

RICO C-130
Instrumentation
Performance Review &
Data Summary
By
Allen Schanot

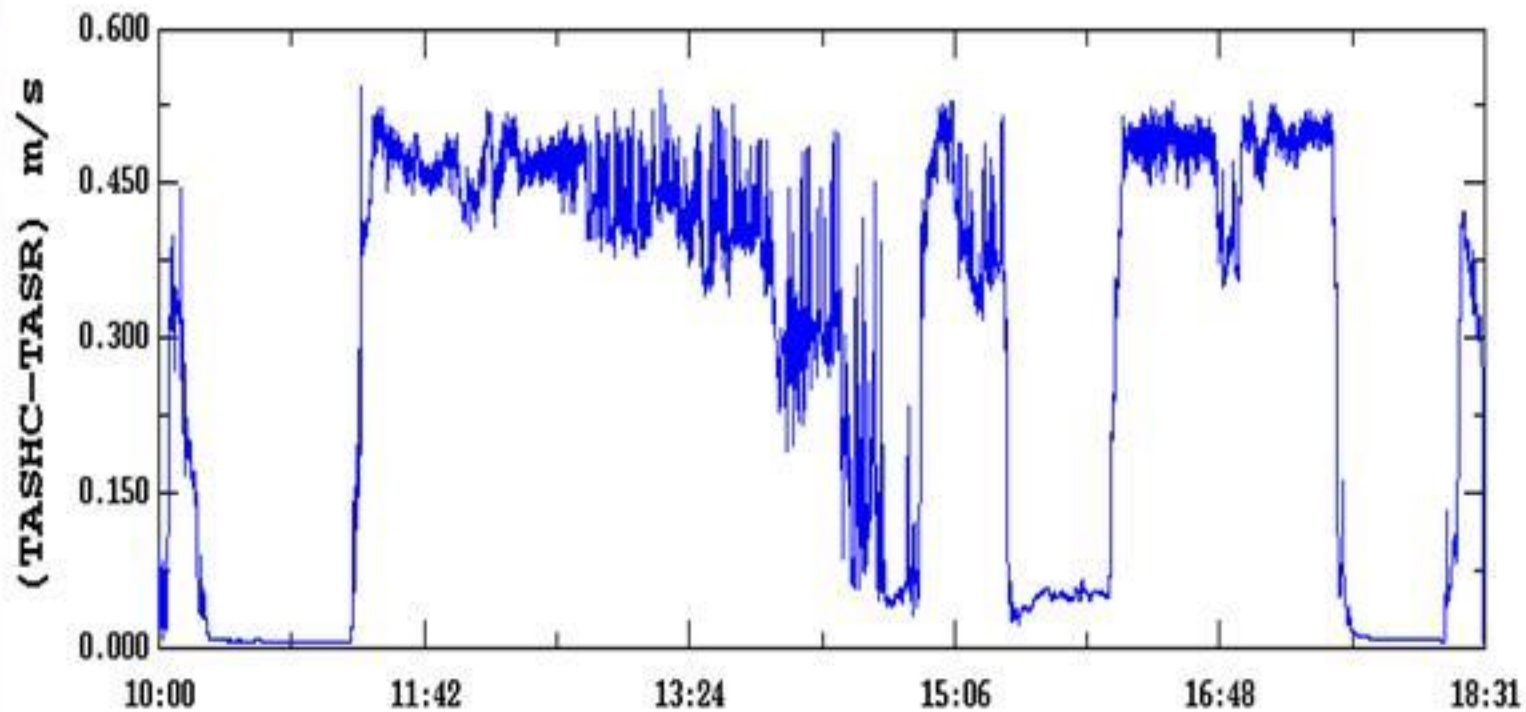
Project Documentation

- RAF web site: raf.atd.ucar.edu/Projects/
 - Detailed Q.A. Summary
 - Instrumentation List / Configuration Charts
 - Calibration Summaries
 - Variable Lists / with definitions
- JOSS web site: joss.ucar.edu/rico/catalog/
 - General overview of specific missions
 - Flight specific instrumentation status

Dynamics - 1

- Ongoing effort to improve 3-D Winds
 - Trailing Cone comparison produces new pcor's / additional testing with diff. GPS on RICO
 - Lenschow review of HRT performance
 - New code to improve GPS correction to ground speed components
 - “Wet” airspeed used as TASX reference (up to +0.5 m/s correction)
 - PITCH & THDG offsets from Cal maneuvers

