

# **ICARTT Measurement Comparison**

## **NASA DC-8 vs. NOAA WP-3D**

Gao Chen

Tom Ryerson

Bill Brune

and INTEX-NA Science Team

# *Objective*

To create a unified observational data set from multi-platforms (i.e., aircraft, ground, and ship) by establishing data comparability between the various platforms and verifying that different analytical techniques are mutually consistent within quantifiable uncertainties.

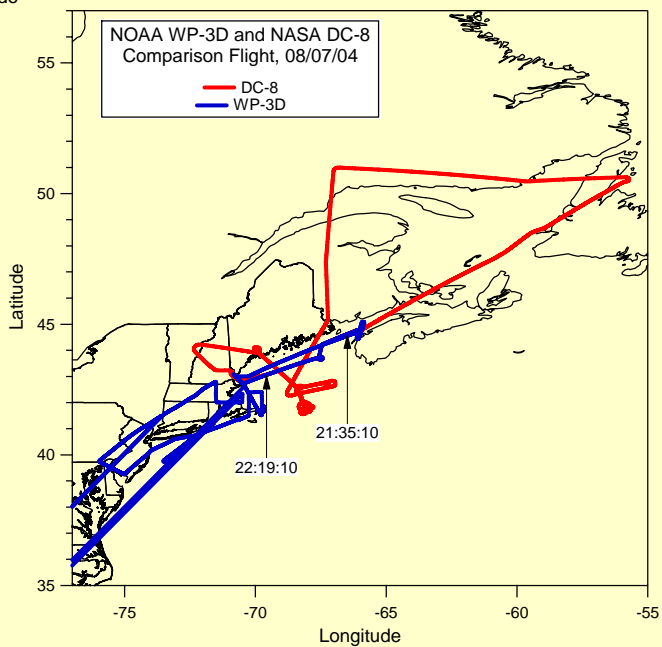
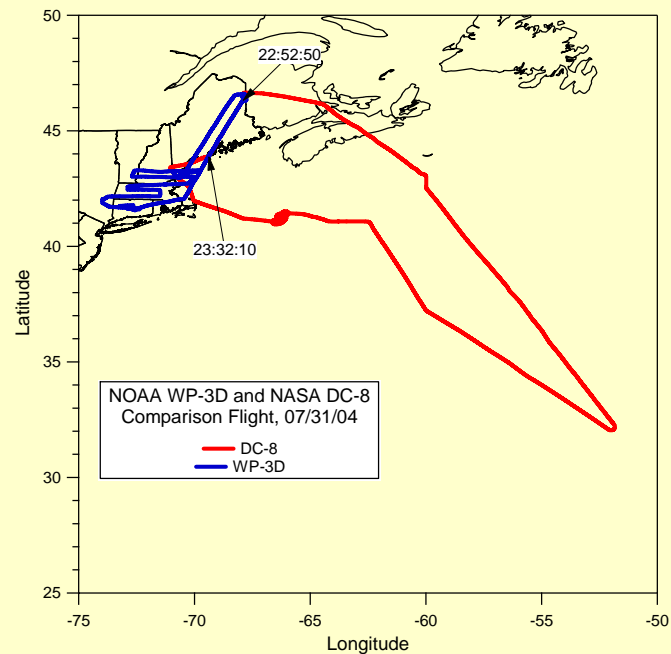
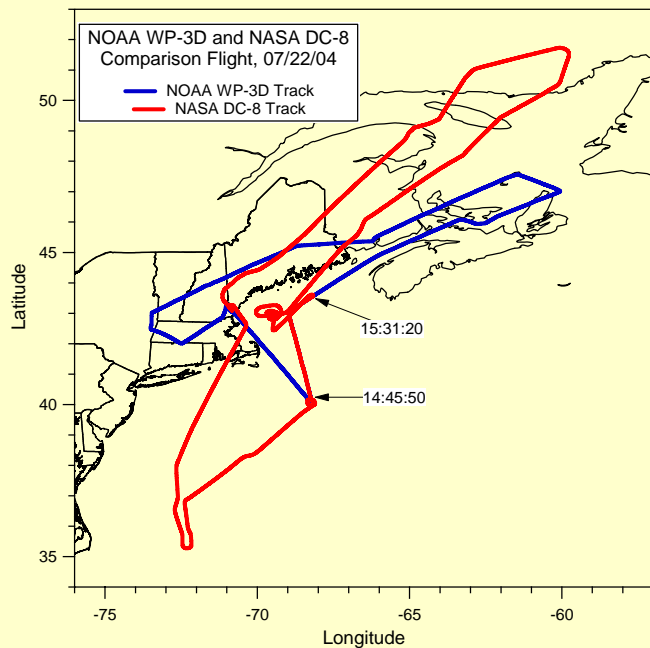
# DC-8 Intercomparison Flights

