**CSET (2015) Data Quality Report**

**Albrecht et al.**

**V2 Release, 31 Mar 2017**

Version 2 of the CSET data were released in Spring 2017. There are two changes in V2:

1. Inclusion of variables: A1DC\_LWOO, AUHSAS\_RWOOU, and ACDP\_LWOI which are raw counts in each histogram bin.
2. Application of new calibration coefficients for RSTB. The original processing included an old calibration that was no longer valid. The new calibration coefficients were derived at NRL after the ORCAS campaign (Spring 2016). The result is a fairly significant change of about +1 degree in RSTB at typical CSET surface temperatures.

**Section I: GV Instrumentation & Layout**

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### Section II: General Discussion

This summary has been written to outline basic instrumentation problems affecting the quality of the data set and is not intended to point out every bit of questionable data. It is hoped that this information will facilitate use of the data as the research concentrates on specific flights and times.

This report covers only the RAF supplied instrumentation and is organized into the following sections.  Section II lists recurring problems, general limitations, and systematic biases in the standard RAF measurements.  Section III lists isolated problems occurring on a flight-by-flight basis.  A discussion of the performance of the RAF specialized instrumentation (i.e, chemistry sensors, 3V-CPI, and MTP) will be provided separately, as will the respective data sets.

RAF staff members have reviewed the data set for instrumentation problems.  When an instrument has been found to be malfunctioning, specific time intervals are noted.  In those instances the bad data intervals have been filled in the netCDF data files with the missing data code of -32767. In some cases a system will be out for an entire flight.

1. **3D Wind Data:** Information on general retrieval of radome winds can be found [here](http://www.eol.ucar.edu/raf/Bulletins/bulletin23.html).The vertical wind data obtained from the radome has been corrected via the algorithm/processing method documented in a NCAR Tech Note authored by Al Copper et al. that is currently under review. The premise of this wind calibration methodology is to calculate a reference Angle of Attack (AOA, *α\**) by assuming that the mean vertical wind over a flight segment is zero:

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where *θ*is pitch, *wp* is the rate of climb of the aircraft, and *V* is true airspeed. After the reference AOA is calculated, linear regression is used to determine the coefficients that provide the best fit to the using following equation:



where Δ*pα* is the vertical differential pressure across the radome, *q* is the fuselage dynamic pressure, and *M* is mach number. There is a known altitude dependency of the vertical winds, thus the sensitivity coefficients for AOA have been defined for the following altitudes:

SFC-6500m

c0=4.18;

c1=14.02;

c2=8.20;

6500-9300M

c0=4.07;

c1=12.26;

c2=9.49;

>9300M

c0=4.44;

c1=28.12;

c2=-8.61;

Despite these corrections, the vertical winds for altitudes above 9300 m were often suspect and should be used analyzed with extreme caution.