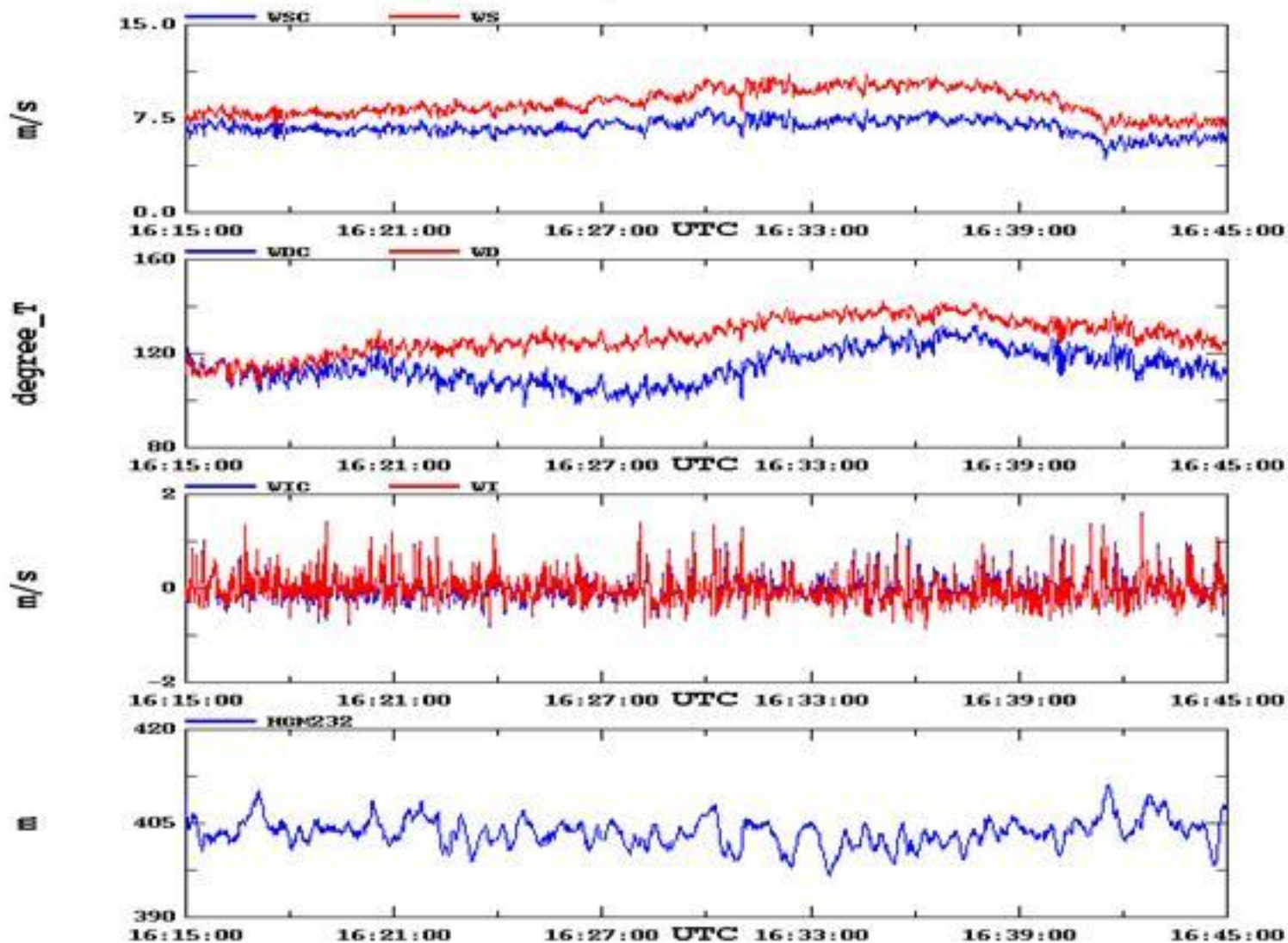
Wet Airspeed



mean	sigma	var	min	max
0.29	0.20	0.04	0.00	0.54

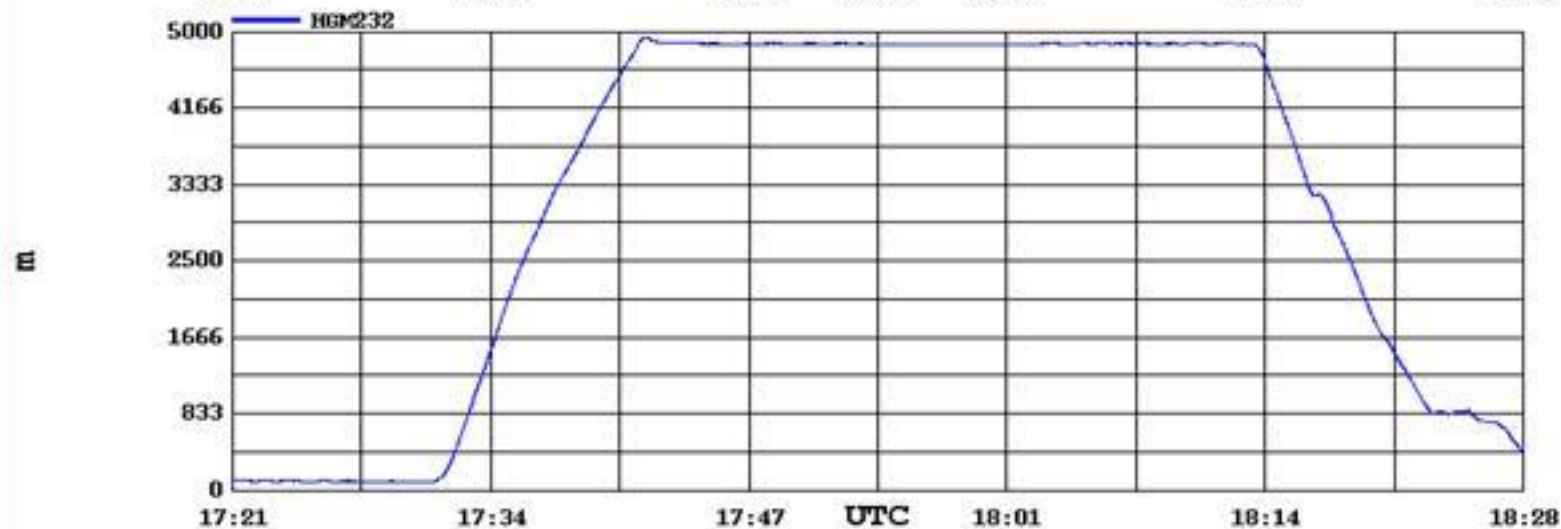
GPS Wind Corrections

RICO, Flight #rf18
01/23/2005, 16:15:00-16:45:00



Vertical Velocity

RICO, Flight #rf18
01/23/2005, 17:21:00-18:28:00



Dynamics - 2

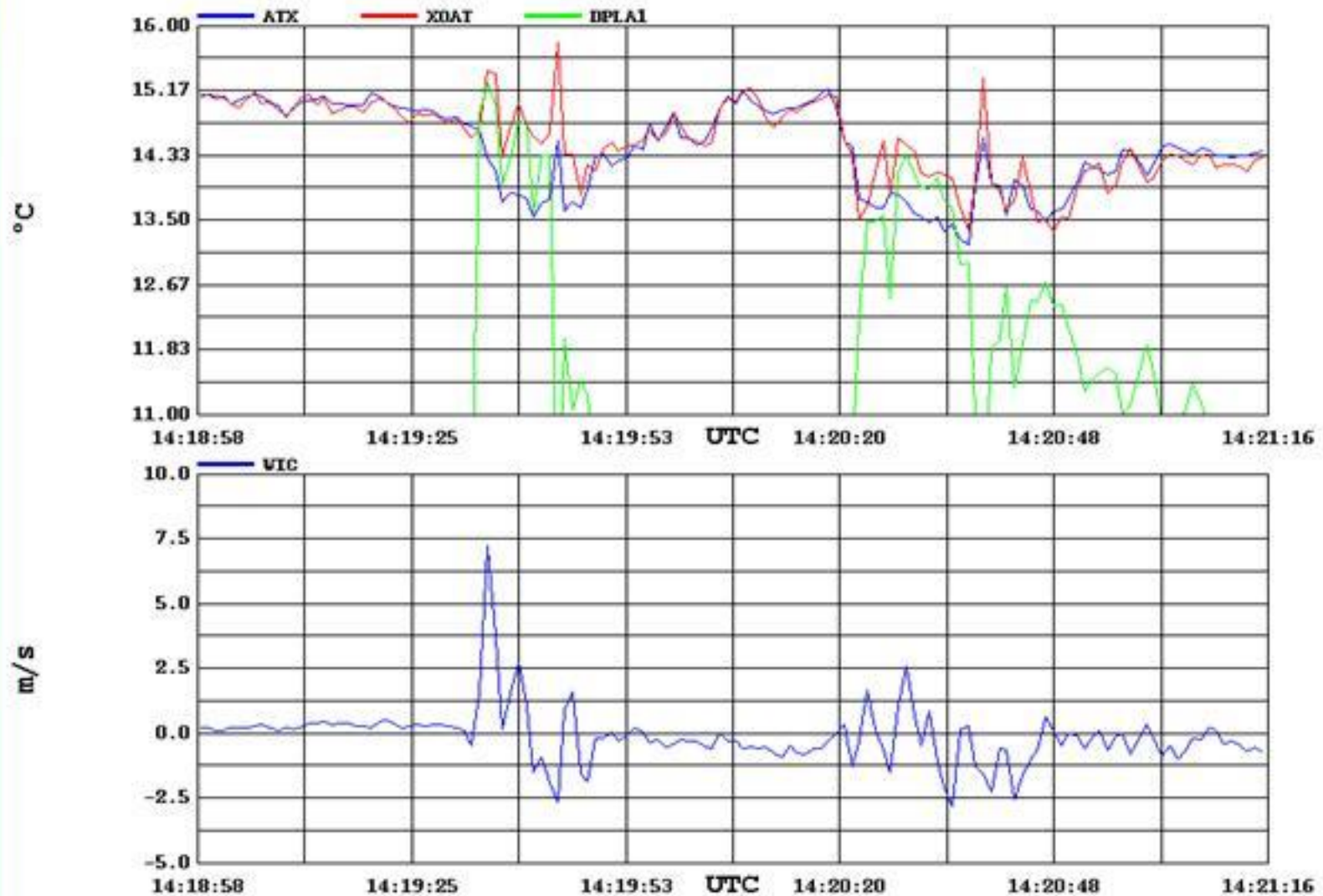
- Recommendations / Warnings
 - Airspeed correction impacts intercomparisons
 - Significant drift in IRS. Use GPS corrected winds (WSC, WDC, etc) and position data
 - Choose vertical wind variable by performance (WIC = fn(VSPD) / climbs - general)
(WI = fn(WP3) / descents)

Temperature - 1

- Reference Sensor ($ATX = ATRR$)
 - Rosemount unheated 102 / radome ring
 - In-cloud wetting
- OPHIR Radiometric
 - Not an independent calibration (OAT – project) / (XOAT – loose coupled)
 - Sfc included in field of view for sharp turns
- Wet/Dry Bulb
 - Raw data / calibration adjustments required