- July 15, 2004 DC-8 vs. Cobra King Air
- July 22, 2004 DC-8 vs. WP-3D
- July 28, 2004 DC-8 vs. BAE 146
- July 31, 2004 DC-8 vs. WP-3D
- August 7, 2004 DC-8 vs. WP-3D

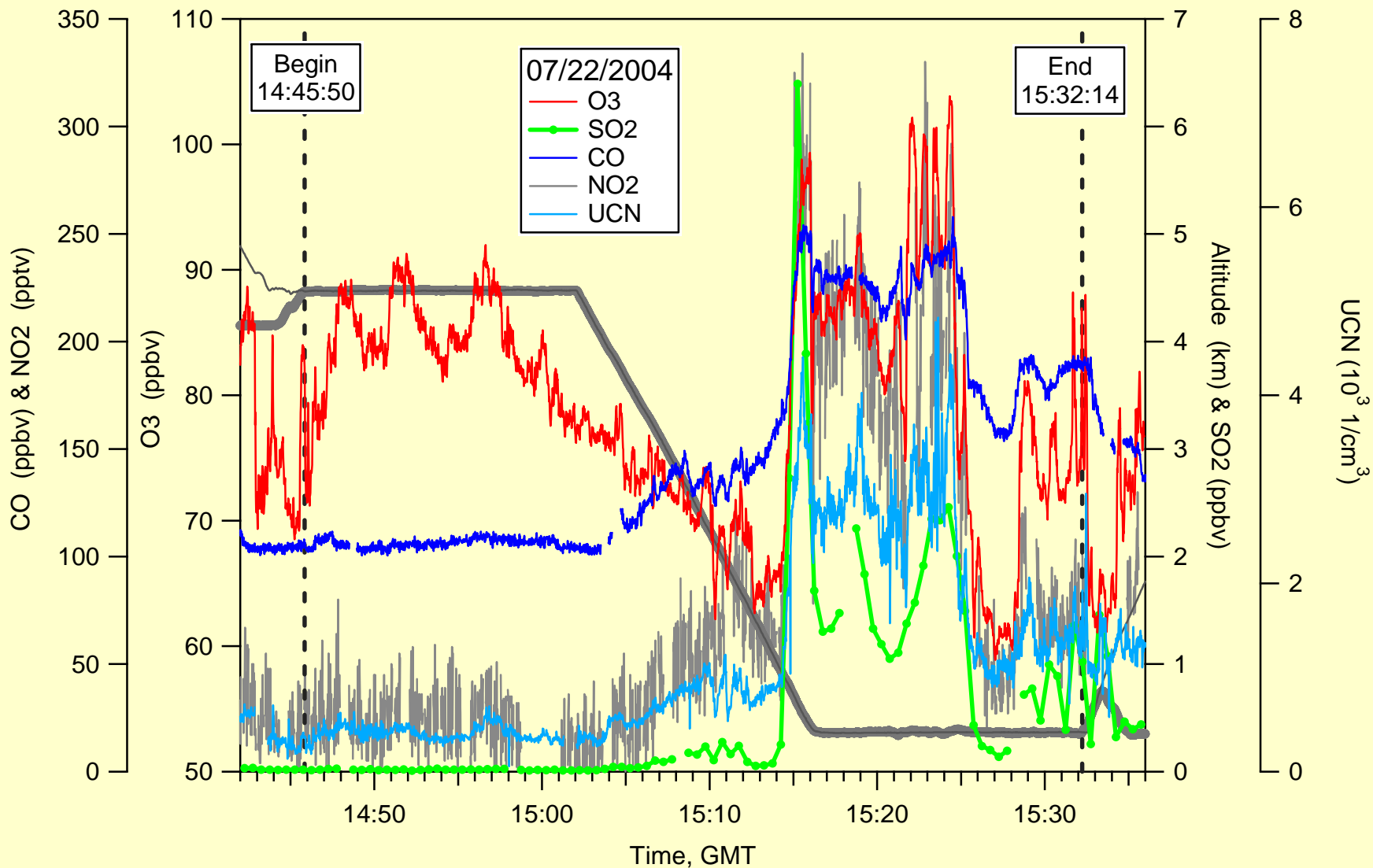
# Approach

- Field Data Comparison
  - Double-Blind comparison.
  - Results presented in time series and x-y plots posted at:  
<http://www.al.noaa.gov/ICARTT/FieldOperations/FOMC.shtml>  
Standard INTEX access user name and password.
- Final Data Comparison
  - On-going.
  - Available plots will be distributed in pdf files.
  - Final results will be posted on the ICARTT website.
  - Paper (TBD).

