

RAF aerosol data

Rogers, Schanot & RAF technical staff

Aerosol measurements

- *C-130 netcdf*
- *CN & UltraFine CN*
- *RDMA*
- *nephelometers*
- *PCASP = SPP200*

inlets & tubing

- *RAF inlets*
- *DRI inlet*

Losses, delays, artifacts

- *losses*
- *time delays*
- *splash artifacts*



CN & UltraFine

total particle concentration

> 10 nm (CN) or 3 nm (UF)

ten variables:

<i>CNTEMP</i>	<i>CN Counter Inlet Temperature</i>
<i>CNTS</i>	<i>TSI CN Counter Output</i>
<i>CONCN</i>	<i>Condensation Nuclei (CN) Concentration</i>
<i>FCN</i>	<i>Raw CN Counter Sample Flow Rate</i>
<i>FCNC</i>	<i>Corrected CN Counter Sample Flow Rate</i>
<i>PCN</i>	<i>CN Counter Inlet Pressure</i>
<i>XICN</i>	<i>CN Isokinetic Side Flow Rate</i>
<i>XICNC</i>	<i>Corrected CN Isokinetic Side Flow Rate</i>
<i>XUFCT</i>	<i>Ultra Fine CN Counter Output</i>
<i>XUFFLOW</i>	<i>Ultr-fine CN Counter Flow</i>

RDMA

radial differential mobility analyzer

aerosol size distribution & concentration

- *8 to 130 nm, 60 channels*
- *one size distribution ~90 seconds*

calibrations

- *80 & 100 nm PSL*

status:

part of C-130 netcdf file as "missing data"

- *later release will overwrite with real values*

applying corrections for air density

- *affects sizes & concentrations*

submission date: end of August

RDMA - 11 variables + size distr.

CRDMA_FCR array of dN/dLogD

CONCR_FCR RDMA Concentration (all particles)

RDMAHVPS_FCR RDMA High Voltage Power Supply

RDMA_PABS_FCR RDMA Absolute Pressure

RDMAQA_FCR RDMA Aerosol Inflow

RDMAQEX_FCR RDMA Excess Outflow

RDMAQSH_FCR RDMA Sheath Inflow

RDMAQS_FCR RDMA Classified Aerosol Outflow

RDMARH_FCR RDMA Relative Humidity

RDMA_TEMP_FCR RDMA Sample Temperature

RDMAVD_FCR RDMA Dilution Valve Control Voltage

RDMAVSH_FCR RDMA Sheath Valve Control Voltage

RAF nephelometers

optical extinction, scattering
at 540 nm

calibrate

- CO_2 - dry air - $RF134a$

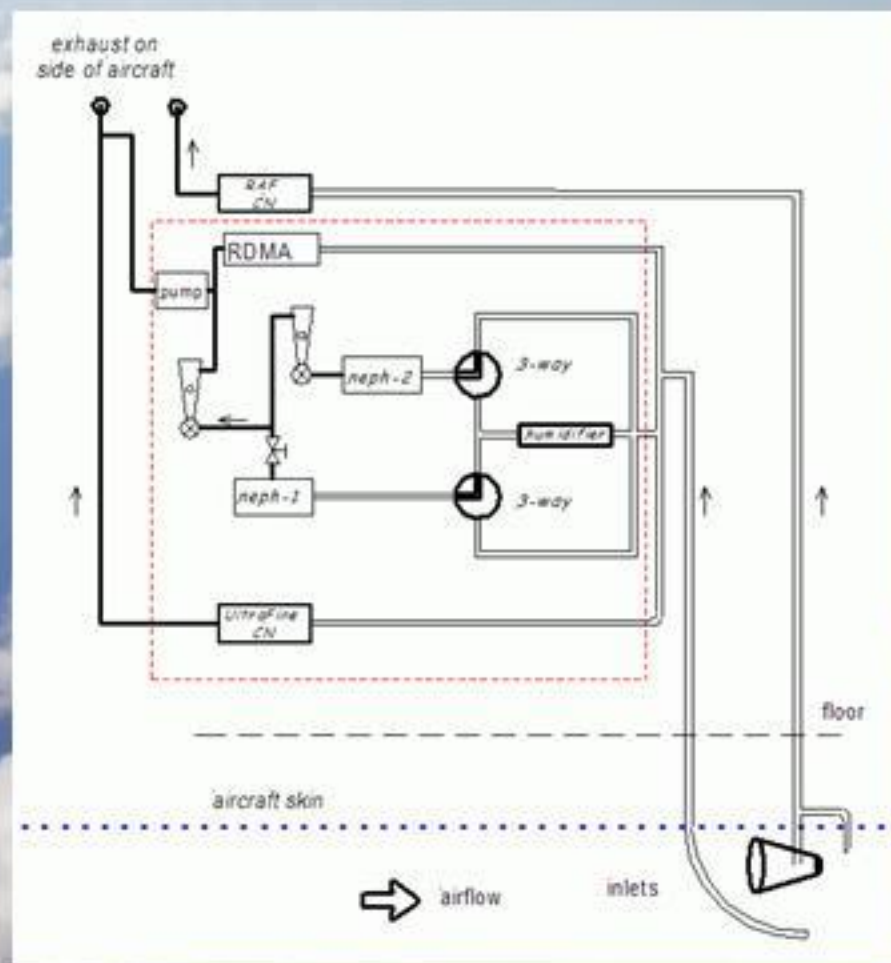
two nephs

- one humidified $RH = 80\%$

changes:

