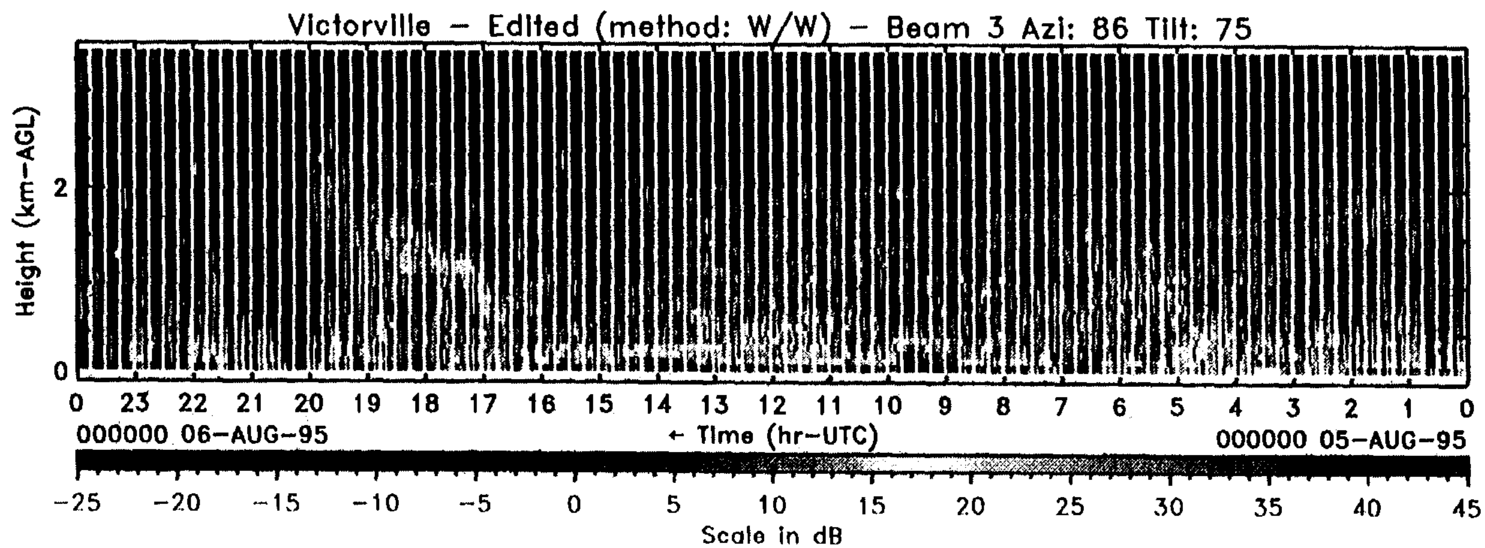
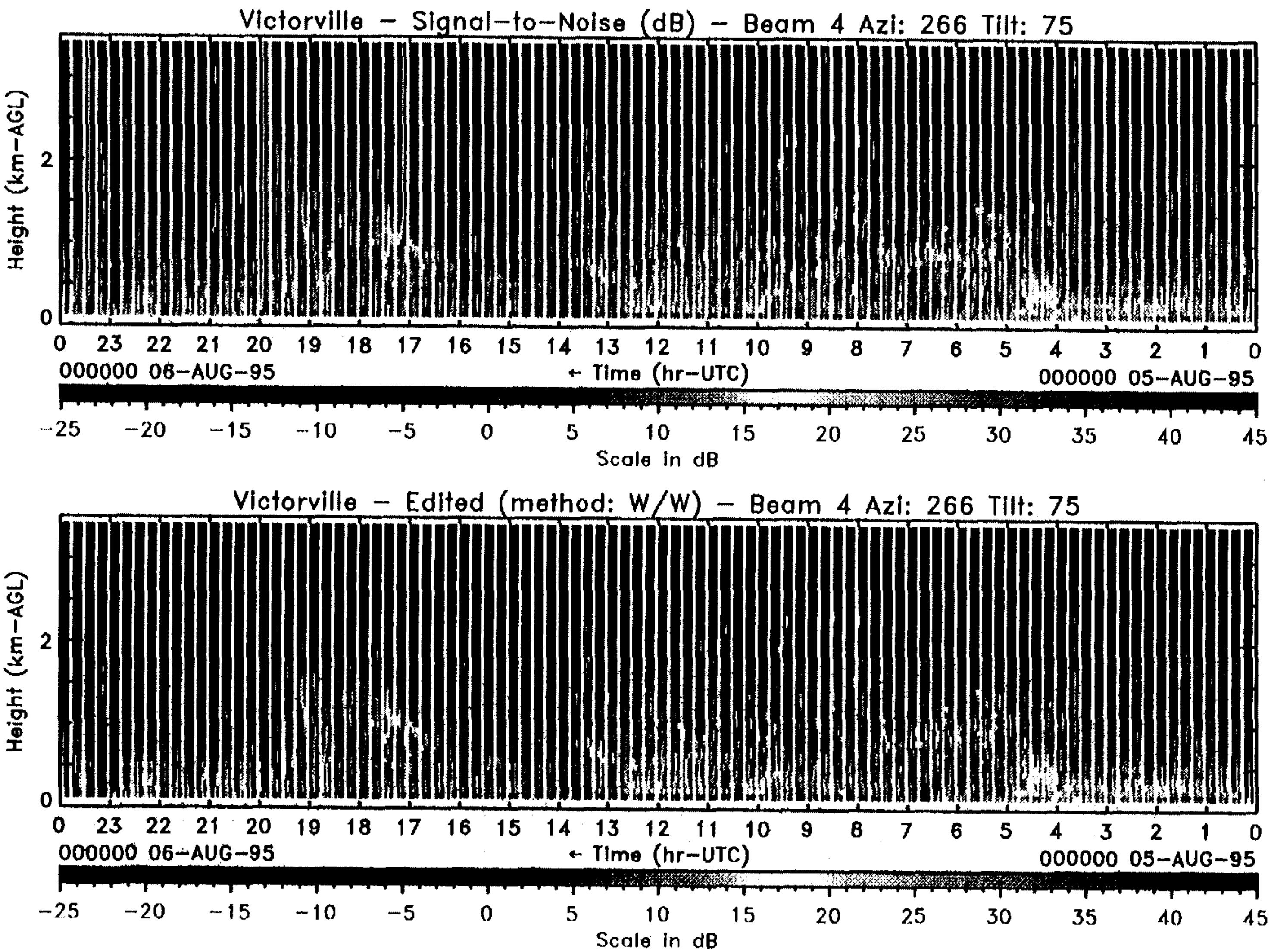

Victorville – Edited (method: W/W) – Beam 3 Azi: 86 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–25 –20 –15 –10 –5 0 5 10 15 20 25 30 35 40 45
Scale in dB

Figure 5d:



Victorville – Signal-to-Noise (dB) – Beam 4 Azi: 266 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB
Victorville – Edited (method: W/W) – Beam 4 Azi: 266 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45
Scale in dB

Figure 5e:

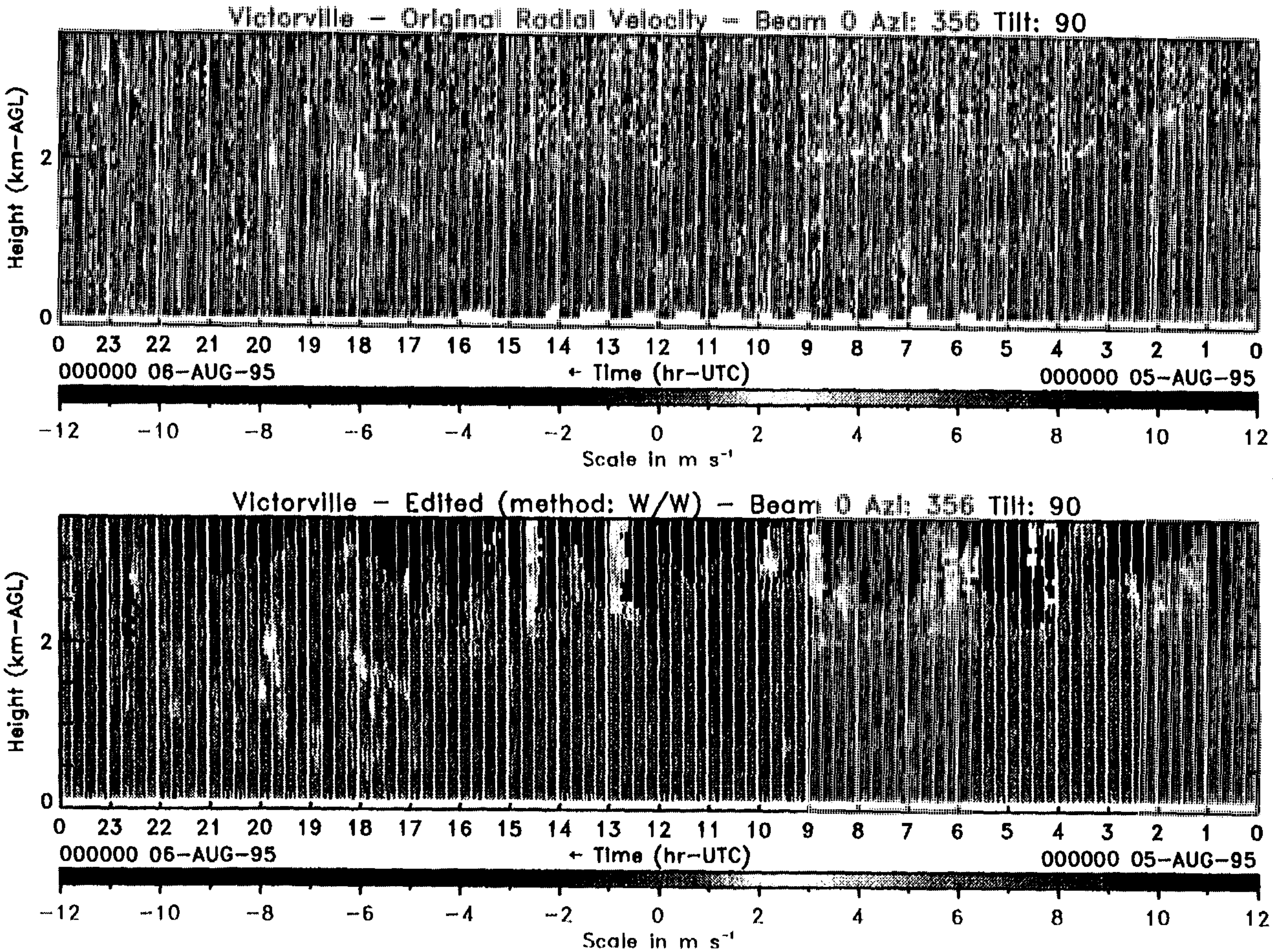


Figure 6a: Radial velocities for antenna beam 0, azimuth 356°, and tilt 90° on 5 Aug (JD 217). Top plot is raw unedited data and bottom plot is after quality control. Vertical stripes are RASS sampling periods. Black regions in edited plots are data flagged as bad or missing.

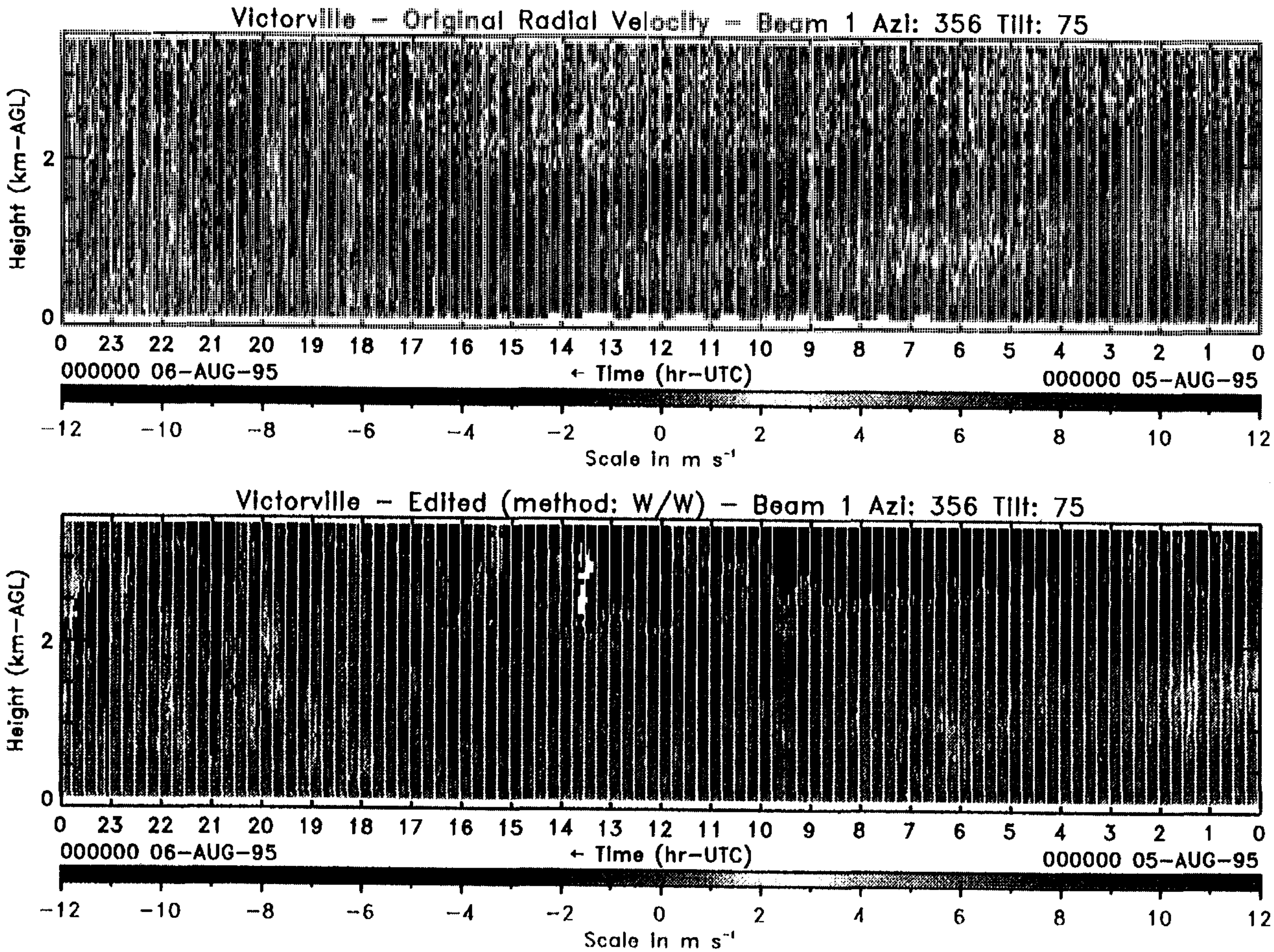

Victorville – Original Radial Velocity – Beam 1 Azi: 356 Tilt: 75
Height (km–AGL)
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹
Victorville – Edited (method: W/W) – Beam 1 Azi: 356 Tilt: 75
Height (km–AGL)
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹

Figure 6b:

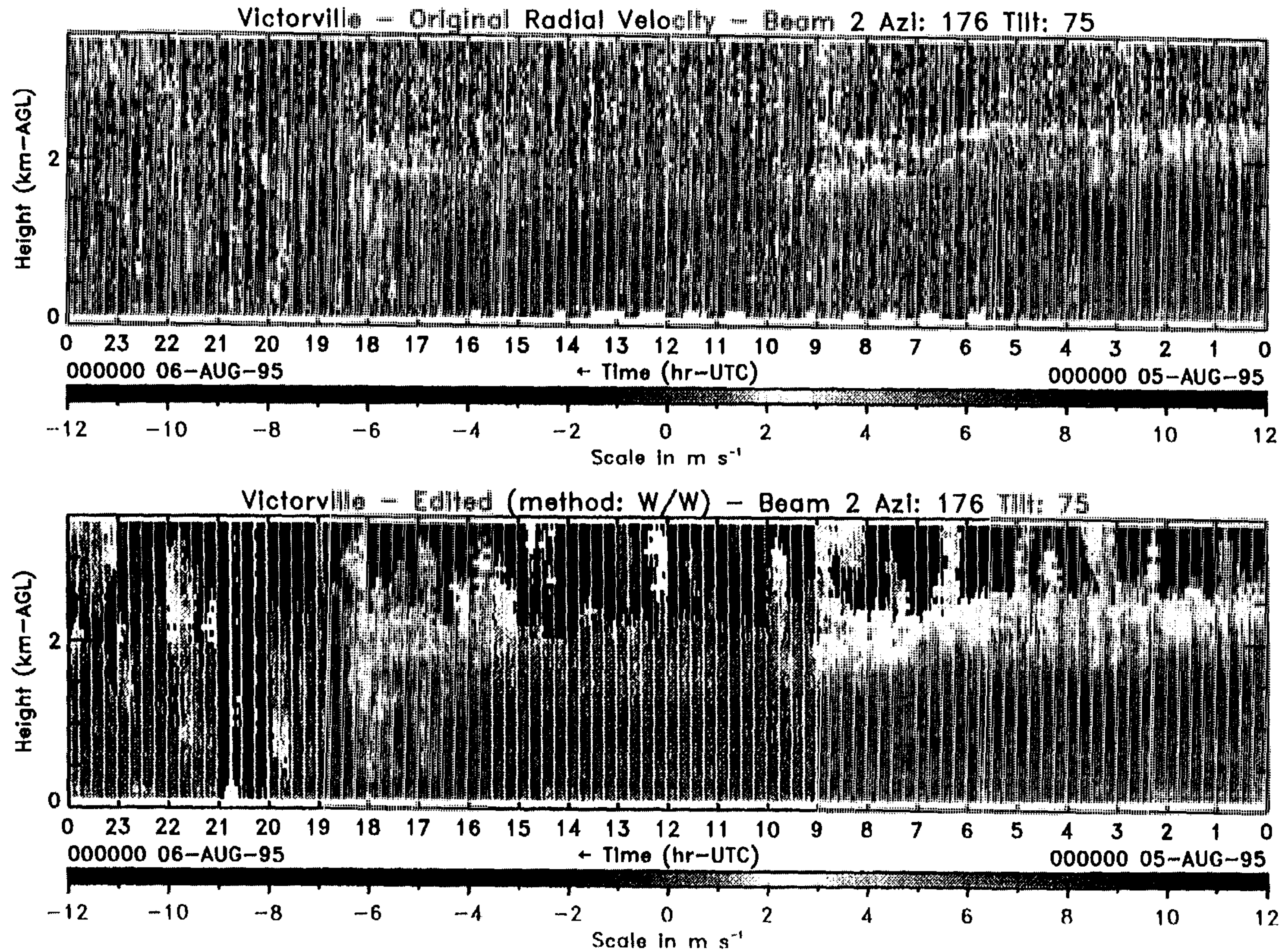

Victorville – Original Radial Velocity – Beam 2 Azi: 176 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹
Victorville – Edited (method: W/W) – Beam 2 Azi: 176 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹

Figure 6c:

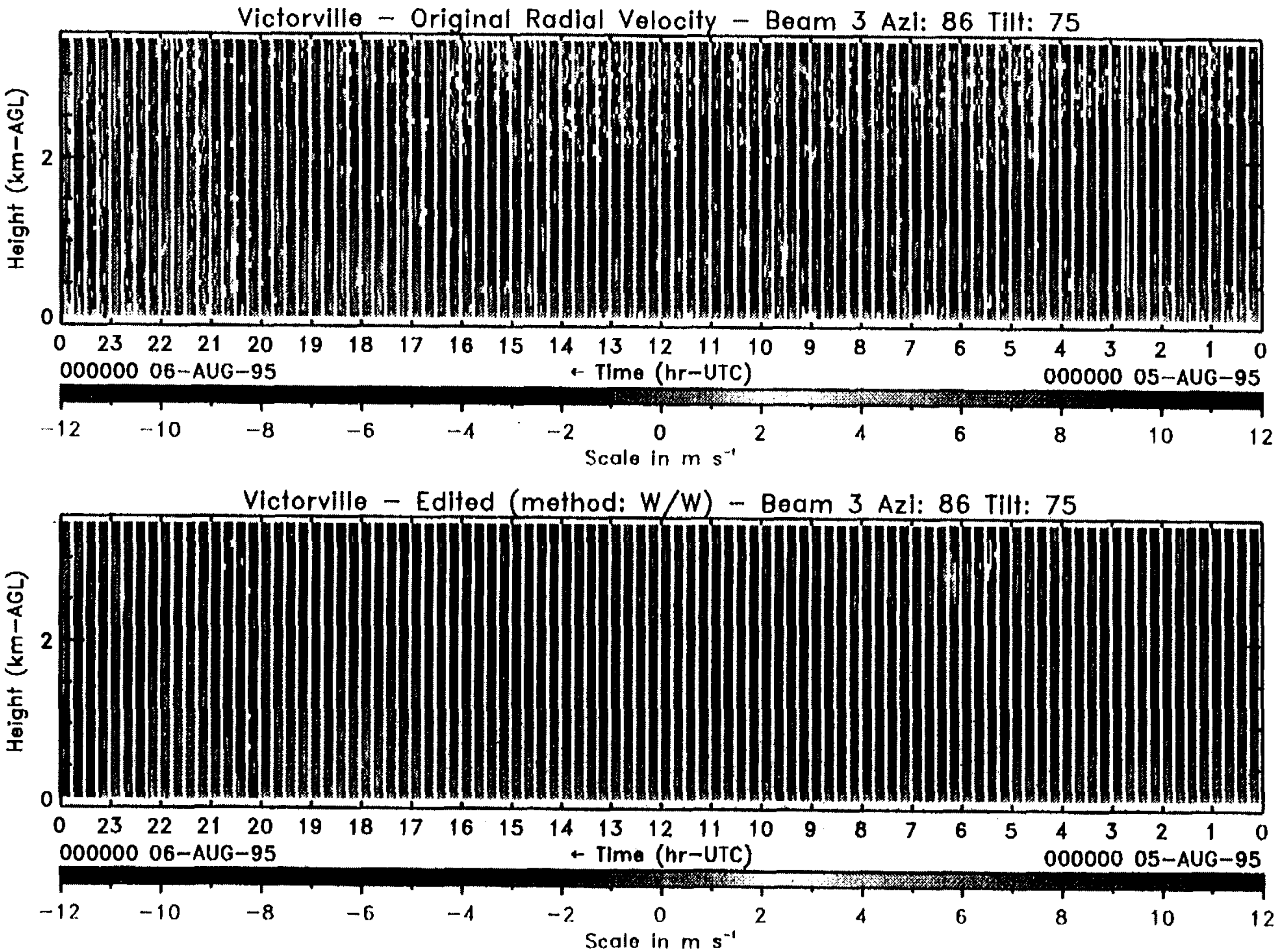
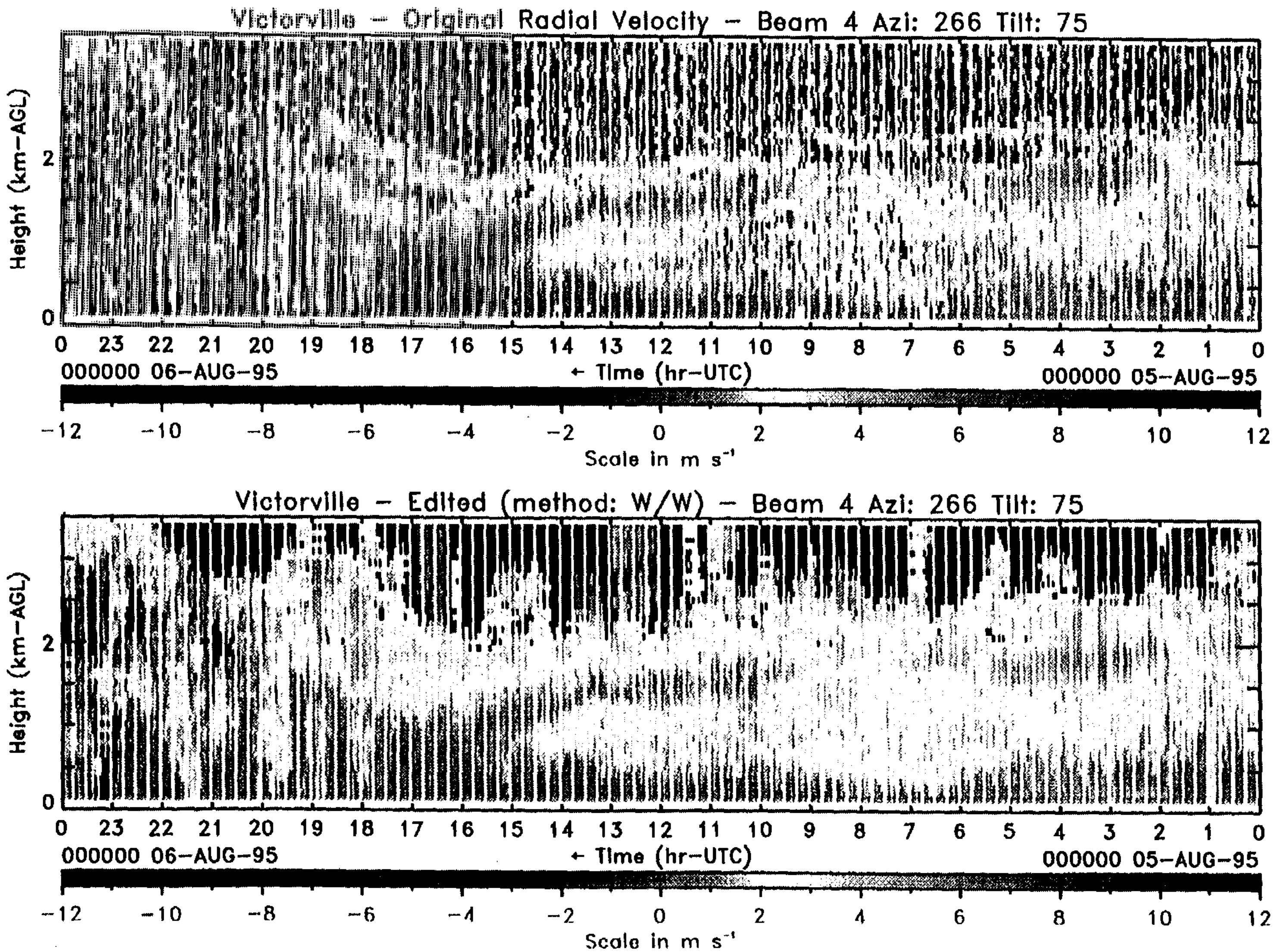

Victorville – Original Radial Velocity – Beam 3 Azi: 86 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹
Victorville – Edited (method: W/W) – Beam 3 Azi: 86 Tilt: 75
Height (km–AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–12 –10 –8 –6 –4 –2 0 2 4 6 8 10 12
Scale in m s⁻¹

Figure 6d:



Victorville - Original Radial Velocity - Beam 4 Azi: 266 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12
Scale in m s⁻¹
Victorville - Edited (method: W/W) - Beam 4 Azi: 266 Tilt: 75
Height (km-AGL)
0
2
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06-AUG-95
← Time (hr-UTC)
000000 05-AUG-95
-12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12
Scale in m s⁻¹

Figure 6c:

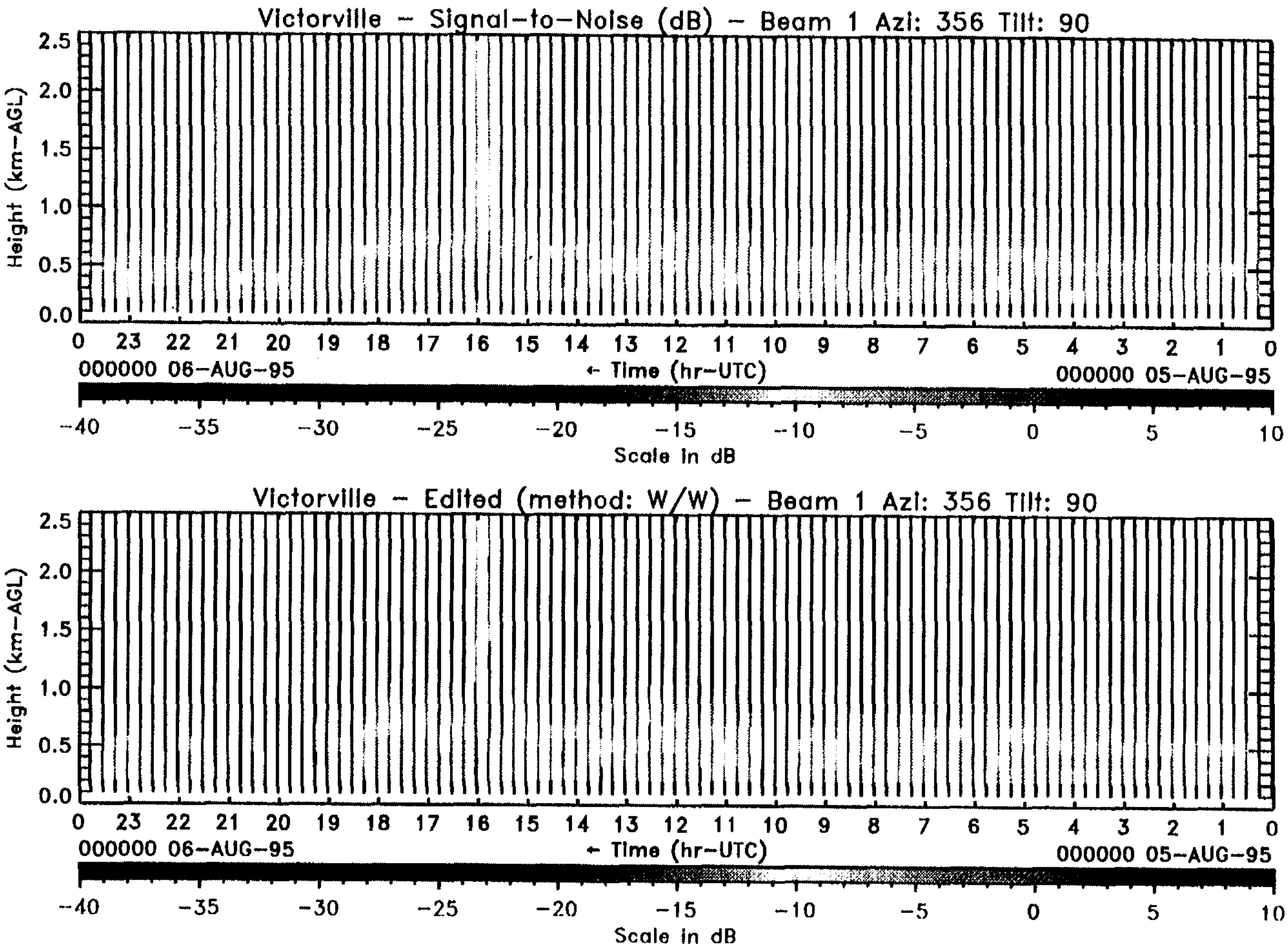


Figure 7: SNR for the RASS acoustic beam on 5 Aug (JD 217) as actually sampled in time.