Sensor Wetting

RICO, Flight #rf18
01/23/2005, 14:18:58-14:21:16



Temperature - 2

■ Recommendations

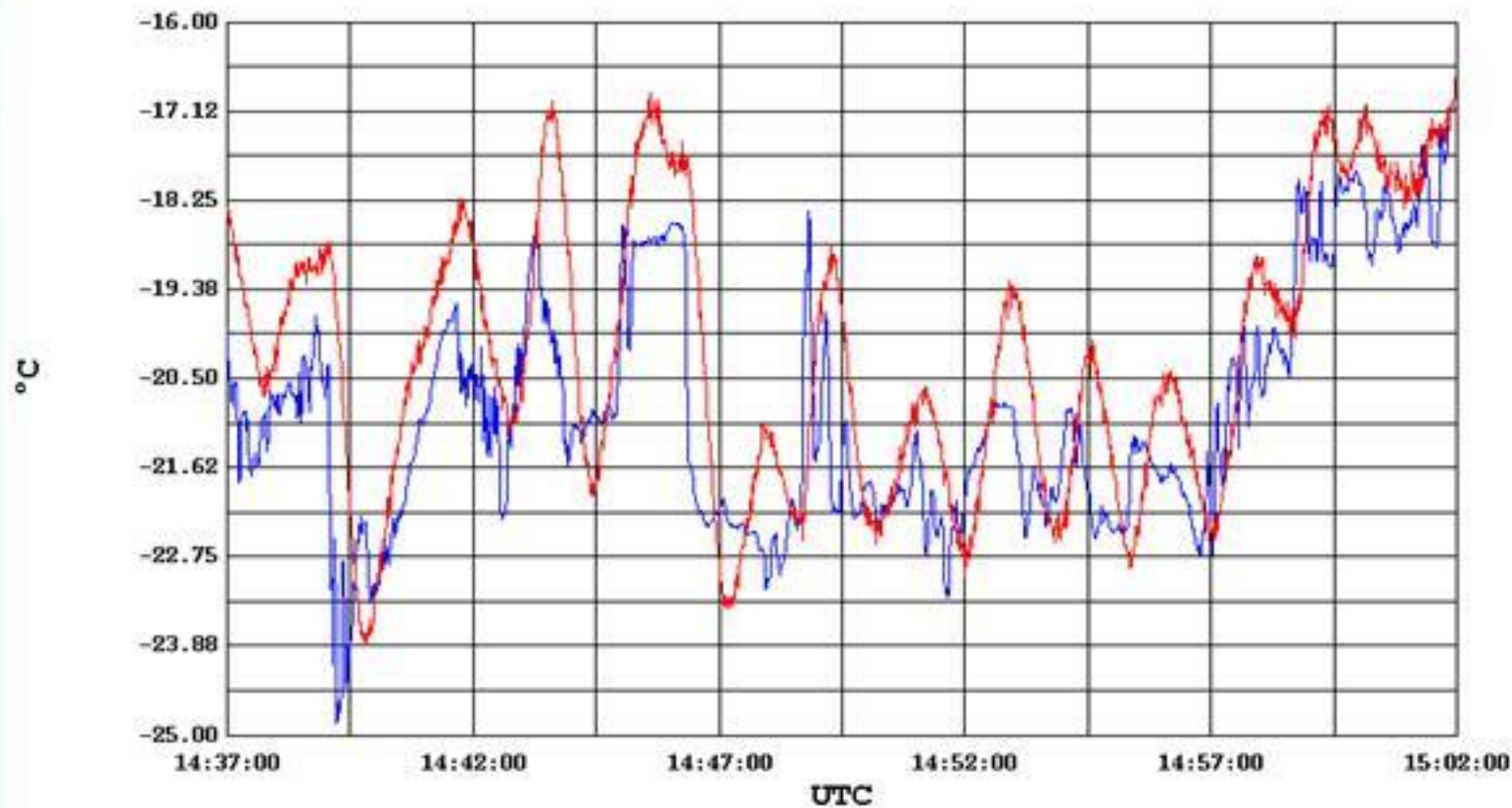
- Use *ATX* for clear air
- Use *XOAT* for cloud penetrations (wall-to-wall)
- Do not use wet/dry bulb data at this time

Humidity - 1

- **Reference Sensor (DPXC = DPBC)**
 - GE 1011b / radome ring
 - Input to derived parameters (THETA_E, TASHC, etc)
 - Time response dependent on Td depression
 - Overshooting for rapid humidity changes
- **Lyman-alpha**
 - Not an independent calibration (loose couple processing)
 - Gain shifts for isolated flight sections
 - Sensor swap (MRLA to MRLA1 for rf14-rf19)
- **TDL Laser Hygrometer**
 - Extensive post processing required

Time Response Differences

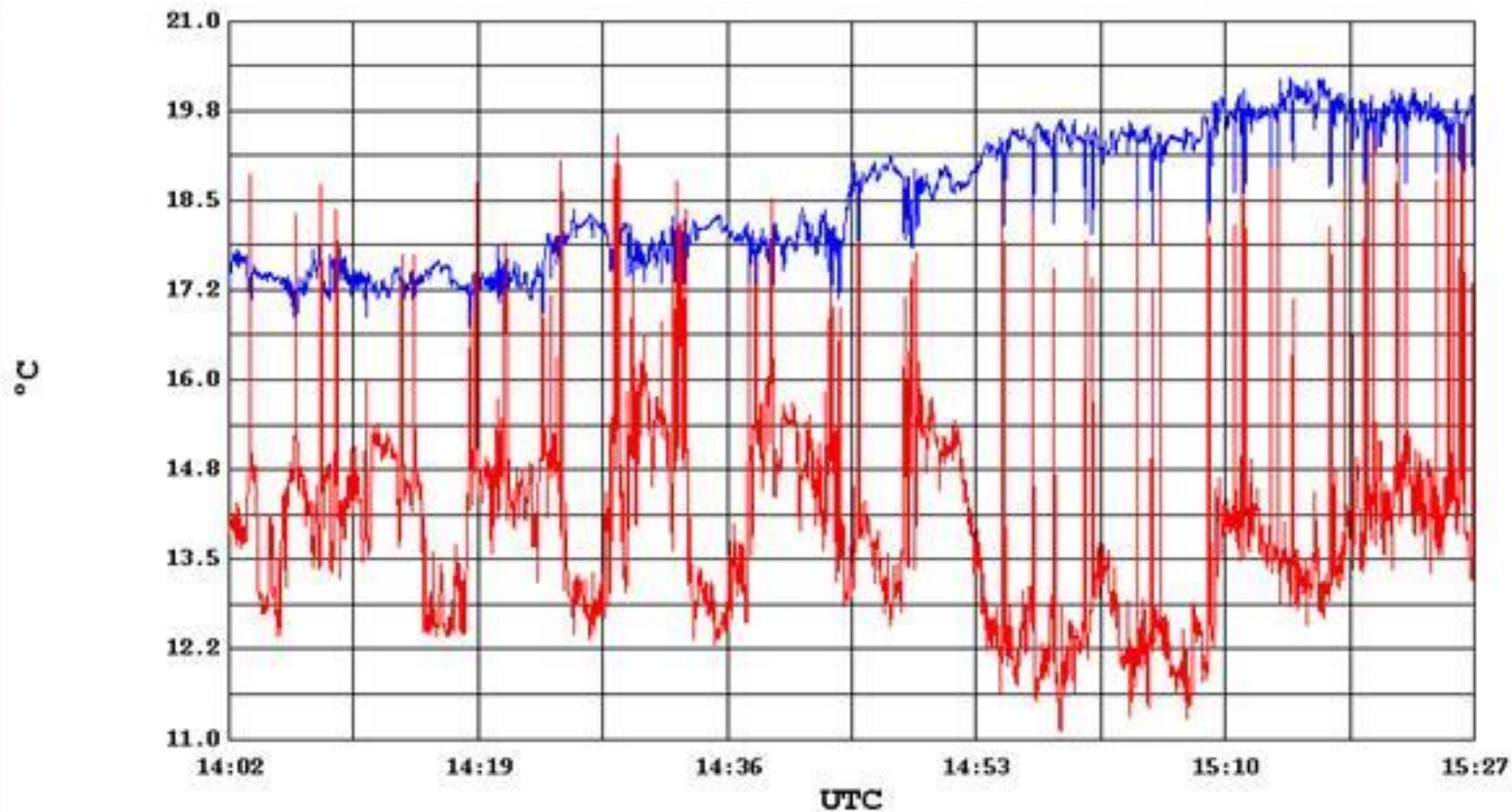
RICO, Flight #rf06
12/16/2004, 14:37:00-15:02:00



	mean	sigma	min	max
DPBC (°C), 1 s/sec	-20.19	1.73	-23.86	-16.69
DPLA (°C), 1 s/sec	-20.92	1.48	-24.85	-17.07

Lyman-alpha Response - 1

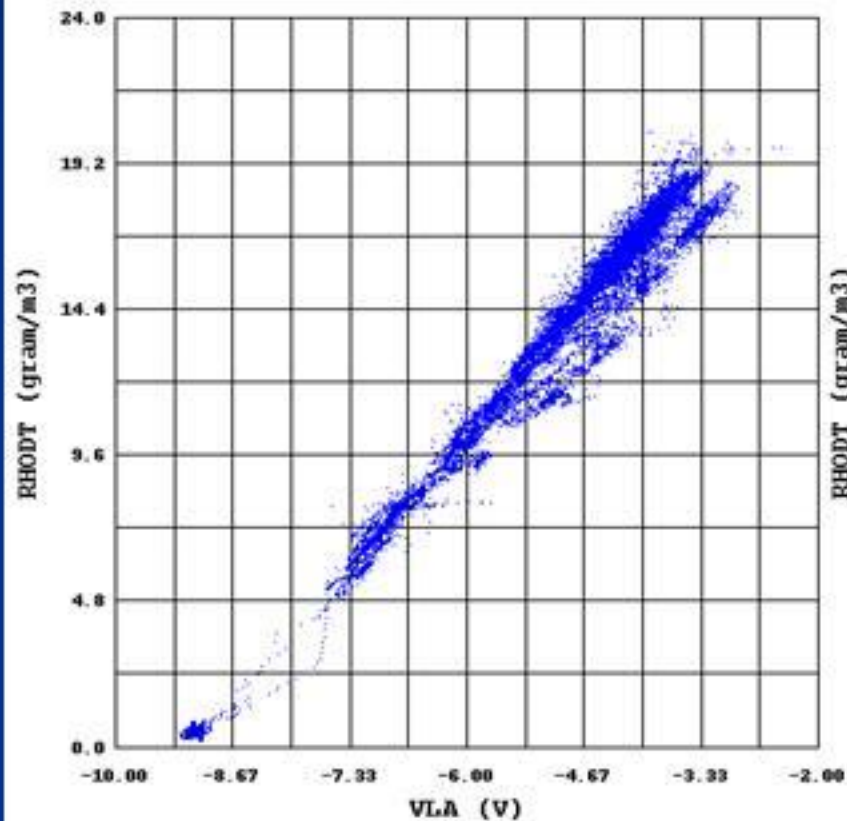
RICO, Flight #rf09
12/20/2004, 14:02:00-15:27:00