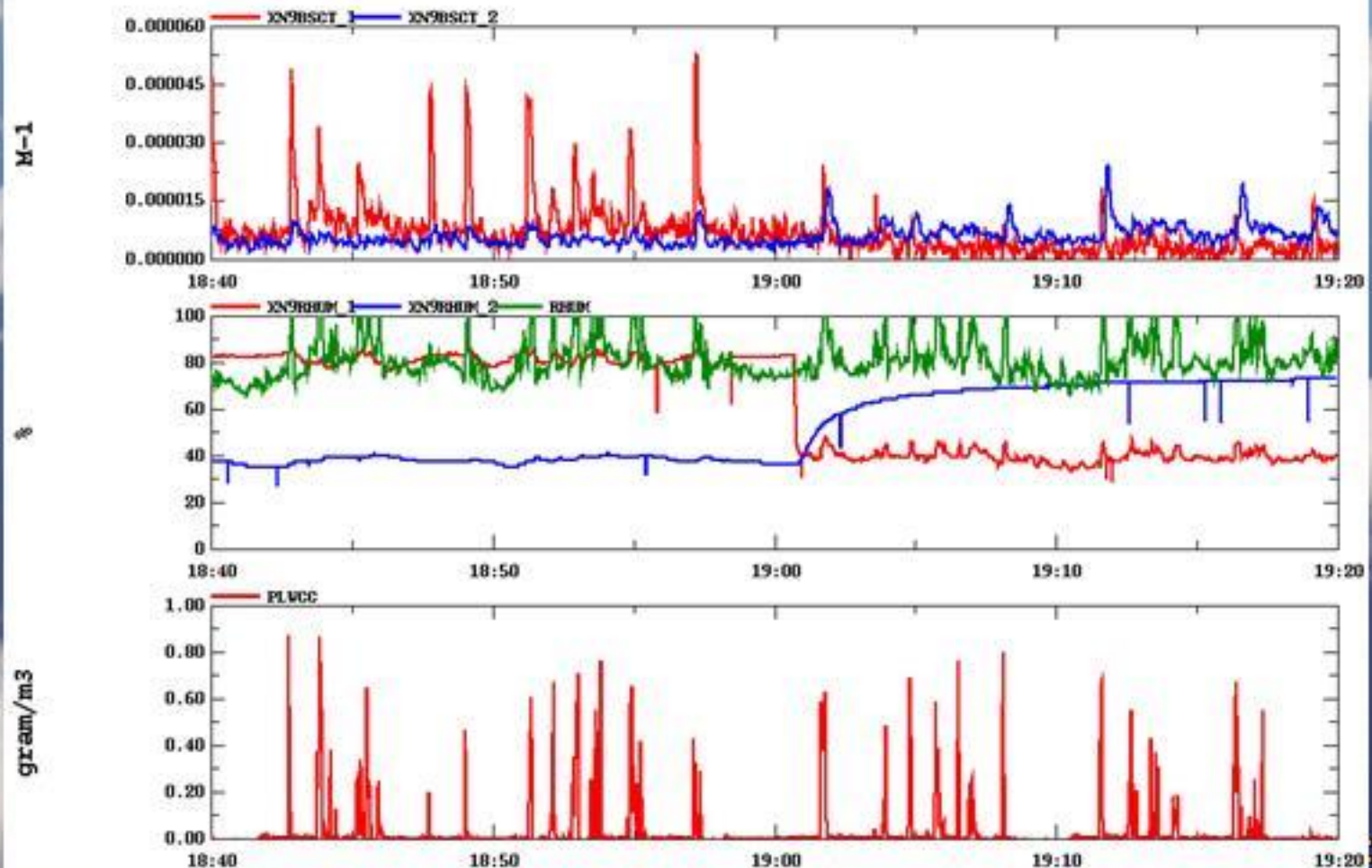
- signal average \rightarrow faster
December: 20 & 60 s
January: 3 s