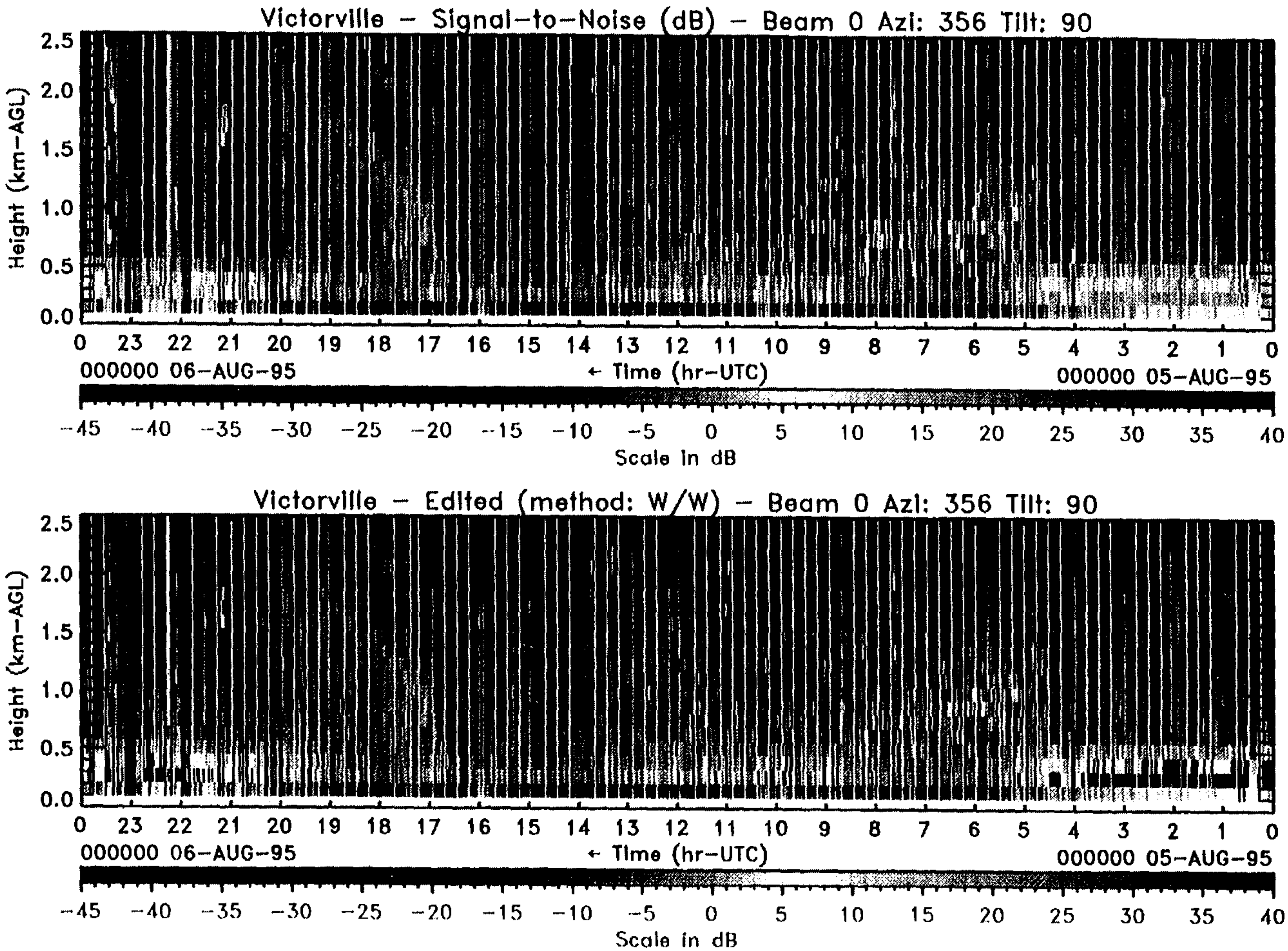


Figure 8a: SNR for the RASS acoustic beam depicted as if sampled uniformly in time on 5 Aug (JD 217). Vertical stripes represent breaks in RASS sampling.

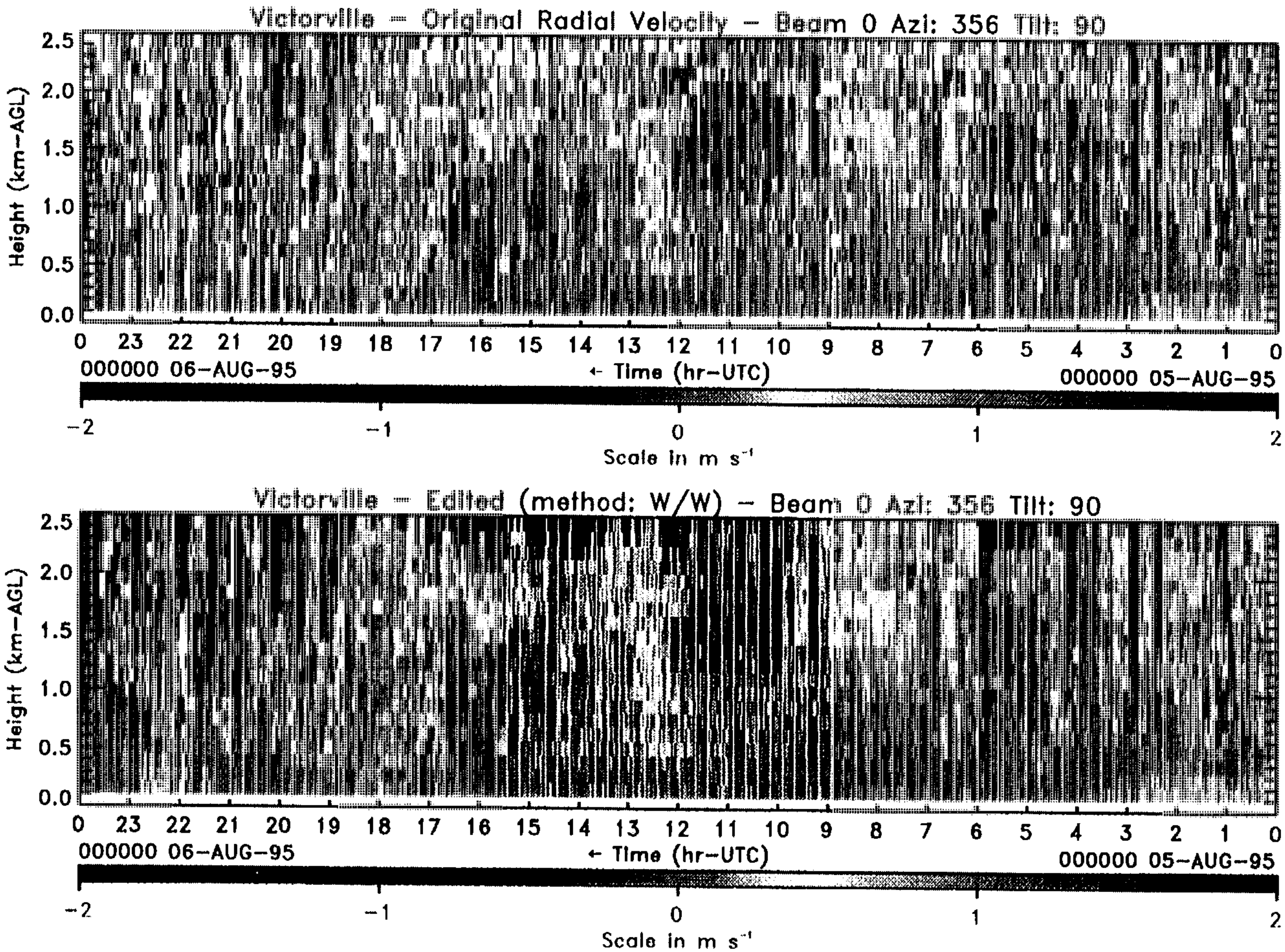

Victorville – Original Radial Velocity – Beam 0 Azi: 356 Tilt: 90
Height (km–AGL)
2.5
2.0
1.5
1.0
0.5
0.0
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–2 –1 0 1 2
Scale in m s⁻¹
Victorville – Edited (method: W/W) – Beam 0 Azi: 356 Tilt: 90
Height (km–AGL)
2.5
2.0
1.5
1.0
0.5
0.0
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–2 –1 0 1 2
Scale in m s⁻¹

Figure 8b:

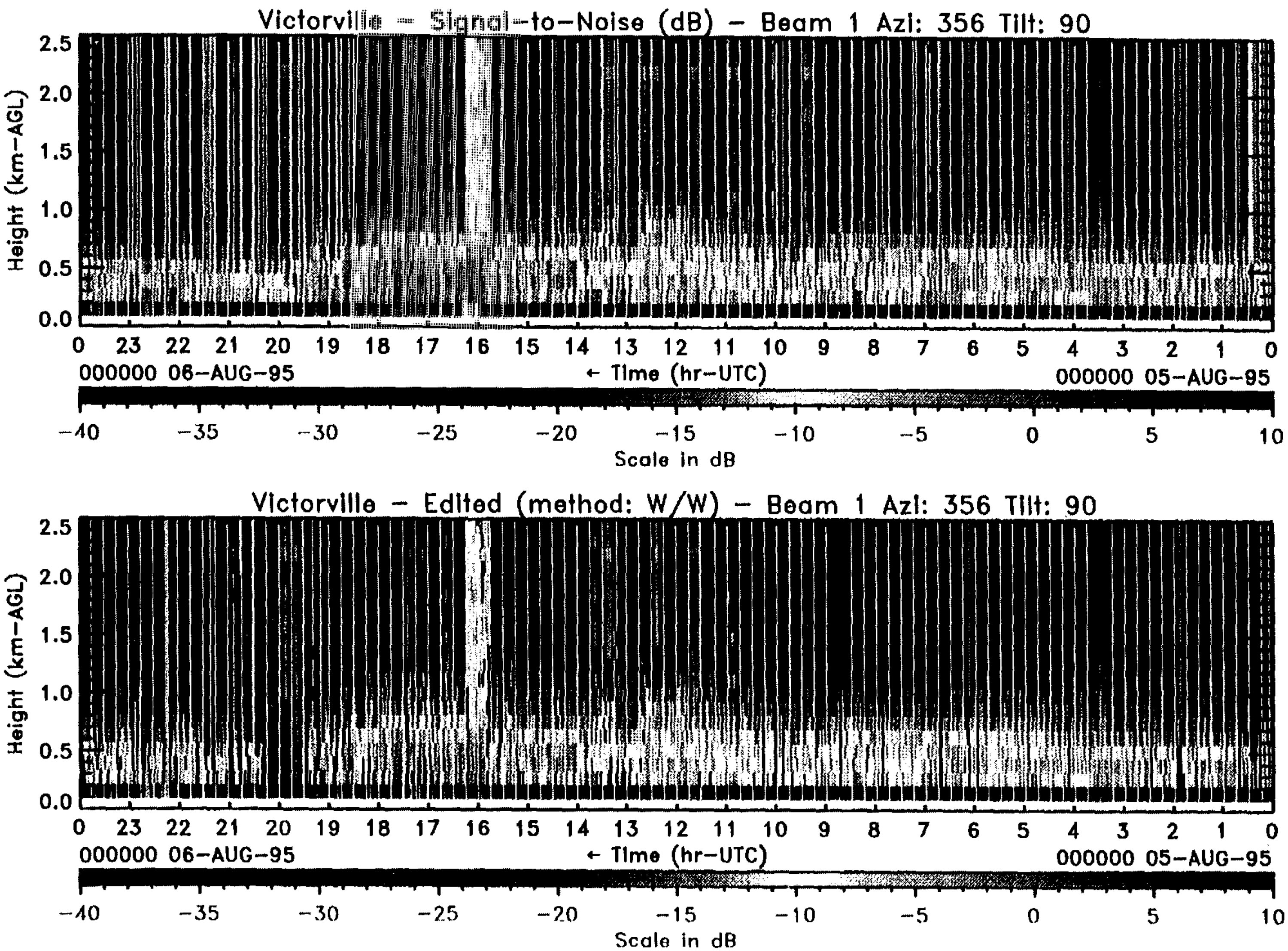
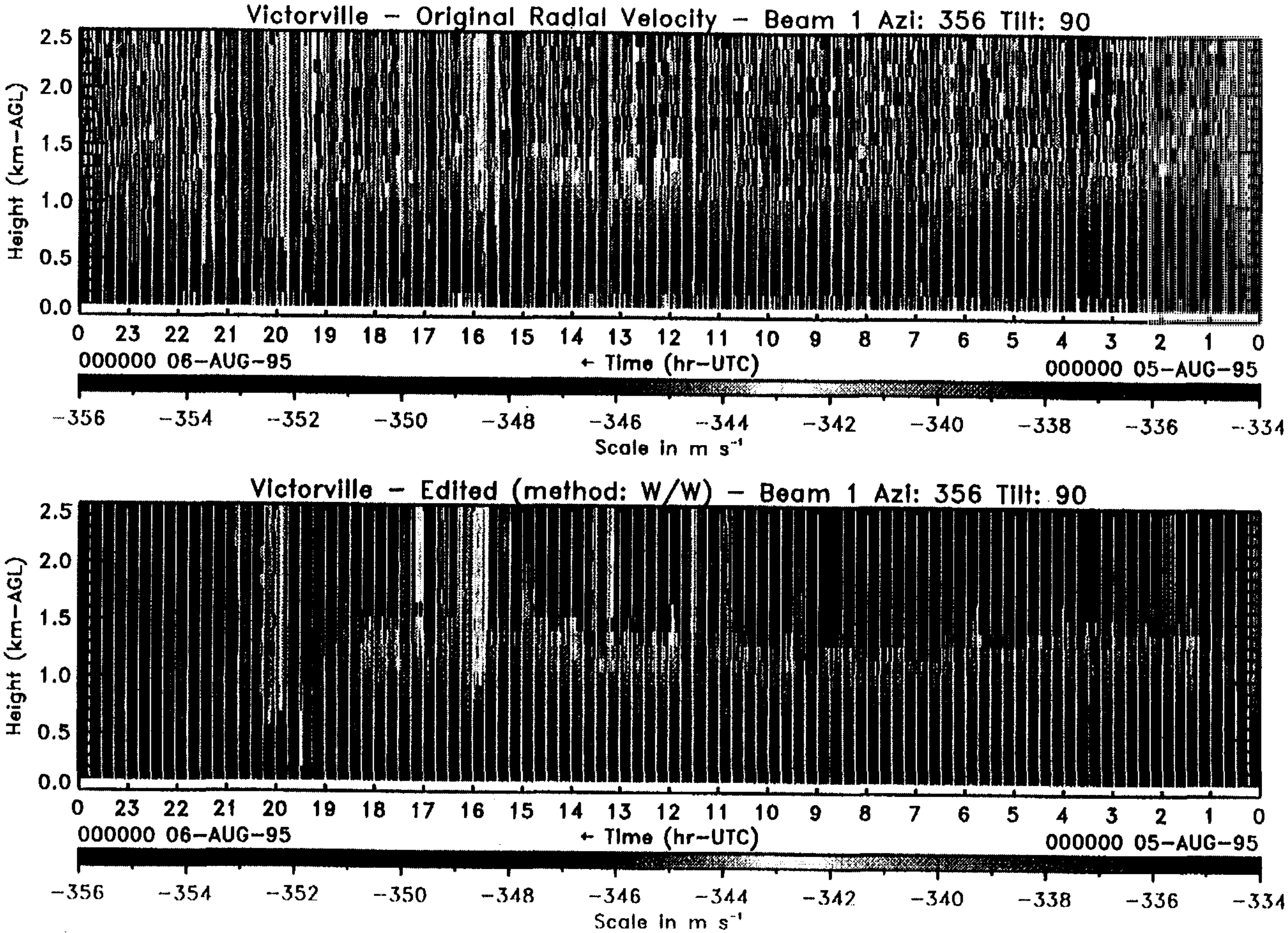


Figure 9a: SNR of the vertical wind component measured during the RASS mode and depicted as if sampled uniformly in time on 5 Aug (JD 217). Vertical white stripes represent breaks in RASS sampling.



Victorville – Original Radial Velocity – Beam 1 Azi: 356 Tilt: 90
Height (km–AGL)
0.0 0.5 1.0 1.5 2.0 2.5
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–356 –354 –352 –350 –348 –346 –344 –342 –340 –338 –336 –334
Scale in m s⁻¹
Victorville – Edited (method: W/W) – Beam 1 Azi: 356 Tilt: 90
Height (km–AGL)
0.0 0.5 1.0 1.5 2.0 2.5
0 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
000000 06–AUG–95
← Time (hr–UTC)
000000 05–AUG–95
–356 –354 –352 –350 –348 –346 –344 –342 –340 –338 –336 –334
Scale in m s⁻¹

Figure 9b:

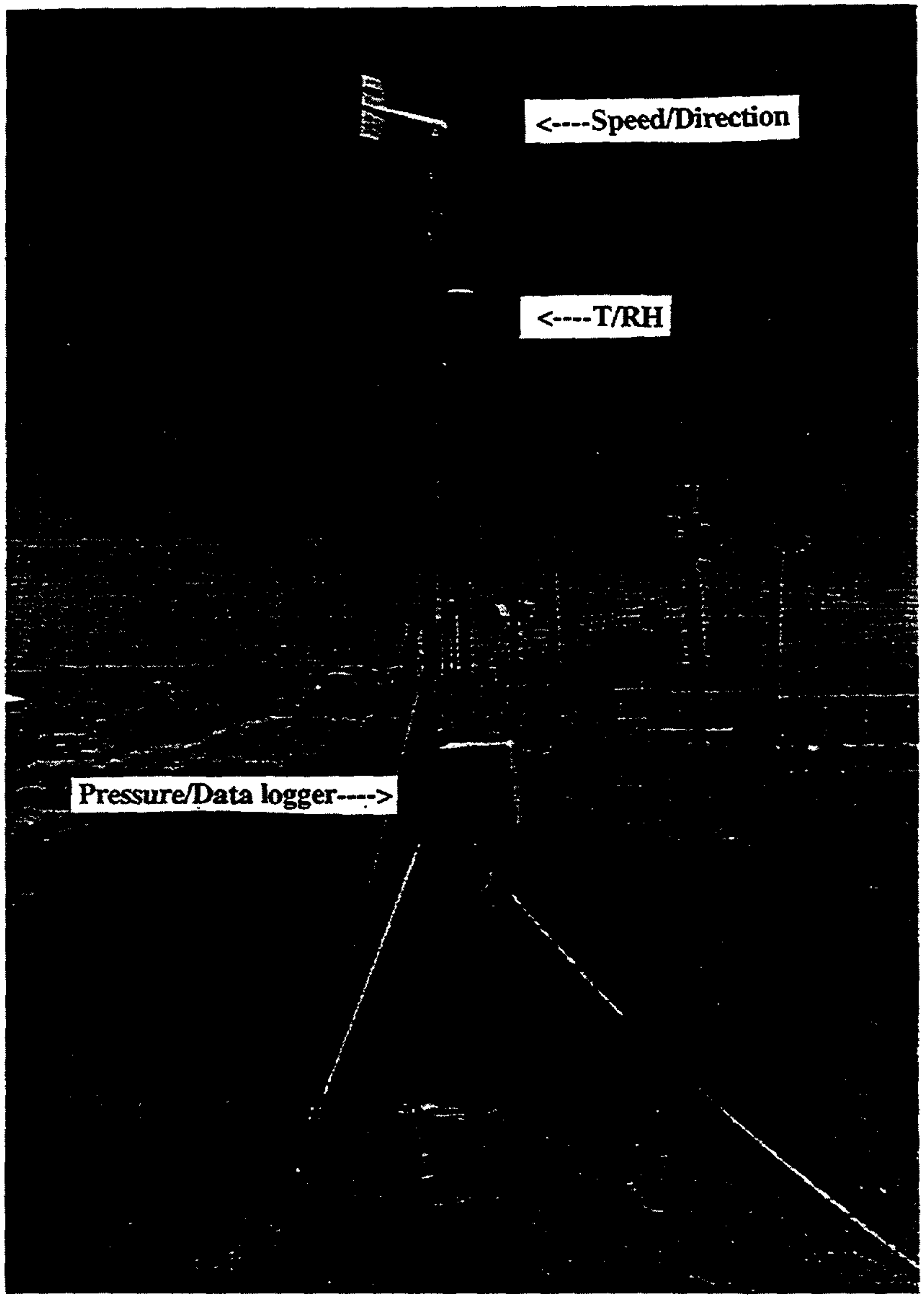


Figure 10: Surface meteorological 3-meter tower with the temperature, RH, pressure, wind speed and direction sensors: looking to the north

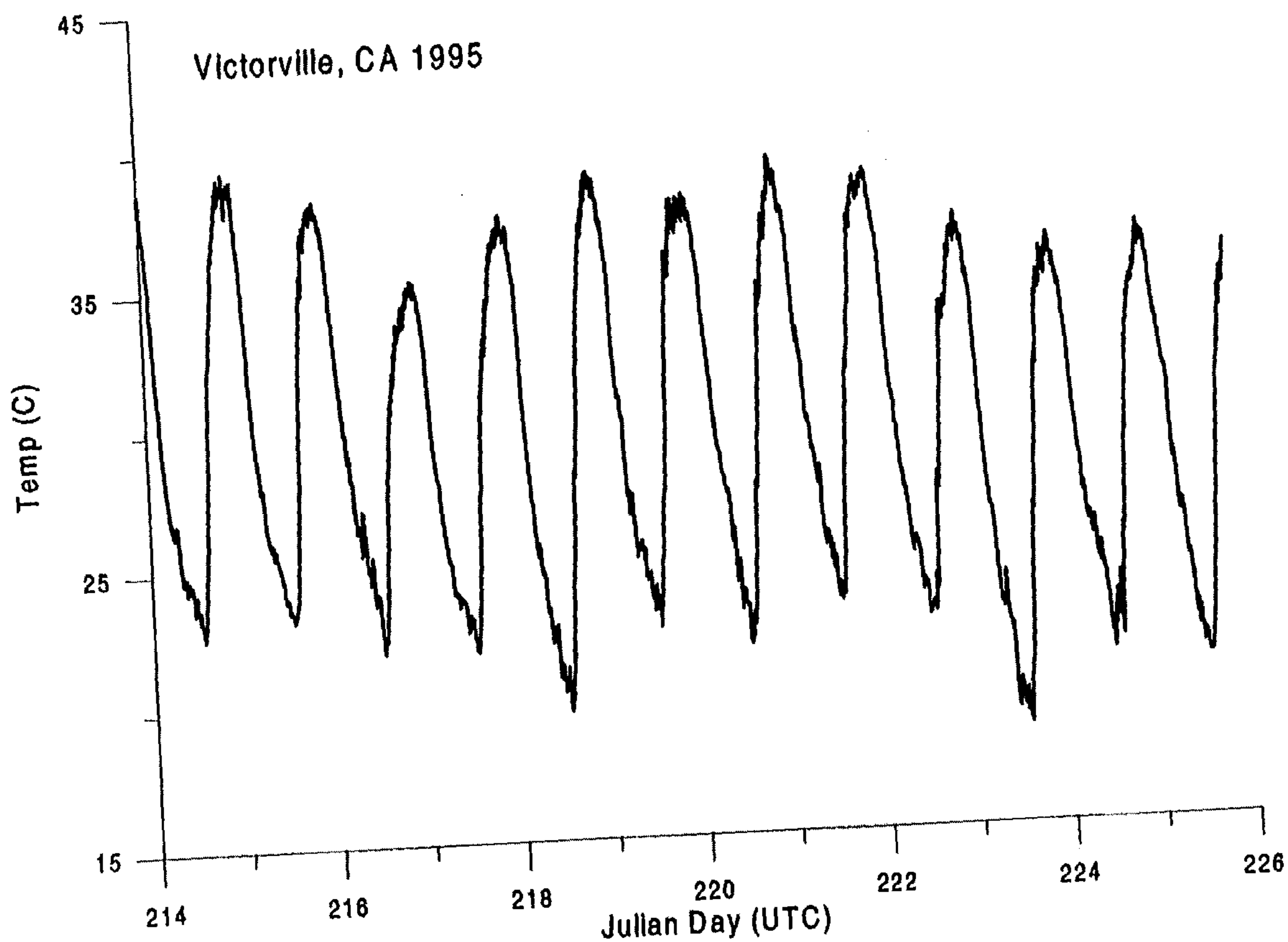


Figure 11a: Surface meteorological tower time series of 5-minute average temperature data from 2-13 Aug 1995.

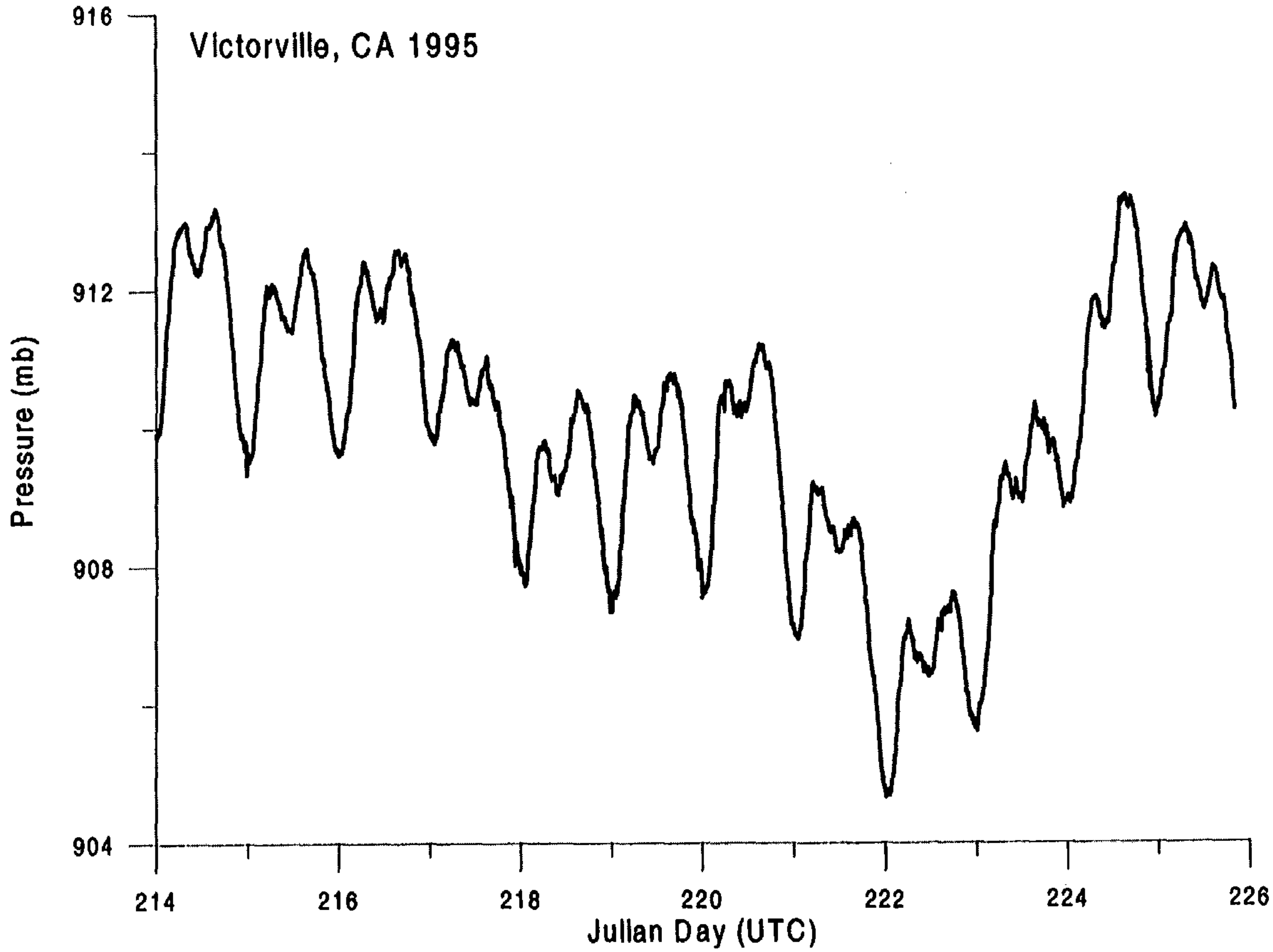

Victorville, CA 1995
Pressure (mb)
916
912
908
904
214
216
218
220
222
224
226
Julian Day (UTC)

Figure 11b:

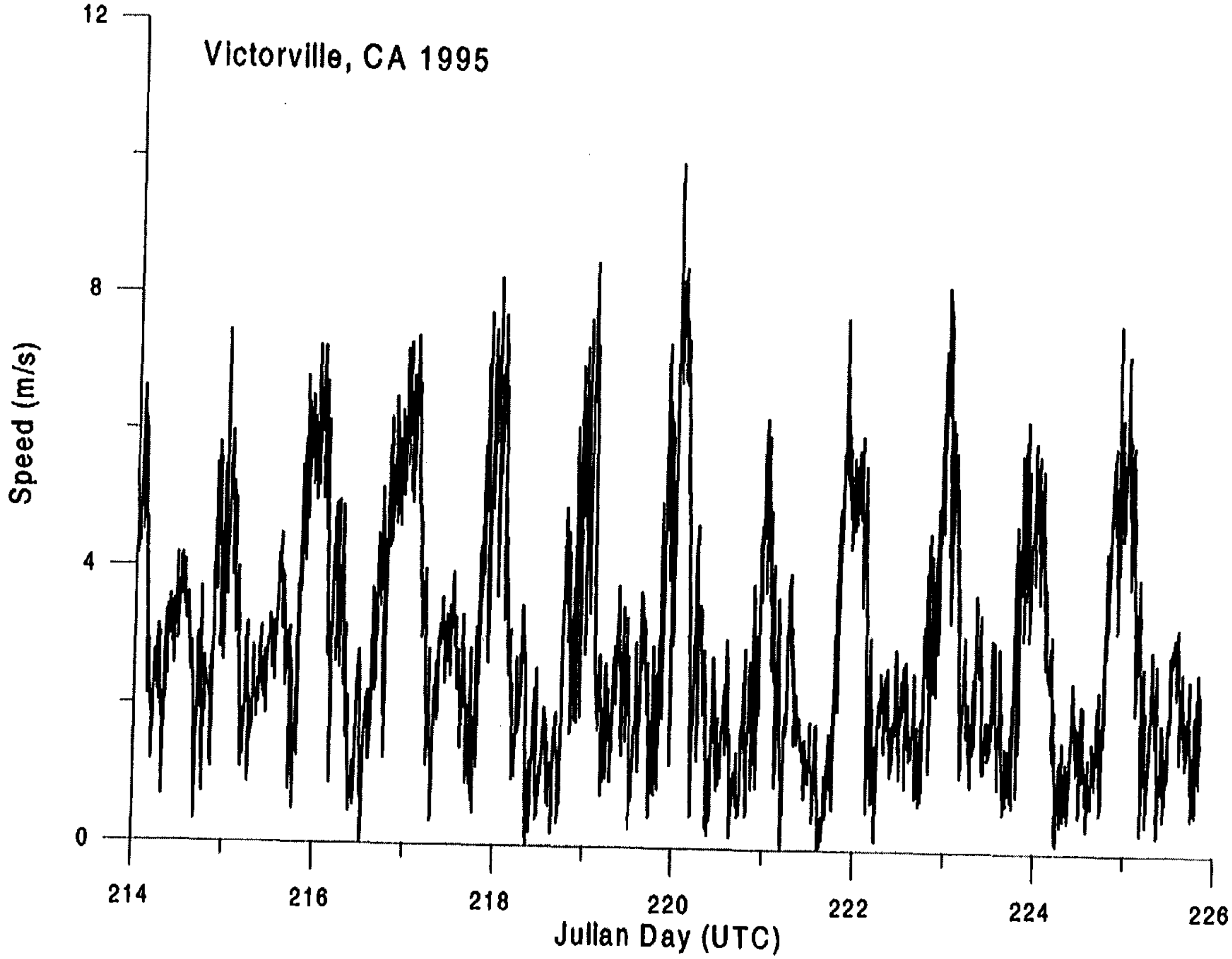

Victorville, CA 1995
Speed (m/s)
12
8
4
0
214
216
218
220
222
224
226
Julian Day (UTC)