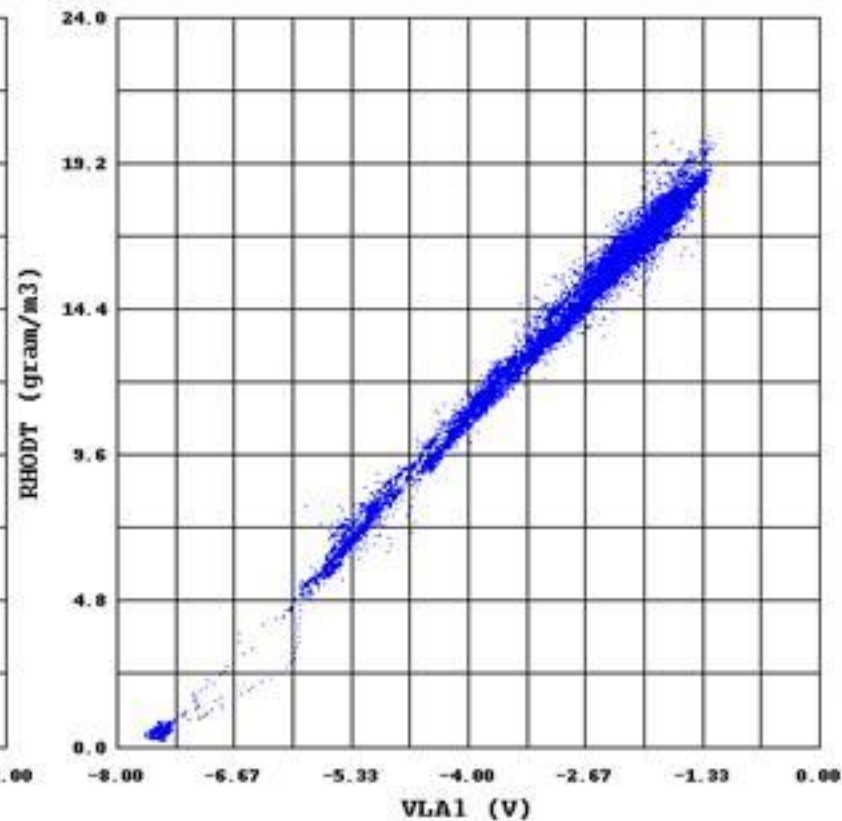
	mean	sigma	min	max
DPLA (°C), 1 s/sec	13.97	1.32	11.10	19.54
ATX (°C), 1 s/sec	18.50	0.95	16.34	20.21

Lyman-alpha Response - 2

RICO, Flight #rf16
01/18/2005, 11:28:44-19:11:57



— RHODT (gram/m³)
— VLA (V)



— RHODT (gram/m³)
— VLA1 (V)

Humidity - 2

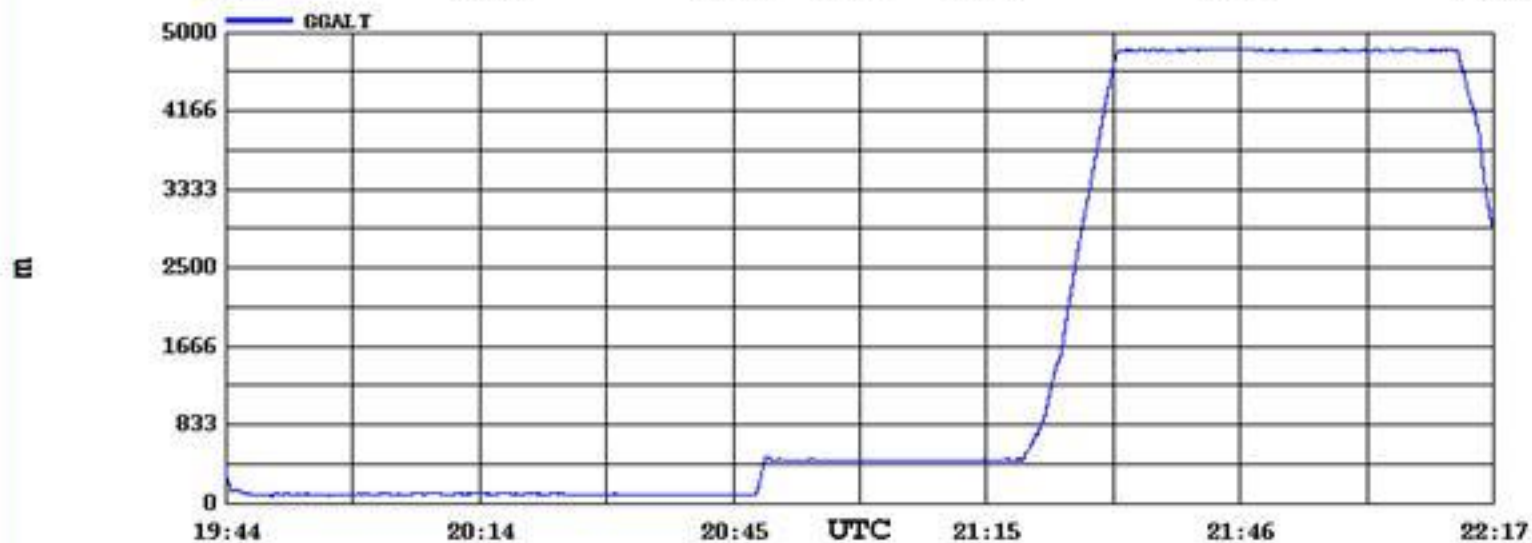
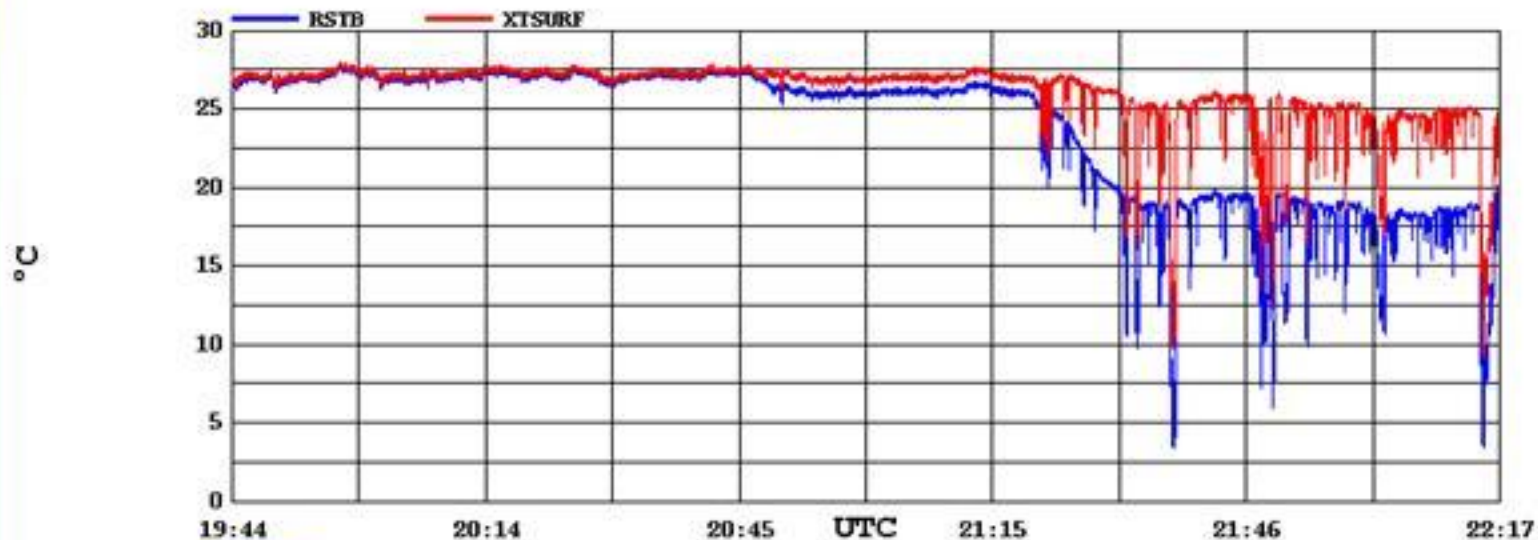
- Recommendations & Warnings
 - Use lyman-alpha data for all work around clouds / cross flow housing prevents wetting
 - Be aware of isolated response problem on some cloud passes
 - TDL data still being processed.