- 3-way valves:
 $neph1 \leftarrow humid \rightarrow neph2$



RAF nephelometers - *swap humidifier*

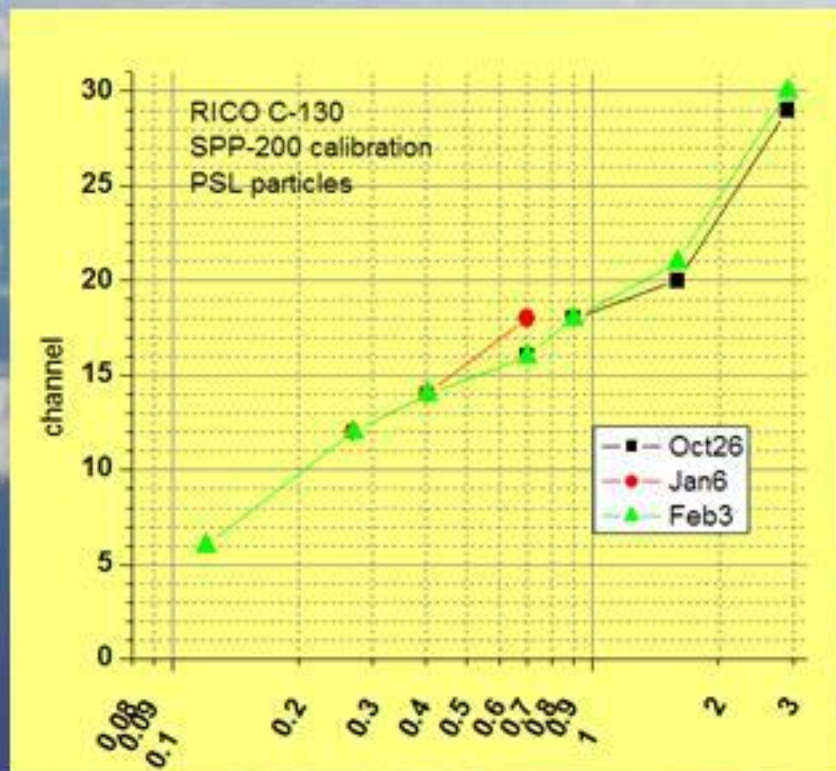
RICO, Flight #rf14
01/14/2005, 18:40:00-19:20:00



nephelometer - 2 x 5 variables

XN9ATX_1	Nephelometer Air Temperature
XN9BSCT_1	Nephelometer Light Scattering Extinction Coefficient
XN9CAL_1	Nephelometer Calibration Gas
XN9PSX_1	Nephelometer Pressure
XN9RHUM_1	Nephelometer Relative Humidity
XN9ATX_2	Nephelometer Air Temperature
XN9BSCT_2	Nephelometer Light Scattering Extinction Coefficient
XN9CAL_2	Nephelometer Calibration Gas
XN9PSX_2	Nephelometer Pressure
XN9RHUM_2	Nephelometer Relative Humidity

PCASP = SPP200



particle size distribution & conc
~ 0.1 to 3 μm dia (30 bins)

problems:

- *particles probably not dry*
- *pipng leaks RF-06, 07*

SPP200 - 11 variables + size distr.

A5200_RWO	<u>array</u> SPP-200 counts per bin
CONCP_RWO	PCAS Concentration (all cells)
DBARP_RWO	PCAS Mean Particle Diameter
PFLWC_RWO	PCAS Corrected Flow
PFLWS_RWO	SPP-200 Sheath Flow
PFLW_RWO	PCAS Flow
PHGB_RWO	SPP-200 High-Gain Baseline
PLGB_RWO	SPP-200 Low-Gain Baseline
PMGB_RWO	SPP-200 Mid-Gain Baseline
PREF_RWO	PCAS Laser Reference Voltage
PTMP_RWO	PCAS Detector Temperature
PVOLP_RWO	PCASP Equivalent Volume
TCNTP_RWO	PCAS Total Counts (all cells)

belly aerosol inlets

December: aft-facing
goosenecks



January: one inlet replaced
→ forward-facing cone to
reduce spray artifacts



2004.12.04 18:22

DRI inlet



2004.12.04 18:22

DRI inlet



DRI inlet



variables:

XDRIF

Hudson CCN Inlet - Diff. Pressure

→ *calculate flow rate*

2004.12.04 18:22

Aerosol losses

CN feed: 290 cm long, 8mm i.d.