1. **Ambient Temperature Data:** Temperature measurements were made using heated (ATH1 & ATH2) and fast response (ATF1) sensors. The temperature sensors generally tracked well throughout the project. There were occurrences where ATF1 cooled up to 0.5 degrees in clouds with large drops, precipitation, or high liquid water content due to wetting and evaporative cooling on the sensor. This causes what appears to be large areas of supersaturation and may result in the appearance of instability in a well mixed cloud. Users should use caution when interpreting the fast response temperature data when in cloud. ATH2 was chosen as the reference temperature (ATX).
2. **Humidity Data:** Humidity measurements were made using two collocated thermoelectric dew point sensors and the VSCEL hygrometer.  The chilled mirror dewpointers (\_DPL, \_DPR) typically perform poorly in the flight profiles of the GV as they flood on descent and take time to restabilize. There are also unphysical oscillations that occur occasionally in the chilled mirror sensors. These observations have (mostly) been removed from the data set, however, due to the large number of occurrences each time is not listed in the flight-by-flight summary. **The chilled mirror dewpointers should only be used when VSCEL data is missing and even in these situations, should be used with caution.** The VSCEL performed generally well throughout the campaign. There were short dropouts on mode changes, a couple longer ones from ACGAIN->0 lockup, and some low laser intensity periods. The VSCEL is the reference humidity (DPX) for CSET.
3. **CN Concentration:** The CN counter operated reliably throughout CSET. The location of the CN HIMIL for this project, high and far back from the nose to accommodate other inlet needs in the payload, was not optimal for particle sampling. Turbulent wakes from upstream objects such as the GV windshield and other inlets lead to some size-dependent, unquantifiable particle losses. At times CONCN was less than CONCU, a condition that normally would not occur since the CN counter size range includes the UHSAS range. Many of these events noted during the project were due to false counts at small diameters in the UHSAS (see the notes for that probe). Reduced CN sampling efficiency only becomes apparent when the fine aerosol concentration, and typically the total aerosol loading as well, is low. The length of sample tubing between the HIMIL and the CN counter induces a time lag in the instrument response to changes in particle concentration. Calculation based on measured total flow, and comparisons with the wing-mounted UHSAS, indicate the CN counter lags by 2 +/- 0.5 seconds, and a constant 2 second correction has been applied to the CN data. Two factors contribute to the uncertainty in this time lag. First, the sample flow rate varies slightly with ambient pressure and other state parameters. More importantly, CONCN and CONCU are not highly correlated in general due to combined effects of their very different size ranges and variability in the ambient aerosol size distribution. At times, they are instead anticorrelated, so features for time lag determination must be chosen carefully.
4. **UHSAS:** The UHSAS operated well for the most part during CSET, but there were some problems affecting most flights. Because of the time spent at low altitudes in relatively warm ambient temperatures, the probe frequently exceeded its proper operating temperature, and at times the laser temperature could not be maintained. Often following low-altitude legs the probe was turned off for approximately ten minutes to allow cooling, but overheating nevertheless led to frequent optical instability producing false particle counts in the first few (smallest) size channels. For this reason, and to maintain a consistent size range across all flights, the first eight channels have been dropped from the reported data, making 75 nm the effective starting diameter of the probe. Although the range from 75 nm down to 60 nm typically has high concentrations, the UHSAS detection efficiency declines through it, so discarding these low channels omits a small portion of the measured spectrum. Occasional intervals of severe instability have been blanked entirely.
5. **Radiometers:** Data from the Kipp & Zonen CG4 pyrgeometers and CMP22 pyranometer are of good quality except for the data drop-out noted for RF11. Users should be aware that these sensors were not on a stabilized platform, so data are most reliable during straight and level flight segments. Variations introduced by aircraft pitch, roll, and heading (wrt solar angle) changes are most evident in VISB since that field is not isotropic.

The radiometric surface temperature data are of good quality except for the data drop-out noted during RF11. Uncertainty is introduced into this measurement by water vapor emission from the atmospheric layer between the aircraft and the surface.

1. **GPS Positioning:** There were some OmniSTAR dropouts, but except as noted in individual flights (RF06, 07, 09, 11, 15, 16), the receiver had a good position fix and the uncertainty in horizontal position (RMS) is better than 1.8 meters, and ~3.3 meters uncertainty in vertical position.
2. **SPECIAL** **NOTE:** Virtually all measurements made on the aircraft require some sort of airspeed correction or the systems simply do not become active while the aircraft remains on the ground.  None of the data collected while the aircraft is on the ground should be considered as valid.

### Section III:  Flight-by-Flight Summary

### RF01

**2DC:** Detector saturation in the middle of the diode array (16:43:51 24:16:02).

**UHSAS:** Poor data quality (17:37:02-17:37:05, 17:54:53-17:55:02, 19:00:50-19:00:50, 19:27:10-19:27:10, 19:28:07-19:43:09, 20:28:12-20:28:33, 20:29:35-20:30:26)

**Dewpointers:** Unphysical oscillations in DPL (17:53:46-17:59:57).

**Vertical winds:** Poor calibration of vertical winds (19:02-19:29).

### RF02

### VSCEL: Low laser intensity (16:40:30-16:40:33, 17:19:30-17:19:34, 17:19:40-17:19:59, 17:22:49-17:23:14).

VSCEL restart (16:32-16:39).

**UHSAS:** Poor data quality (14:55:00-15:00:23, 15:09:43-15:09:47, 15:12:39-15:12:48, 15:12:53-15:13:02, 15:13:22-15:13:26)

**Vertical winds:** Poor calibration of vertical winds (19:42-21:15).

**Temperatures:**

Wetting of the Fast Response temperature sensor (ATF1, 16:30:36-16:41:27, 15:59:59-16:00:39, 16:56:58-16:57:52, 17:13:00-17:34:00, 18:07:00-18:17:00, 18:27:21-18:27:59)

**Radiometers:** Failed on final descent (RSTB, 21:11:41-21:14:00).

### RF03

**UHSAS:** Poor data quality (16:42:45-16:42:45, 22:17:34-22:17:36).

### VSCEL: Power cycle at 22:00, down for approximately 25 minutes.

### Shorter outages due to low laser intensity (20:43:56-20:44:30, 23:02:50-23:03:26)

### Temperatures: Wetting of the Fast Response temperature sensor (ATF1, 18:38:34-18:50:02, 21:08:00-21:18:00, 21:31:00-21:32:00).