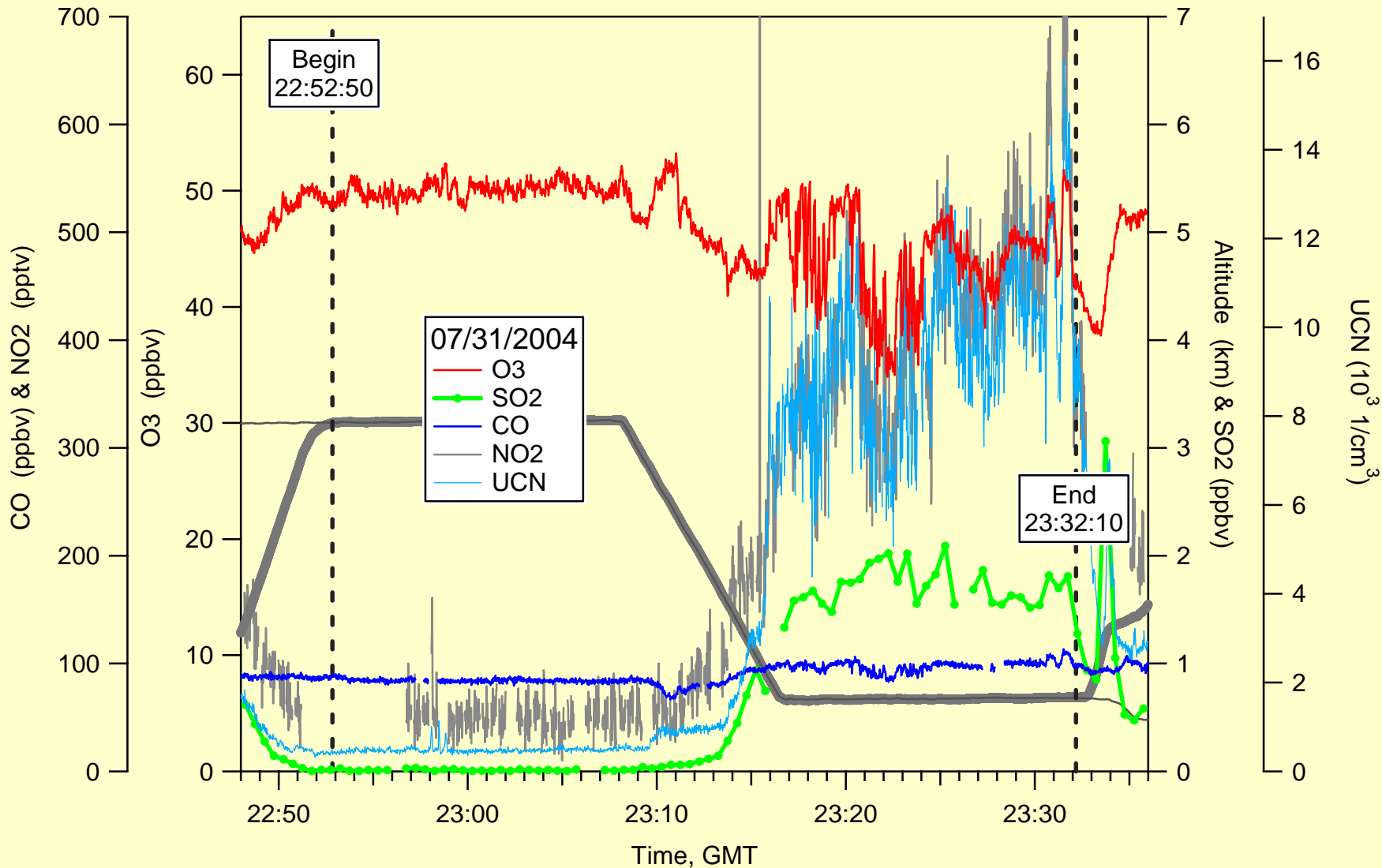
# Comparison Locations/Periods



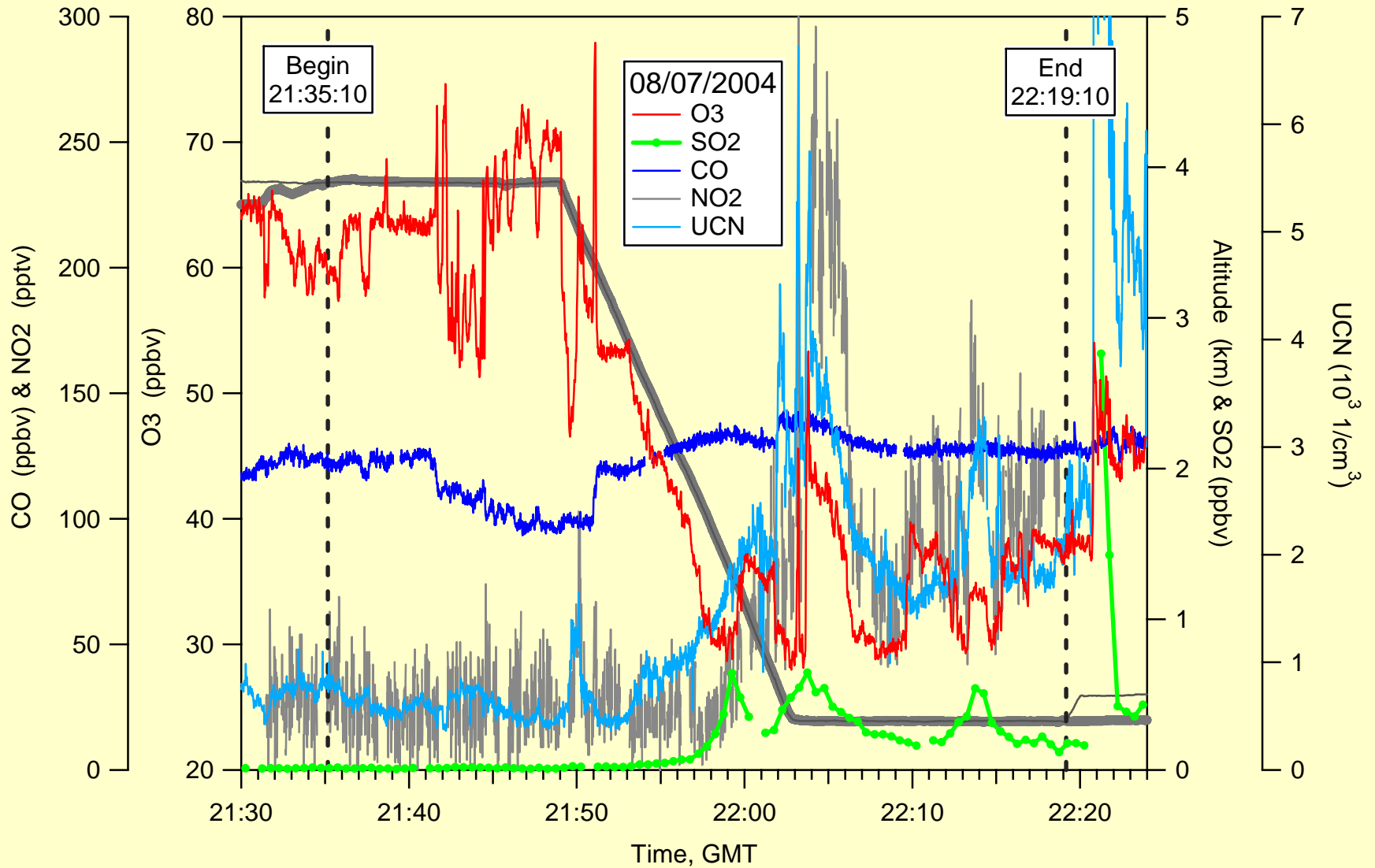