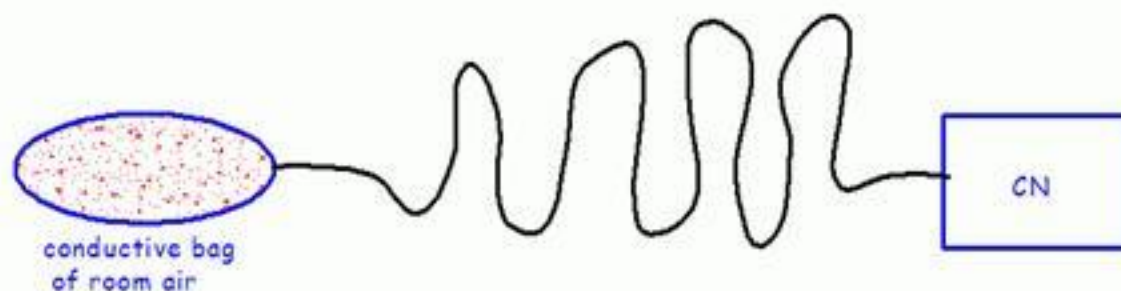
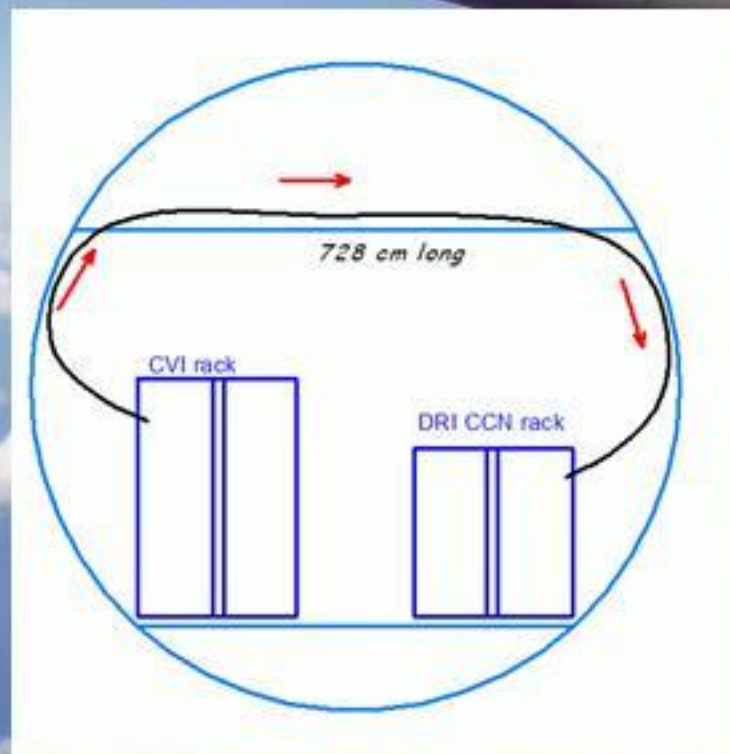
CVI-CCN feed: 728 cm long, 5mm i.d.

use room air to estimate sampling loss:

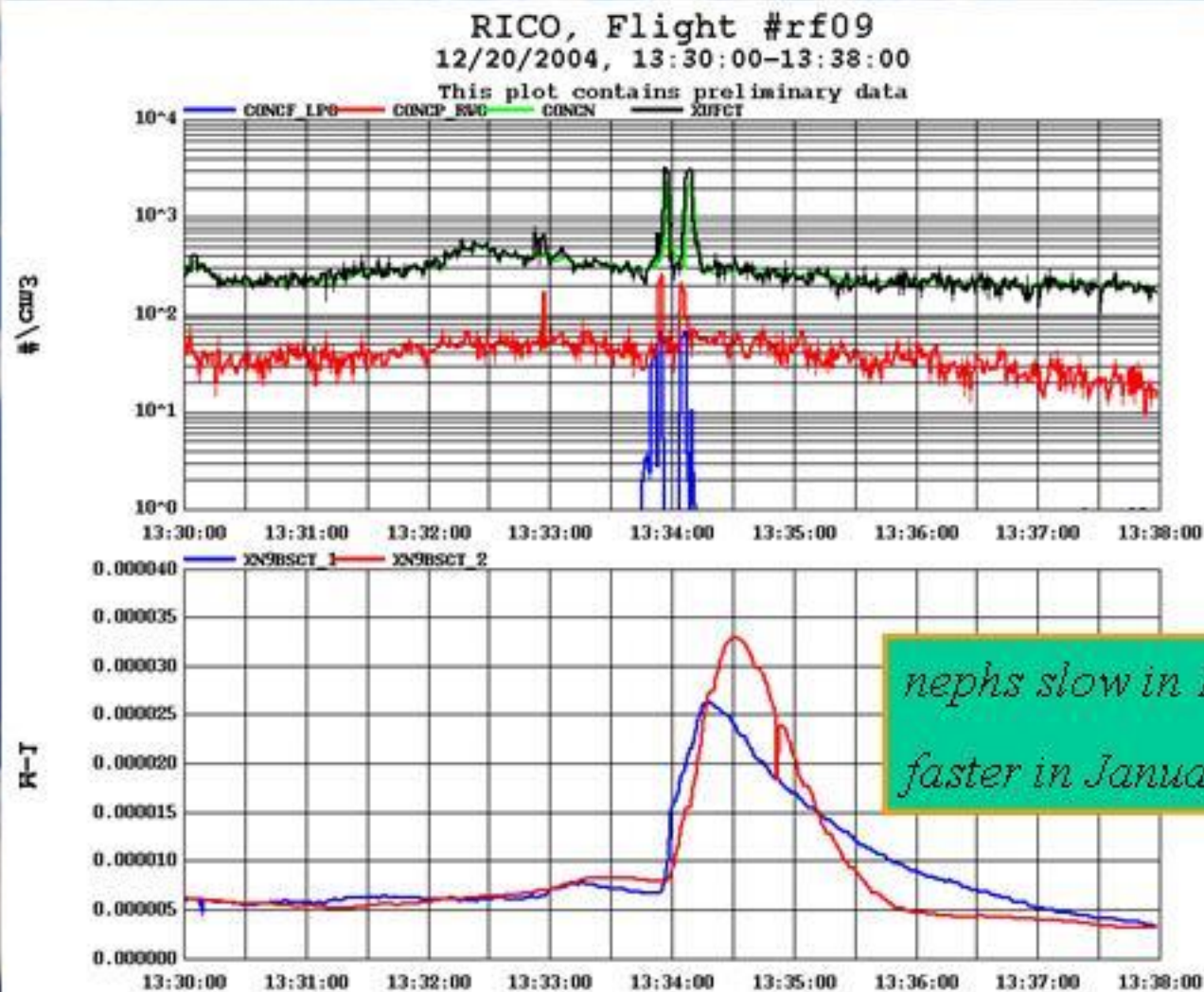
- 16% loss of CN at 1.5 LPM

rdma size-dependent losses

- (analysis in progress)