### PLWC: Outage (16:30:00-17:21:07).

### 2DC: Just putting out timing data (22:16-22:59).

### MTP Restarts: 19:22, 20:21, 21:13, 21:38.

### RICE: Out (16:30:00-17:21:07).

**Vertical winds:** Poor calibration of vertical winds (22:18-23:27).

### RF04

### 2DC, CDP, PLWC: power cycled at 15:49.

### Temperatures: Wetting of the Fast Response temperature sensor (ATF1, 18:21:52-18:24:24, 18:28:24-18:30:04, 16:35:21-16:35:54, 17:51:04-17:51:23).

**Radiometers:** Out (RSTB, 21:25:18-21:28:00).

### Failed on descent (21:25-landing).

### MTP Restarts: 16:53, 17:44, 18:32, 18:58.

### UHSAS/RICE Restart: 18:37.

### VSCEL: Low laser intensity (16:14:05-16:14:23).

### RF05

### UHSAS: Poor data quality (17:53:21-17:53:21, 17:54:06-17:54:07, 19:49:17-20:09:00, 20:34:42-21:01:00, 21:42:16-21:42:16, 22:58:27-22:58:27).

### PLWC: Outage (16:40:00-16:50:40).

### 2DC: Power cycle at 23:46.

### MTP Restarts: 18:13, 19:10, 20:06, 20:58, 21:49.

### UHSAS/RICE Restarts: 19:57, 20:48.

### RF06

### VSCEL: Low laser intensity (19:11:23-19:11:29).

### CDP: Detector saturation (14:57:44-17:34:07).

### MTP Restart: 18:11.

**UHSAS:** Poor data quality (15:40:22-15:40:22, 15:49:55-15:49:55, 16:20:33-16:20:34, 16:28:06-16:28:06, 17:07:06-17:07:06, 17:53:04-17:53:04, 18:47:47-18:47:47, 18:48:15-18:48:15, 18:51:46-18:51:46)

### RF07

### VSCEL: Low laser intensity (18:06:27-18:06:35).

### Missing data due to reset (Takeoff-16:48, 17:42:05-17:42:25).

### UHSAS/RICE Restarts: 19:45, 20:37.

### PLWC: Bad data (16:22:00-16:27:17).

### MTP Restarts: 17:45, 18:12, 19:01, 19:57, 20:49, 21:32.

### UHSAS: Poor data quality (17:46:23-17:46:24, 17:48:04-17:48:04, 17:50:07-17:50:07, 18:06:41-18:06:42, 18:53:34-18:53:39, 18:57:55-18:57:55, 19:34:57-19:34:58, 19:35:12-19:35:13, 19:40:27-19:40:27, 19:45:36-19:57:45, 20:37:29-20:46:25, 21:24:29-21:24:29).

### GPS: Several periods of brief GPS dropout between 17:51-17:56.

### Dewpointers: Unphysical oscillations (DPR, 16:28:13-16:35:38).

### RF08

### VSCEL: Low laser intensity (18:30:44-18:30:47).

**UHSAS:** Poor data quality (16:16:39-16:16:40, 17:58:52-17:58:52, 18:48:42-18:48:42, 18:52:44-18:52:46)

### Temperatures: Wetting of the Fast Response temperature sensor (ATF1, 17:04:24-17:06:21).

### MTP Restarts: 16:13, 17:07, 17:35, 17:57, 18:49.

### Dewpointers: Unphysical oscillations (00:09:36-00:21:43).

### RF09

### Radiometers: Heats on descent (RSTB, 00:54-landing).

### 2DC: Detector saturation (16:29:45-18:32:52).

### UHSAS/RICE Restarts: 19:44, 20:37, 21:24.

### RF10

**UHSAS:** Poor data quality (18:31:40-18:42:40, 19:37:57-19:38:05, 19:43:59-19:43:59, 19:46:23-19:46:23, 19:46:46-19:46:46)

**VSCEL:** Low laser intensity (16:40:21-16:40:23, 16:40:34-16:40:36, 16:40:47-16:40:56, 17:05:24-17:05:30, 18:58:37-18:58:39).