Surface Temperature

- Reference Sensor (RSTB)
 - Heimann KT-19 (2 down / 1 up)
 - Altitude dependent / see corrected XTSURF
 - Minor thermal drift at altitude

Remote Surface Temperature

RICO, Flight #rf15
01/16/2005, 19:44:10-22:17:00

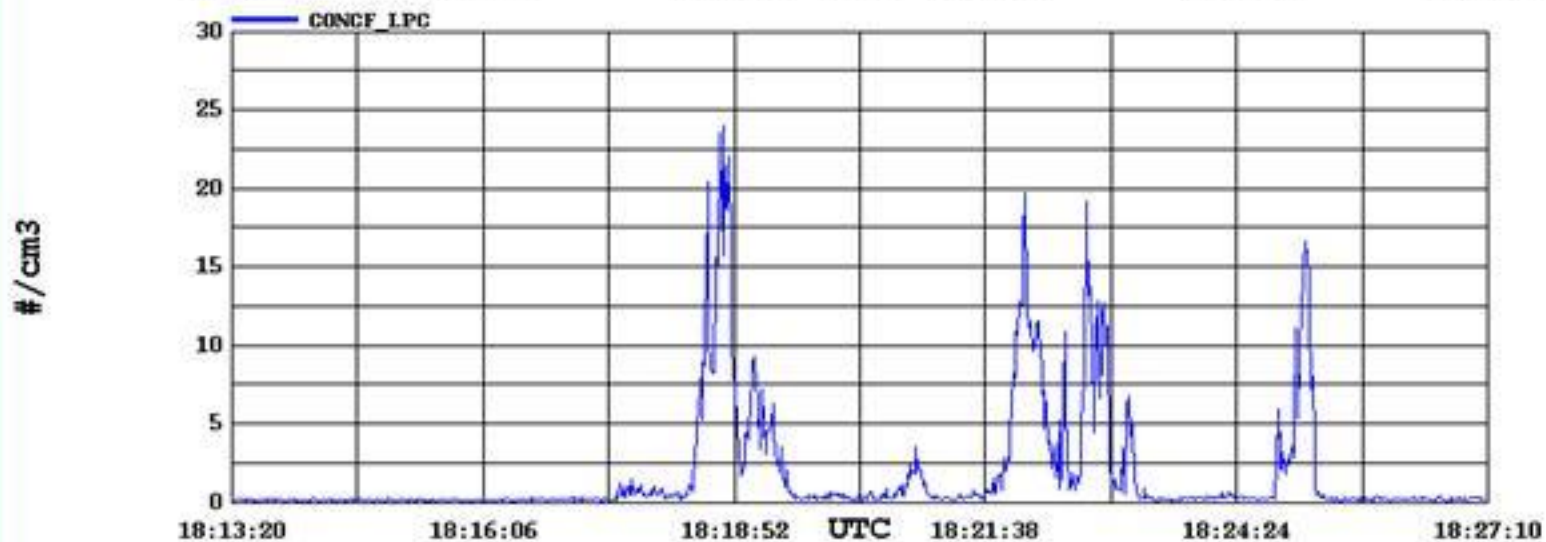
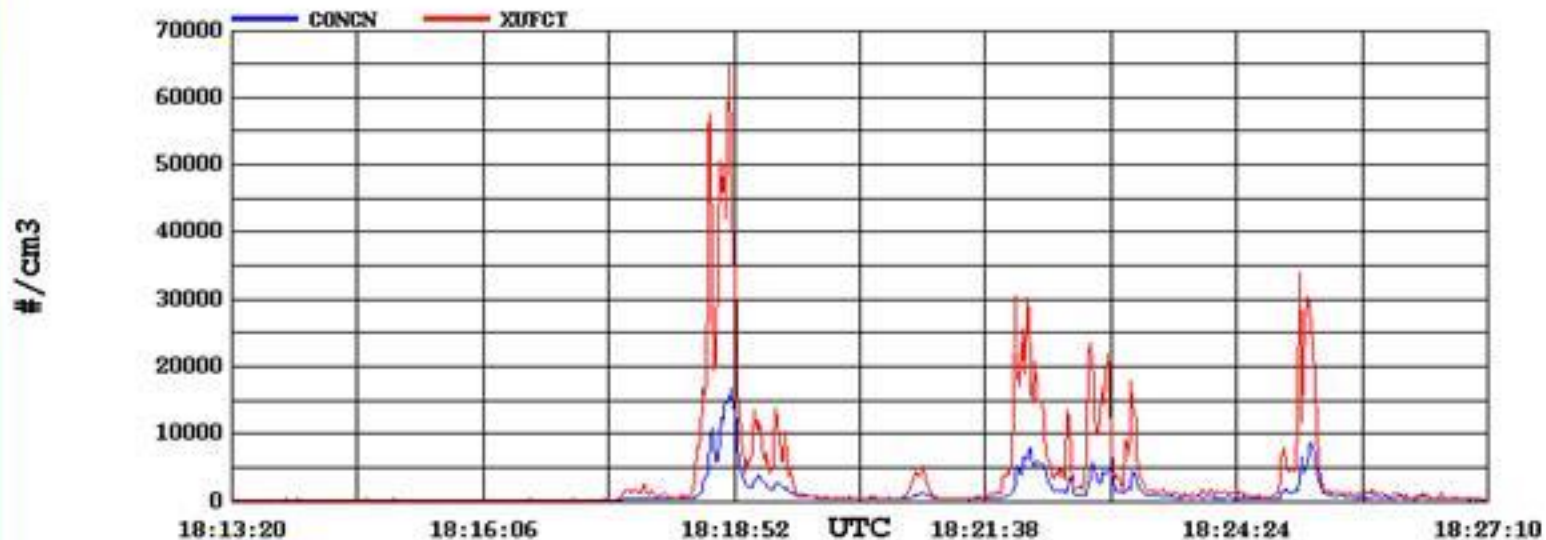


Standard Aerosols

- **CN – Total Conc. (not STC): 0.01 – 3 μm**
 - Aft facing belly inlet / time delayed (3 s)
 - Inlet changed between rf09 & rf10
 - In-cloud droplet shattering / not valid in-cloud
- **Ultrafine CN – Total Conc. (not STC): 0.003 – 3 μm**
 - Aft facing belly inlet / time delayed (3 s)
 - In-cloud droplet shattering / not valid in-cloud
- **Small Aerosols – Size Distribution: 0.1 – 3 μm**
 - Sampling technique invalid in-cloud
 - Sample volume measured directly & corrected (not STC)

