Counterflow Virtual Impactor (CVI) Data Report: ICE-T, 19 March 2012

PLEASE READ BEFORE USING DATA!

Data provided by NCAR, Cynthia Twohy (twohy@coas.oregonstate.edu), and Darin Toohey (toohey@colorado.edu)

1) CVI File Variable Names in C-130 Netcdf File

Name	Units	Description
CVINLET	none	CVI Inlet Flag: 0=CVI, 1=ambient
CVFXFLOWS	none	*CVI Flow Flag* see below
CVPCN	mb	CVI CN inlet pressure
CVTCN	C	CVI CN inlet temp
CVFX5C	vlpm	CVI user flow 5 (Anderson SEM&TEM)
CVFX6C	vlpm	CVI user flow 6 (Prather ATOF-MS)
CVFX7C	vlpm	CVI user flow 7 (DeMott CFDC)
CVFX8C	vlpm	CVI user flow 8 (DMT SP-2 & APSD)
CVCWC	g m-3	CVI condensed water content
CVRAD	microns	CVI inlet cut radius
CVCFACT	none	CVI concentration factor

2) General Comments

1) Please Note: Condensed water content, CVCWC, was measured with a new TDL using direct absorption at high values. CVCWC is set to missing value for any of these three conditions:

  a) Ambient sample was taken (CVINLET=1)
  b) Airspeed < 85 m/s (takeoff and landing, poor airflow into inlet)
  c) Occasional periods of saturation due to inadequate flows, usually for CVCWC ≥2g/m3 for altitudes flown in this project. See "*Flight Specific Comments*."

2) CVCWC data lagged approximately 3 sec behind wing probes due to sample line and data system delays; this has been corrected in the merged netcdf files.
3) Cut size CVRAD was increased whenever an impactor sample was changed—CVCWC may miss small droplets or ice during that time.
4) CVCWC sometimes had variable baseline offset at low altitudes due to problem with user flow adjustments, which has been corrected to some extent. The most significant of these times are noted in "*Flight Specific Comments*."
5) For discrete passes without saturation but with substantial hysteresis, the CWC in the hysteresis tail following pass was integrated, divided by the number of in-cloud seconds (determined from CDP/FSSP and 2D-C probes) and added back into main cloud pass (Gerber et al., 1998). This will allow accurate CVCWC for integration across the cloud pass, although details of the cloud structure may be lost.

6) A UHSAS optical particle counter was provided by Darin Toohey to measure cloud residual size distributions. This data must be used with caution due to breakup of large drops and ice crystals during sampling. Contact Twohy (twohy@coas.oregonstate.edu) for total UHSAS number concentration and Toohey (Darin.Toohey@Colorado.edu) for actual size distribution data.

3) Flight Specific Comments

RF01: This flight had hysteresis correction of CWC in cloud passes starting at the following times in seconds after midnight: 56858s, 57095s, 57506s, 58269s, 58301s, 58834s. One cloud pass early in flight was saturated, with missing data noted.

RF02: This flight had smaller clouds and therefore no hysteresis correction. However, the TDL had line shift issues that affected the baseline values. This was corrected as much as possible by applying mean offsets, but is still noisy in spots. Many ambient samples were taken this flight in clear air.

RF03: This flight had the old TDL in place due to line shift problems with the new one. Project post-cals from the prior project (PREDICT) for line pressures of 685 to 730 mb were used for the old TDL. Also special hysteresis processing occurred for the following time (UTC sec): 67640s only. Missing data 62895-63177s due to gas cylinder valve swap. High cut size applied for low level clouds at end of flight due to apparent instrument leak issues.

RF04: This flight had larger clouds with hysteresis corrections for passes starting at 65450, 65775, 66046, 67924, 68249, 68315, 68629, 69250, 69718, 70593, 71051, and 71379s. The new TDL again had line shift issues that affected the baseline (out of cloud) values only. This was corrected as much as possible by setting CVCWC at the line shift times to 0. Other clear air data at beginning of flight with poor baseline was replaced with missing data. Two sets of in-cloud saturation periods between 67605-67640s and 70392-70418s were replaced by missing data values. One in-cloud period with no counterflow was set as missing data at 62960-63080s.