### 2DC: No data from 19:26-landing.

### MTP Restarts: 17:29, 18:19, 19:06.

### UHSAS/RICE Restart: 18:31.

### Dewpointers: Unphysical oscillations (DPL, 21:49: 21-21:50:44).

### RF11

**UHSAS:** Poor data quality (17:32:28-17:32:28, 18:00:56-18:12:15, 18:16:47-18:16:47, 18:18:34-18:18:34, 18:26:12-18:26:13, 18:50:53-19:13:05, 19:38:57-19:49:45)

### 2DC: Detector saturation (16:30:00-19:21:00).

### VSCEL: Low laser intensity (19:30:06-19:30:10).

### UHSAS/RICE Restarts: 18:00, 18:50, 18:38.

### MTP Restarts: 17:51, 18:34, 19:15, 20:31, 21:10.

### Radiometers: Failed on takeoff, reset (takeoff-19:22).

### GPS: Intermittent, short outages between 19:11-19:16.

### RF12

**UHSAS:** Poor data quality (15:50:31-15:51:17, 16:07:58-16:07:58, 16:31:01-16:31:01, 19:00:21-19:12:50, 19:15:09-19:15:09, 19:23:46-19:23:46, 21:25:12-21:25:12)

**VSCEL:** Low laser intensity **(**17:36:16-17:36:19, 17:36:56-17:37:22, 17:37:32-17:37:58, 17:38:03-17:38:29).

### UHSAS/RICE Restart: 1900.

### 2DC: Shut down after 1947.

### MTP Restarts: 17:09, 18:02, 18:49.

### Dewpointers: Unphysical oscillations (17:36:36-17:38:52).

### RF13

**UHSAS:** Poor data quality (16:25:48-16:25:48, 17:35:39-17:35:39, 17:55:52-17:55:52, 18:41:29-18:41:29, 18:41:56-18:41:56, 19:07:20-19:18:35, 19:46:59-19:46:59, 19:56:14-20:09:30, 20:26:34-20:26:34, 20:45:20-20:57:25, 21:21:09-21:21:09, 21:49:25-21:49:25).

### VSCEL: Missing data (17:24:51-17:25:10).

### UHSAS/RICE Restarts: 17:07, 19:56, 20:45.

### MTP Restarts: 17:33, 18:04, 18:57, 19:44, 20:32.

**Temperatures:** Wetting of the Fast Response temperature sensor (ATF1, 18:26:00-18:26:04, 18:27:32-18:27:35, 20:40:54 20:41:05).

### RF14

### VSCEL: Low laser intensity (18:16:18-18:16:26).

### UHSAS: Poor data quality (16:14:54-16:14:54, 16:16:19-16:16:19, 16:16:25-16:16:25, 16:16:36-16:16:36, 16:27:12-16:27:12, 17:02:54-17:02:55, 17:03:36-17:03:36, 17:22:04-17:22:04, 17:22:13-17:22:15, 17:51:43-17:51:43, 18:16:32-18:16:39, 18:27:02-18:40:25)

### RICE: Abnormal spike (15:06:20-15:06:53).

### MTP Restarts: 17:24, 18:14.

### RF15

**UHSAS:** Poor data quality **(**17:37:24-17:37:24, 17:56:48-18:05:30, 18:08:29-18:08:29, 18:11:31-18:11:31, 18:13:20-18:13:20, 18:17:40-18:17:40, 18:18:19-18:18:19, 18:48:11-18:58:30, 19:14:10-19:19:30, 19:38:01-19:43:35, 19:54:42-19:55:05, 20:34:50-20:49:15).

### GPS: Satellite dropout (21:16:35-21:16:37).

### UHSAS Restart: 20:34.

### MTP Restarts: 18:02, 19:09, 19:46, 20:13.

### RF16

**UHSAS:** Poor data quality **(**16:13:30-16:13:42, 16:32:58-16:32:58, 20:57:24-20:57:24, 20:57:33-20:57:38)

**2DC:** Detector saturation **(**15:25:00-20:24:23, 22:02:31-22:03:57)

### GPS: Short intermittent dropouts between 18:22-18:27.

### Dewpointers: Unphysical oscillations (DPR, 15:34:01-15:38:47, 20:40:00 21:41:00; DPL, 16:15:00 17:14:00, 19:46:00 21:42:00).