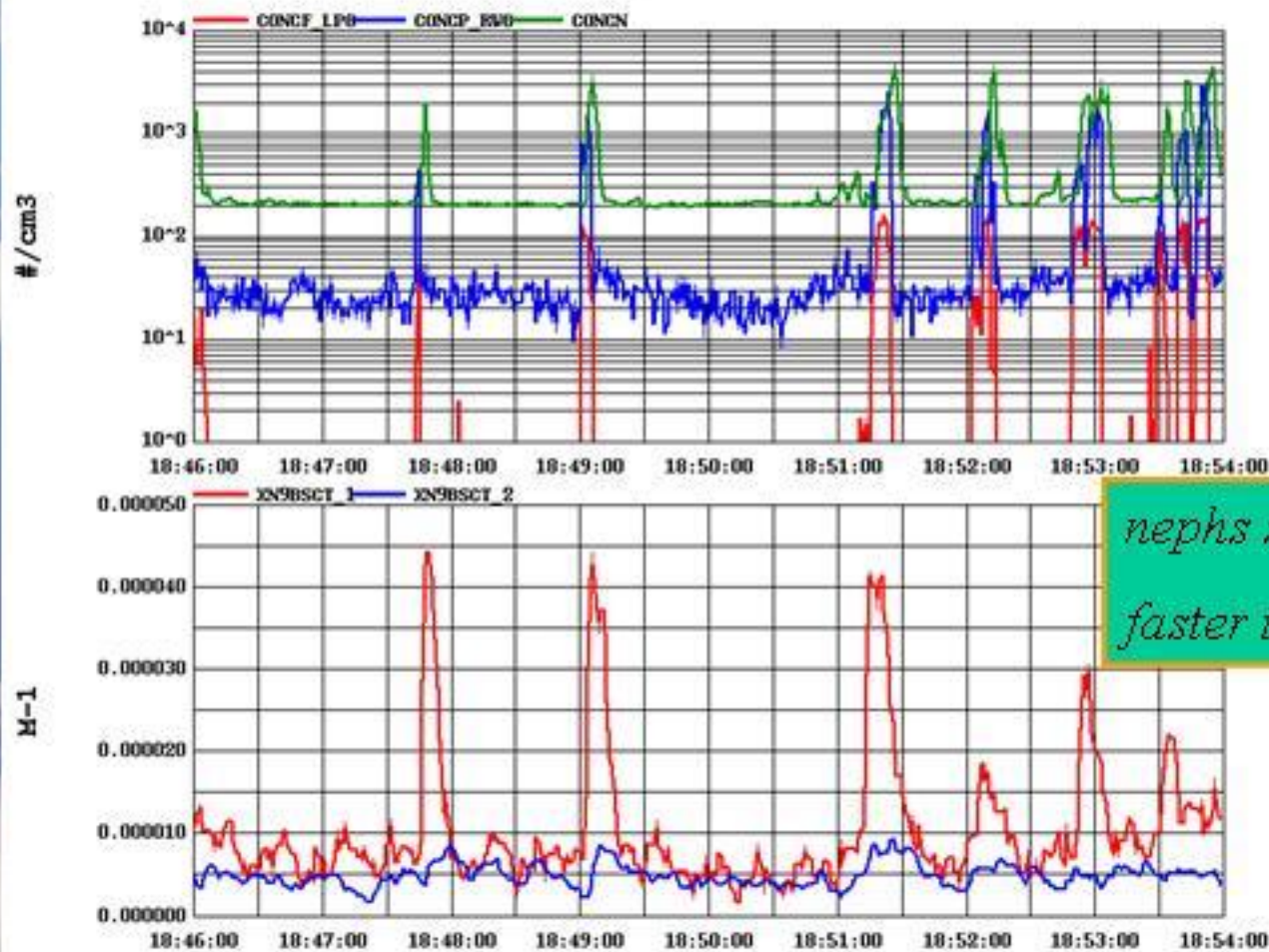
time delays - aerosol instrument response