Figure 11c

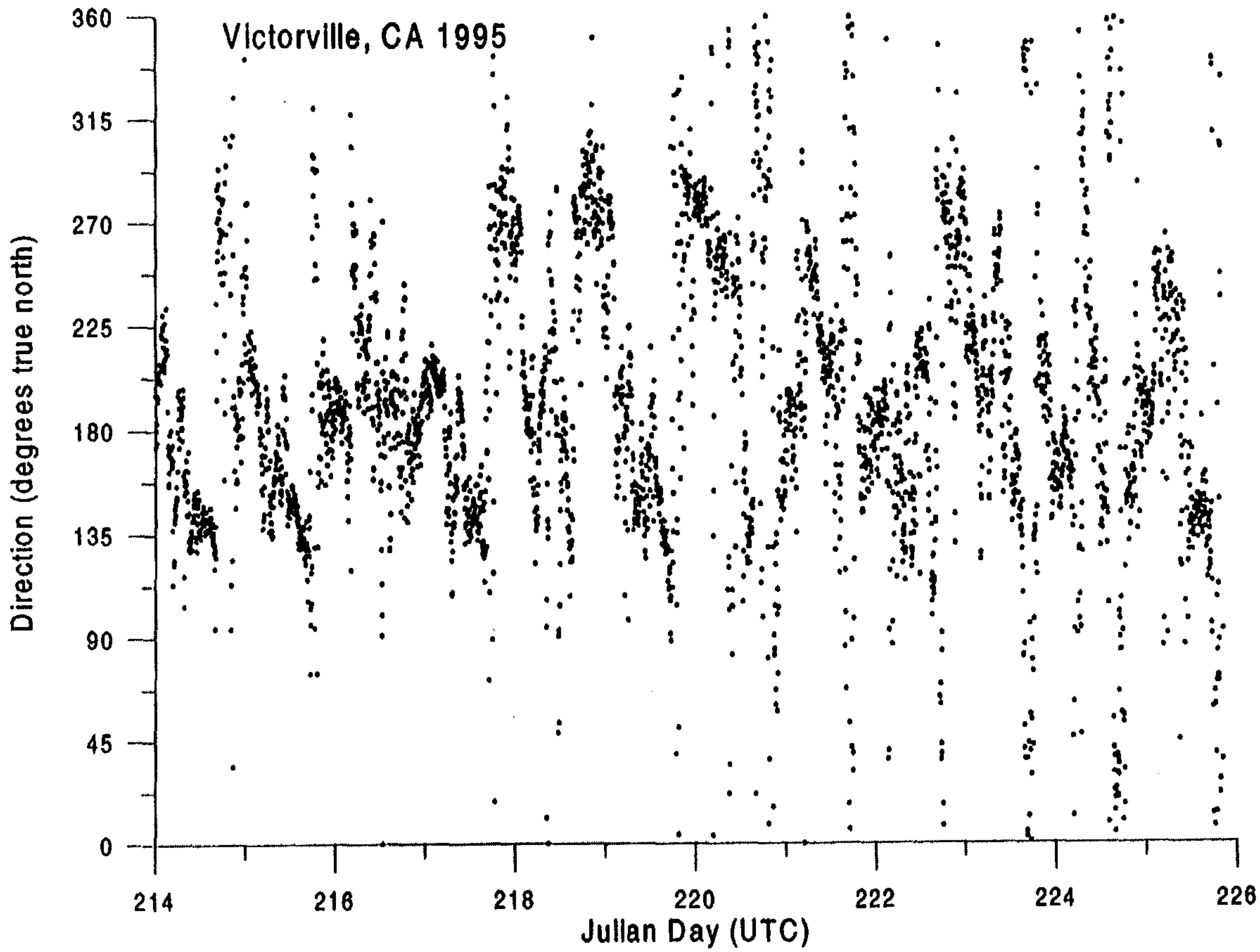
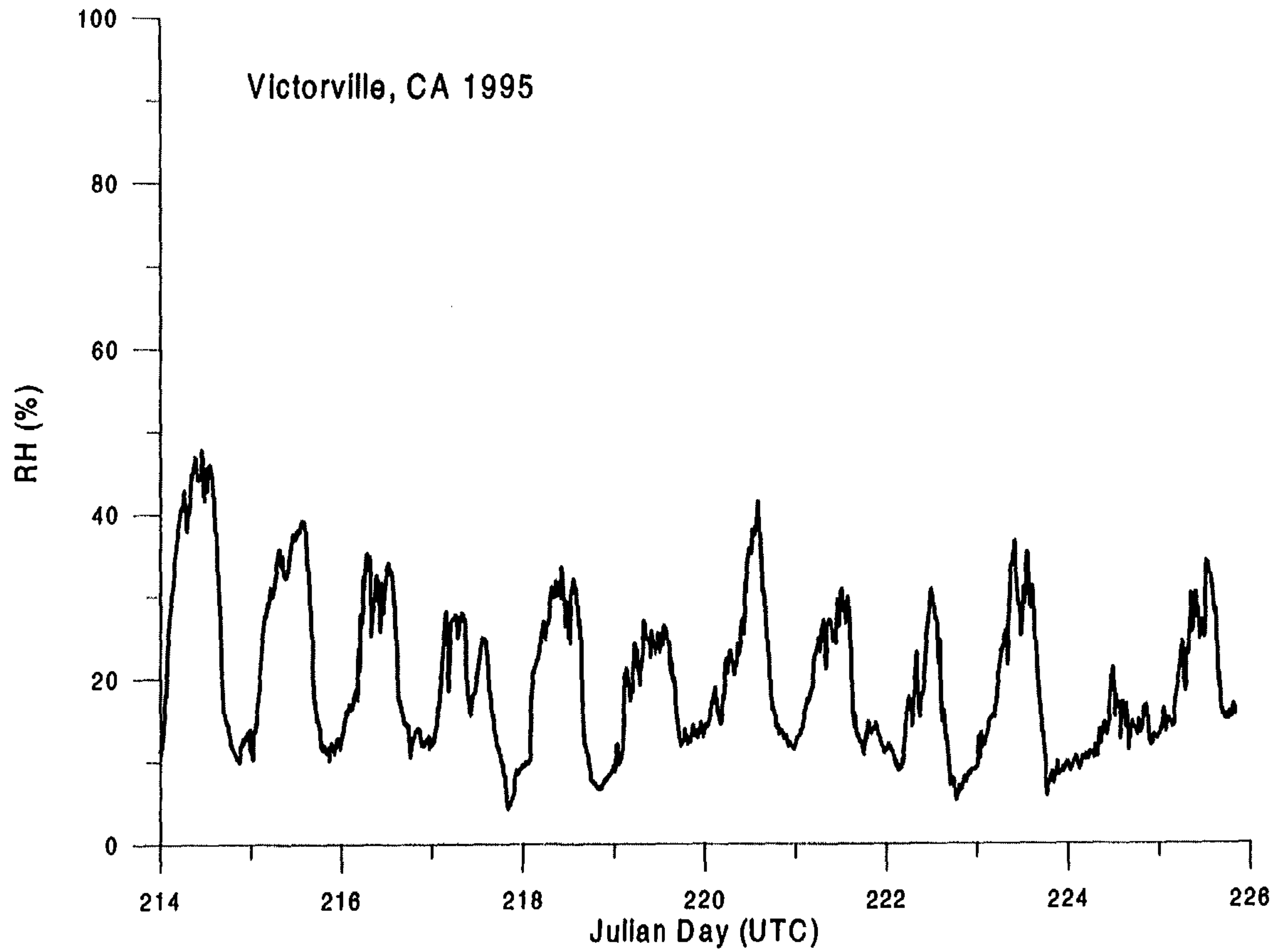

Victorville, CA 1995
Direction (degrees true north)
360
315
270
225
180
135
90
45
0
214
216
218
220
222
224
226
Julian Day (UTC)

Figure 11d:



Victorville, CA 1995
RH (%)
100
80
60
40
20
0
214
216
218
220
222
224
226
Julian Day (UTC)

Figure 11e:

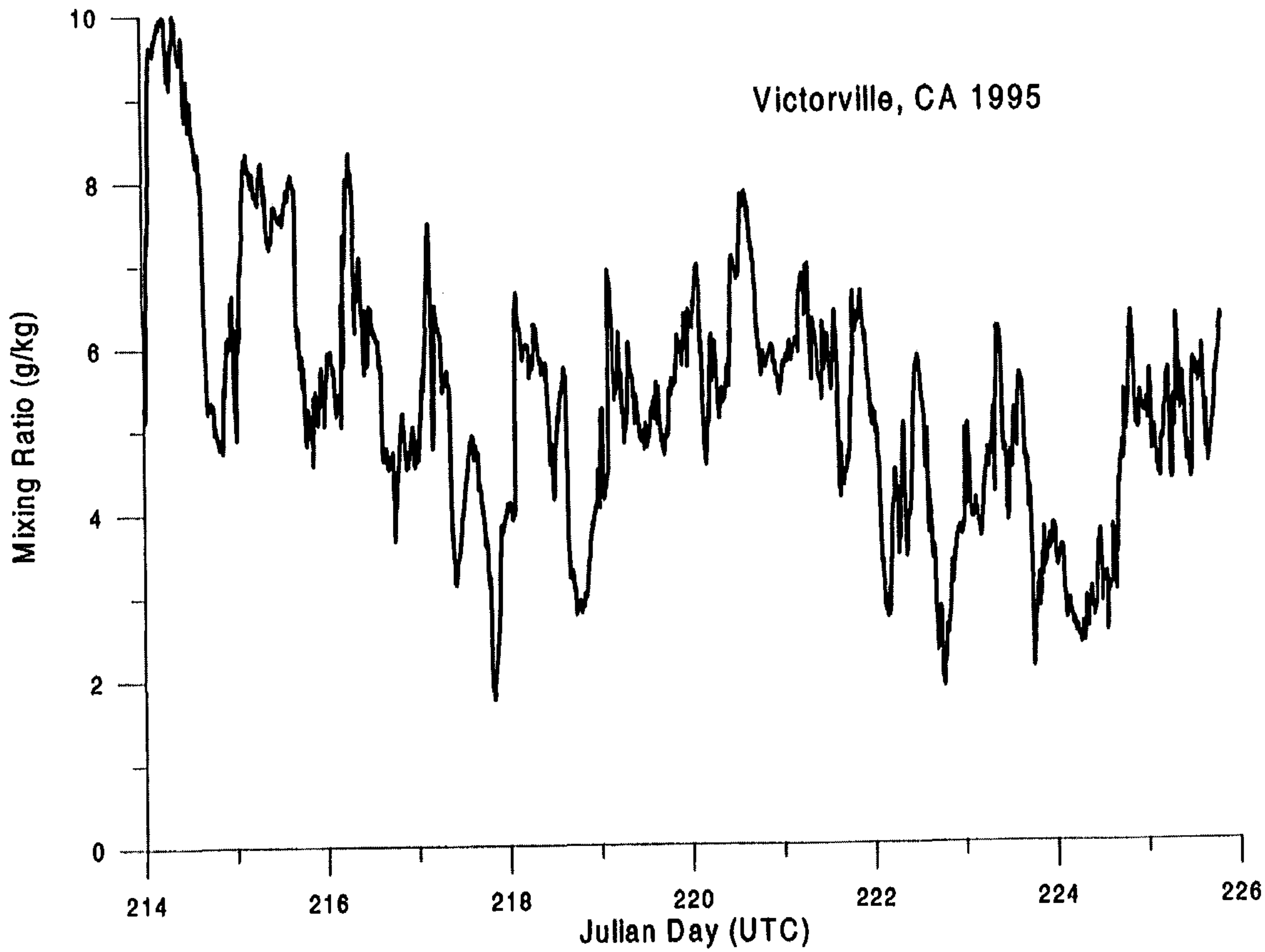

Victorville, CA 1995
Mixing Ratio (g/kg)
Julian Day (UTC)
0
2
4
6
8
10
214
216
218
220
222
224
226

Figure 11f:

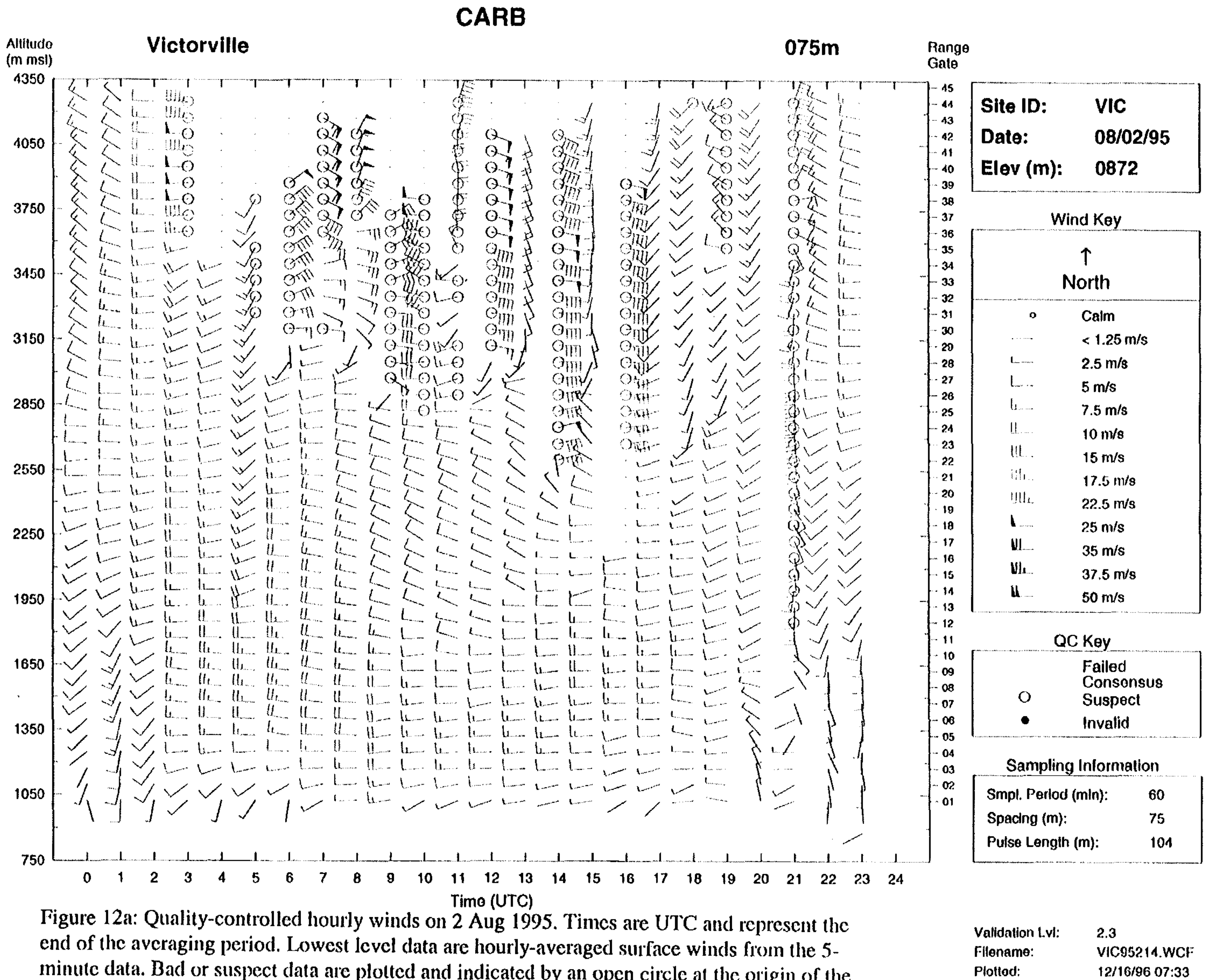
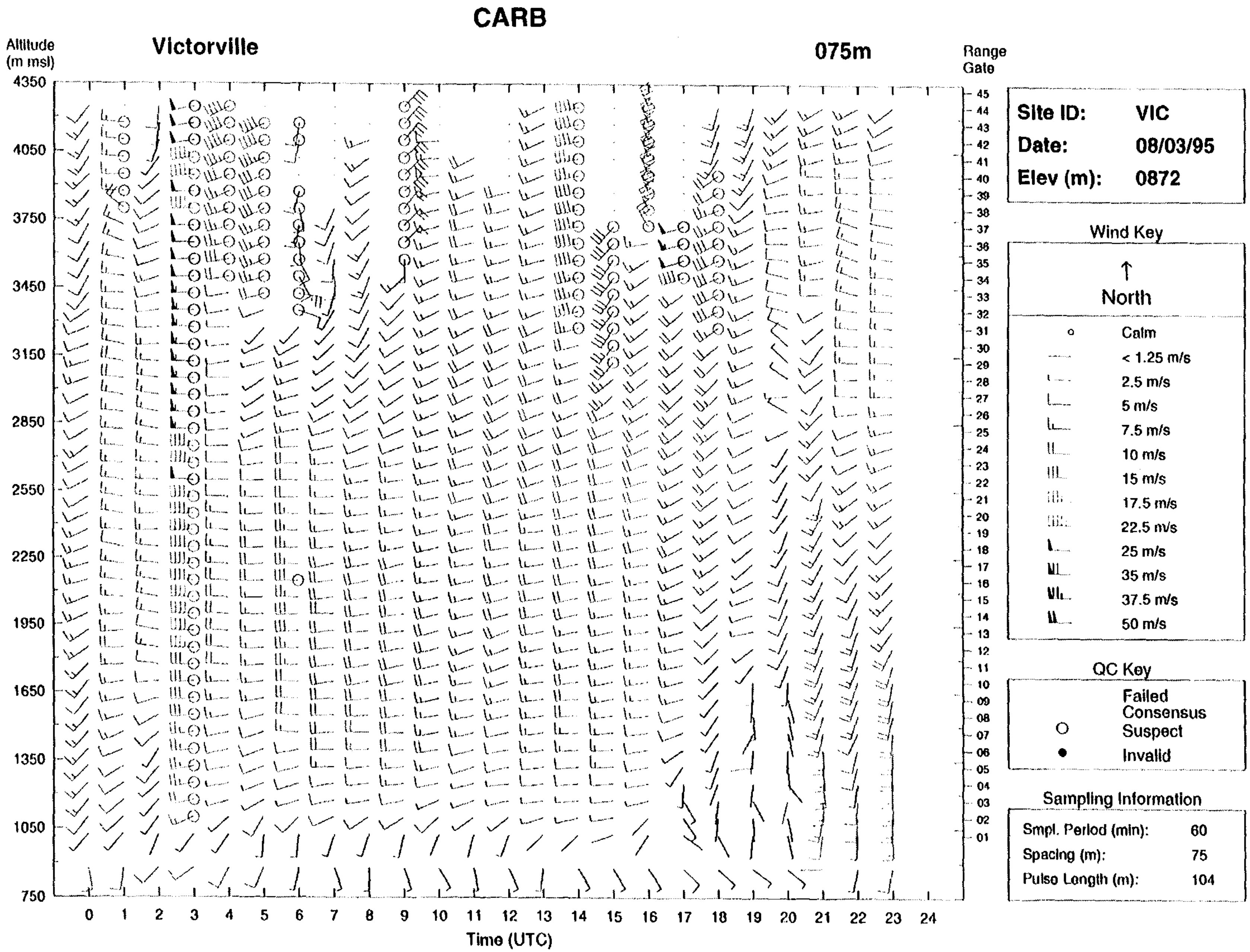
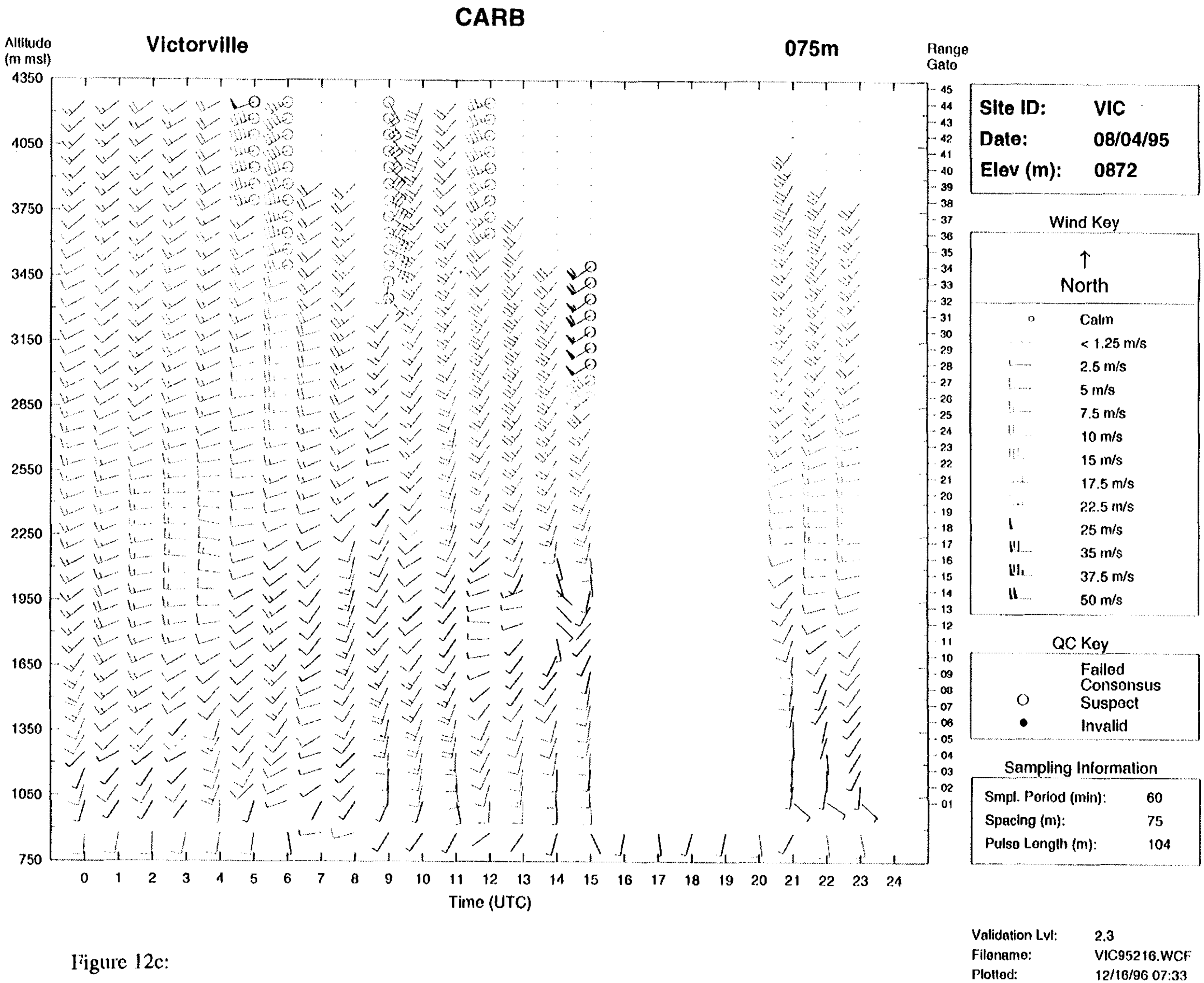


Figure 12a: Quality-controlled hourly winds on 2 Aug 1995. Times are UTC and represent the end of the averaging period. Lowest level data are hourly-averaged surface winds from the 5-minute data. Bad or suspect data are plotted and indicated by an open circle at the origin of the barb (see QC key).

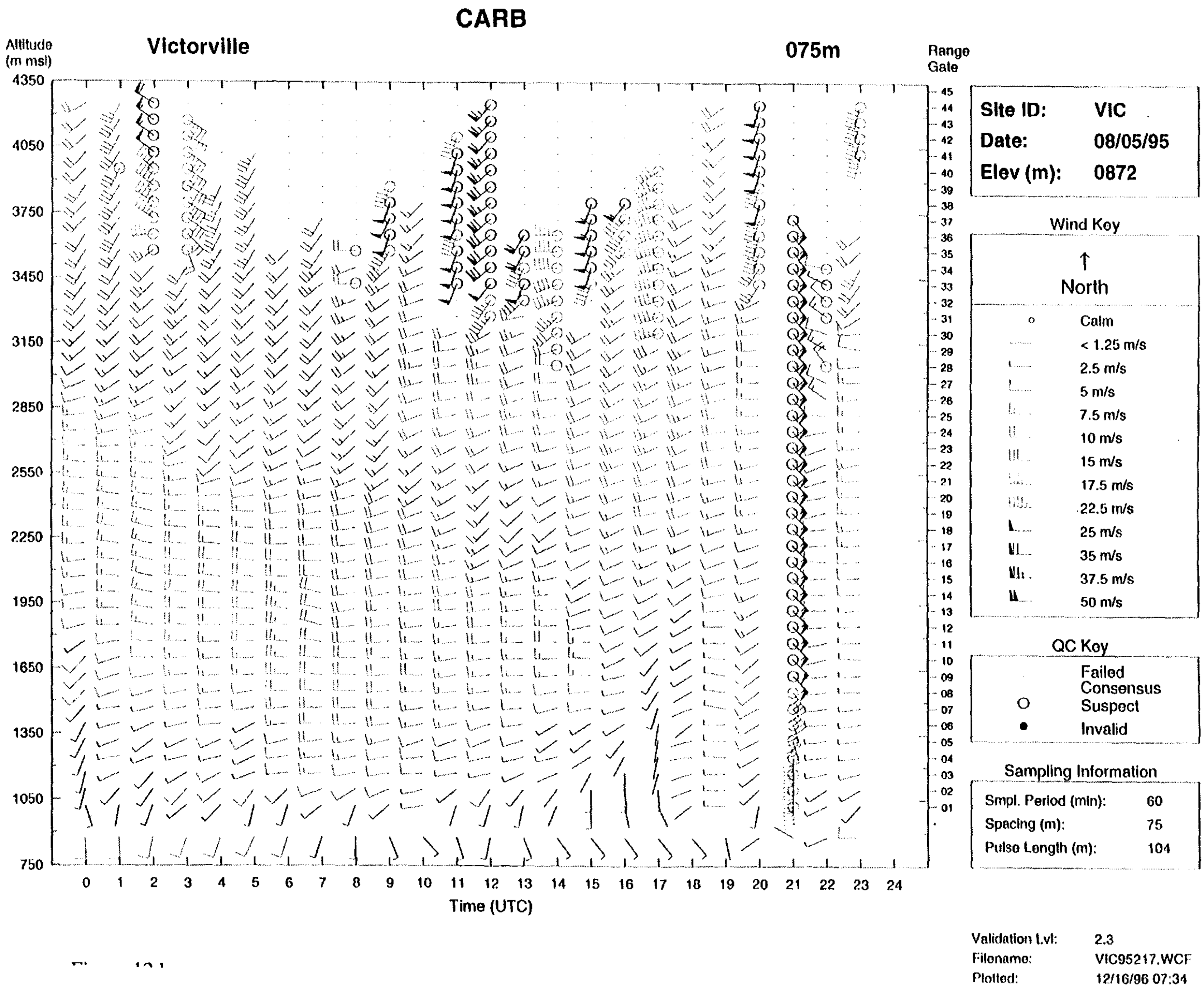


Validation Lvl: 2.3
Filename: VIC95215.WCF
Plotted: 12/16/96 07:33



CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/04/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95216.WCF
Plotted: 12/16/96 07:33

Figure 12c:



CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Range Gate
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.WCF
Plotted: 12/16/96 07:34

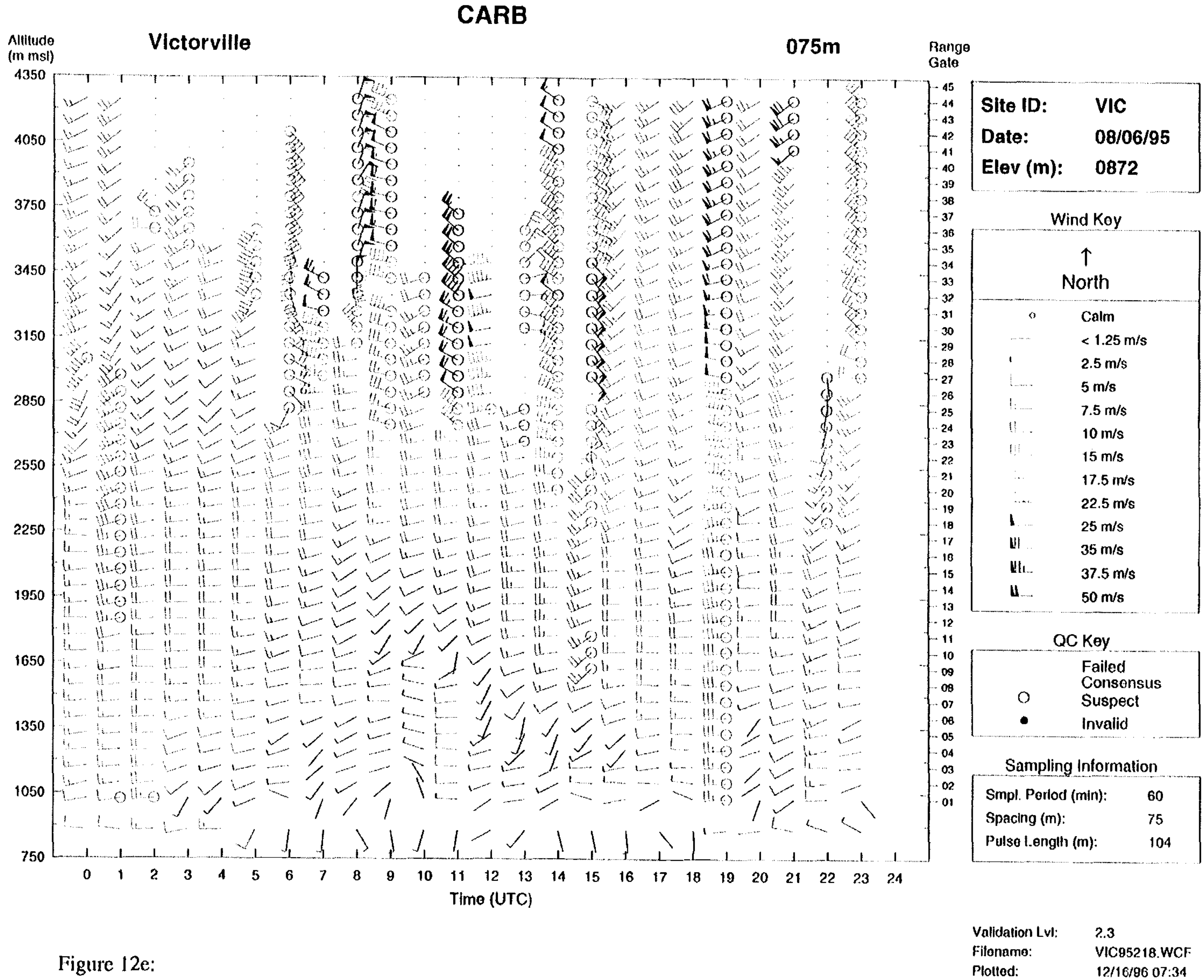
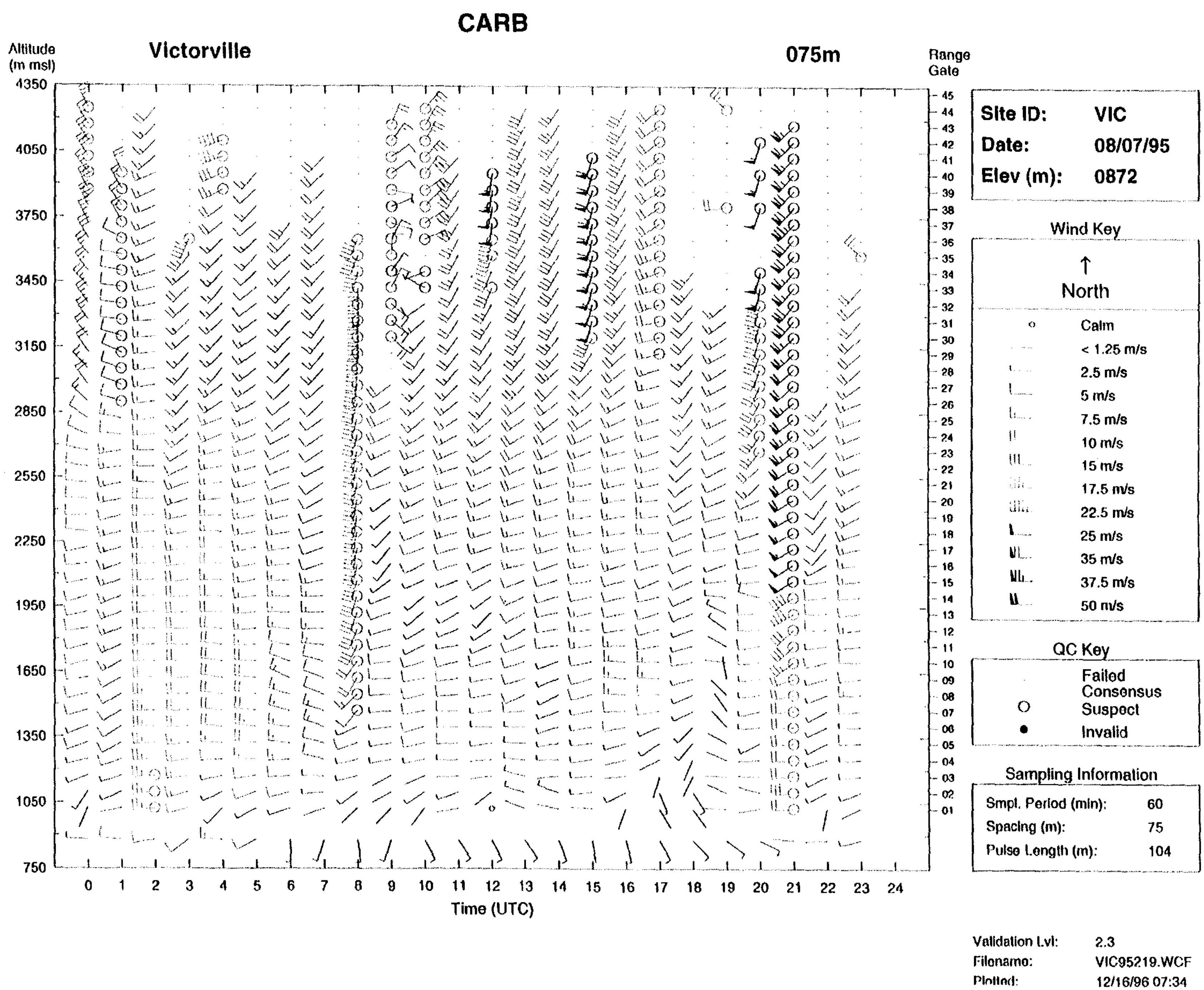

CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/06/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95218.WCF
Plotted: 12/16/96 07:34

Figure 12e:



CARB
Victorville
075m
Altitude (m msl)
Range Gate
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Time (UTC)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Site ID: VIC
Date: 08/07/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95219.WCF
Plotted: 12/16/96 07:34

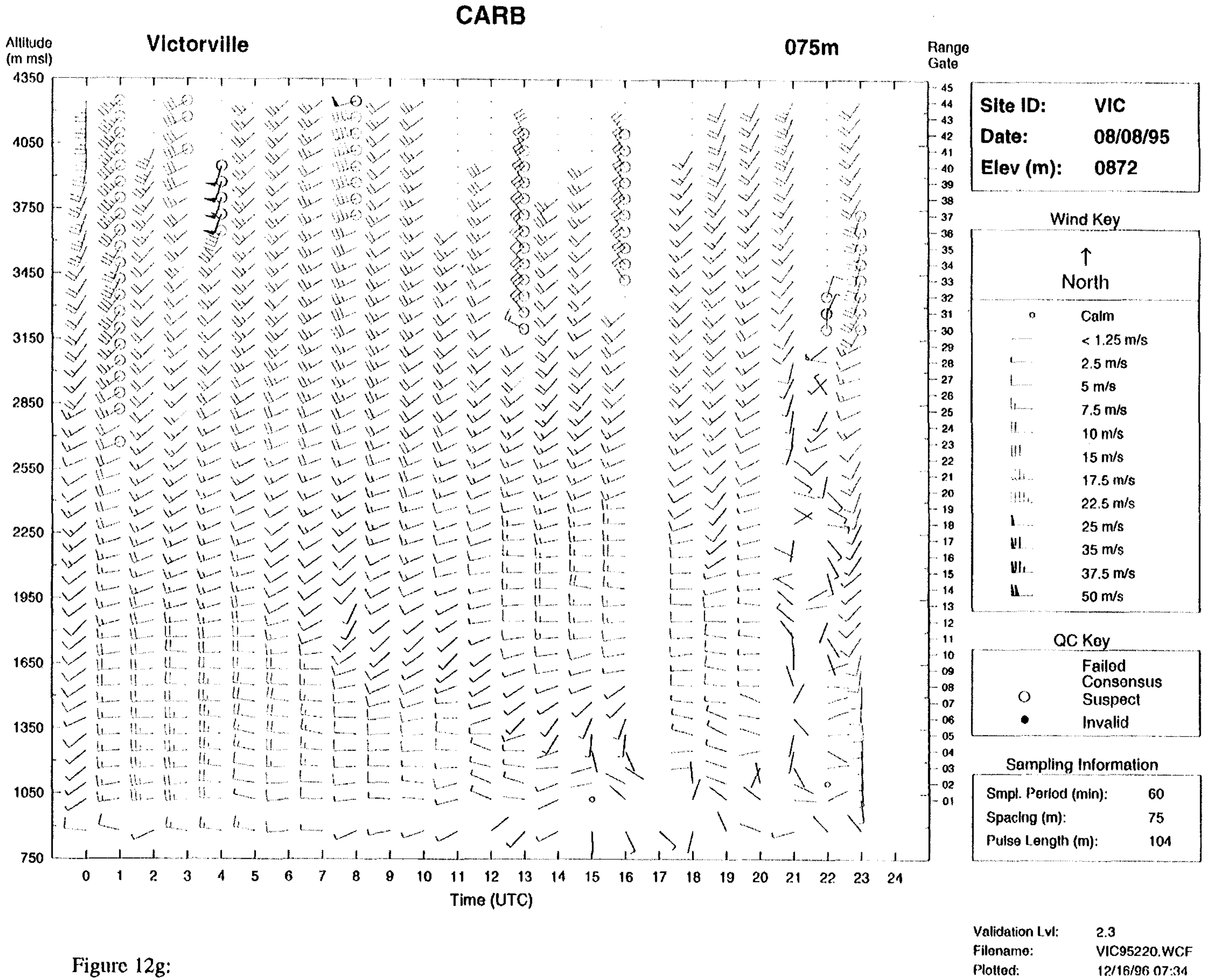
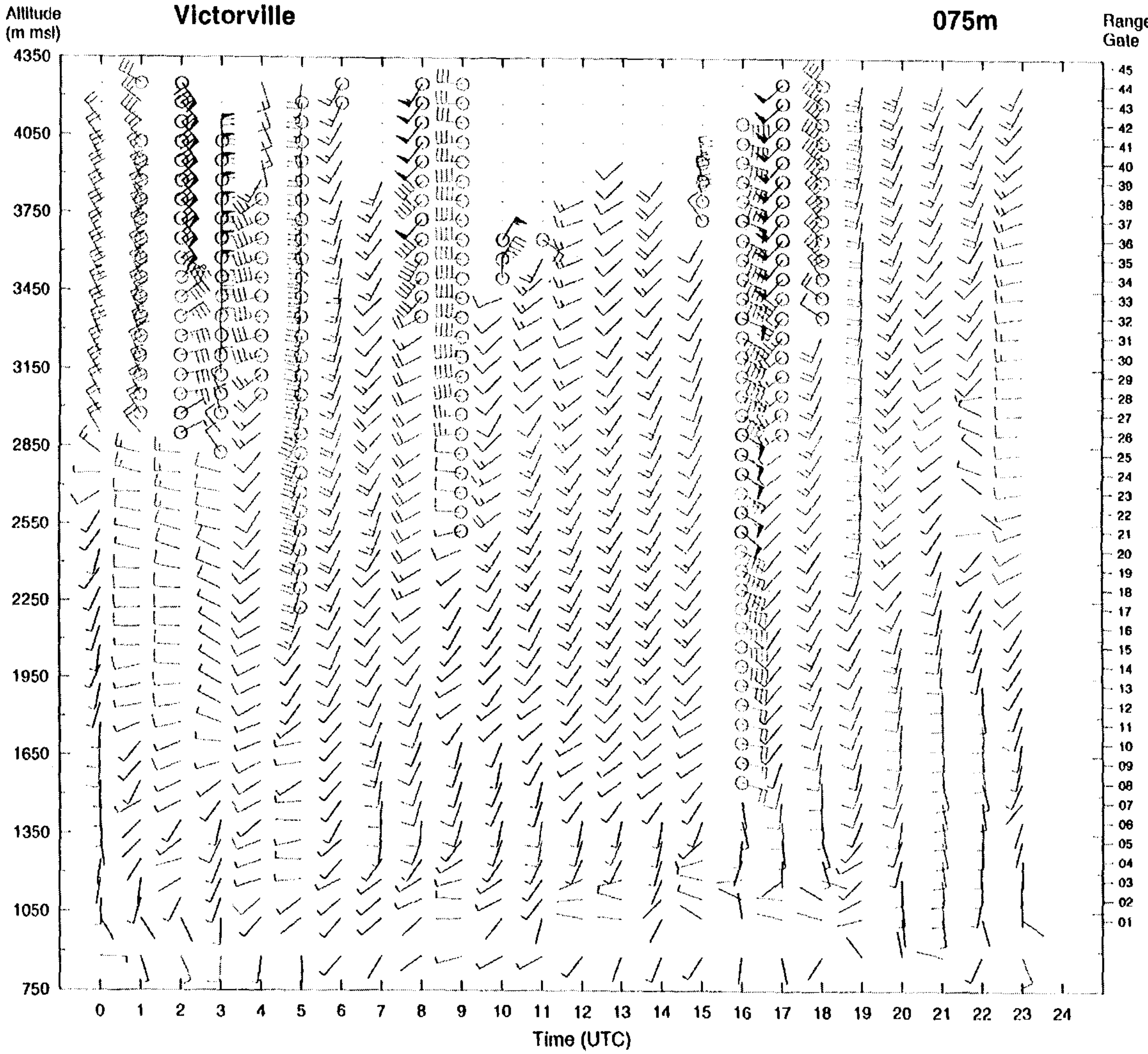

CARB
Victorville
075m
Altitude (m msl)
Range Gate
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01
Site ID: VIC
Date: 08/08/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95220.WCF
Plotted: 12/16/96 07:34

Figure 12g:

CARB

Victorville — 075m



Site ID:	**VIC**
Date:	**08/09/95**
Elev (m):	**0872**

Wind Key

↑ North

o	Calm
	< 1.25 m/s
	2.5 m/s
	5 m/s
	7.5 m/s
	10 m/s
	15 m/s
	17.5 m/s
	22.5 m/s
	25 m/s
	35 m/s
	37.5 m/s
	50 m/s

QC Key

·	Failed Consensus
O	Suspect
●	Invalid

Sampling Information

Smpl. Period (min):	60
Spacing (m):	75
Pulse Length (m):	104

Validation Lvl:	2.3
Filename:	VIC95221.WCF
Plotted:	12/16/96 07:34

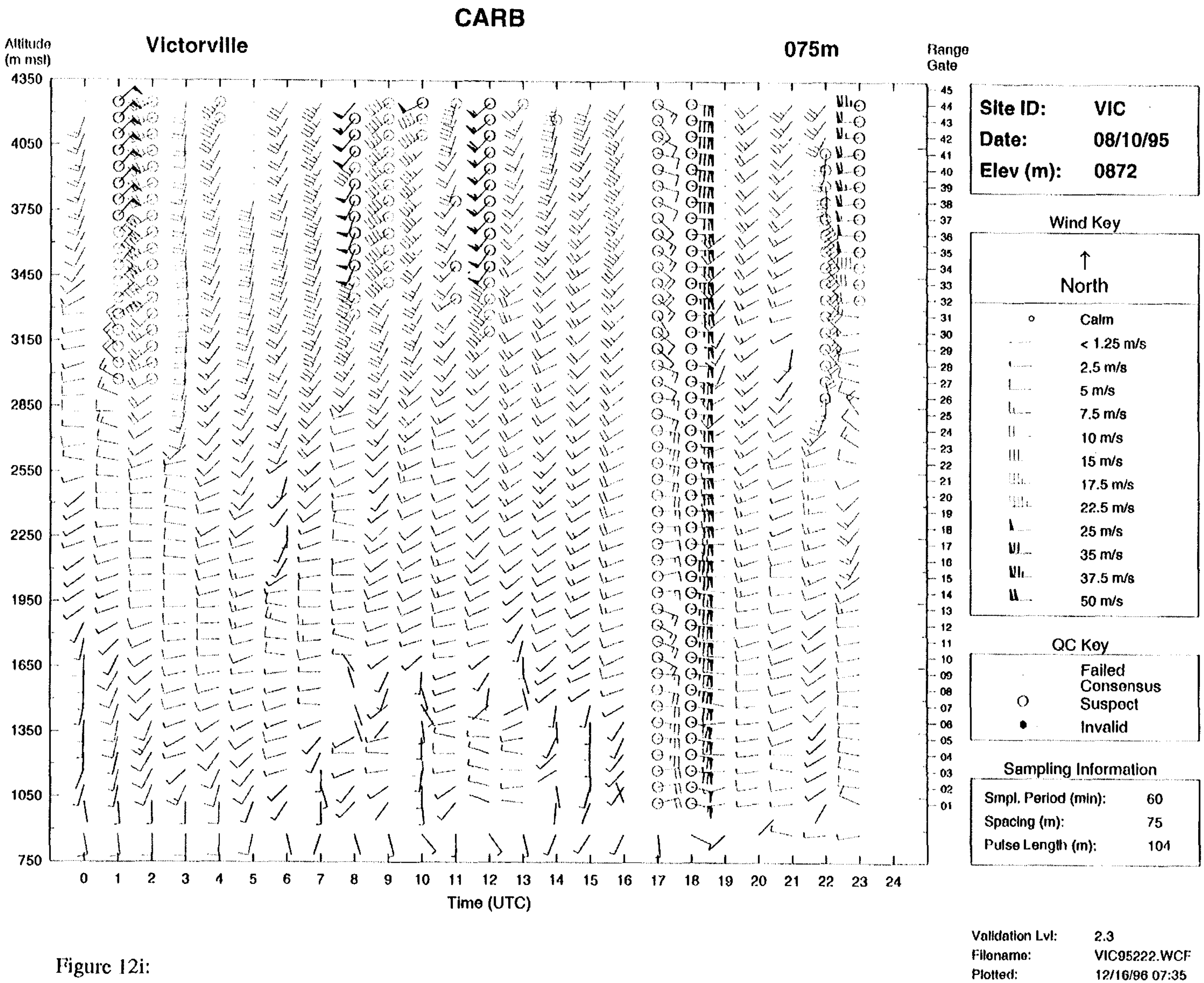

CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/10/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95222.WCF
Plotted: 12/16/96 07:35

Figure 12i:

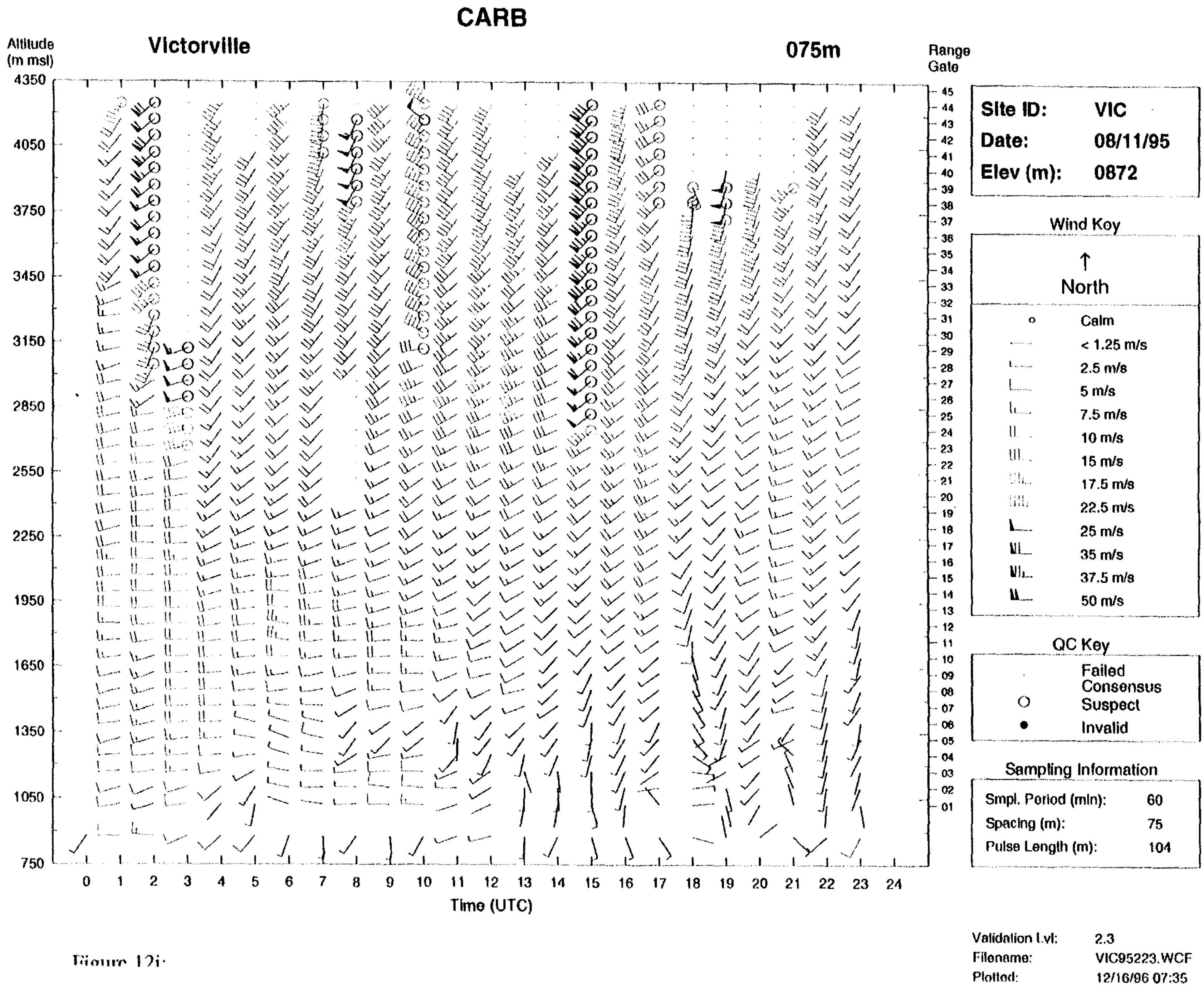
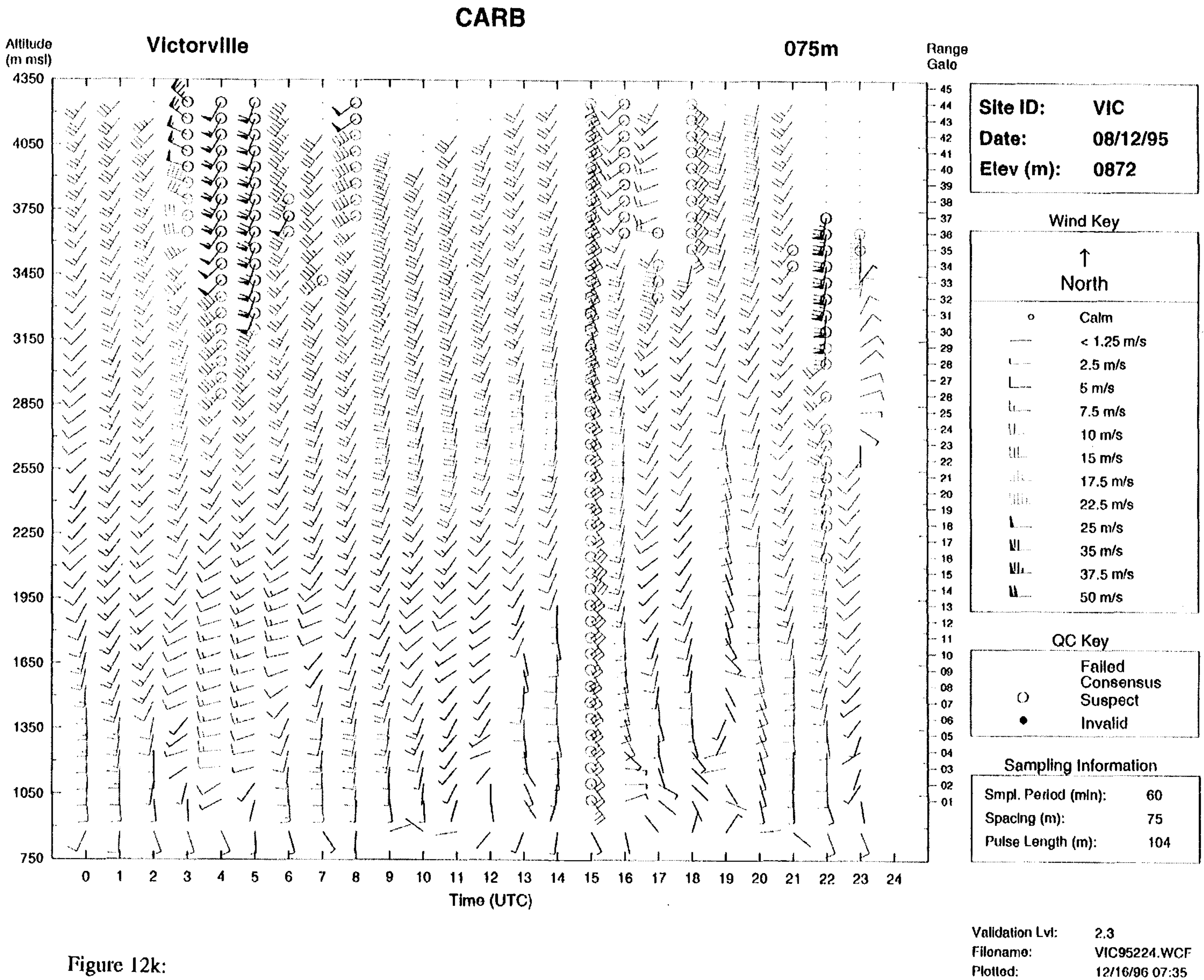
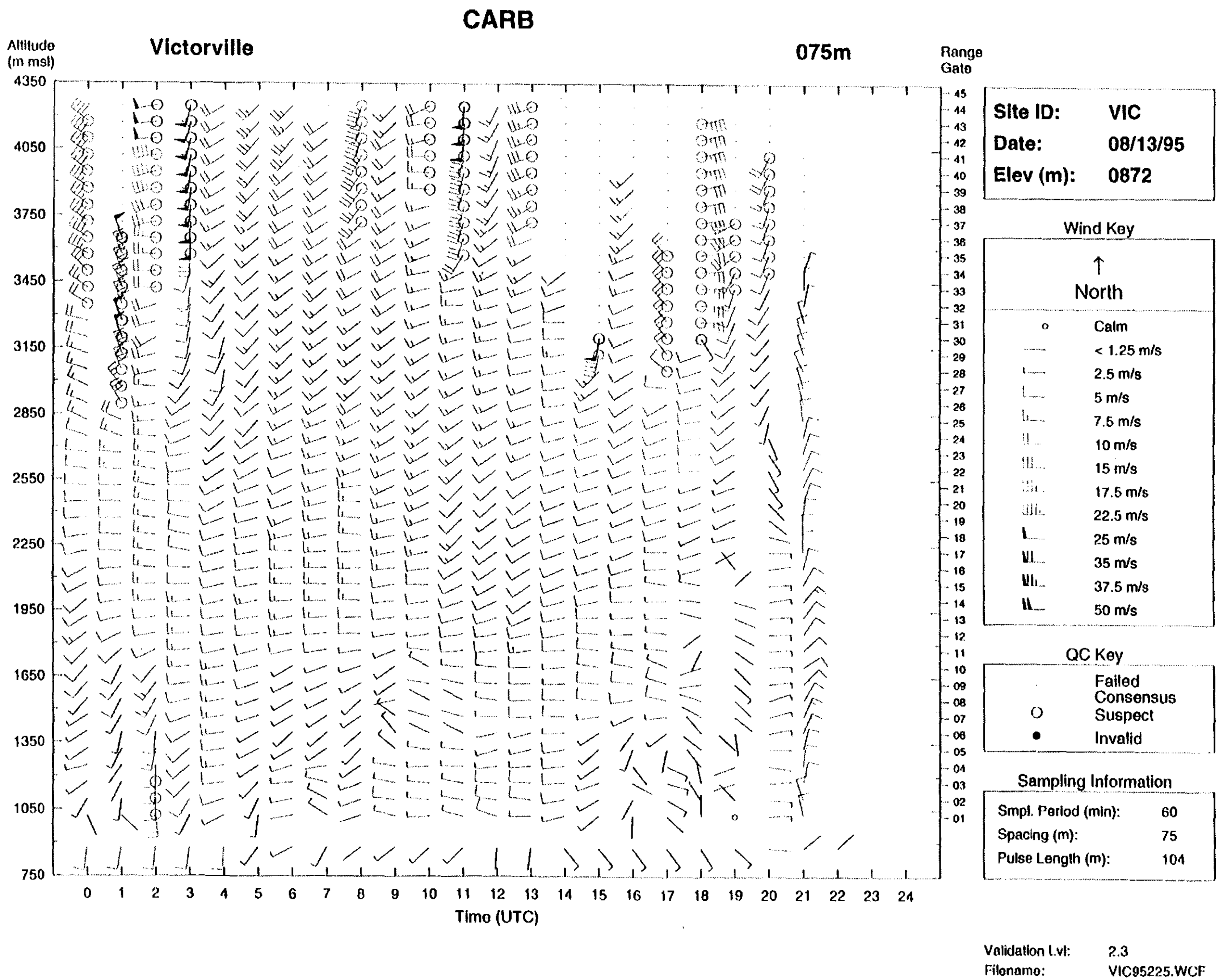

CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/11/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95223.WCF
Plotted: 12/16/96 07:35

Figure 12i:



CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/12/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95224.WCF
Plotted: 12/16/96 07:35

Figure 12k:


CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/13/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 60
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95225.WCF

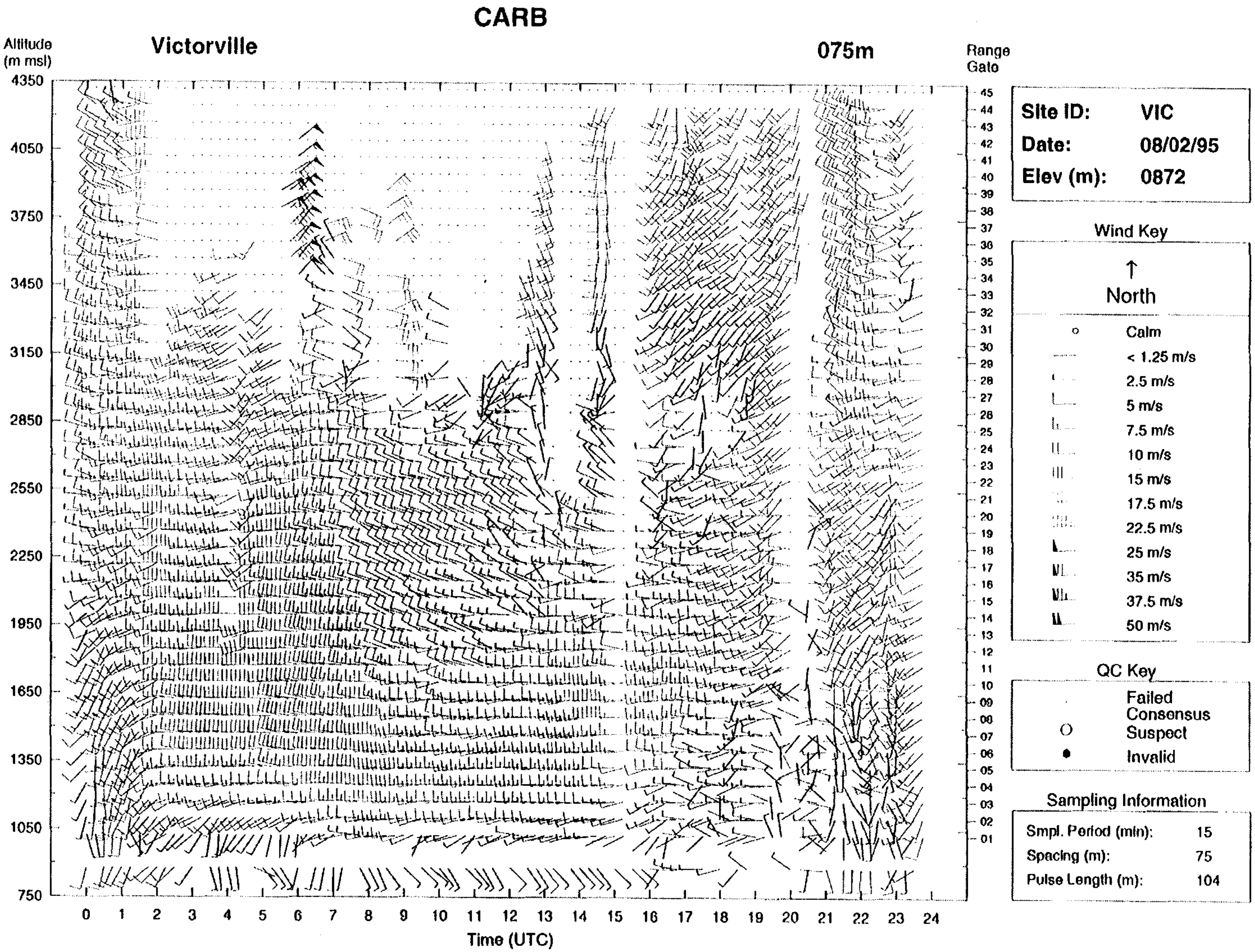
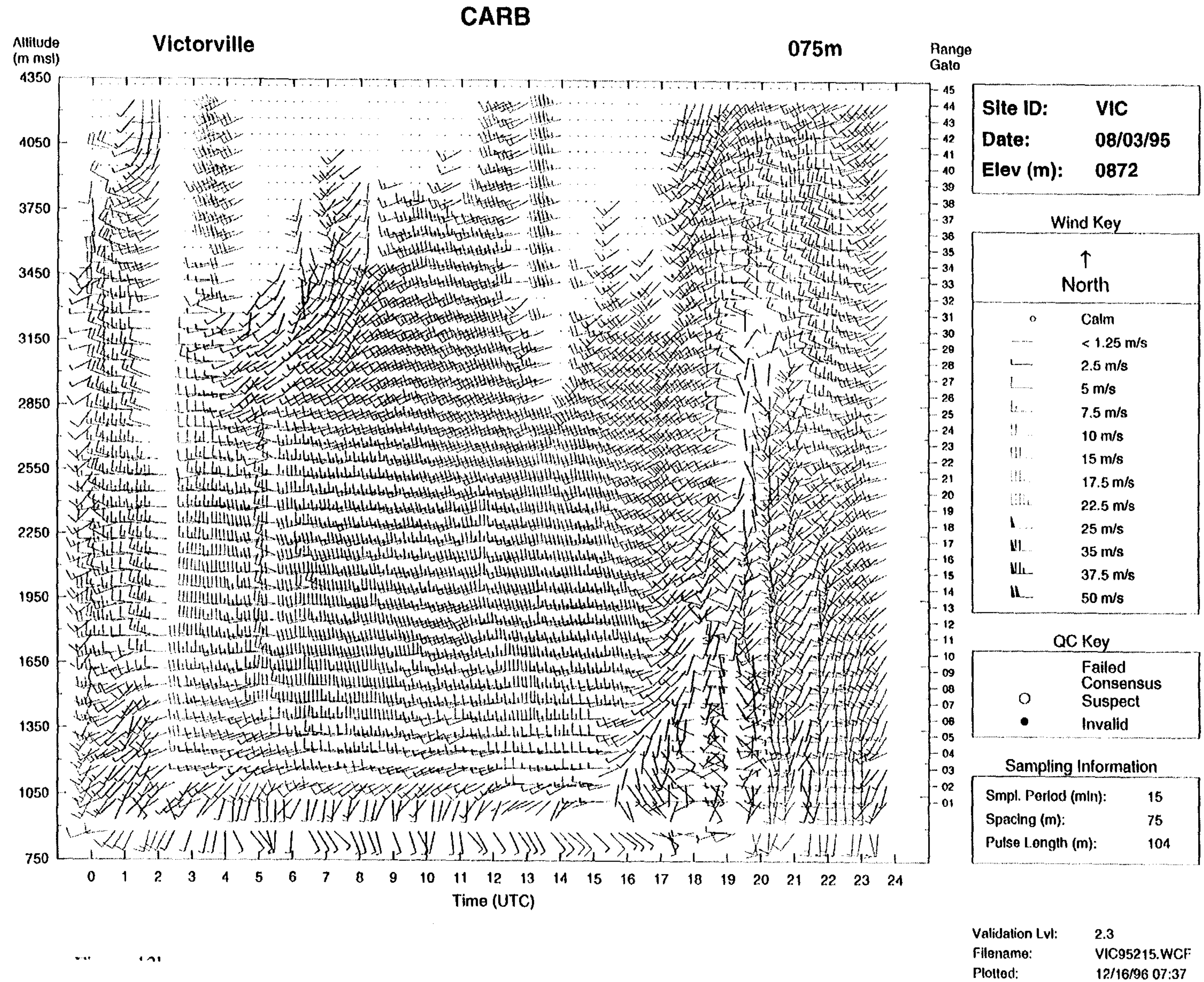


Figure 13a: Quality-controlled 15-minute winds on 2 Aug 1995. Times are UTC and represent the end of the averaging period. Lowest level data are from a single 5-minute average point closest in time to each 15-minute period. Bad or suspect data ...