RF05: This flight had some special processing of CWC in cloud passes starting at the following times (UTC sec): 61592, 62449, 64412, 64860, 65490, 67425, 68247, 68441, 68601, 68799, 69276, 69734, and 70217s. Missing data in saturated cloud pass 635298-63598s. Low cloud passes at beginning of flight had high baseline due to user flow issues—adjusted as possible.

RF06: This flight had some special processing of CWC in cloud passes starting at the following times (UTC sec): 55202, 55226, 55565, 55607, 56154, 56590, 56998, 57558, 57863, 58180, and 58542s. Missing data in saturated cloud passes starting at 54736s, 56156s and 58841s. Missing data for some of low cloud passes early in flight due to user flow problems.

RF07: This flight had some special processing of CWC in cloud passes starting at the following times (UTC sec): 61255, 64570, 64598, 65278, 65605, and 66348s. Missing data 58888-59289 due to TDL line shift issues, 69373-69698s due to user flow issues.

RF08: This flight had no special processing of CWC in cloud passes, since they were small clouds only. Variable CWC baseline at end of flight cloud passes (48418-49211s) due to user flow issues.

RF09: This flight had special processing of CWC in cloud passes starting at the following times (UTC sec): 51598, 52225, 52995, 54099, 55038, 56635, 56752, 57486, 57660, 57919, 58155, 58327, 60805, 61175, and 66048s. Missing data in saturated cloud pass 635298-63598s. Low cloud passes at beginning and end of flight had high baseline due to user flow issues--adjusted as possible.. Some missing data here as a result.

RF10: This flight had some special processing of CWC in cloud passes starting at the following times (UTC seconds): 67179s, 68811, 70772, 71102, 71148, NS 82032s. Also missing data during saturated passes starting at 69580s (very high 2D-C conc) and 71828s.

RF11: This flight had some special processing of CWC in cloud passes starting at the following times per special request (UTC sec): 55934, 56163, 56416, 56804, 57063, 65979, 66751, 68423, 68783, 69310, 70531s. Other cloud passes exhibiting substantial hysteresis (57332, 57521, 57553, 58447, 59409, 69771s) were also corrected by this technique.

RF12: This flight had some special processing of CWC in cloud passes starting at the following times per special request (UTC sec): 63629, 64731, 66780, 67189, 68096, 68729s. Other cloud passes exhibiting substantial hysteresis (54345, 54764, 54978, 55367, 55457, 56154, 56536, 60539, 63993, 65116, 65817, 66218, 67096, 67776s) were also corrected by this technique. Two periods with saturation in CVI system set as missing data (starting at 54649 and 65095s.)

RF13: This flight had some special processing of CWC in all heavy cloud passes starting at the following times (UTC sec): 57830, 57873, 58161, 58536, 58846, 59181, 59483, 59941, 60219, 61992, 62368, 62746, 63127, 63997, 64486, 64890, 65713, 66002, 67281s. One period with saturation in CVI system set as missing data (starting at 66360s.) One period set to missing data dude to user valve problems (66984-67176s.)

4) CVFXFLOWS Key

The number in the first column, below, is the CVFXFLOWS integer value in the netcdf file. The second set of values is what combination of user instruments were on CVI at that particular time period, according to the table below.

1: CVFX5C
2: CVFX6C
3: CVFX5C, CVFX6C
4: CVFX7C
5: CVFX5C, CVFX7C
6: CVFX6C, CVFX7C
7: CVFX5C, CVFX6C, CVFX7C
8: CVFX8C
9: CVFX5C, CVFX8C
10: CVFX6C, CVFX8C
11: CVFX5C, CVFX6C, CVFX8C
12: CVFX7C, CVFX8C
13: CVFX5C, CVFX7C, CVFX8C
14: CVFX6C, CVFX7C, CVFX8C
15: CVFX5C, CVFX6C, CVFX7C, CVFX8C

Name	Description
CVFX5C	CVI user flow 5 (Anderson SEM&TEM)
CVFX6C	CVI user flow 6 (Prather ATOF-MS)
CVFX7C	CVI user flow 7 (DeMott CFDC)
CVFX8C	CVI user flow 8 (DMT SP-2 & APSD)

Reference:

Gerber, H., C. H. Twohy, B. Gandrud, A. J. Heymsfield, G. M. McFarquhar, P. J. DeMott, and D. C. Rogers, 1998: Measurements of wave-cloud microphysical properties with two new aircraft probes. *Geophys. Res. Lett.*, **25**, 1117-1120.