*nephys slow in December
faster in January*

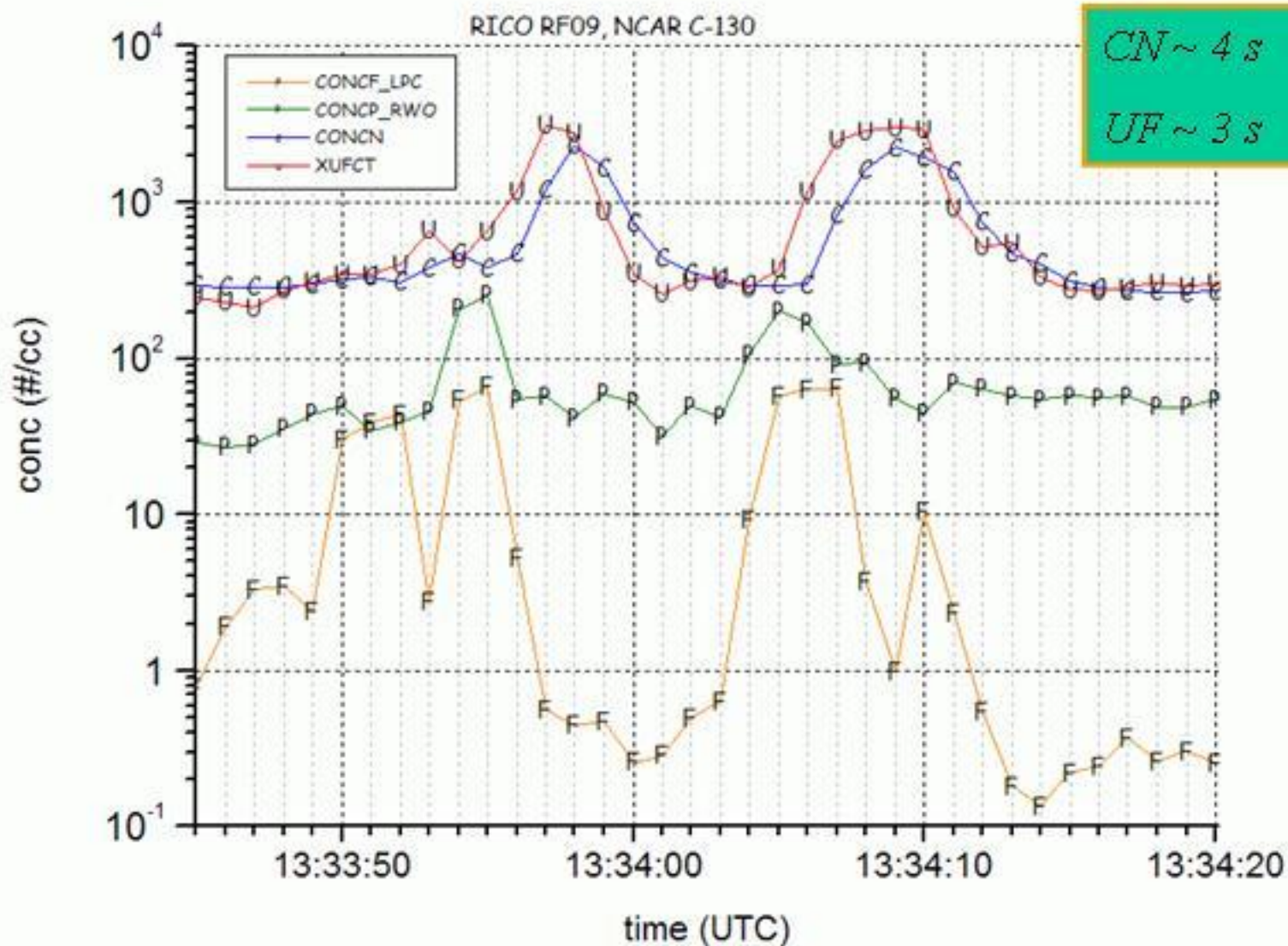
time delays - aerosol instrument response