# Chemical Overview: Intercomparison 1



# Chemical Overview: Intercomparison 2

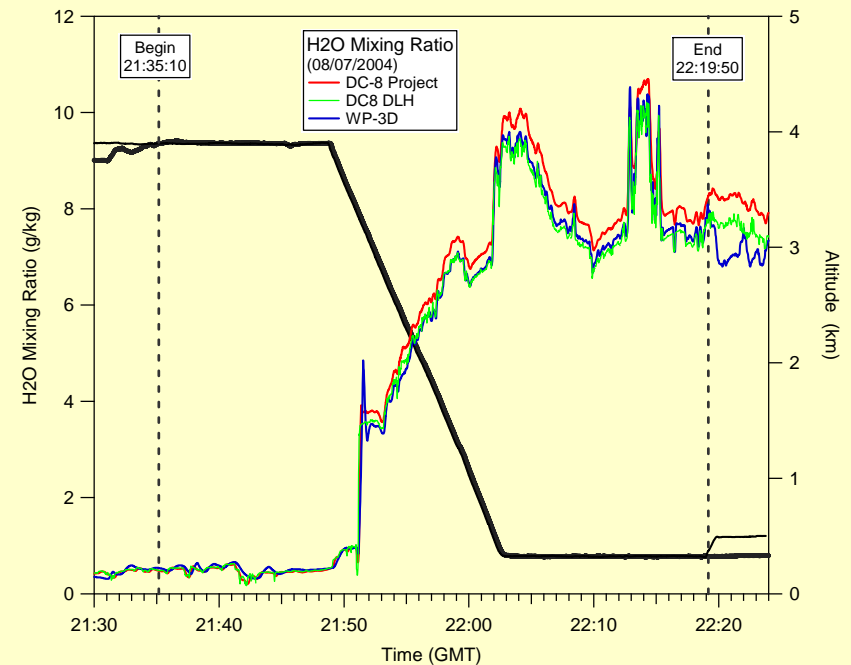
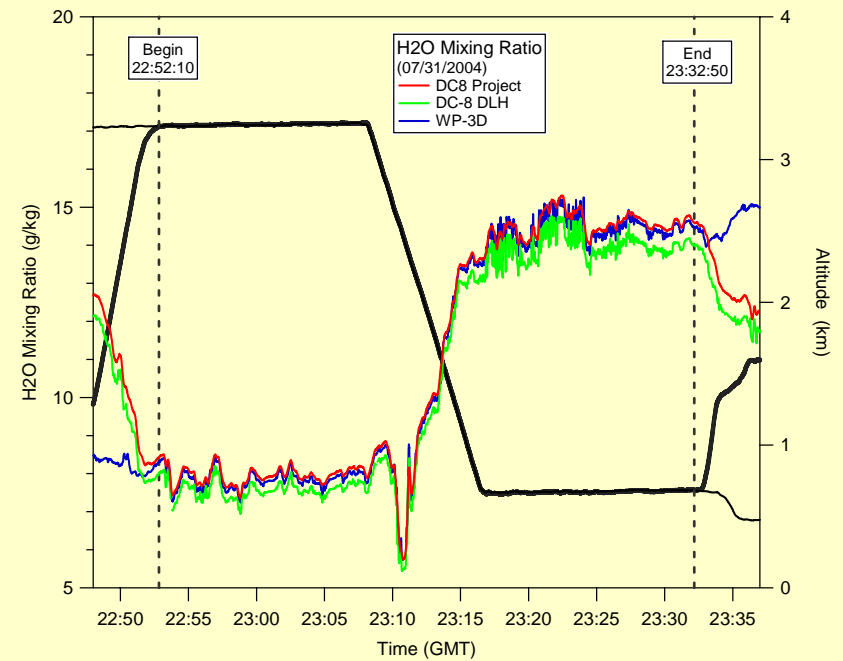
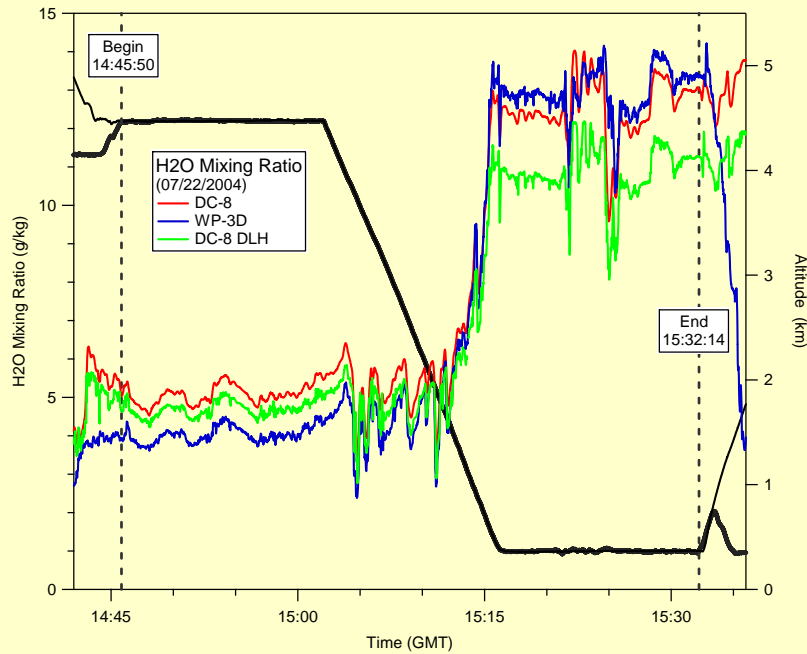