Validation Lvl: 2.3
Filename: VIC95214.WCF
Plotted: 12/16/96 07:36



CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
Time (UTC)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Site ID: VIC
Date: 08/03/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95215.WCF
Plotted: 12/16/96 07:37

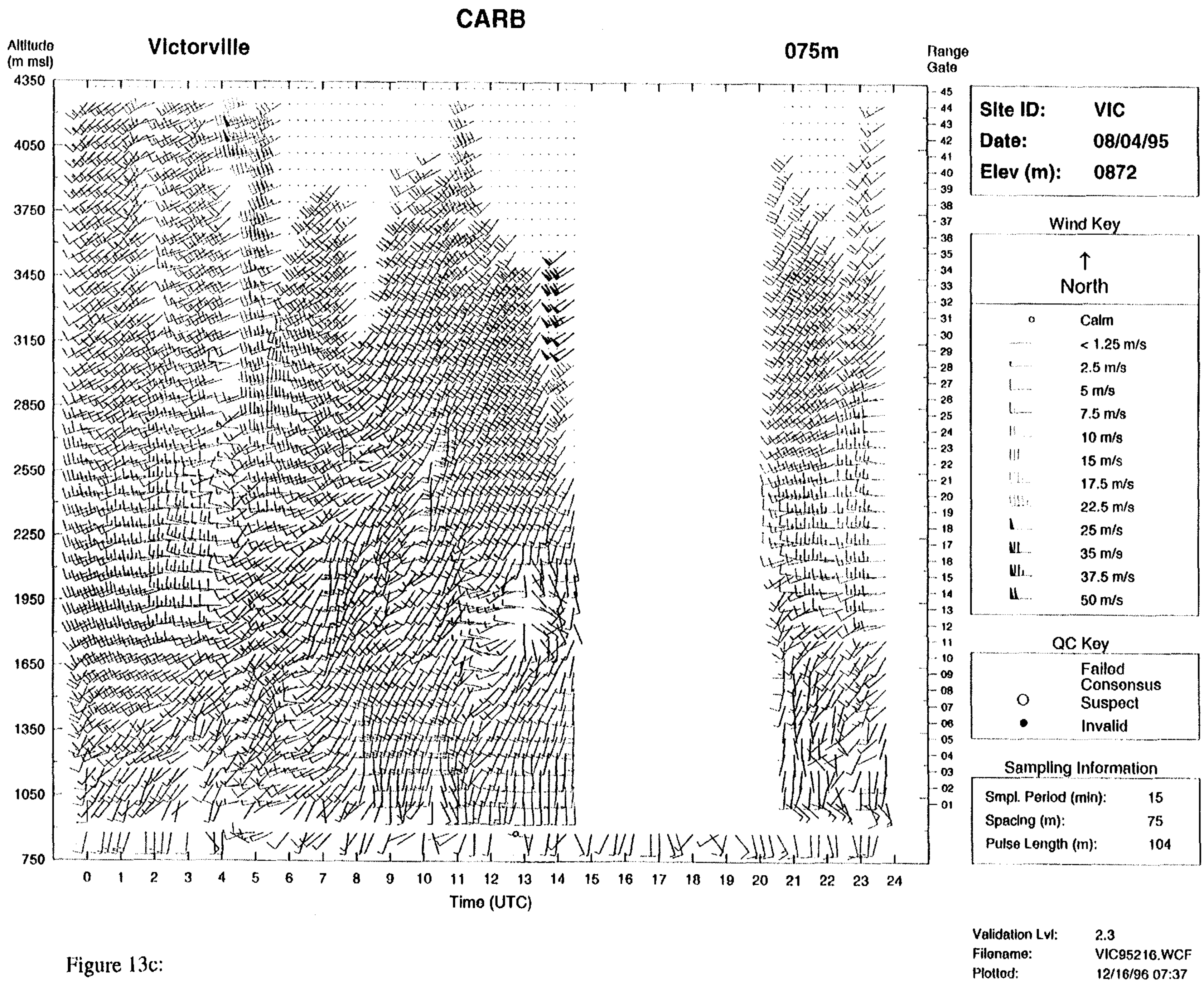
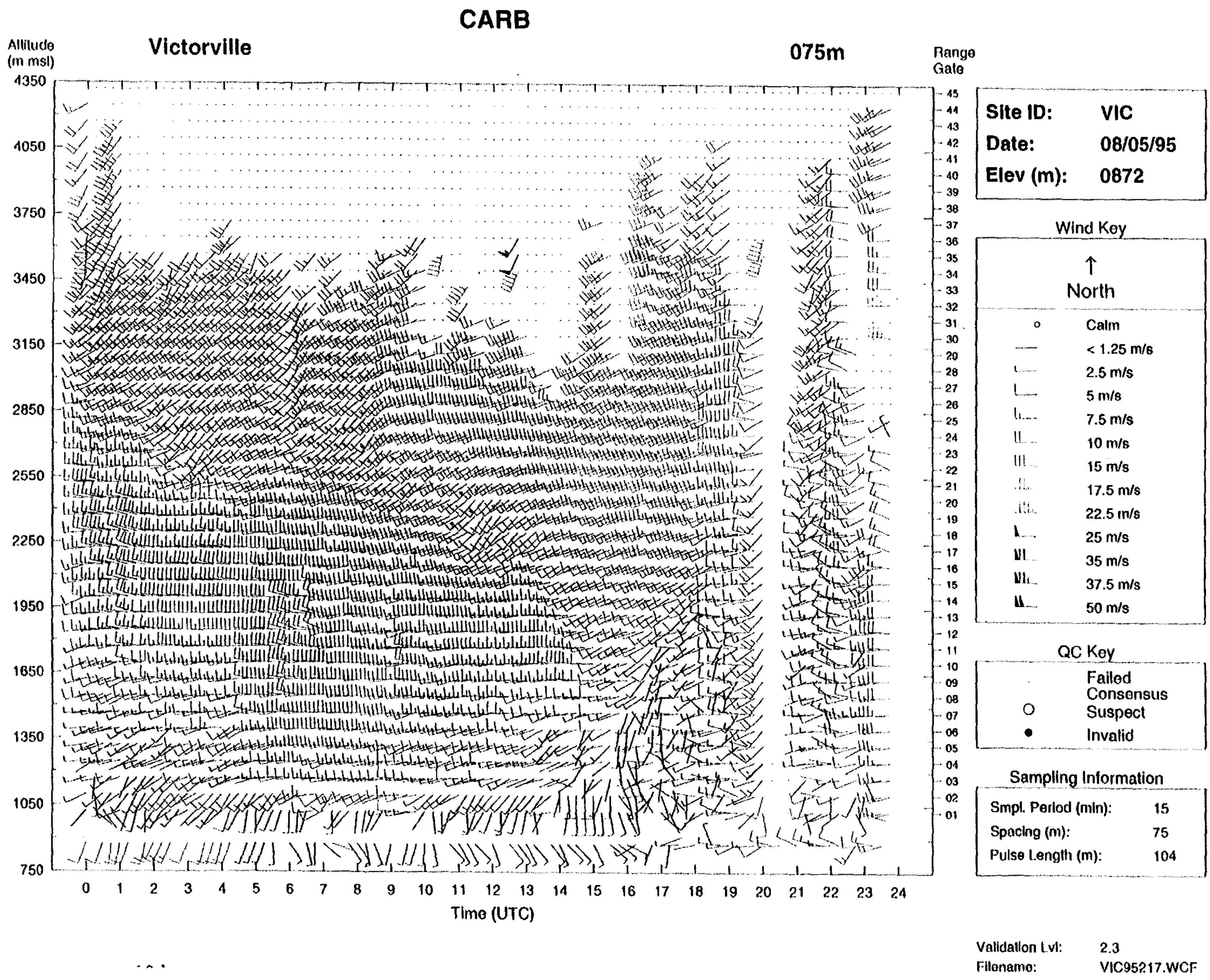

CARB
Victorville
075m
Altitude (m msl)
Range Gate
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01
Site ID: VIC
Date: 08/04/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95216.WCF
Plotted: 12/16/96 07:37

Figure 13c:


CARB
Victorville
075m
Altitude (m msl)
Range Gate
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Time (UTC)
Validation Lvl: 2.3
Filename: VIC95217.WCF
Plotted: 12/16/96 07:38

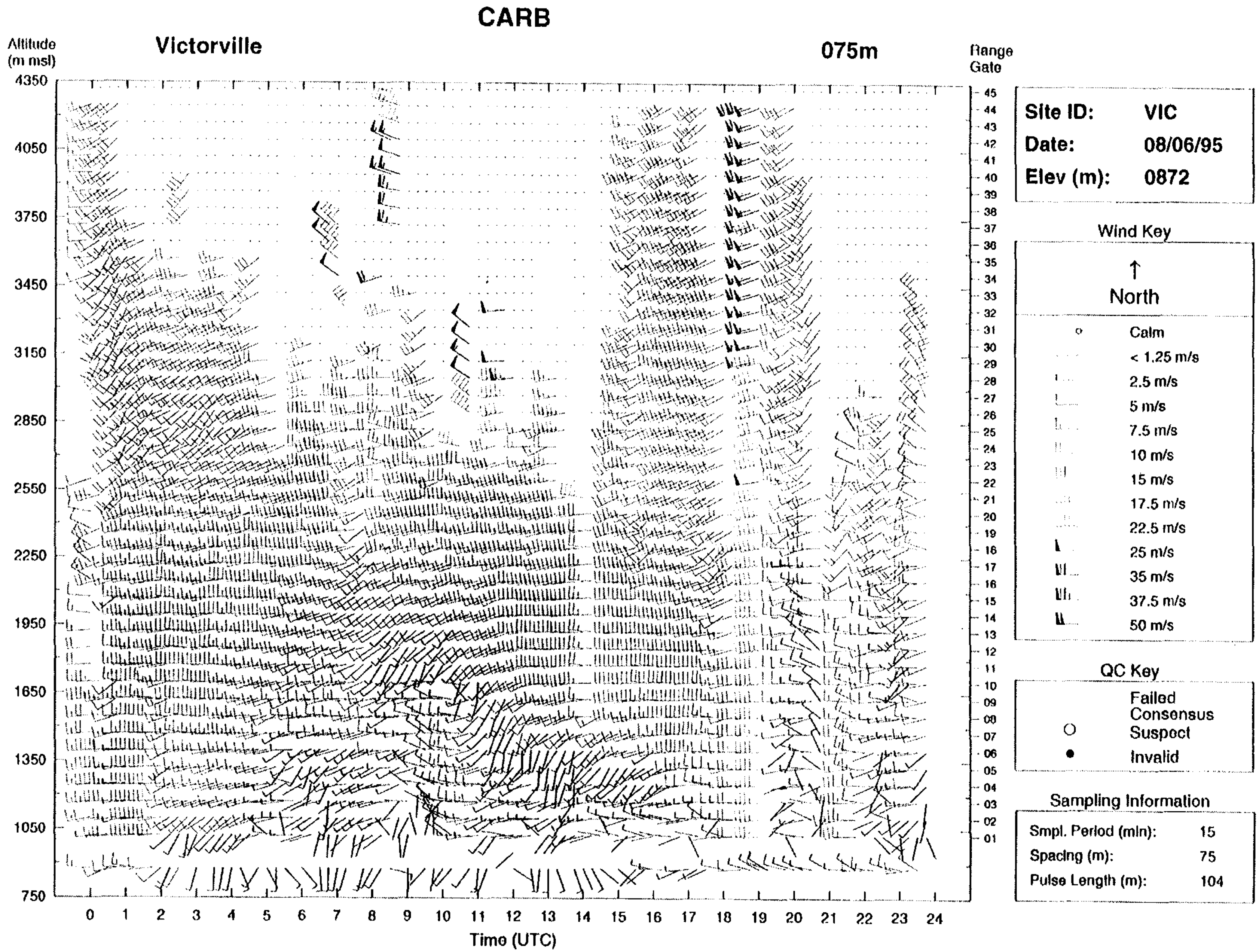
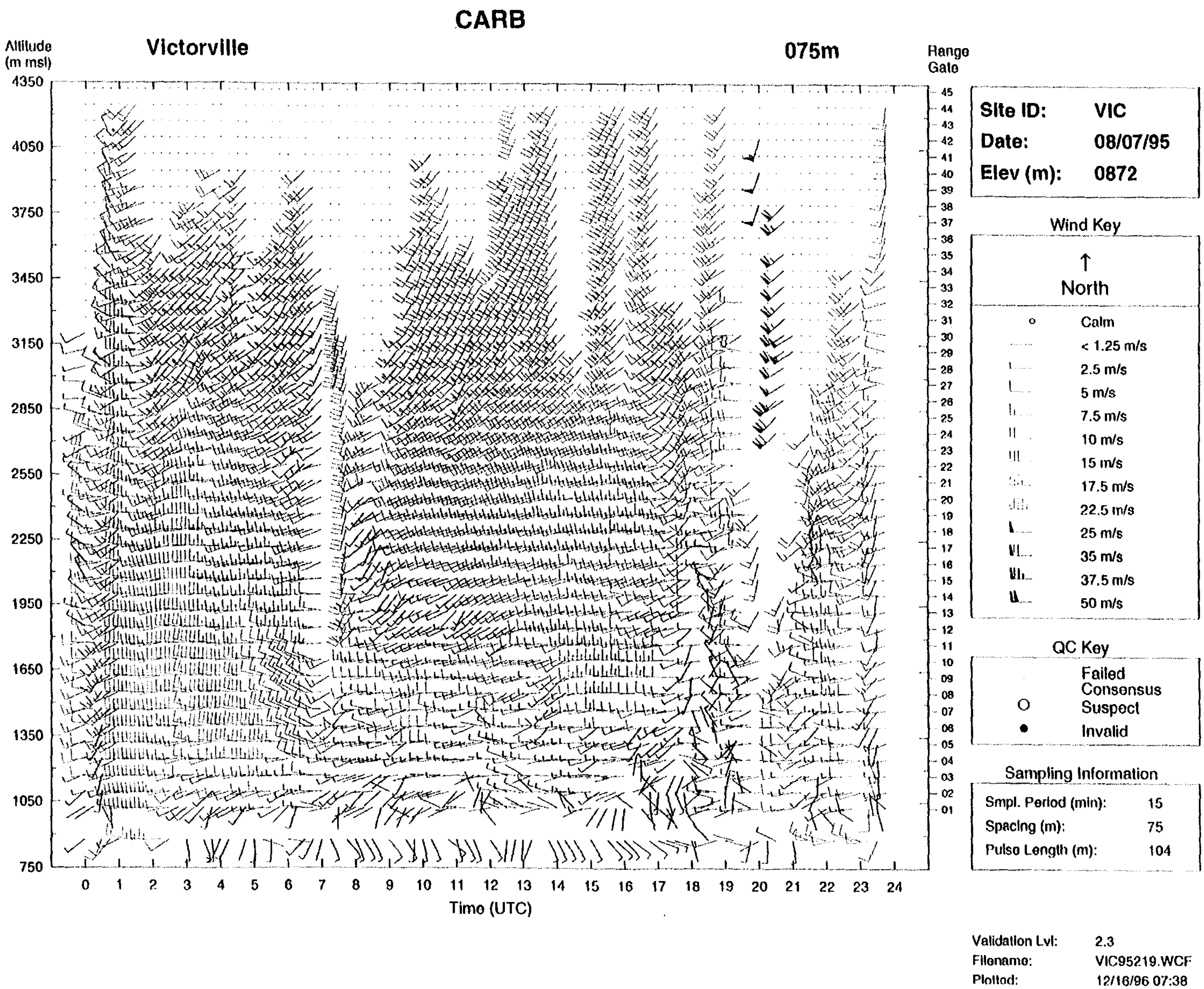

CARB
Victorville
075m
Altitude (m msl)
Range Gate
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/06/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95218.WCF
Plotted: 12/16/96 07:38

Figure 13c:



CARB
Victorville
075m
Altitude (m msl)
Range Gate
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/07/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95219.WCF
Plotted: 12/16/96 07:38

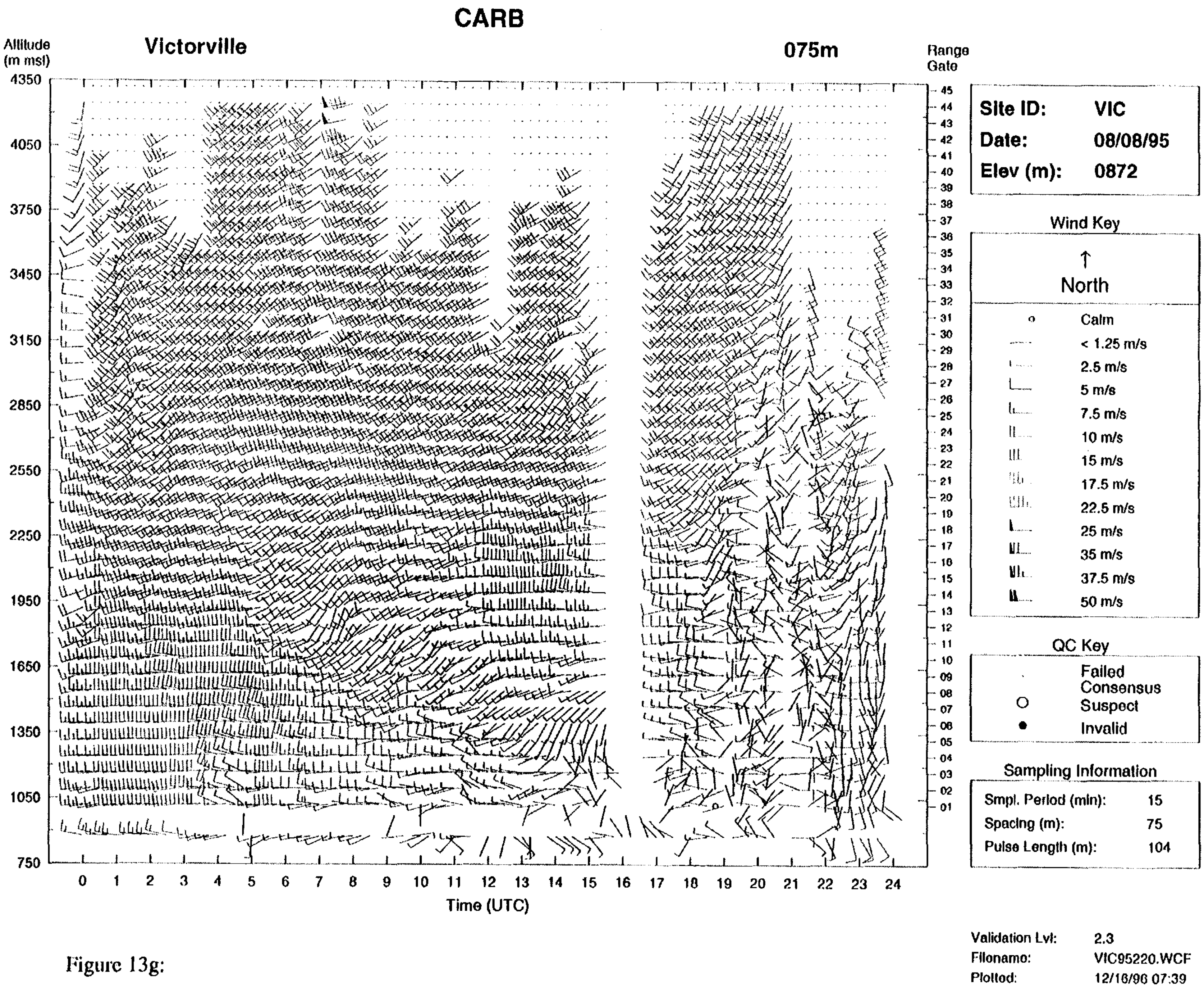
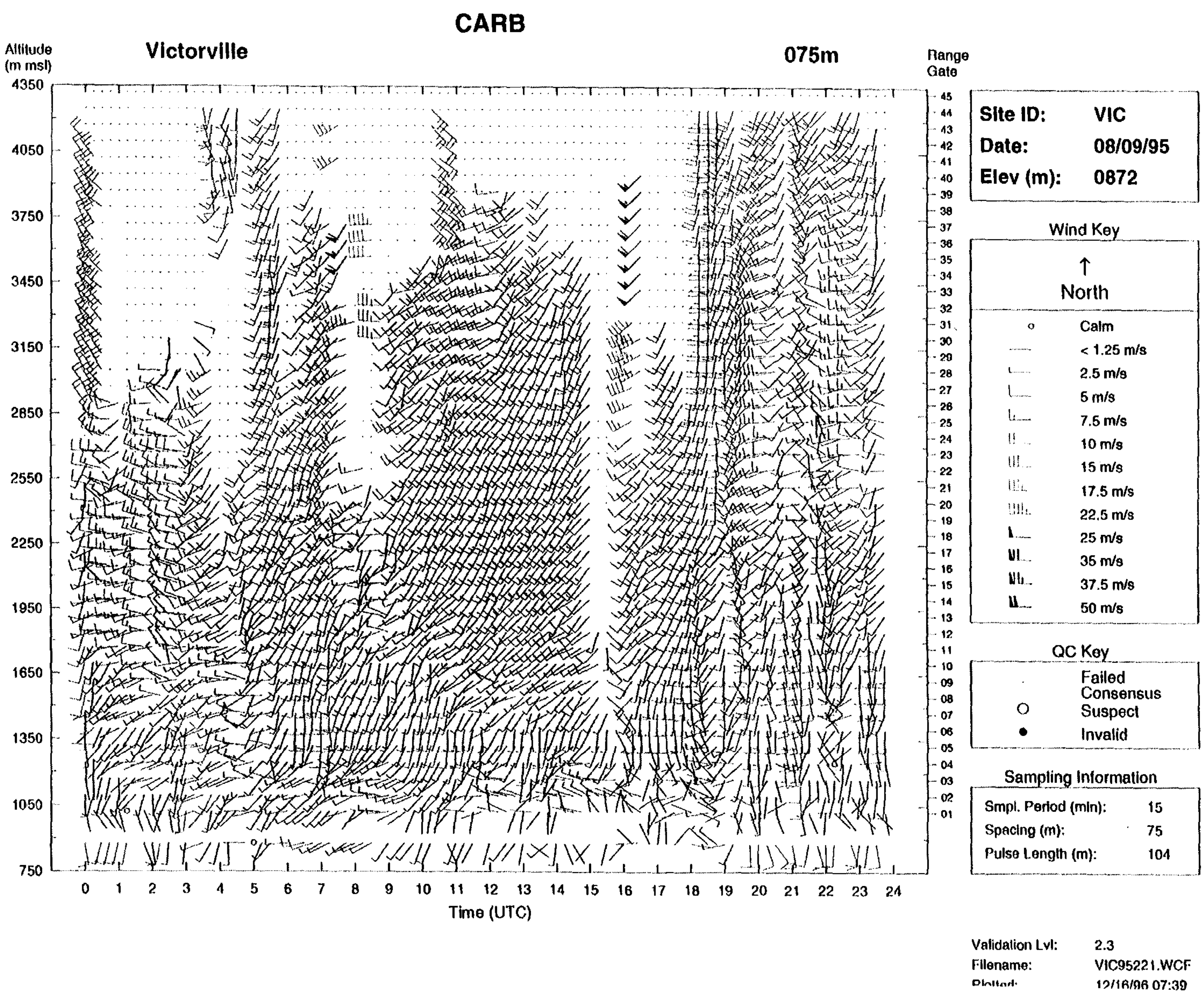

CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/08/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95220.WCF
Plotted: 12/16/96 07:39

Figure 13g:



CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/09/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95221.WCF
Plotted: 12/16/96 07:39

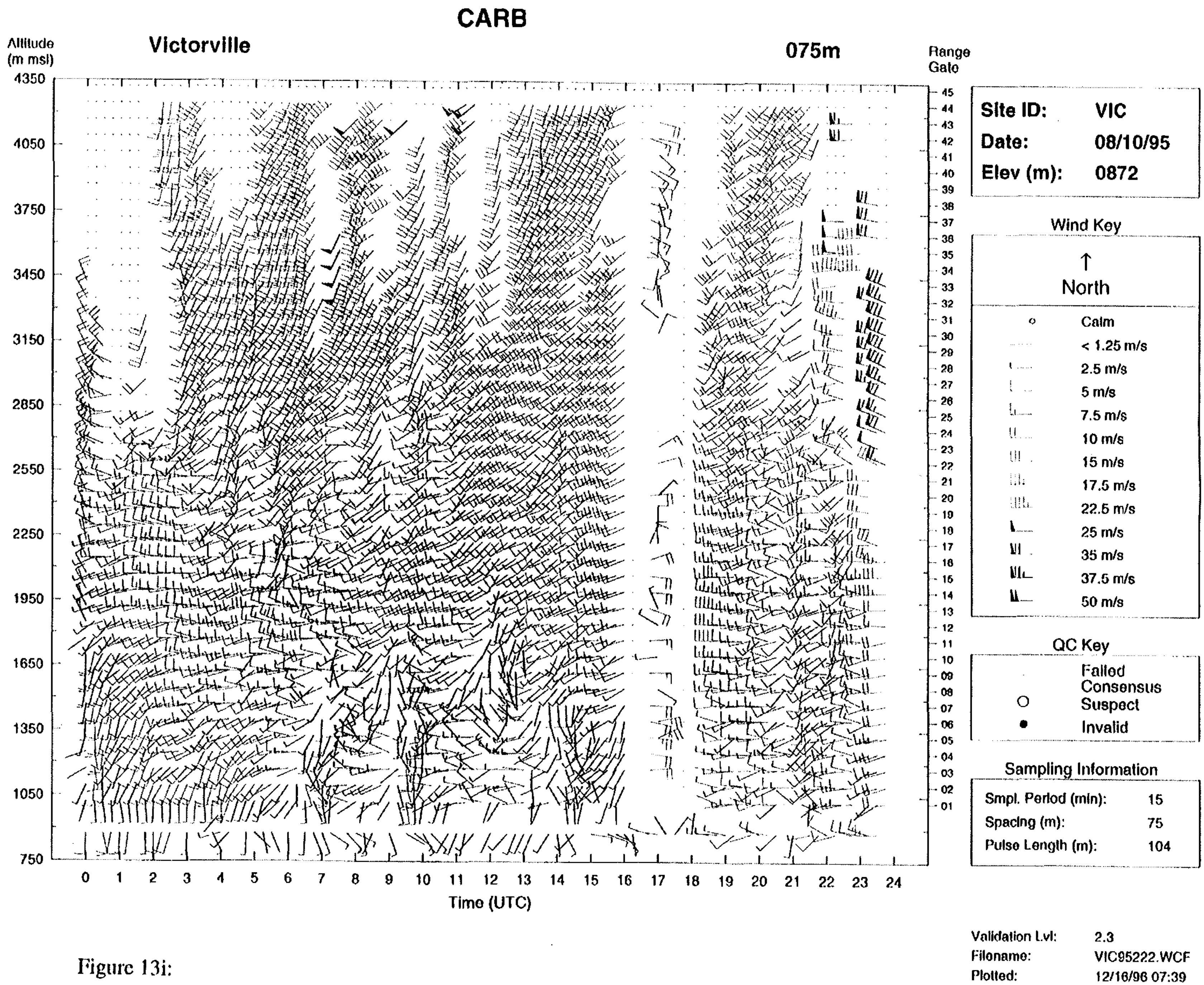
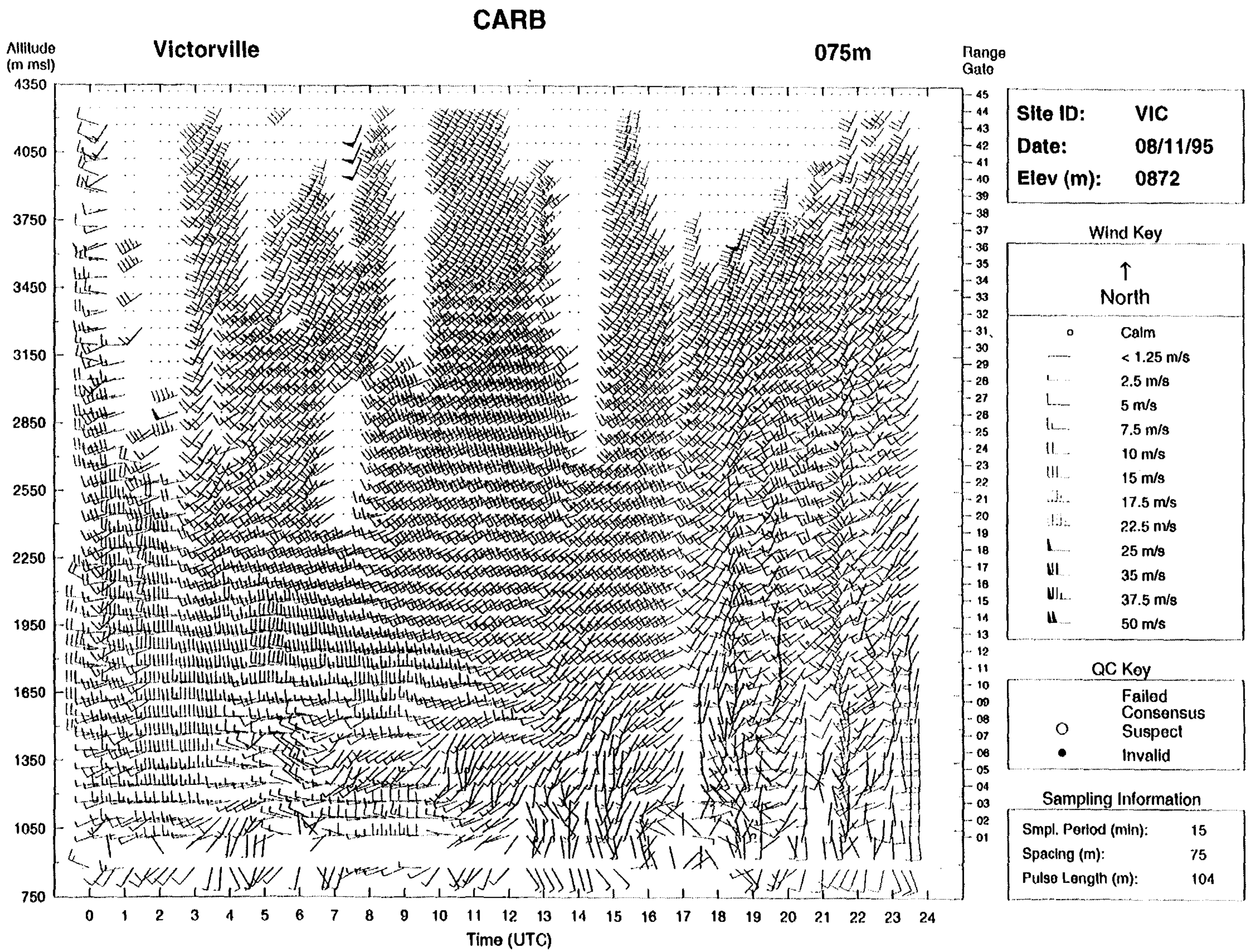

CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
Time (UTC)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Site ID: VIC
Date: 08/10/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95222.WCF
Plotted: 12/16/96 07:39

Figure 13i:



Validation Lvl: 2.3
Filename: VIC95223.WCF
Plotted: 12/16/96 07:40

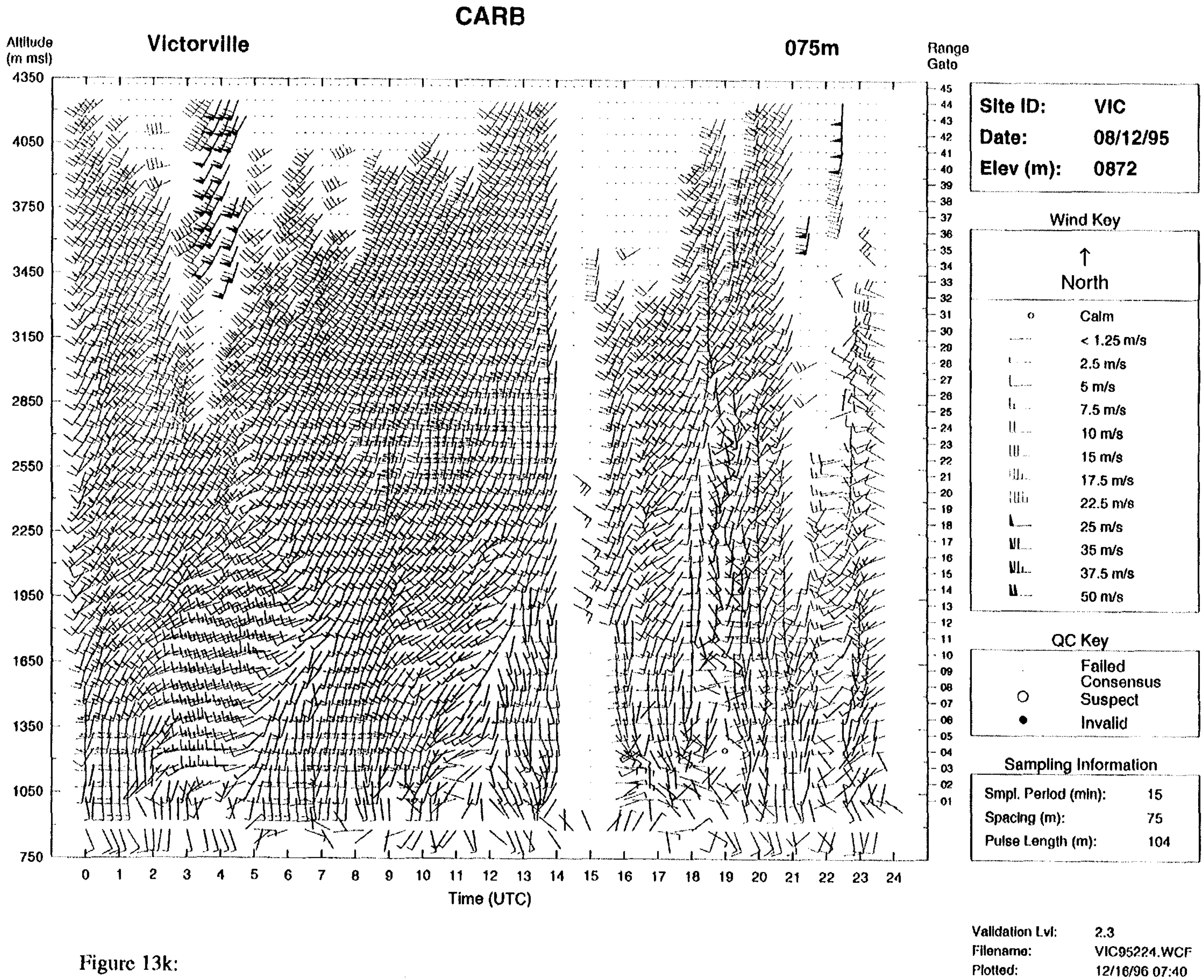
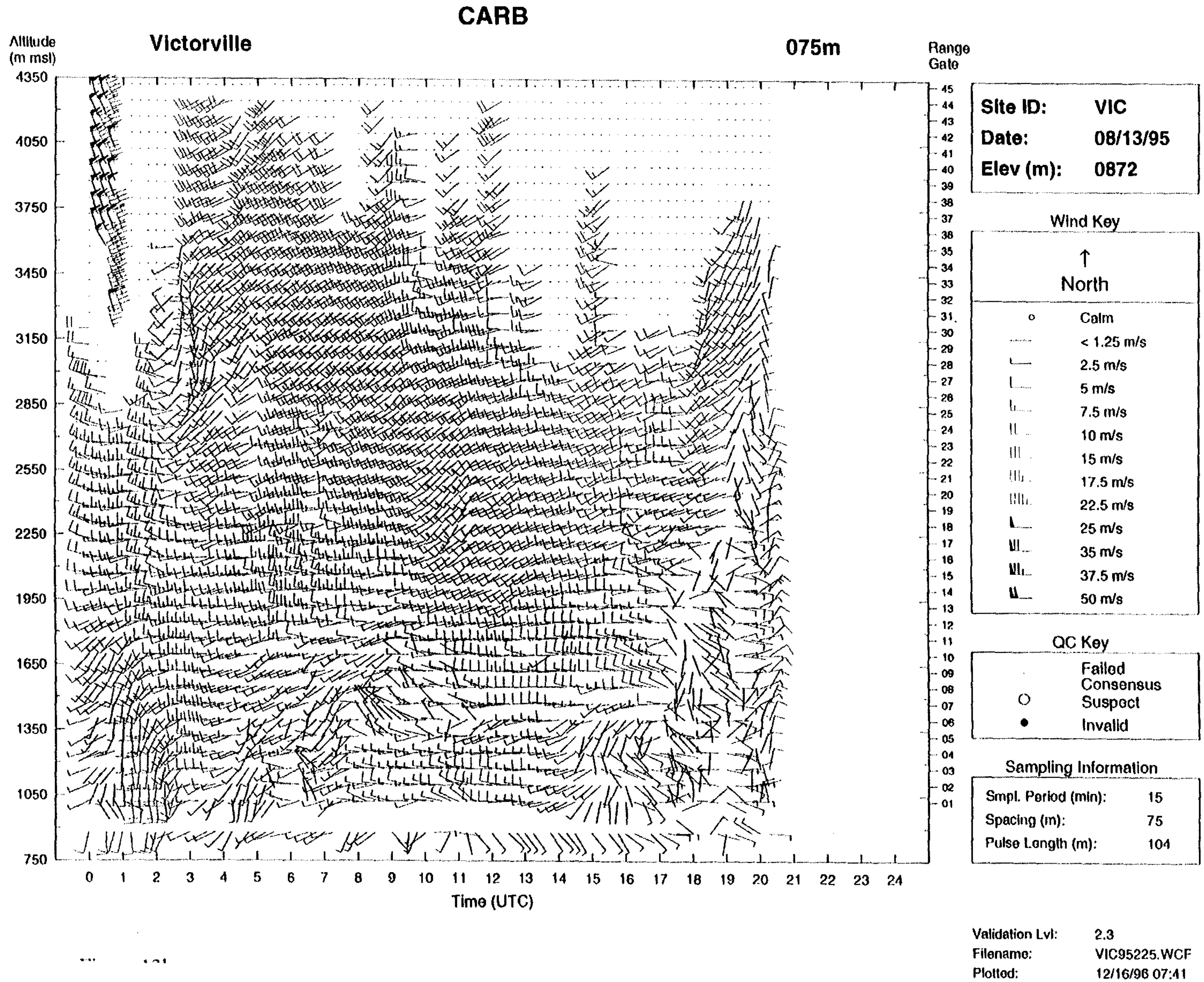

CARB
Victorville
075m
Altitude (m msl)
Range Gate
Time (UTC)
Site ID: VIC
Date: 08/12/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95224.WCF
Plotted: 12/16/96 07:40

Figure 13k:



CARB
Victorville
075m
Altitude (m msl)
4350
4050
3750
3450
3150
2850
2550
2250
1950
1650
1350
1050
750
Range Gate
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Time (UTC)
Site ID: VIC
Date: 08/13/95
Elev (m): 0872
Wind Key
North
Calm
< 1.25 m/s
2.5 m/s
5 m/s
7.5 m/s
10 m/s
15 m/s
17.5 m/s
22.5 m/s
25 m/s
35 m/s
37.5 m/s
50 m/s
QC Key
Failed Consensus
Suspect
Invalid
Sampling Information
Smpl. Period (min): 15
Spacing (m): 75
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95225.WCF
Plotted: 12/16/96 07:41

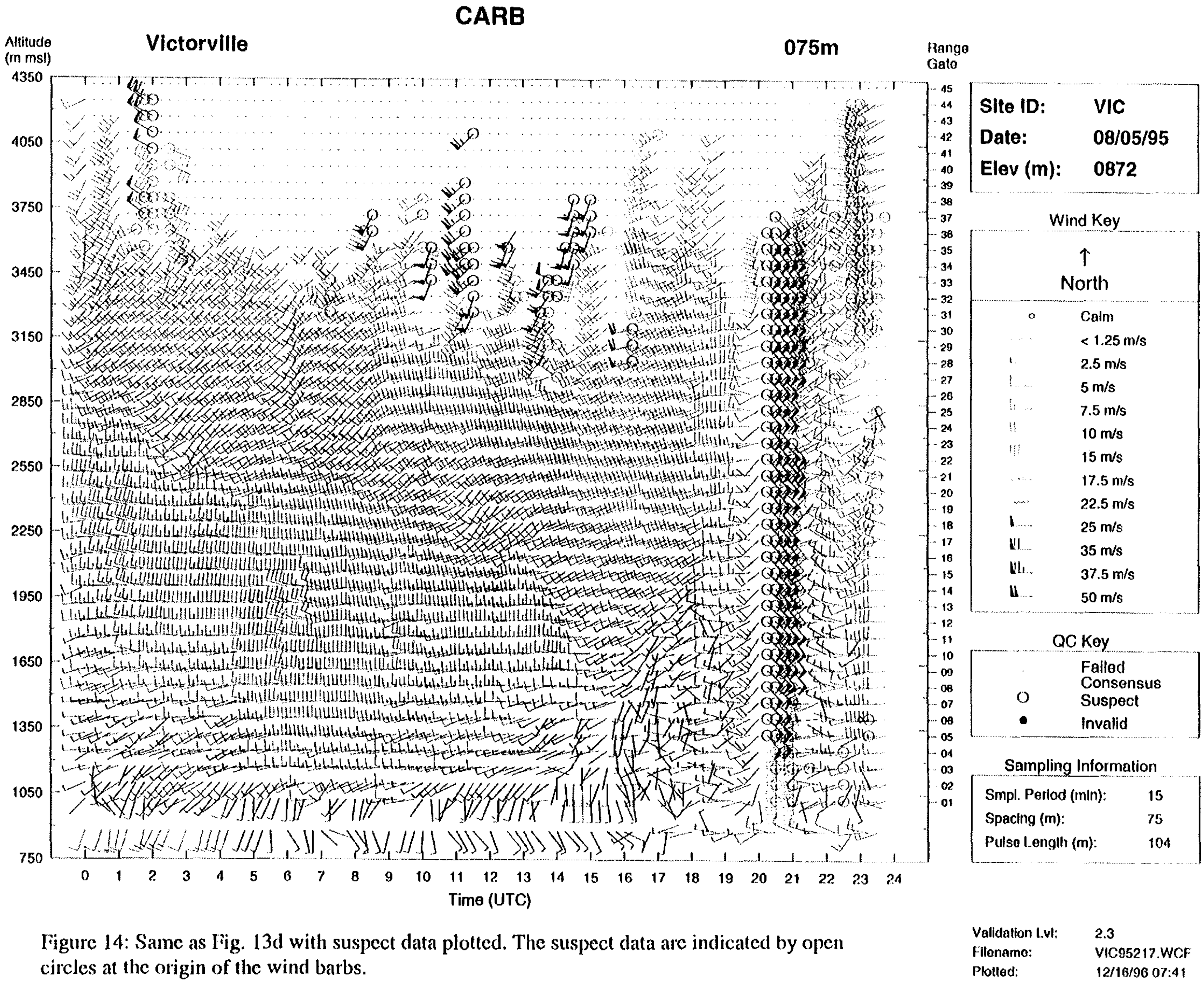


Figure 14: Same as Fig. 13d with suspect data plotted. The suspect data are indicated by open circles at the origin of the wind barbs.

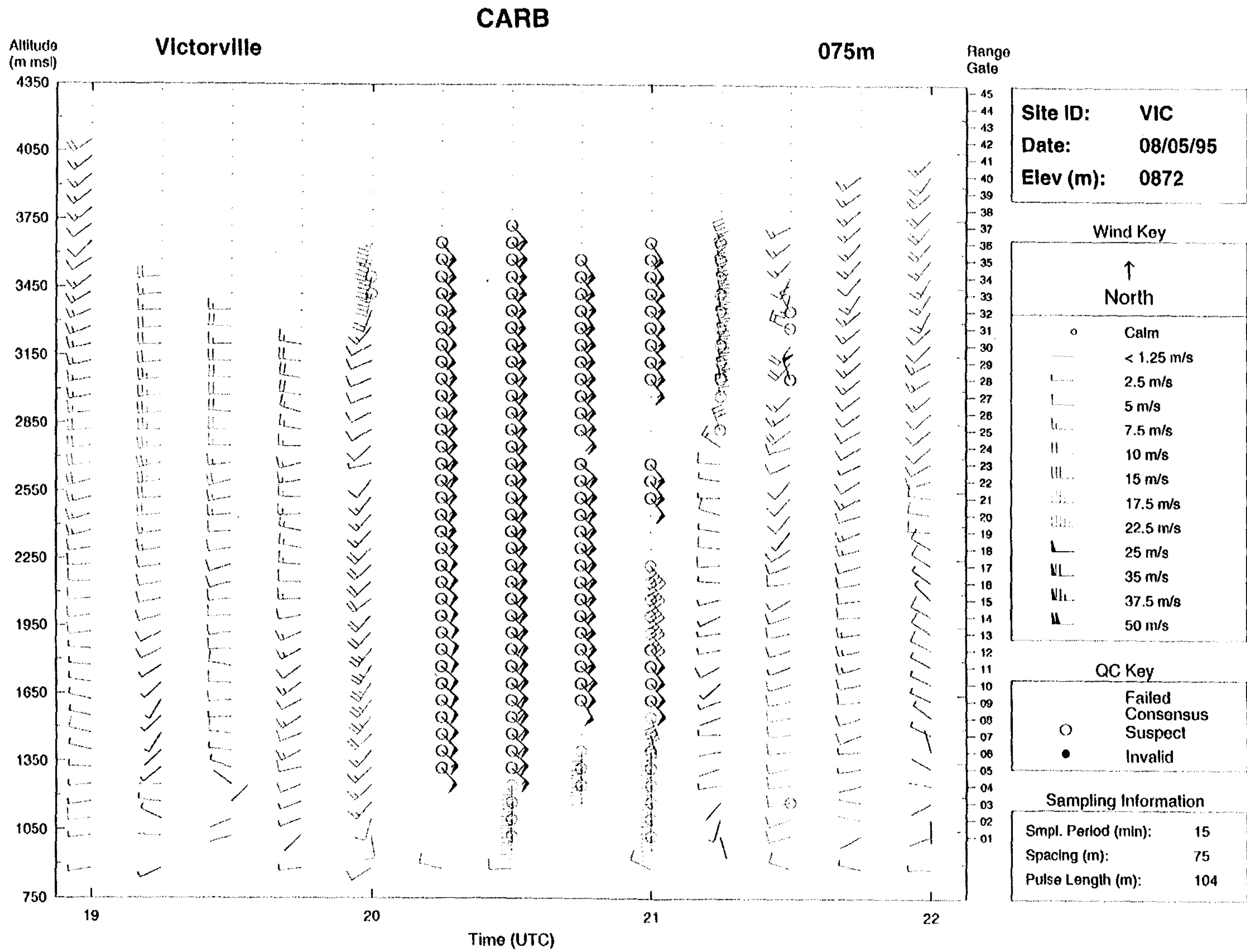


Figure 15: Enlargement of Fig. 14 for the period from 1900-2200 UTC

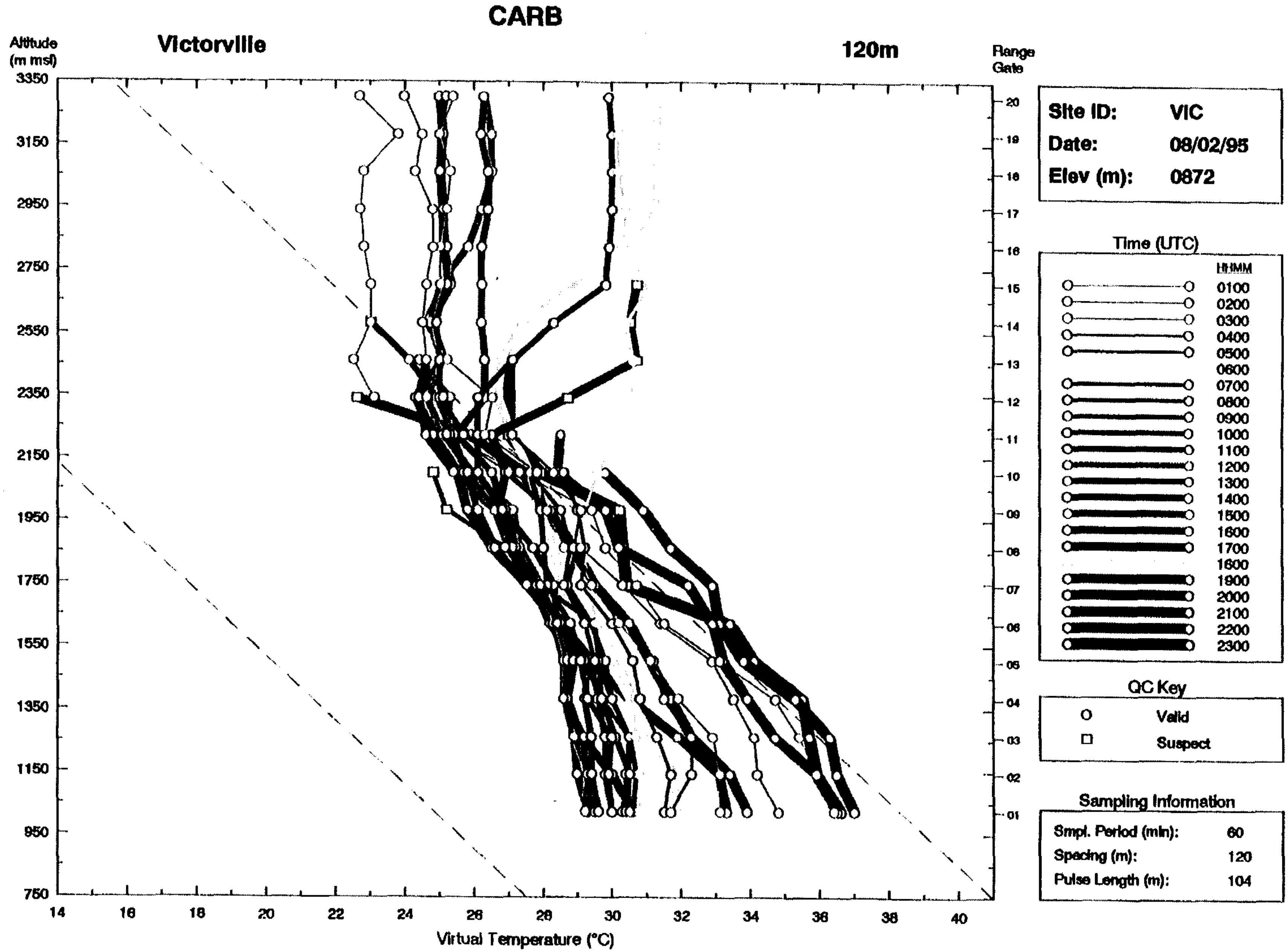
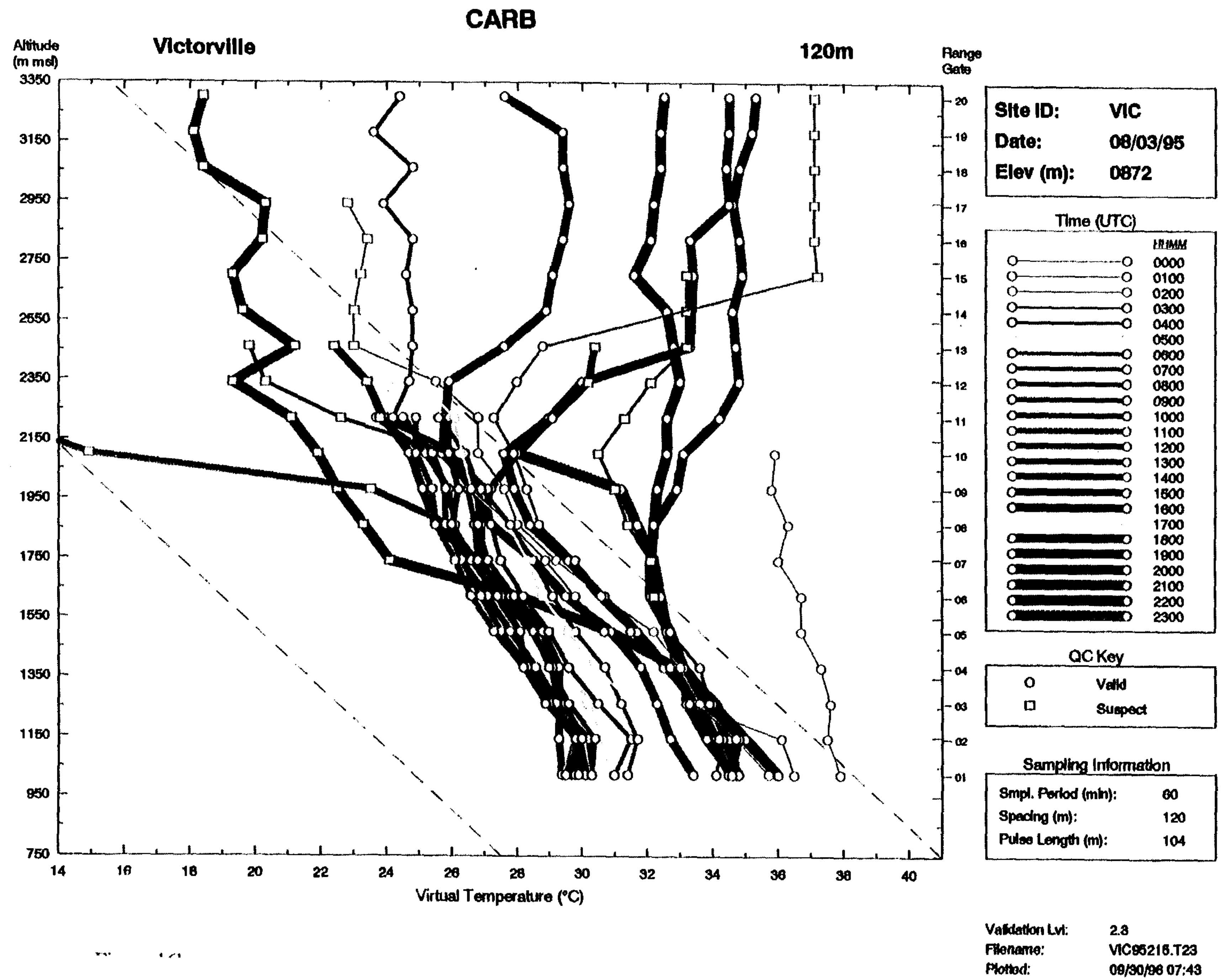
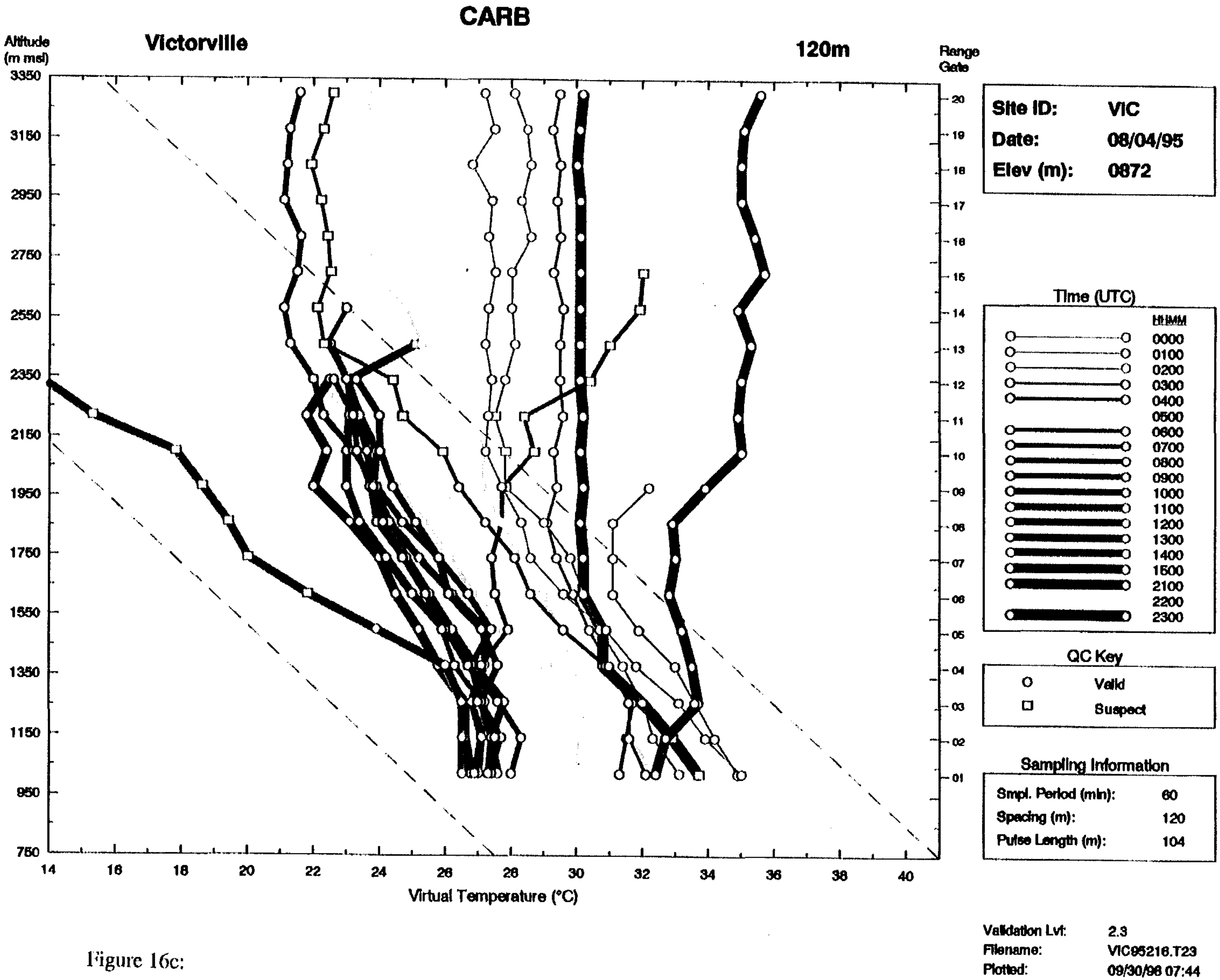


Figure 16a: Profiles of hourly quality-controlled virtual temperatures on 2 Aug 1995. Bad or suspect data are plotted and indicated by an open square (see QC key).