RICO, Flight #rf14
01/14/2005, 18:46:00-18:54:00

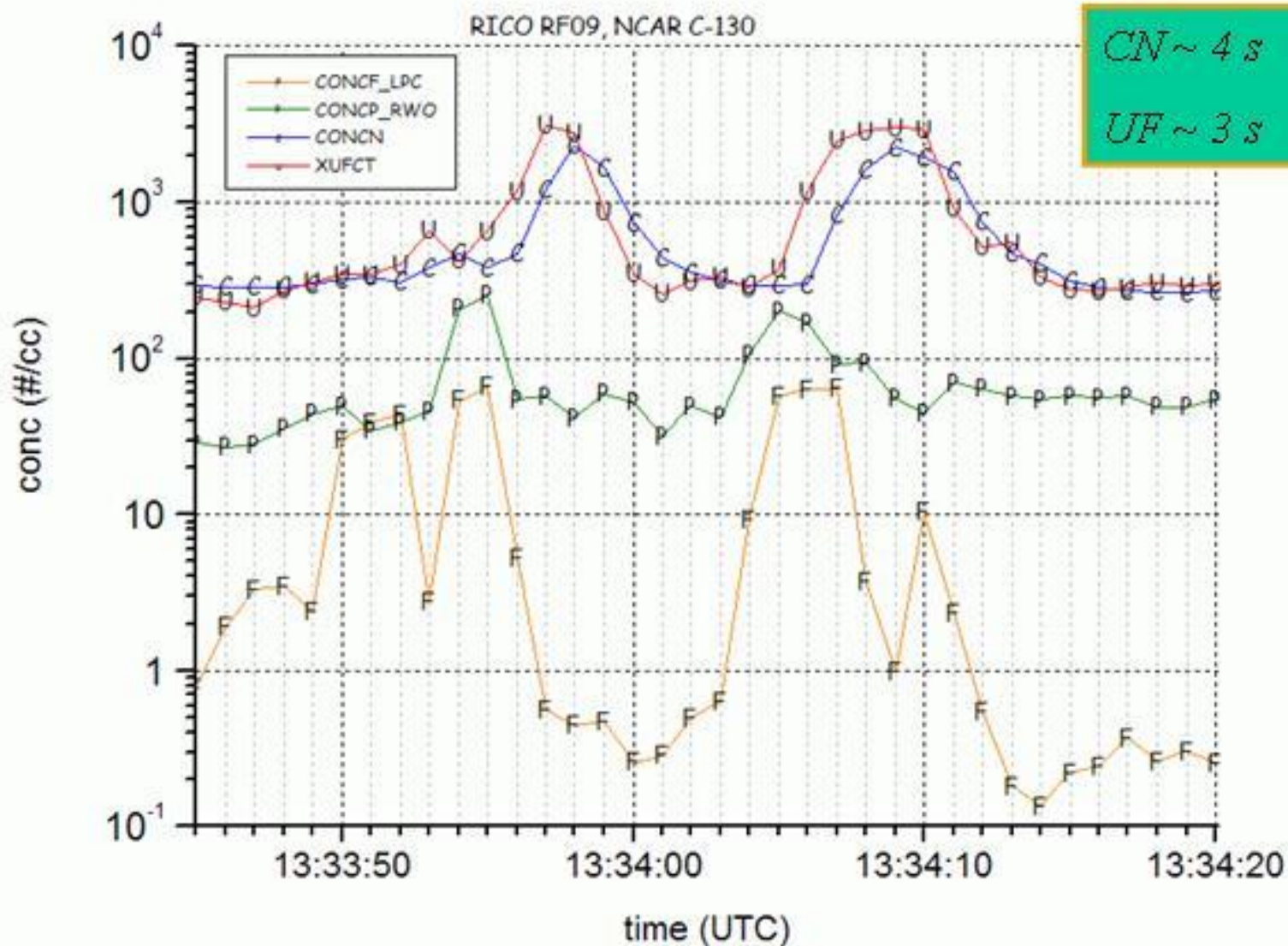


*nephys slow in December
faster in January*

time delays - aerosol instrument response

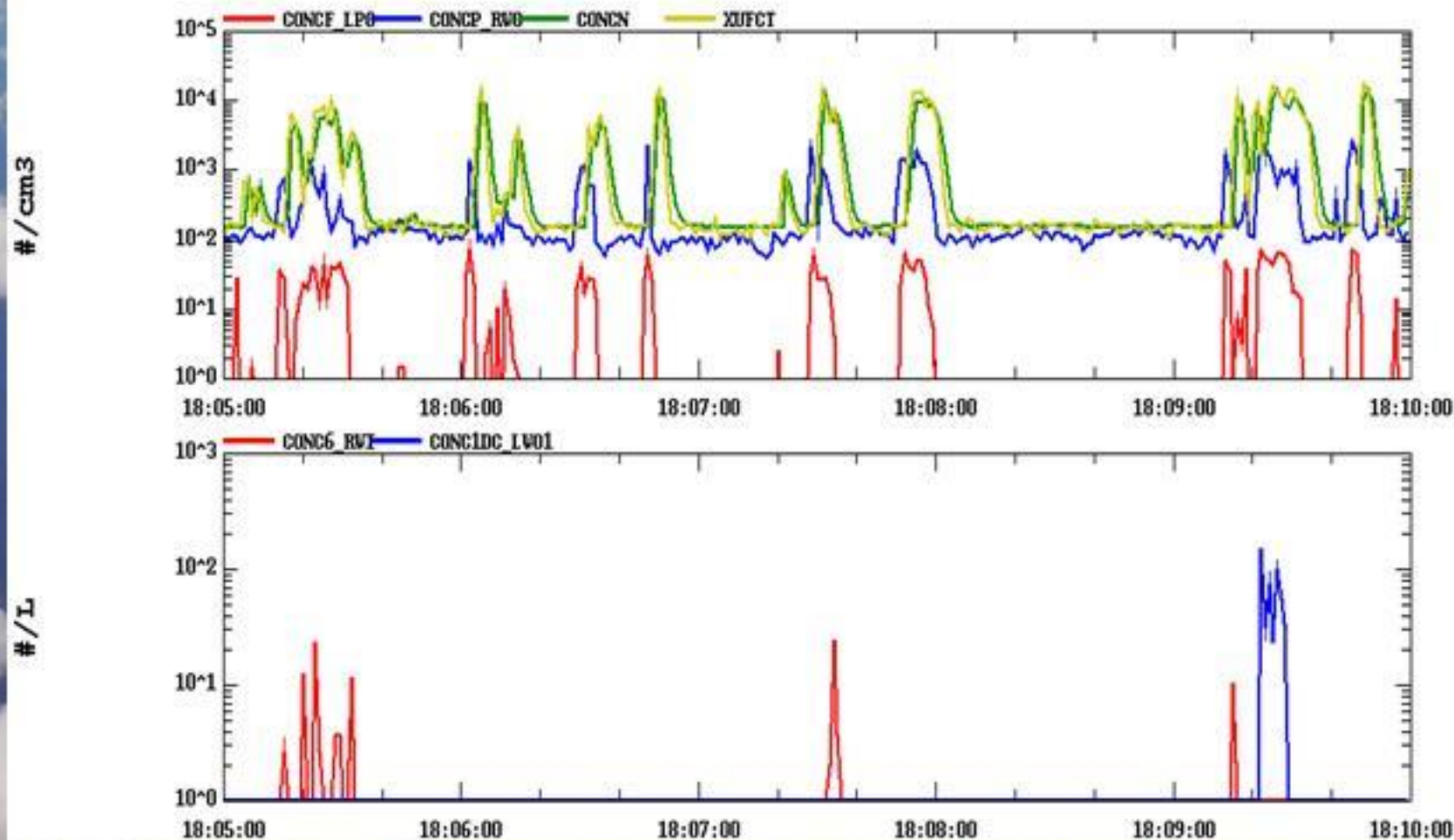


time delays - aerosol instrument response



inlet splash artifacts

RICO, Flight #rf05
12/13/2004, 18:05:00-18:10:00