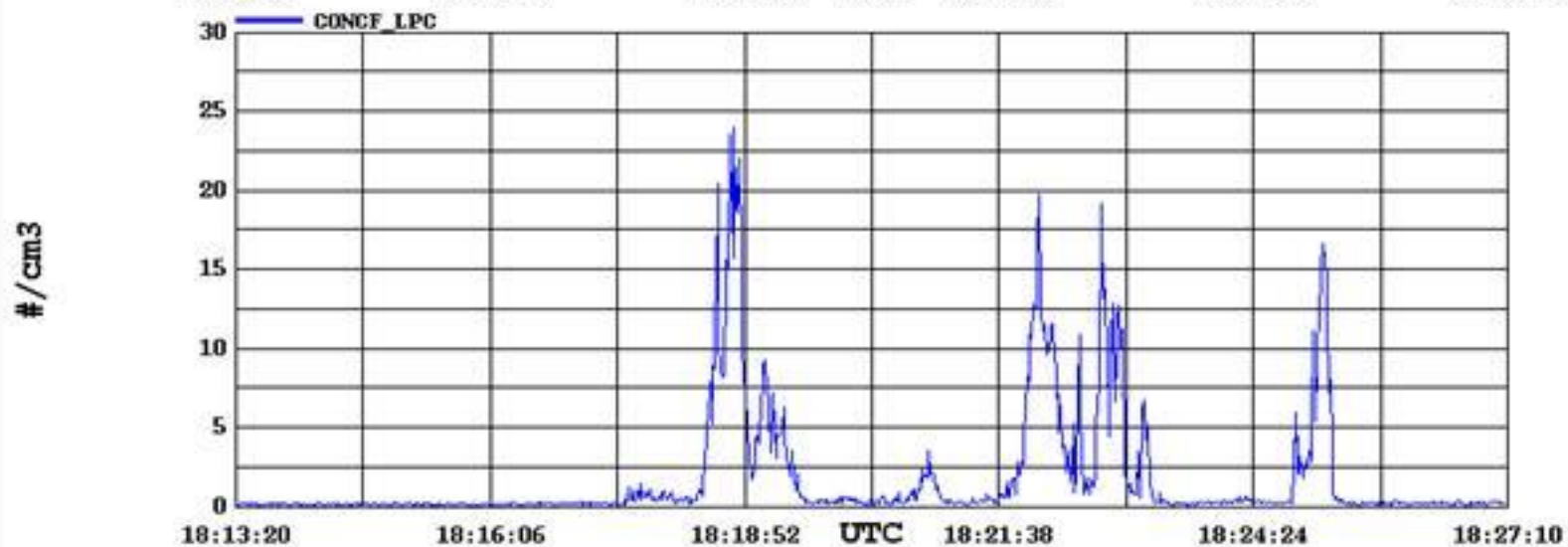
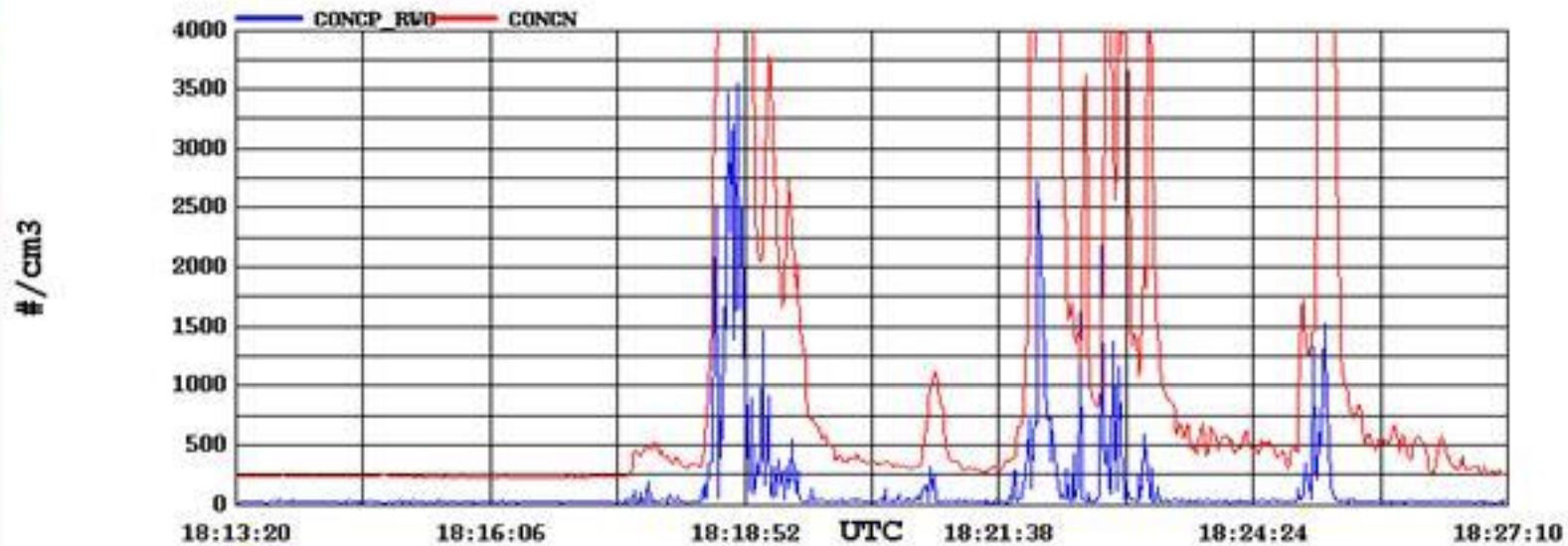
Inlet Droplet Shattering

RICO, Flight #rf15
01/16/2005, 18:13:20-18:27:10



PCASP / SPP-200 Sampling

RICO, Flight #rf15
01/16/2005, 18:13:20-18:27:10



Liquid Water

- Reference Sensor (PLWCC)
 - King Probe / left wing
 - Flight-by-flight wire temperature adjustment
 - Zero-LC offset correction (LRT set only)
- PMS: SPP-100 / FSSP / left wing
 - Set size distribution / stable calibration history
- PVM100 / left wing
 - Zero-cal offset adjustment (LRT & HRT)
- King Probe (PLWCC1) / right wing
 - Flight-by-flight & zero offset correction (LRT only)
- Icing Rate (RICE)
 - Droplet impact signal only (delta 0.2 vdc / normal 5.0 vdc)

Probe Performance Comparison - Dec

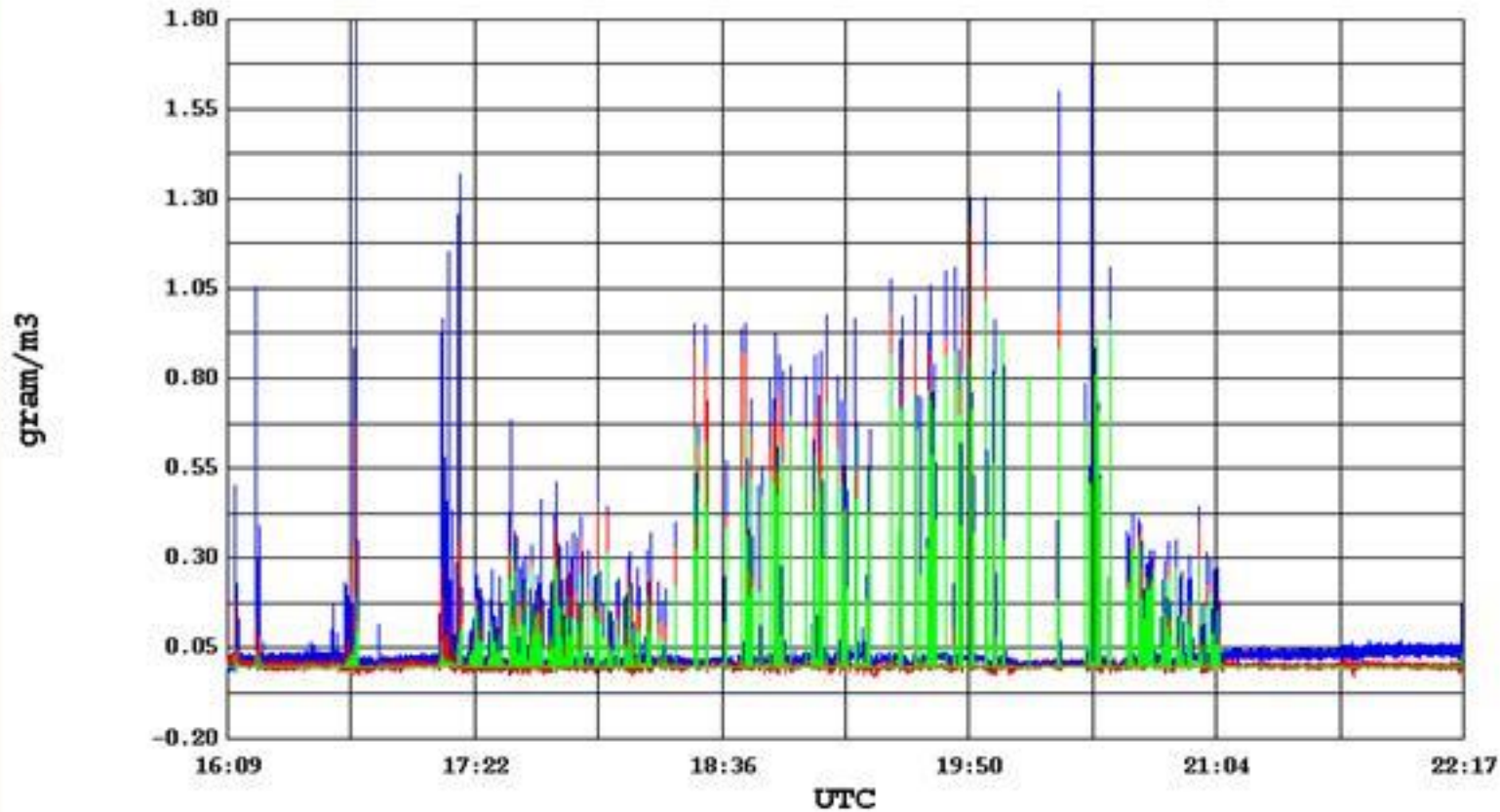
Flight Number	Spp-100 Post Flt Activity	PLWCC/PLWCF	XGLWC/PLWCF
RF01		0.72	0.78
RF02	Cleaning	0.96*	1.17*
RF03		1.37	1.39
RF04	Cleaning / Cal	1.40	1.47
RF05	Cleaning / Cal	0.97	0.97
RF06		1.08	1.32
RF07	Cleaning	0.91	0.77
RF08		0.82	0.73
RF09	Cleaning / Cal	0.78	0.85