**Section IV: Variable List**

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| --- | --- |
| ACINS | IRS Vertical Acceleration |
| ADIFR | Vertical Differential Pressure, Radome |
| AKRD | Attack Angle, Radome Diff. Pressure |
| ALT | IRS Altitude |
| AQRATIO | Ratio of ADIRF to QCF |
| ATF1 | Ambient Temperature, Fast Response |
| ATH1 | Ambient Temperature, Deiced |
| ATH2 | Ambient Temperature, Deiced |
| ATTACK | Attack Angle, Reference |
| ATX | Ambient Temperature, Reference |
| BDIFR | Horizontal Differential Pressure, Radome |
| BLATA | IRS Body Latitudal Acceleration |
| BLONGA | IRS Body Longitudal Acceleration |
| BNORMA | IRS Body Normal Acceleration |
| CNTS | TSI CN Counter Output |
| CNCONC | Condensation Nuclei (CN) Concentration |
| CNFLOW | Corrected BCN Counter Sample Flow Rate |
| CNPS | Pressure in butanol CN counter inlet |
| CONC1DC100\_LWOO | 2DC Concentration, 100 micron and bigger |
| CONC1DC100\_LWOO | 2DC Concentration, 150 micron and bigger |
| CONC1DC100\_LWOO | 2DC Concentration, all cells |
| CONCD\_LWOI | CDP Concentration, all cells |
| CONCN | Condensation Nuclei Concentration |
| CONCU100\_RWOU | UHSAS Concentration, .1 micron and bigger |
| CONCU500\_RWOU | UHSAS Concentration, .5 micron and bigger |
| CONCU\_RWOU | UHSAS Concentration (all cells) |
| CONCV\_VXL | VCSEL Moisture Number Density |
| DBAR1DC\_LWOO | 2DC Mean Particle Diameter |
| DBARD\_LWOI | CDP Mean Particle Diameter |
| DBARU\_RWO | UHSAS Mean Particle Diameter |
| DBZ1DC\_LWOO | 2DC Calculated Reflectivity |
| DBZD\_LWOI | CDP Calculated Reflectivity |
| DISP1DC\_LWOO | 2DC Dispersion (sigma/dbarx) |
| DISPD\_LWOI | CDP Dispersion (sigma/dbarx) |
| DISPU\_RWO | UHSAS Dispersion (sigma/dbarx) |
| DPXC | Dew/Frost Point Temperature, Reference |
| DP\_DPL | Dew/Frost Point Temperature |
| DP\_DPR | Dew/Frost Point Temperature |
| DP\_VXL | Dew/Frost Point Temperature |
| DVALUE | D-VALUE (GGALT - PALT) |
| EWX | Ambient Water Vapor Pressure, Reference |
| EW\_DPL | Ambient Water Vapor Pressure |
| EW\_DPR | Ambient Water Vapor Pressure |
| EW\_VXL | Ambient Water Vapor Pressure (VCSEL) |
| GGALT | Reference GPS Altitude (MSL) |
| GGALTSD | Standard Deviation of Reference GPS Altitude (MSL) |
| GGLAT | Reference GPS Latitude |
| GGLATSD | Standard Deviation of Reference GPS Latitude |
| GGLON | Reference GPS Longitude |
| GGLONSD | Standard Deviation of Reference GPS Longitude |
| GGNSAT | Reference GPS number of satellites used in solution |
| GGQUAL | Reference GPS Qual, 0=inval,1=GPS,2=DGPS |
| GGSPD | Reference GPS Ground Speed |
| GGTRK | Reference GPS Track Angle |
| GGVEW | Reference GPS Ground Speed Vector, East Component |
| GGVNS | Reference GPS Ground Speed Vector, North Component |
| GGVSPD | Reference GPS Vertical Speed |
| LAT | IRS Latitude |
| LATC | GPS-Corrected Inertial Latitude |
| LON | IRS Longitude |
| LONC | GPS-Corrected Inertial Longitude |
| MACHF | Aircraft Mach Number, Fuselage |
| MACHR | Aircraft Mach Number, Radome |
| MACHX | Aircraft Mach Number, Reference |
| MIRRTMP\_DPL | Raw Dew/Frost Point Temperature |
| MIRRTMP\_DPR | Raw Dew/Frost Point Temperature |
| MODE\_VXL | VCSEL Mode |
| MR | Mixing Ratio, T-Electric |
| NOSETMP | Radome Environmental Box Temperature |