inlet splash artifacts

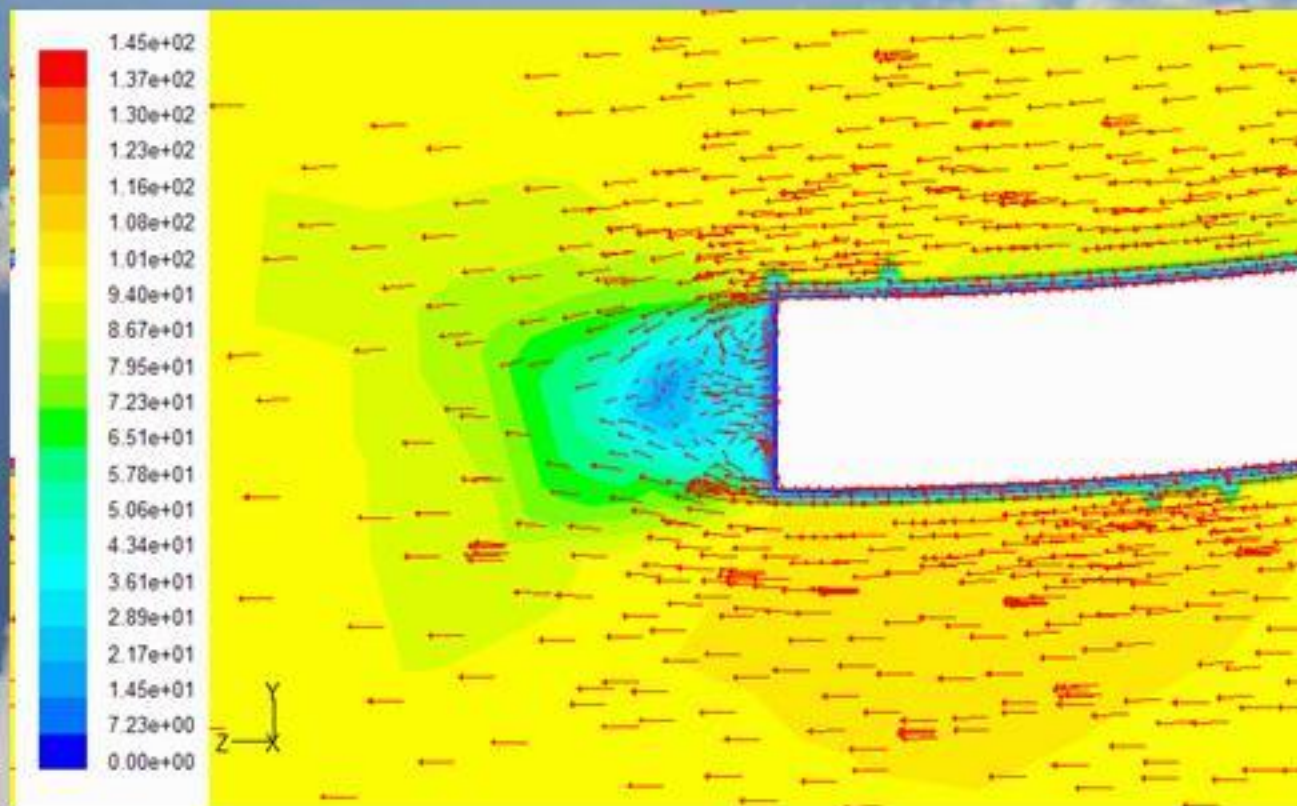
unreliable aerosol measurements in-cloud

- *CN & UltraFine CN*
- *RDMA*
- *nephelometers*
- *PCASP*

CVI is mostly immune

CFD modeling - *inlets & FSSP*

to help understand spray artifact problem



Contours of Velocity Magnitude (m/s)

Dec 30, 2004
FLUENT 6.1 (3d, segregated, lam)

18:22