Probe Performance Comparison - Jan

Flight Number	Spp-100 Post Flt Activity	PLWCC/PLWCF	XGLWC/PLWCF
RF10		0.77	0.81
RF11	Cleaning	0.96	0.79
RF12		0.96	1.02
RF13	Cleaning	1.06	0.80
RF14		1.02	1.07
RF15	Cleaning / Cal	1.01	0.95
RF16		0.88*	0.71*
RF17	Cleaning	0.84	0.65
RF18	Cleaning	0.73	0.75
RF19		no PLWCF	no PLWCF

Baseline Adjustment

RICO, Flight #rf14
01/14/2005, 16:09:00-22:17:55



	mean	sigma	min	max
PLVCF_LPC (gram/m3), 1 s/sec	0.01	0.07	0.00	1.01
PLVCC (gram/m3), 1 s/sec	0.01	0.08	-0.03	1.22
PLVCC (gram/m3), 25 s/sec	0.04	0.08	-0.03	1.79

Radiometers

■ General Comments

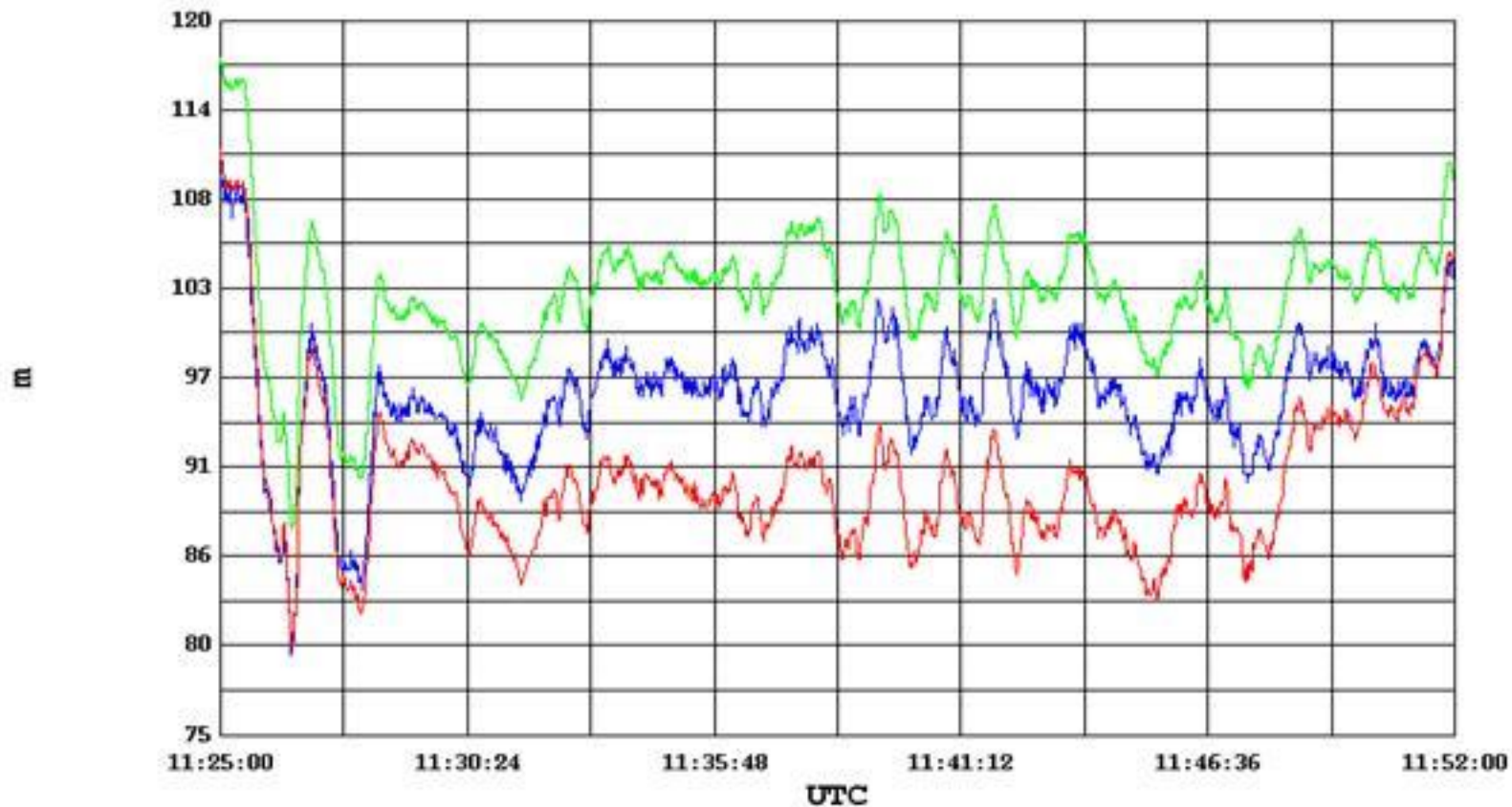
- No aircraft attitude adjustments
- Short wave (SWT, SWB) / no issues
- Ultraviolet (UVT, UVB) / no issues
- Infrared (IRTC, IRBC) / no issues
 - Corrected for variations in dome & sink temps

Altitude / Diff. GPS

- Reference / Garmin-16 (GGALTC)
 - Oscillations remain (+- 10 m)
- Radar Altimeter
 - Accuracy decreases with altitude
 - Sharp turns influence data
- Pressure Altitude
 - Std atmosphere / $T_{sfc}=305K$; $P_{sfc}=1013mb$
- Differential GPS
 - Extensive post processing required
 - Accuracy: 15 cm lateral; 20 cm vertical