| PALT | NACA Pressure Altitude |
| PALTF | NACA Pressure Altitude |
| PCAB | Interior Cabin Static Pressure |
| PDUMPPR | Pressure of instrument exhaust duct, right |
| PITCH | IRS Aircraft Pitch Angle |
| PLWC1DC\_LWOO | 2DC Water/Ice Content |
| PLWCC | Corrected PMS-King Liquid Water Content |
| PLWCD\_LWOI | CDP Water/Ice Content |
| PSF | Raw Static Pressure, Fuselage |
| PSFC | Corrected Static Pressure, Fuselage |
| PSX | Raw Static Pressure, Reference |
| PSXC | Corrected Static Pressure, Reference |
| PS\_A | ADC Static Pressure |
| PVOLU\_RWOU | UHSAS Equivalent Volume |
| QCF | Raw Dynamic Pressure, Fuselage |
| QCFC | Corrected Dynamic Pressure, Fuselage |
| QCR | Raw Dynamic Pressure, Radome |
| QCRC | Corrected Dynamic Pressure, Radome |
| QCX | Raw Dynamic Pressure, Reference |
| QCXC | Corrected Dynamic Pressure, Reference |
| QC\_A | ADC Impact Pressure |
| RHODT | Absolute Humidity, T-Electric |
| RHUM | Relative Humidity |
| RICE | Raw Icing-Rate Indicator |
| ROLL | IRS Aircraft Roll Angle |
| RSTB | Radiometric Surface Temperature |
| RTF1 | Recovery Air Temperature, Fast Response |
| RTH1 | Recovery Air Temperature, Deiced |
| RTH2 | Recovery Air Temperature, Deiced |
| RTRL | Recovery Air Temperature, Radome Left |
| RTX | Recovery Temperature, Reference |
| SOLAZ | Solar Azimuth Angle |
| SOLDE | Solar Declination Angle |
| SOLEL | Solar Elevation Angle |
| SOLZE | Solar Zenith Angle |
| SSLIP | Sideslip Angle, Reference |
| SSRD | Sideslip Angle, Radome Diff. Pressure |
| STATUS\_VXL | VCSEL Status Code |
| TASF | Aircraft True Airspeed, Fuselage |
| TASFLG | TAS Humidity Correction Flag |
| TASDRY | Aircraft True Airspeed, Not Humidity Corrected |
| TASR | Aircraft True Airspeed, Radome |
| TASX | Aircraft True Airspeed, Reference |
| TCAB | Cabin Temperature at ADS Rack Location |
| TCNTD | CDP Total Counts (all cells) |
| TCNTU\_RWO | UHSAS Total Counts (all cells) |
| THDG | IRS Aircraft True Heading Angle |
| THETA | Potential Temperature |
| THETAE | Equivalent Potential Temperature |
| THETAP | Pseudo-adiabatic Equivalent Potential Temperature |
| THETAV | Virtual Potential Temperature |
| TVIR | Virtual Temperature |
| Time | Time of Measurement |
| UFLWC\_RWO | UHSAS Corrected Flow |
| UI | Wind Vector, East Component |
| UIC | GPS-Corrected Wind Vector, East Component |
| UX | Wind Vector, Longitudinal Component |
| UXC | GPS-Corrected Wind Vector, Longitudinal Component |
| VEW | IRS Ground Speed Vector, East Component |
| VEWC | GPS-Corrected Inertial Ground Speed Vector, East Component |
| VI | Wind Vector, North Component |
| VIC | GPS-Corrected Wind Vector, North Component |
| VISB | Raw Visible Irradiance |
| VMR\_VXL | Volume Mixing Ratio |
| VNS | IRS Ground Speed Vector, North Component |
| VNSC | GPS-Corrected Inertial Ground Speed Vector, North Component |
| VSPD | IRS Vertical Speed |
| VY | Wind Vector, Lateral Component |
| VYC | GPS-Corrected Wind Vector, Lateral Component |
| WD | Horizontal Wind Direction |
| WDC | GPS-Corrected Horizontal Wind Direction |
| WI | Wind Vector, Vertical Gust Component |
| WIC | GPS-Corrected Wind Vector, Vertical Gust Component |
| WS | Horizontal Wind Speed |
| WSC | GPS-Corrected Horizontal Wind Speed |