Validation Lvl: 2.3
Filename: VIC95214.T23
Plotted: 09/30/96 07:43


CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/03/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.8
Filename: VIC95215.T23
Plotted: 09/30/96 07:43



CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/04/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95216.T23
Plotted: 09/30/96 07:44

Figure 16c:

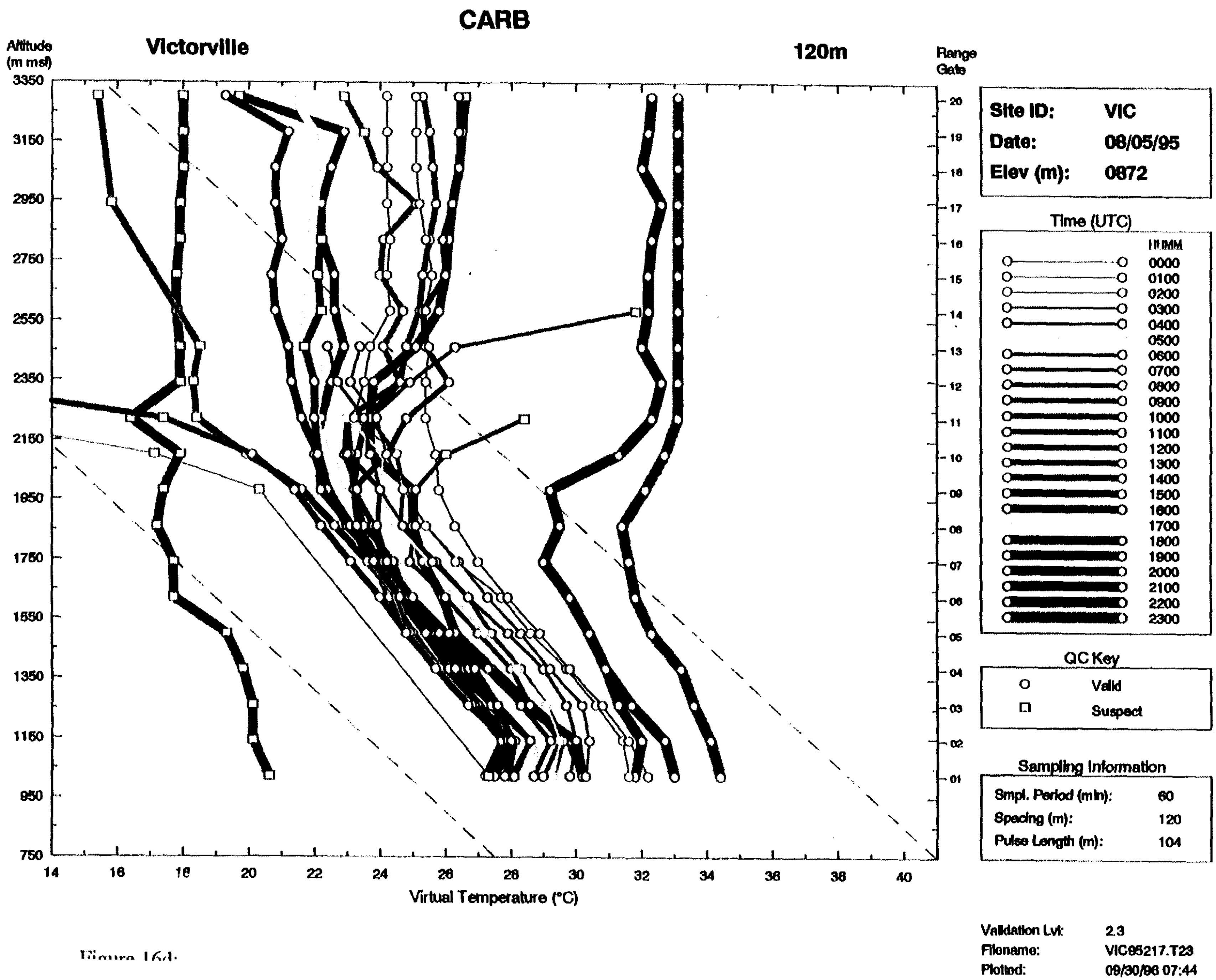

CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/96 07:44

Figure 16d:

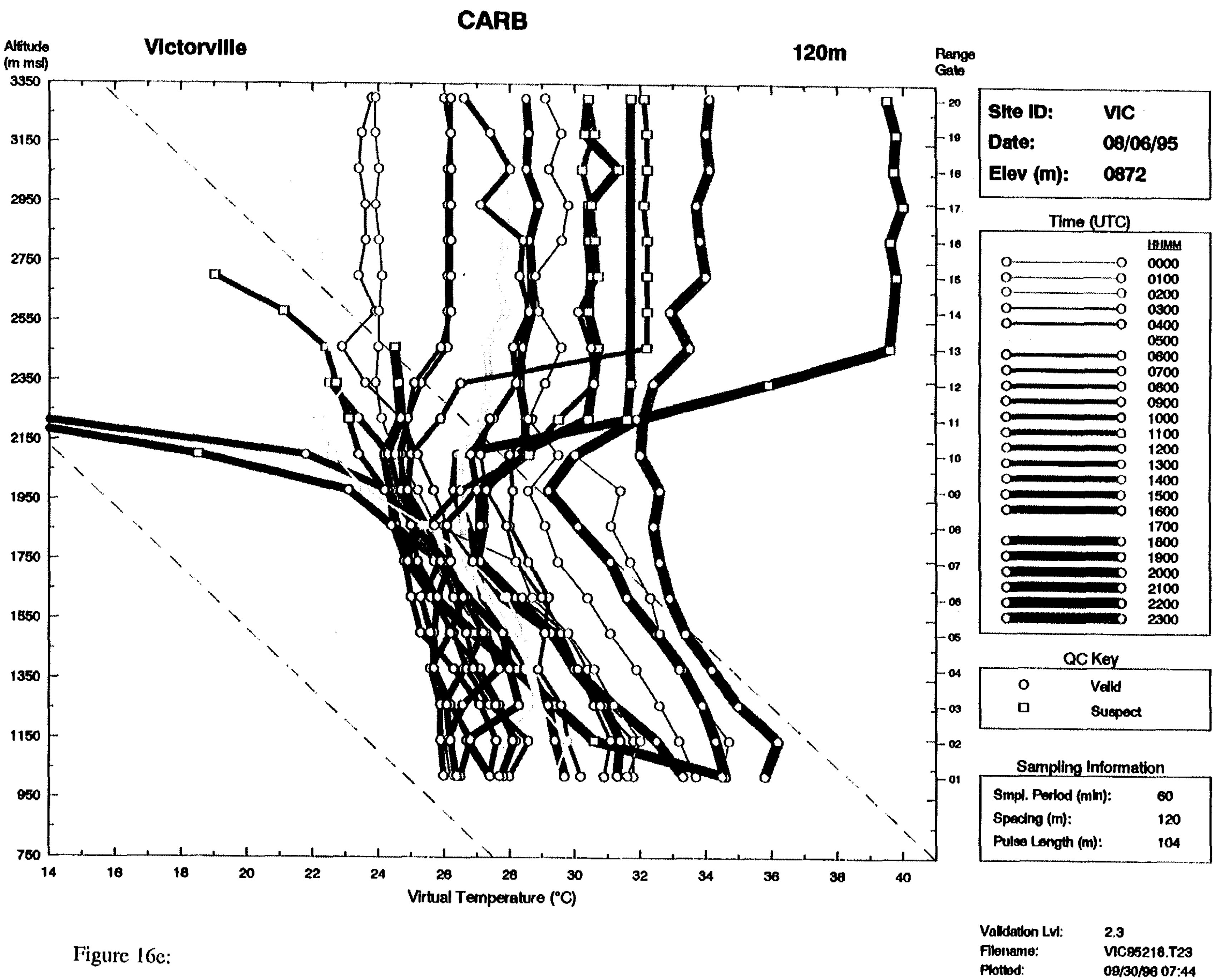
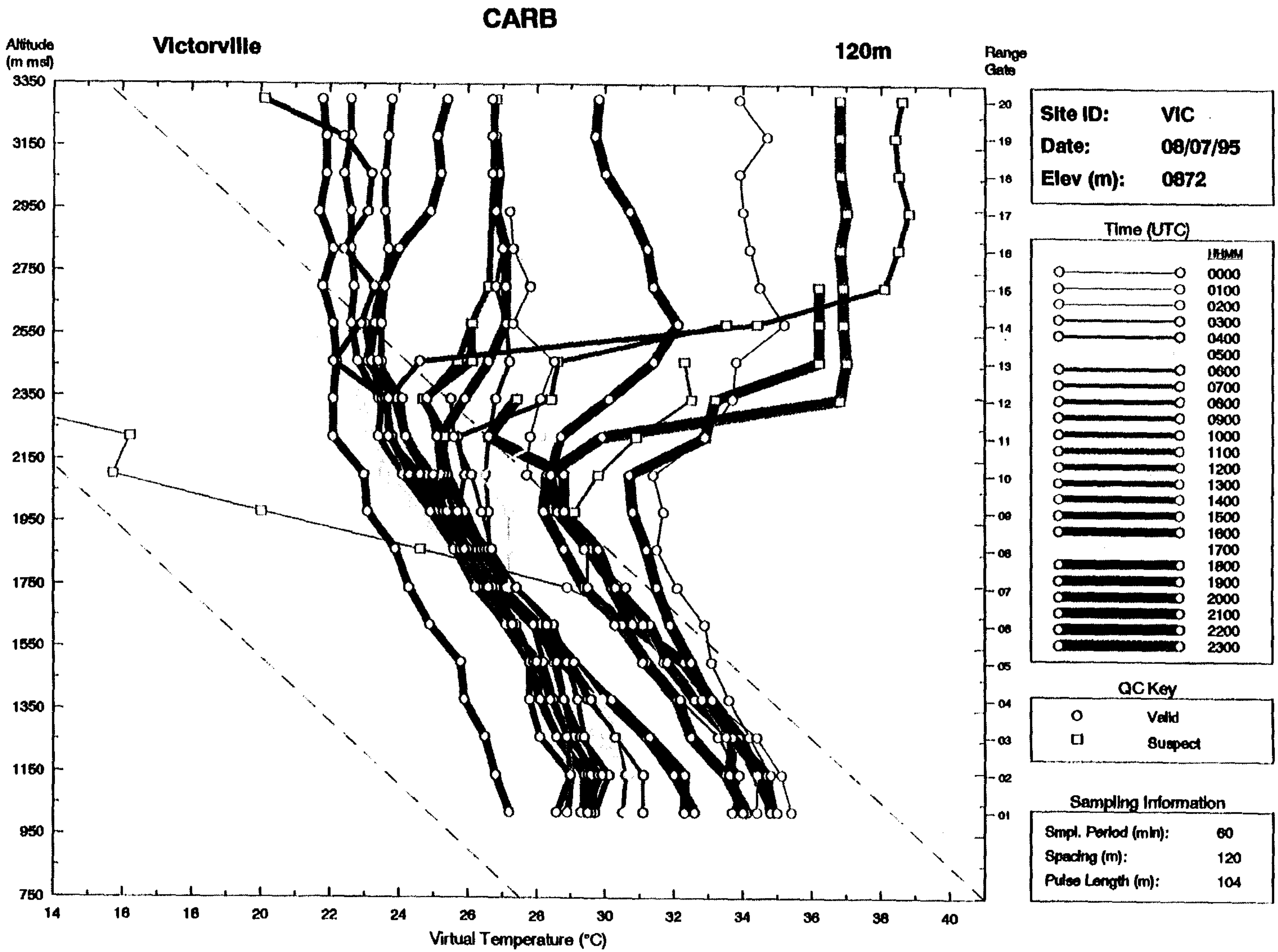

CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/06/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95218.T23
Plotted: 09/30/96 07:44

Figure 16e:



Validation Lvl: 2.3
Filename: VIC95219.T23
Plotted: 09/30/96 07:45

Figure 16f:

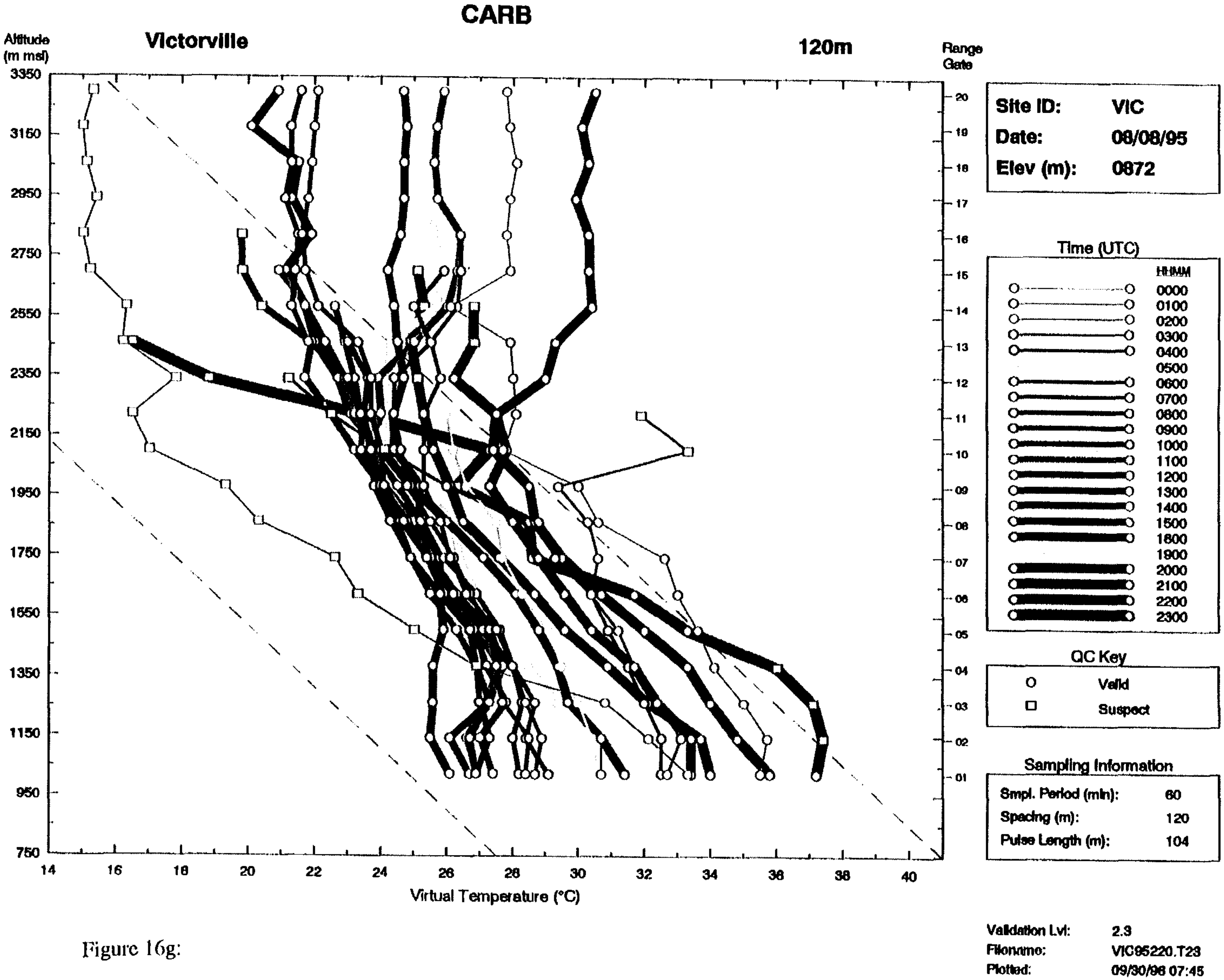
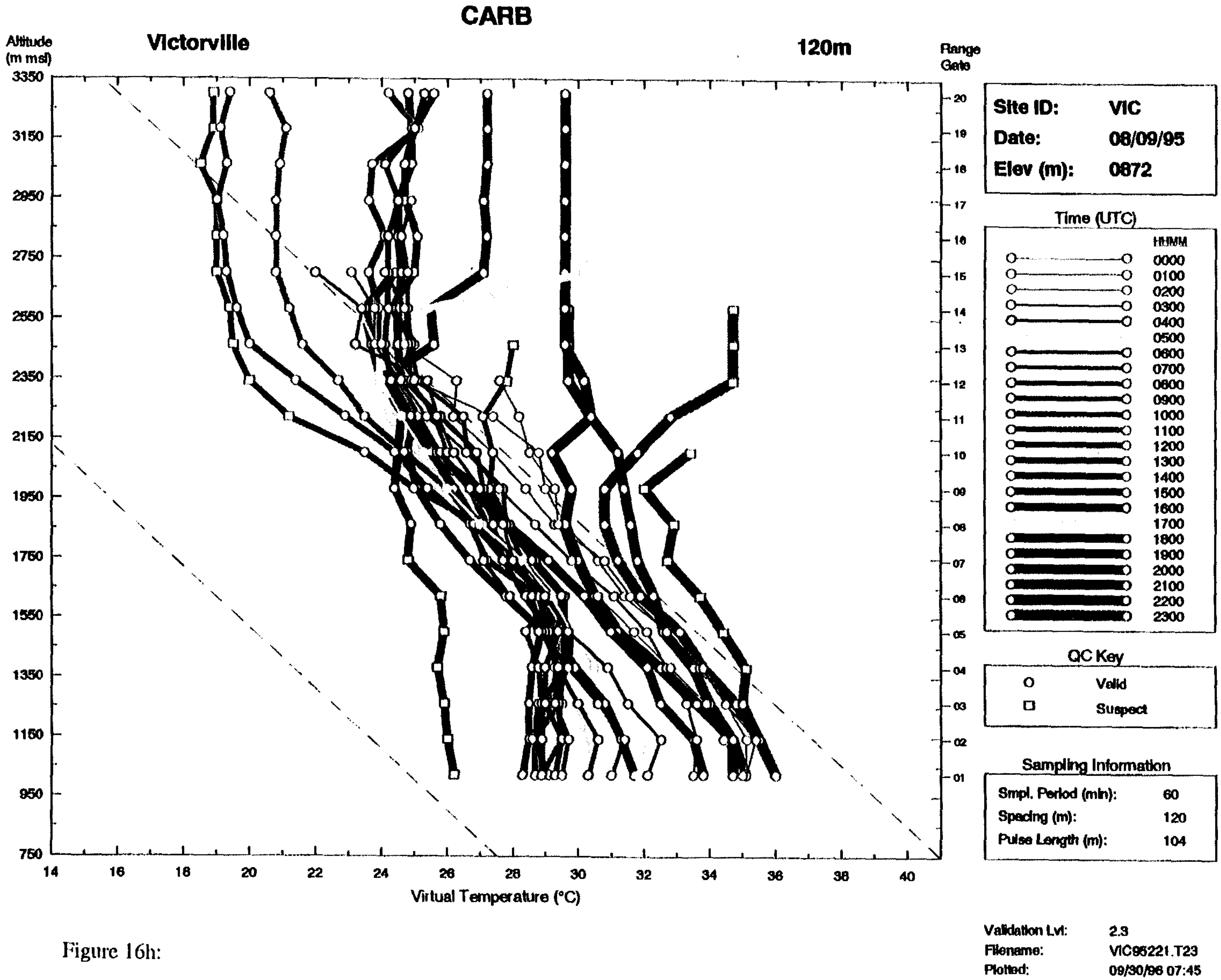

CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/08/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95220.T23
Plotted: 09/30/96 07:45

Figure 16g:



CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/09/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95221.T23
Plotted: 09/30/96 07:45

Figure 16h:

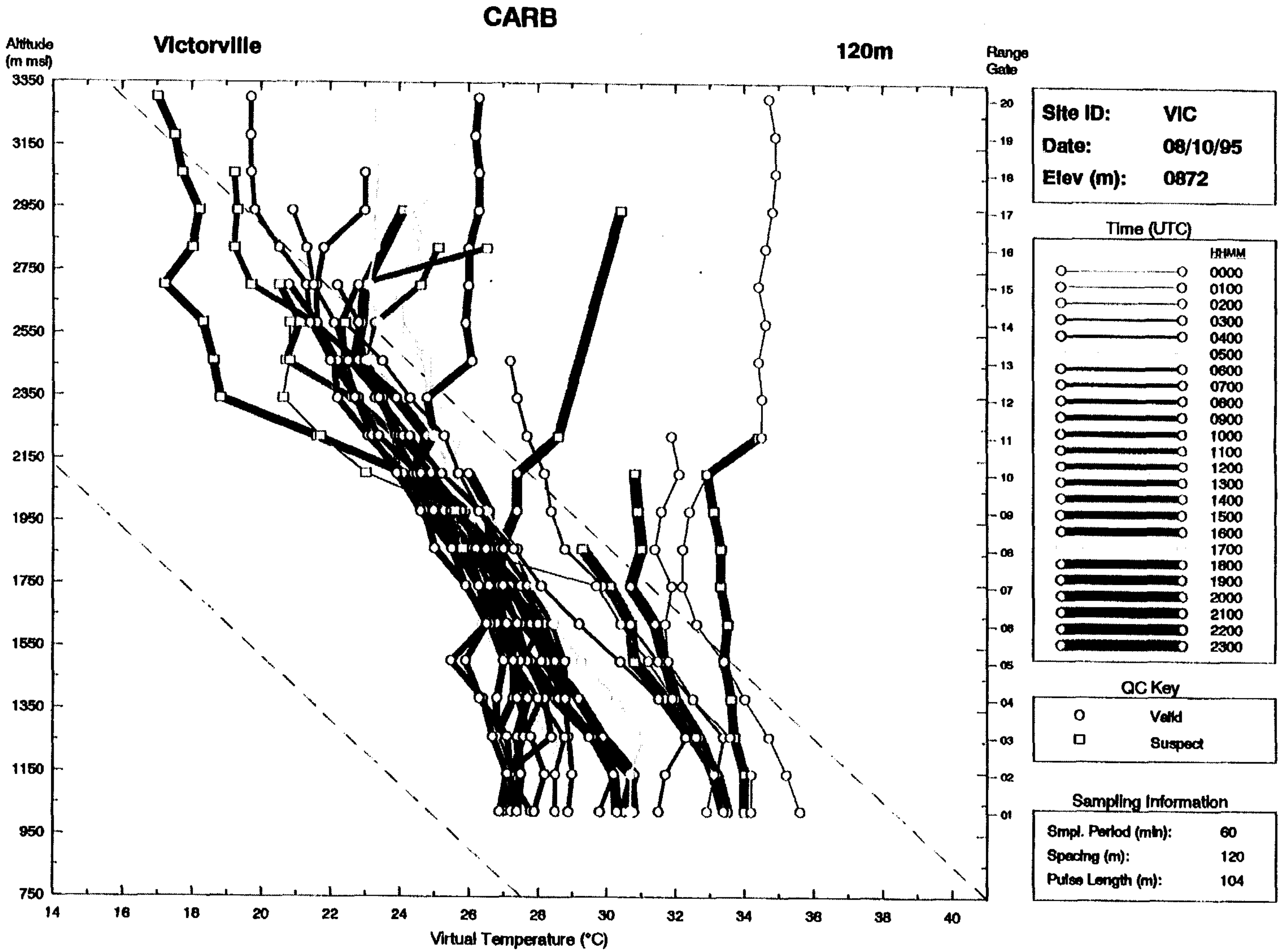

CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/10/95
Elev (m): 0872
Time (UTC)
HHMM
0000
0100
0200
0300
0400
0500
0600
0700
0800
0900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 60
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95222.T23
Plotted: 09/30/96 07:46

Figure 16i:

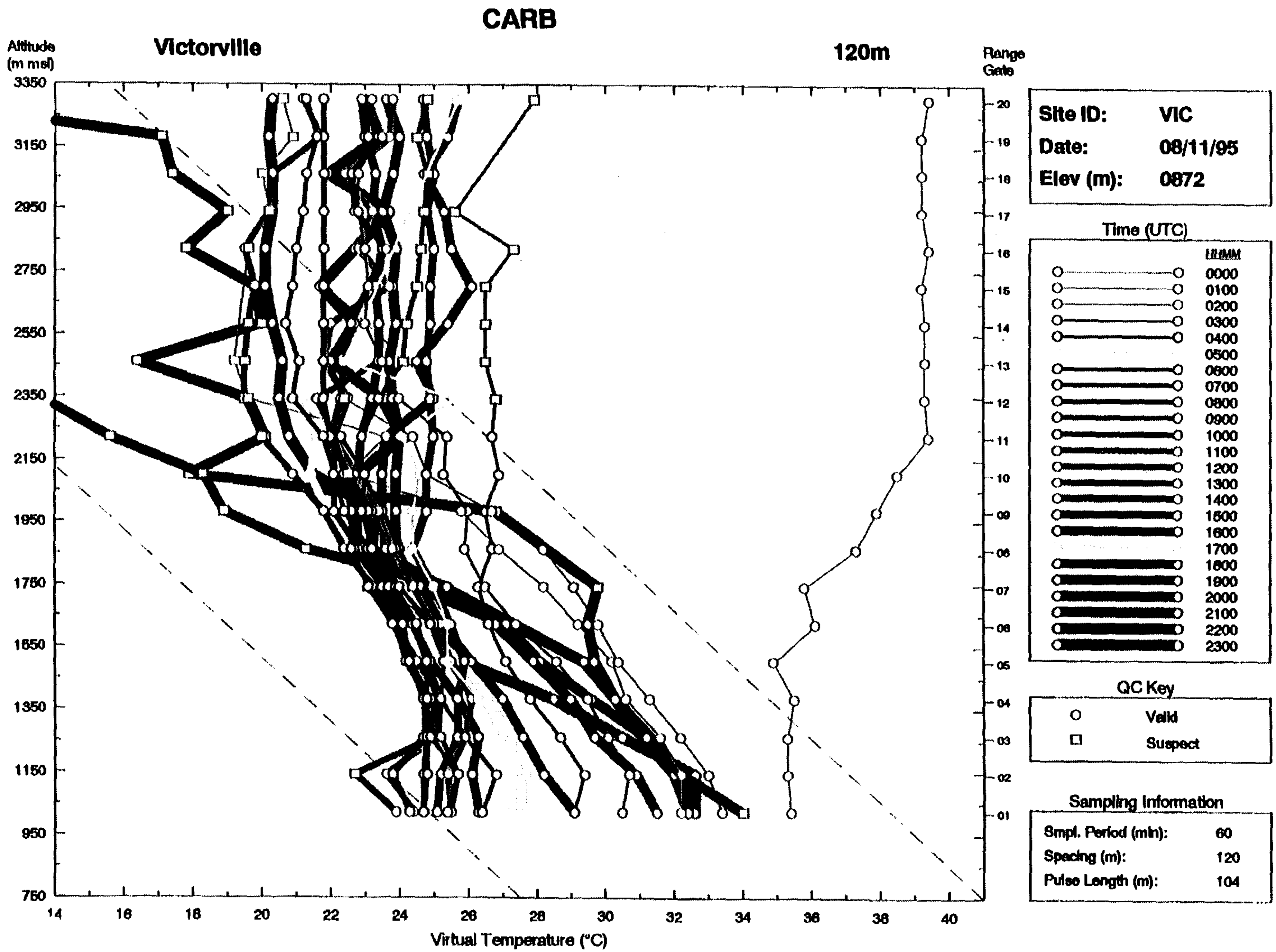
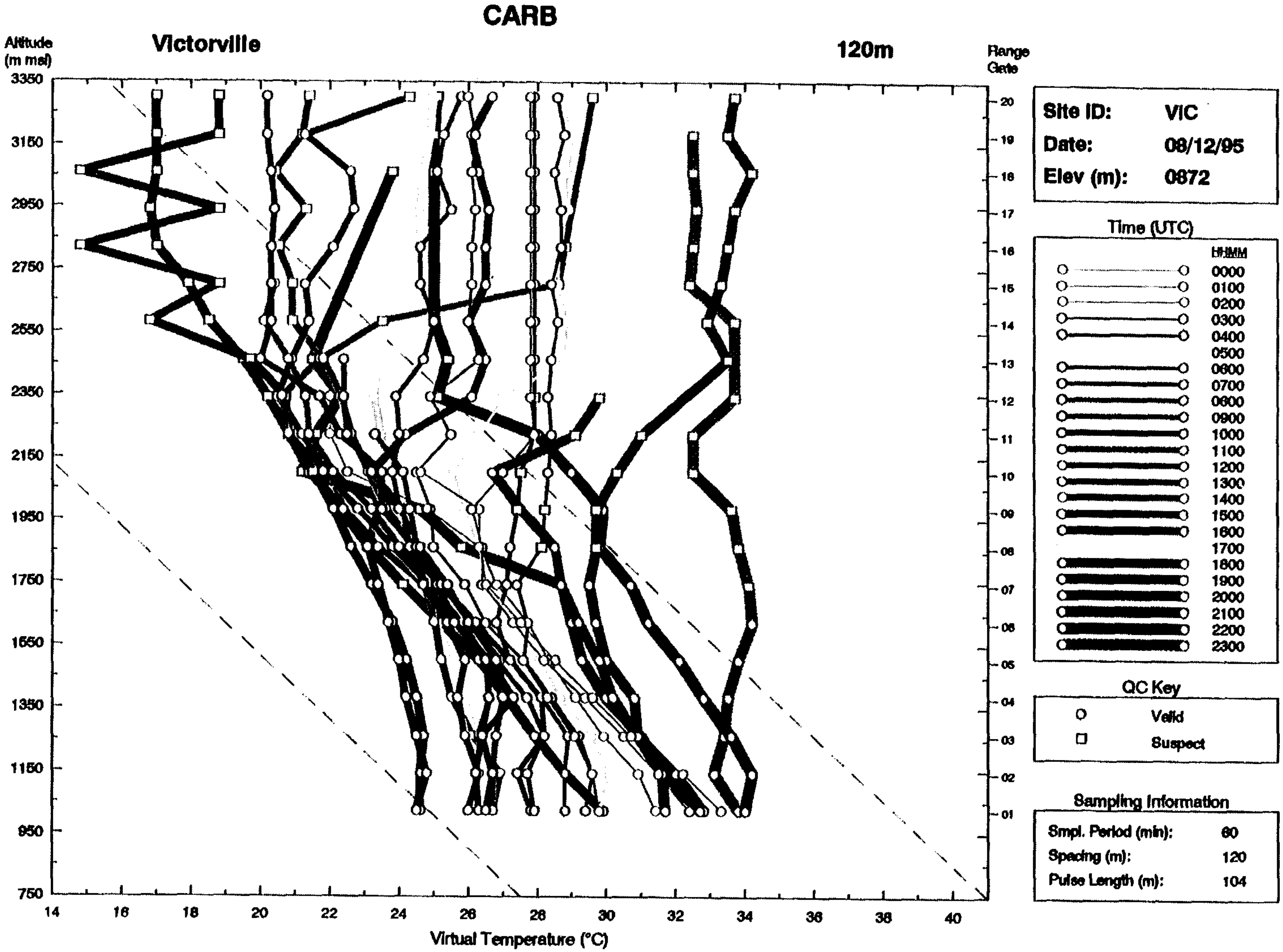


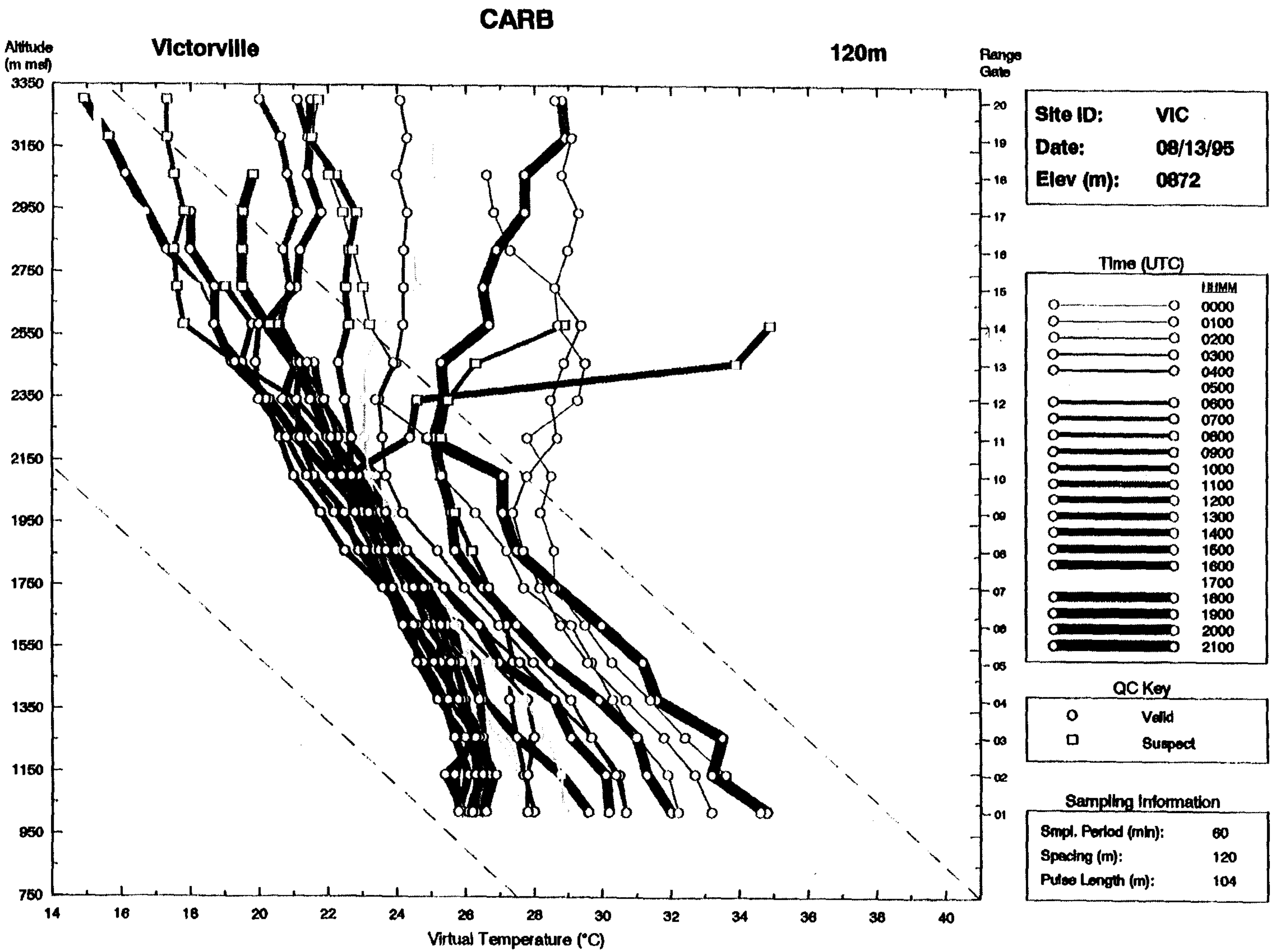
Figure 16j:

Validation Lvl: 2.3
Filename: VIC95223.T23
Plotted: 09/30/96 07:46



Validation Lvl: 2.3
Filename: VIC95224.T23
Plotted: 09/30/96 10:41

Figure 16k:



Validation Lvl: 2.3
Filename: VIC95225.T23
Plotted: 09/30/96 07:47

Figure 16l:

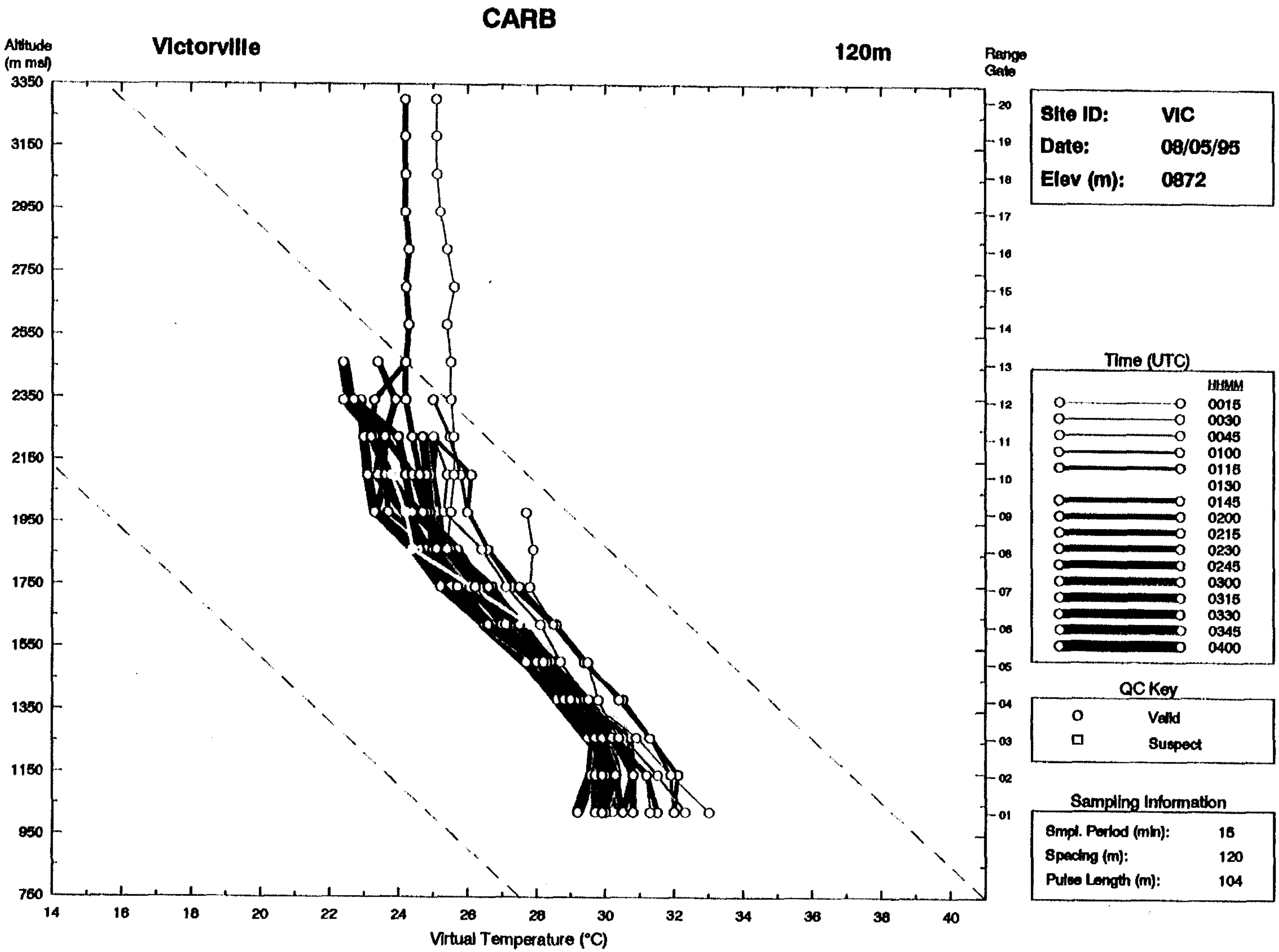
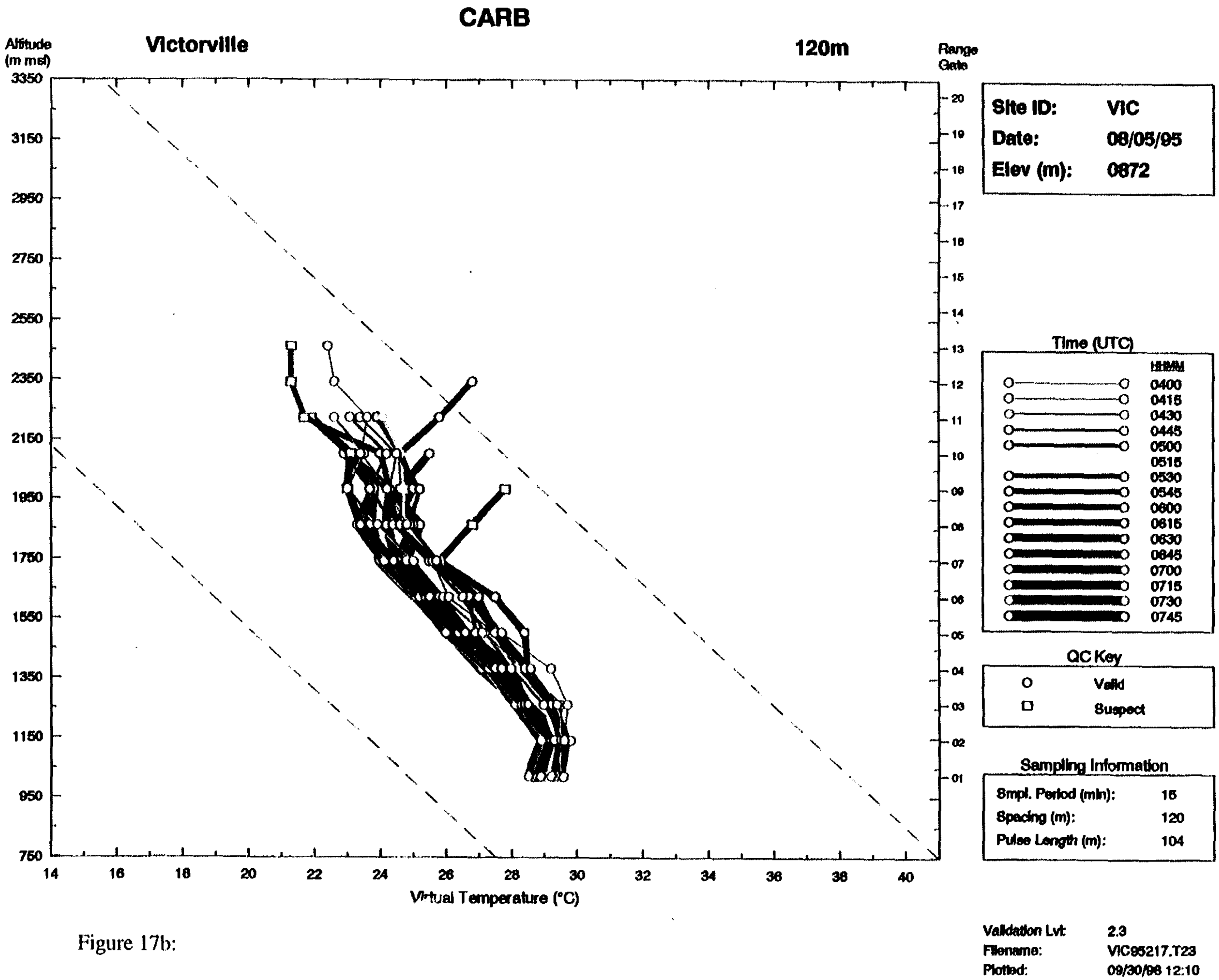


Figure 17a: Profiles of quality-controlled 15-minute average virtual temperatures on 5 Aug 1995 from 0000-0345 UTC. Bad or suspect data are plotted and indicated by an open square (see QC key)



CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
0400
0415
0430
0445
0500
0515
0530
0545
0600
0615
0630
0645
0700
0715
0730
0745
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 15
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/98 12:10

Figure 17b:

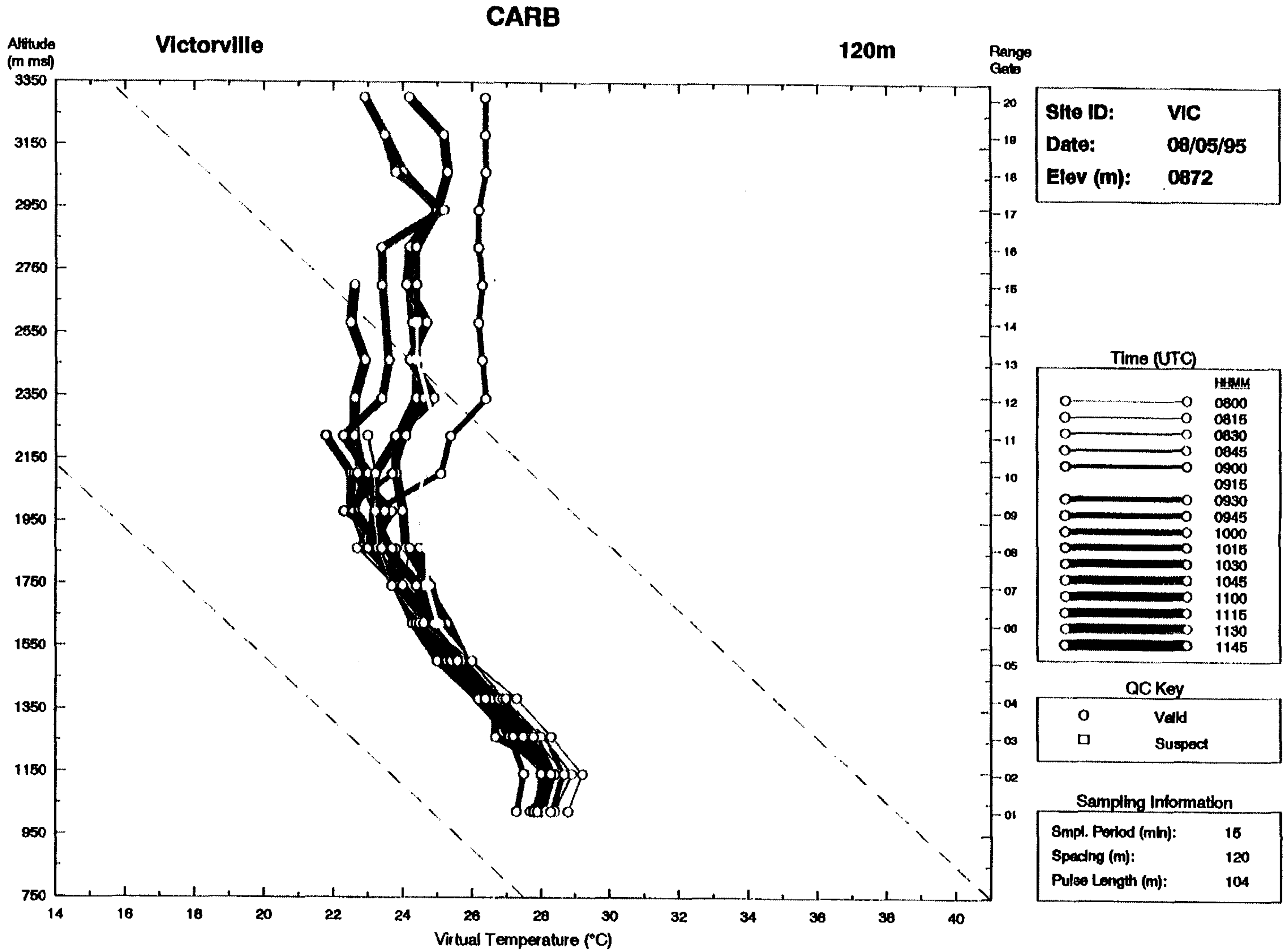
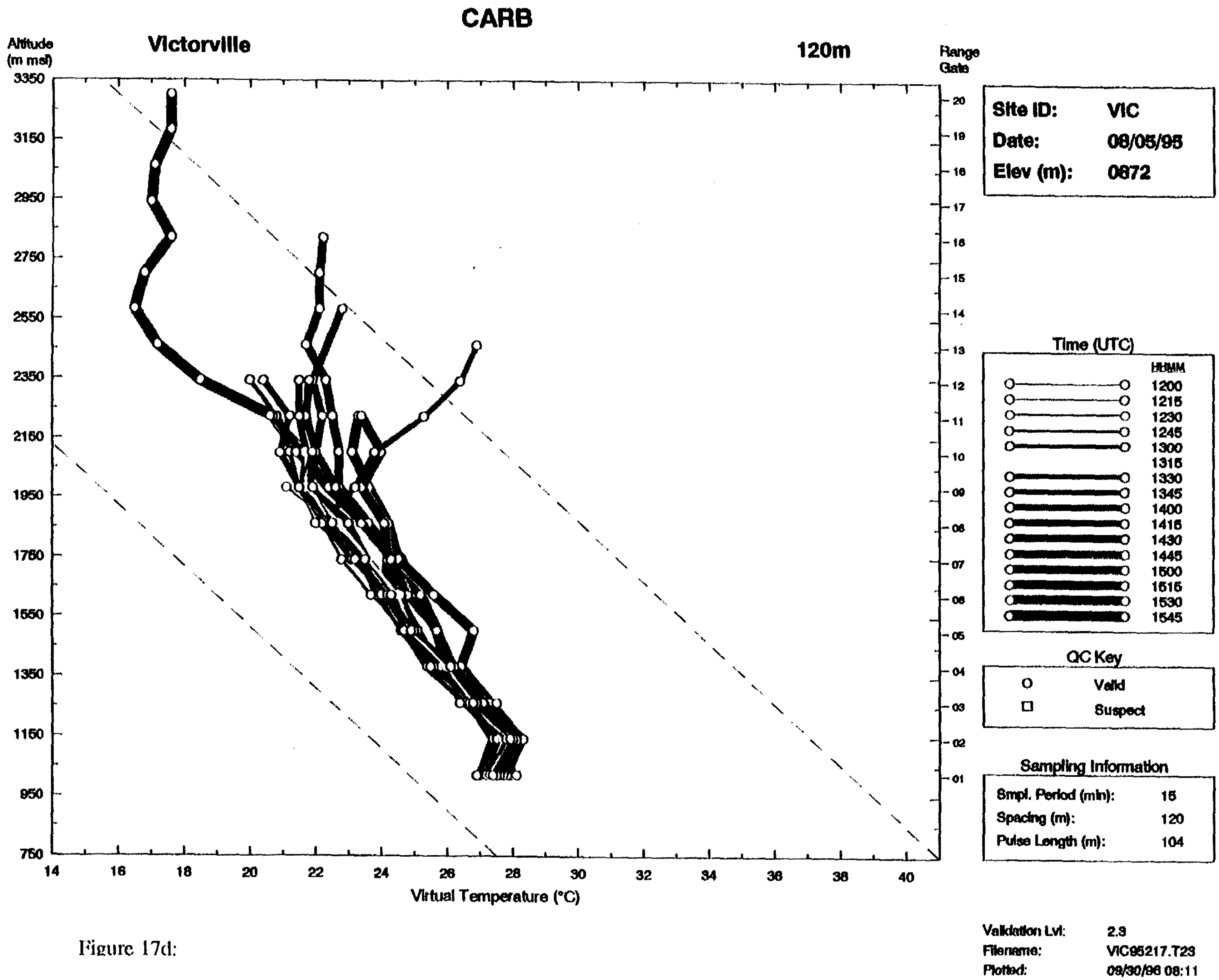
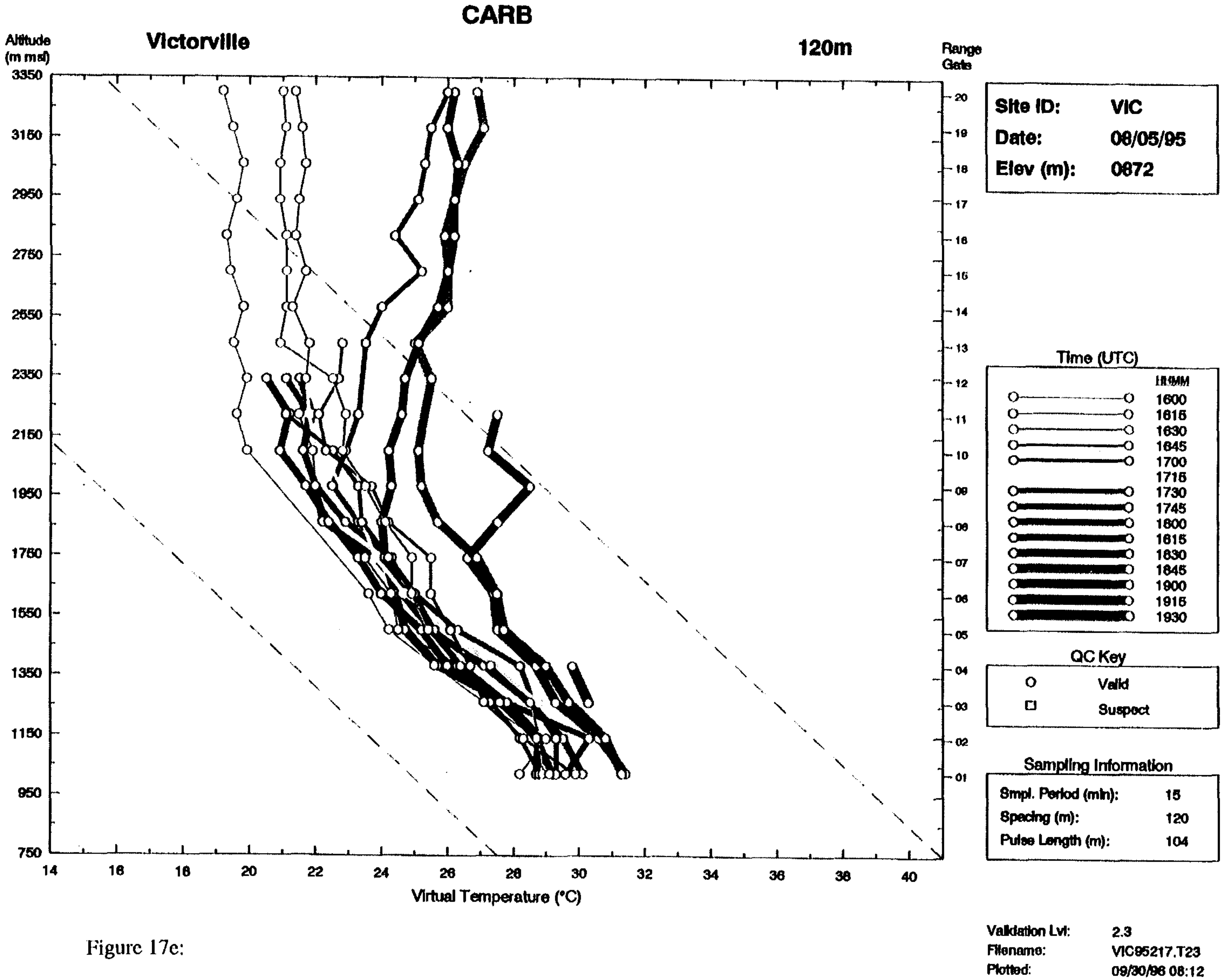

CARB
Victorville
120m
Altitude (m msl)
Range Gate
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
0800
0815
0830
0845
0900
0915
0930
0945
1000
1015
1030
1045
1100
1115
1130
1145
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 15
Spacing (m): 120
Pulse Length (m): 104
Virtual Temperature (°C)
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/96 08:11

Figure 17c:



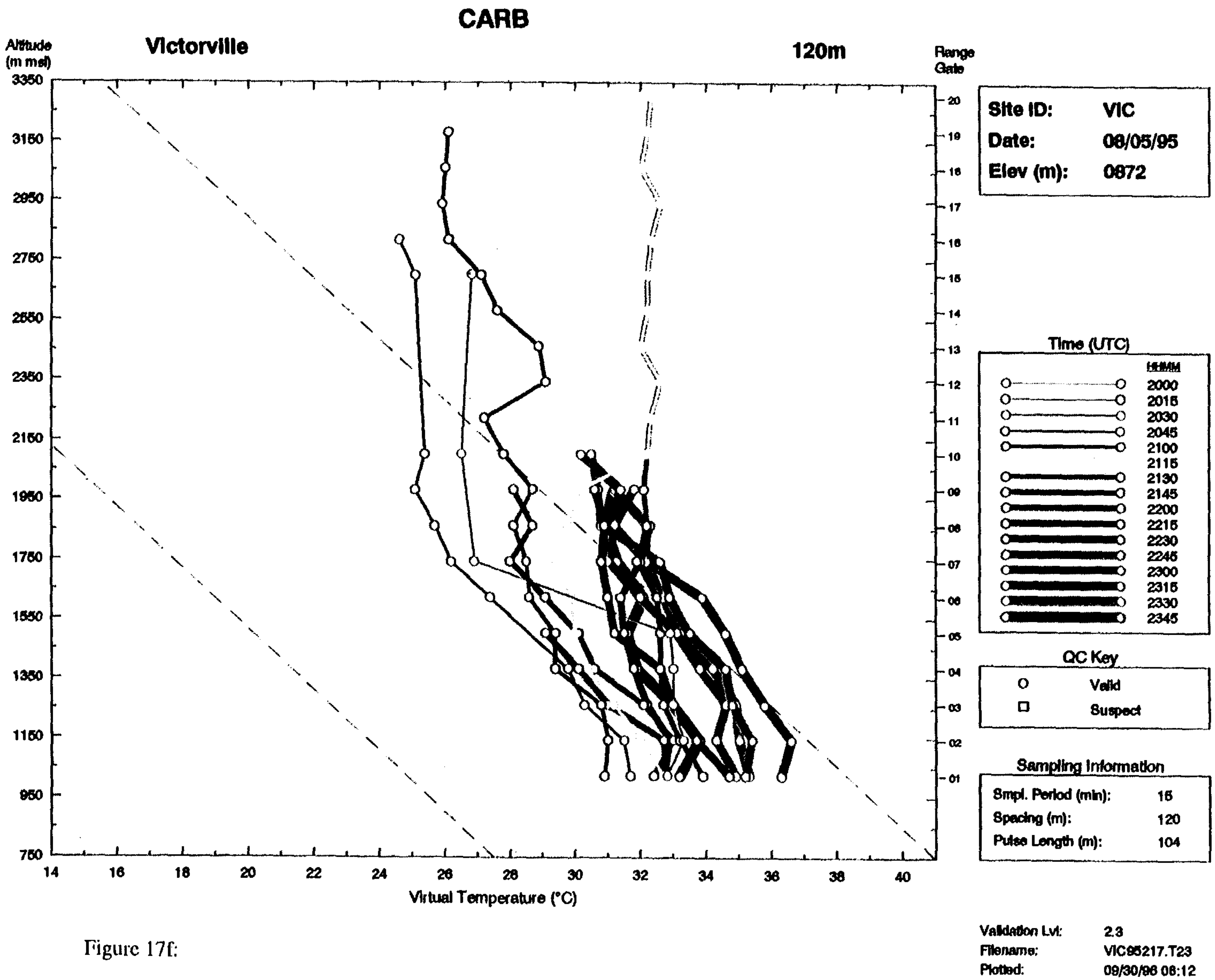
CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
1200
1215
1230
1245
1300
1315
1330
1345
1400
1415
1430
1445
1500
1515
1530
1545
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 15
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/96 08:11

Figure 17d:



CARB
Victorville
120m
Altitude (m msl)
Range Gate
Virtual Temperature (°C)
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
1600
1615
1630
1645
1700
1715
1730
1745
1800
1815
1830
1845
1900
1915
1930
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 15
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/96 08:12

Figure 17e:



CARB
Victorville
120m
Altitude (m msl)
Range Gate
3350
3150
2950
2750
2550
2350
2150
1950
1750
1550
1350
1150
950
750
14
16
18
20
22
24
26
28
30
32
34
36
38
40
Virtual Temperature (°C)
Site ID: VIC
Date: 08/05/95
Elev (m): 0872
Time (UTC)
HHMM
2000
2015
2030
2045
2100
2115
2130
2145
2200
2215
2230
2245
2300
2315
2330
2345
QC Key
Valid
Suspect
Sampling Information
Smpl. Period (min): 15
Spacing (m): 120
Pulse Length (m): 104
Validation Lvl: 2.3
Filename: VIC95217.T23
Plotted: 09/30/96 08:12

Figure 17f:

Figure 18: Smoke plume on 28 July from nearby Cajon Pass (looking south). Plume moving from the SW to the NE (right to left in figure)

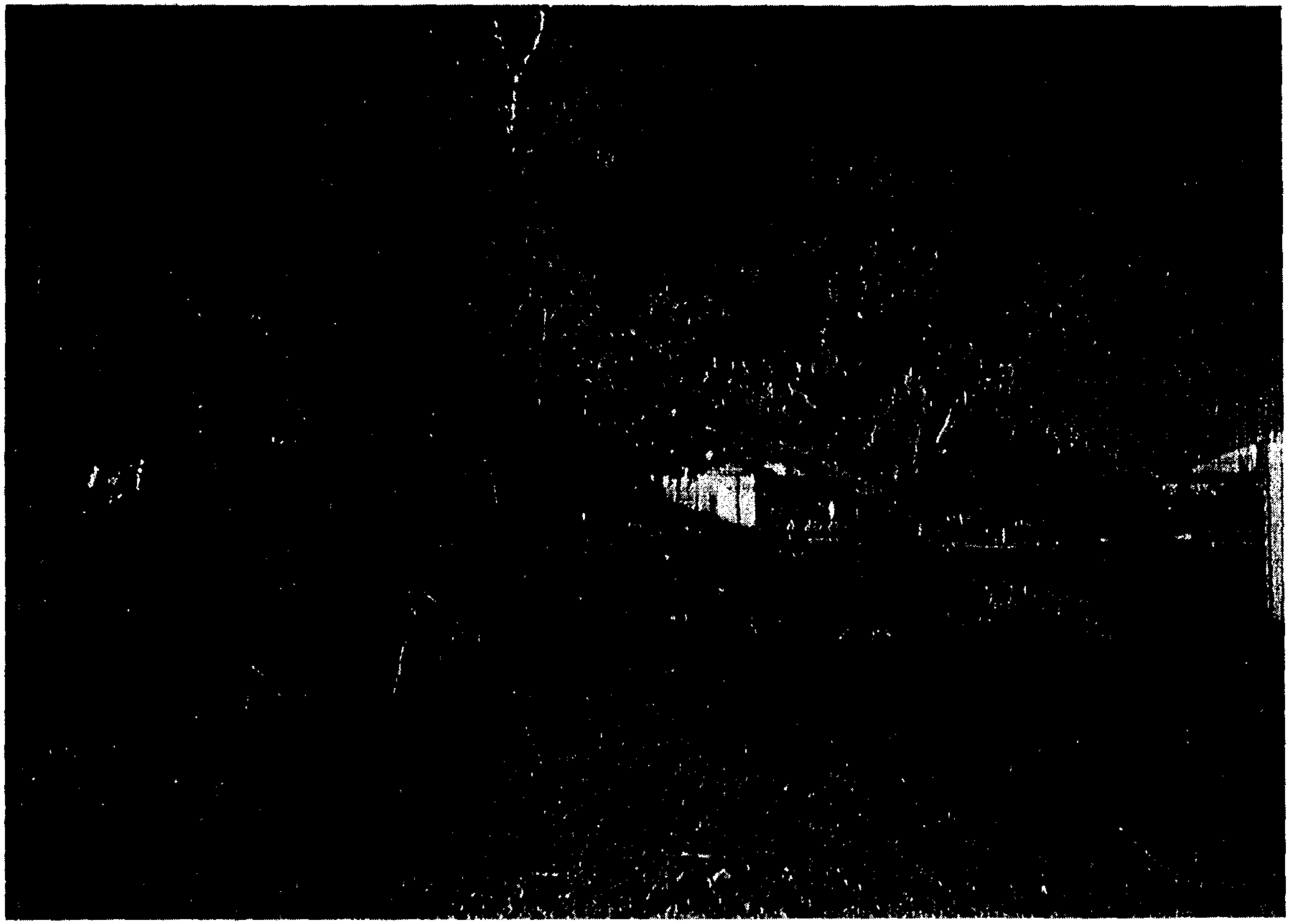


Figure 19a: Tree (500 yds to west of profiler) blown down by strong winds on 30 Jul prior to start of the experiment.

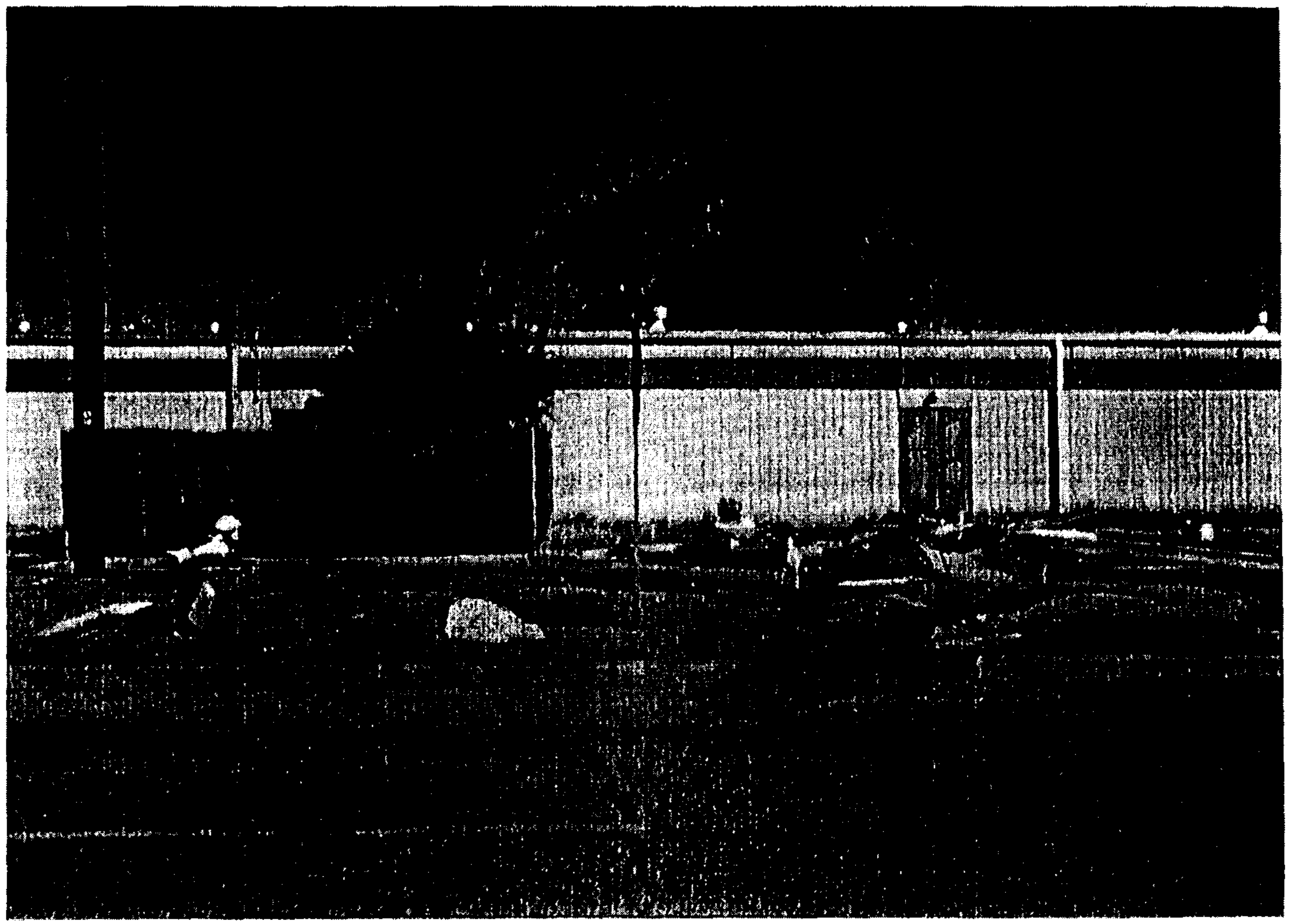


Figure 19b: Sections of roofs from George AFB buildings blown off by strong winds on 30 Jul prior to start of the experiment.