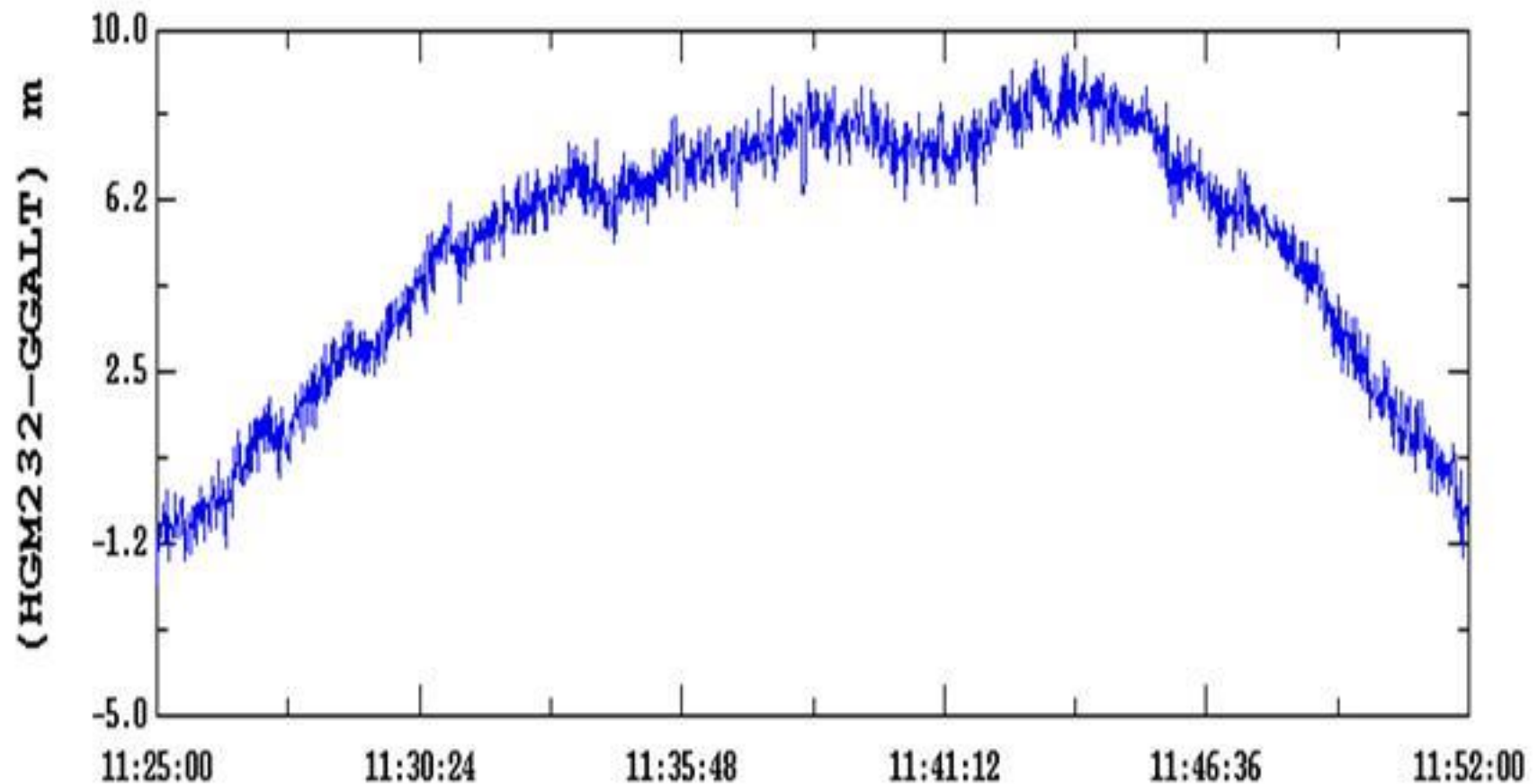
Altitude Options

RICO, Flight #rf18
01/23/2005, 11:25:00-11:52:00



	mean	sigma	min	max
H-MSL (Unk), 25 s/sec	102.70	4.02	87.96	117.62
GGALY (n), 1 s/sec	90.98	4.78	80.40	111.90
HGM232 (n), 1 s/sec	96.24	3.99	79.98	110.22

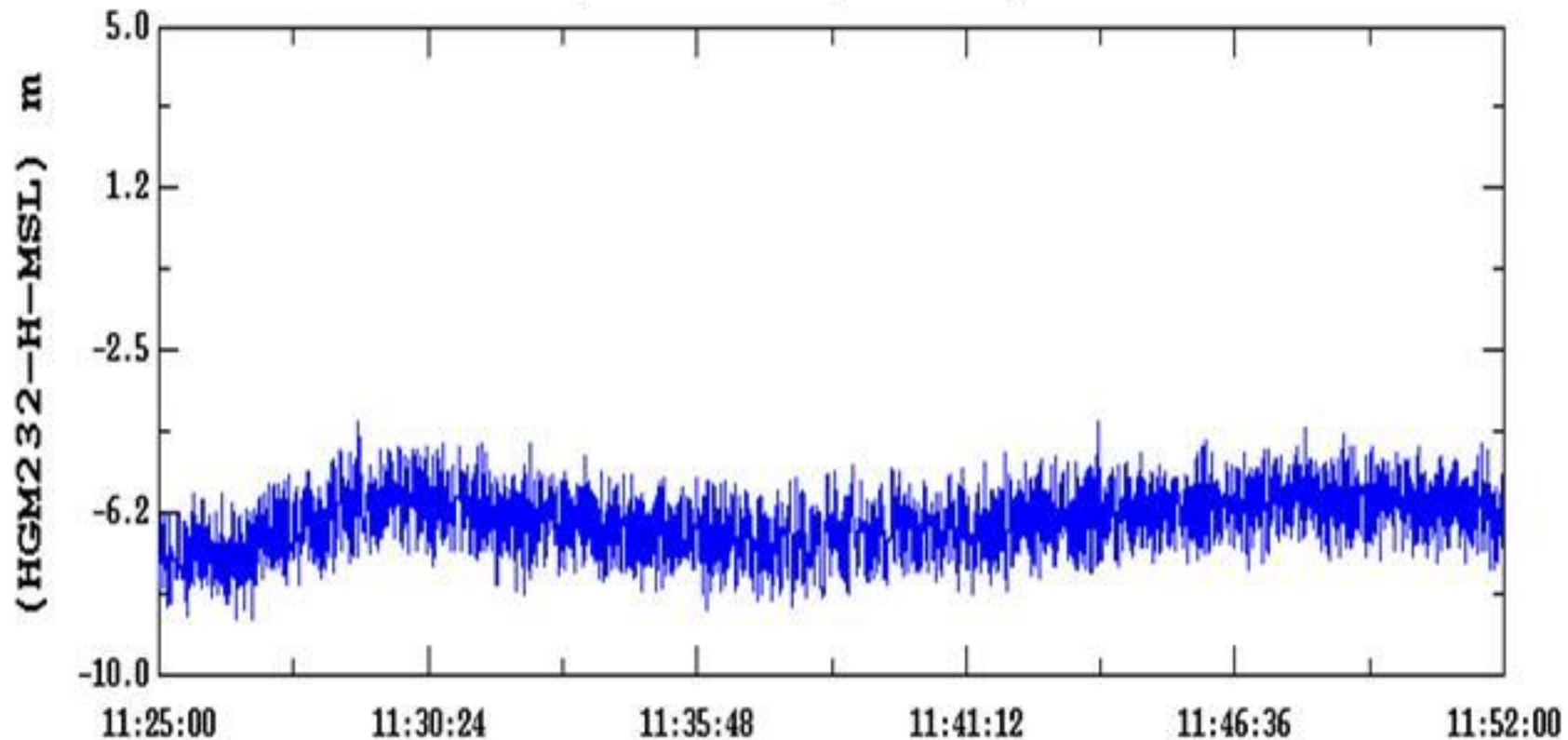
Reference GPS



mean	sigma	var	min	max
5.25	2.84	8.04	-2.17	9.45

Differential GPS

This plot contains preliminary data



mean	sigma	var	min	max
-6.47	0.64	0.41	-8.73	-4.15

Data Access Summary

Measurement	Status	Format	Rate	Availability
RAF Std Instrumentation	Complete	netCDF	1 sps	Current
RAF Std Instrumentation	Complete	netCDF	25 sps	Current
PMS-2D Particles	Complete	binary	async	Current
TDL Humidity	Processing	ASCII	18 sps	Aug 05
RDMA	Processing	netCDF	90 s	Aug 05
Wet/Dry Nephelometer	QA pending	netCDF	1 sps	Current
Giant Nuclei	Processing	ASCII	async	Mar 06
Wet/Dry Bulb Temp	Needs calibration	netCDF	1 sps	Dec 05
Special Chemistry: O ₃ ,CO	Processing	ASCII	25, 1 sps	Aug 05
CVI – Special Request	On Hold			Special
Differential GPS	Processing	netCDF	1 sps	Dec 05
GPS Dropsonde	Complete	text	2 sps	Current
SABL	Complete	netCDF/png	1 sps+	Current
Digital Video	Complete	MPEG 4 / JPEG	1 sps+	6/27/05

EOL - Special Display Tools

- ncplot / C-130 std parameters
 - LINUX / time, XY, XYZ plots & spectral analysis tools
- ncpp / C-130 PMS size distribution
 - LINUX
- xpms2d / C-130 PMS-2D images & stats
 - LINUX
- n2asc / netCDF to ASCII conversion
 - LINUX
- sabl_nc / Profile data to time segment SABL Images
 - IDL / generate - customize 2 dimensional profiles
- aspen / Dropsonde QA & visualization
 - WINDOWS / manipulate and output netDCF, ASCII, CSD
- aeros-beta / C-130 std parameters
 - WINDOWS & LINUX / time, XY, XYZ plots & spectral analysis tools

Aircraft Intercomparisons

■ C-130 to King Air

- 12/10/04 : C-130 RF04 / UW-20041210
 - Time together: 1600 to 1630 CUT / wing-to-wing
- 12/19/04 : C-130 RF08 / UW-20041219
 - Time together: 1342 to 1355 CUT / staggered

■ C-130 to BAE-146

- 1/23/05 : C-130 RF18 / B079
 - Time together: 1550 to 1700 CUT?

■ C-130 to Seward Johnson

- 1/11/05 : C-130 RF12
 - Time together: ?

Video

■ Digital Video

- Fwd View MPEG-4 loops enhanced with time, position, and a list of selected state parameters
- Individual second-by-second images
- Access files through normal file downloads

■ VHS Video

- Fwd, Down, & Side looking video tape recordings enhanced with time and position data
- Access through copies of original tapes included in JOSS archive

Bermuda Triangle Incident

- Bad “auto” date used in processing of C-130 flight FF05. Files accessed prior to 6/27/05 will have the flight date recorded as 1/25/05. New files correct the date to 1/26/05.