# Chemical Overview: Intercomparison 3





# H<sub>2</sub>O Comparison



$R^2$  values: 0.99

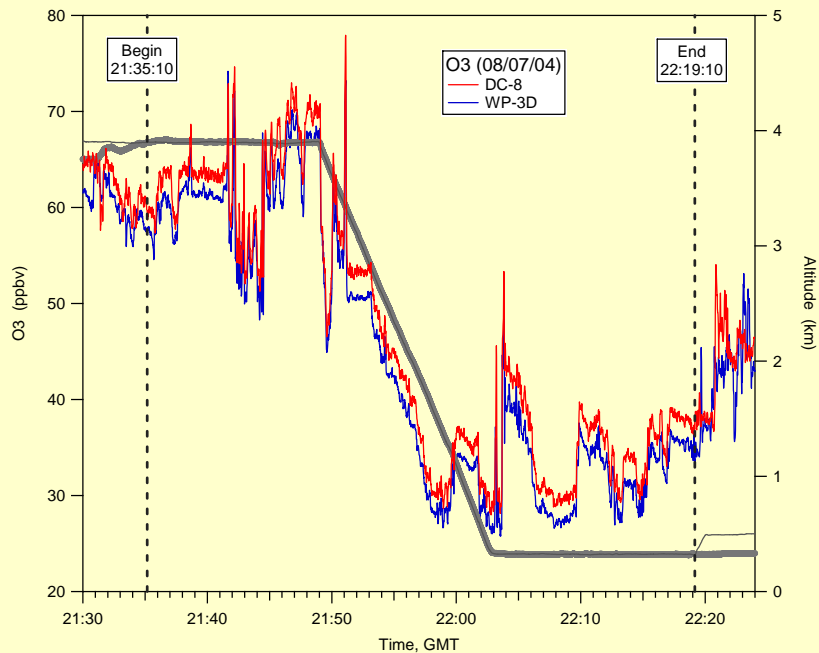
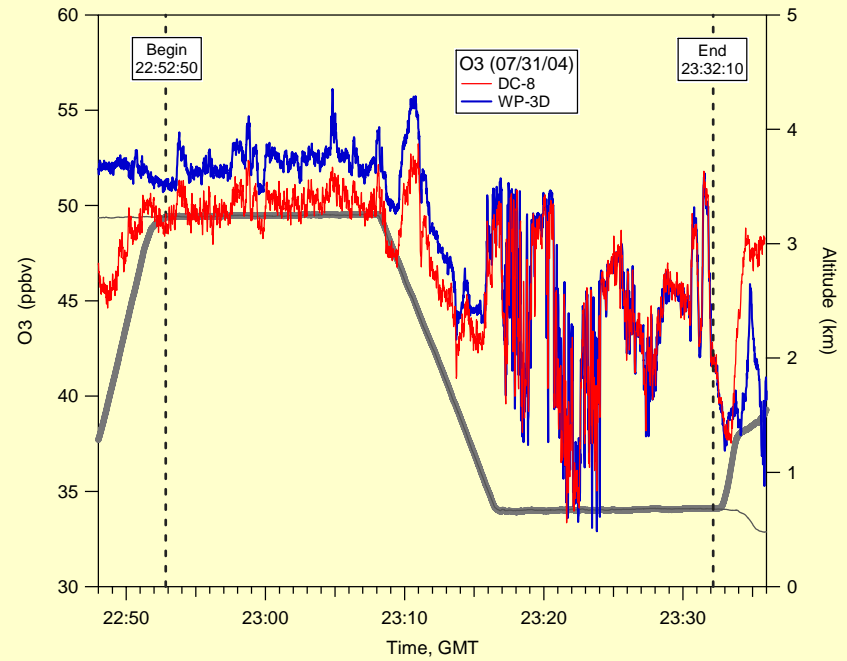
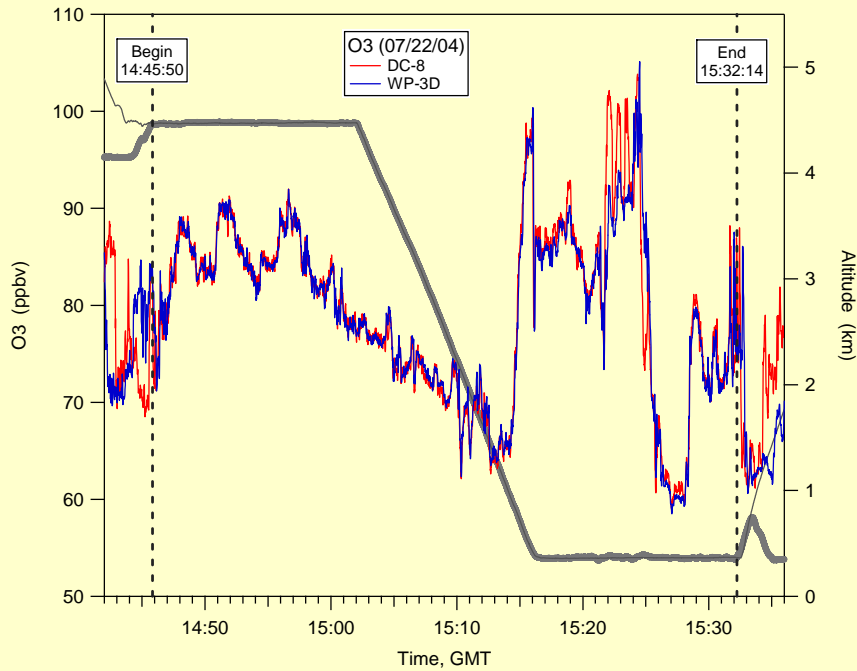
DC-8 DLH vs. WP-3D Slope:

0.70 – 0.97

DC-8 Project vs. WP-3D Slope:

0.84 – 1.05

# O<sub>3</sub> Comparison



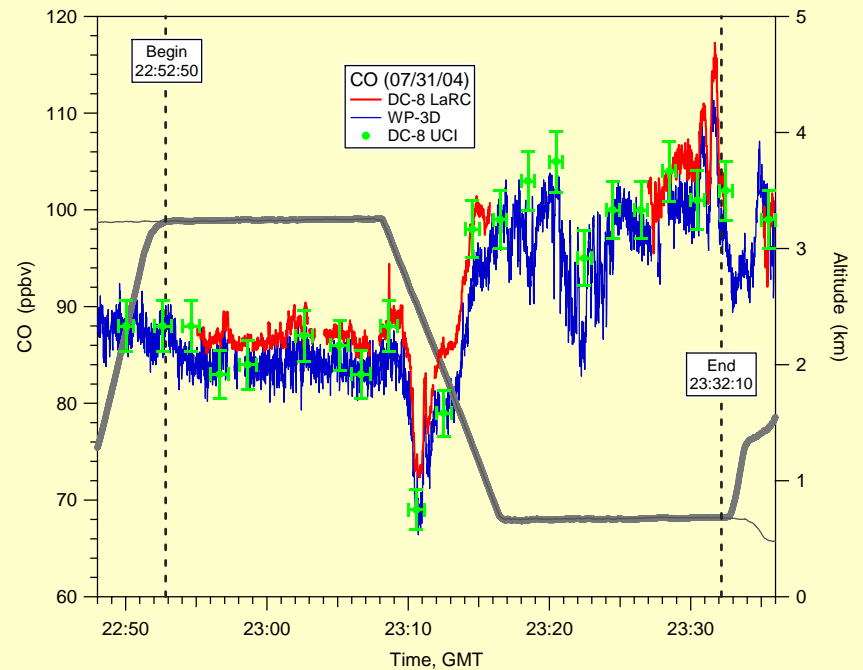
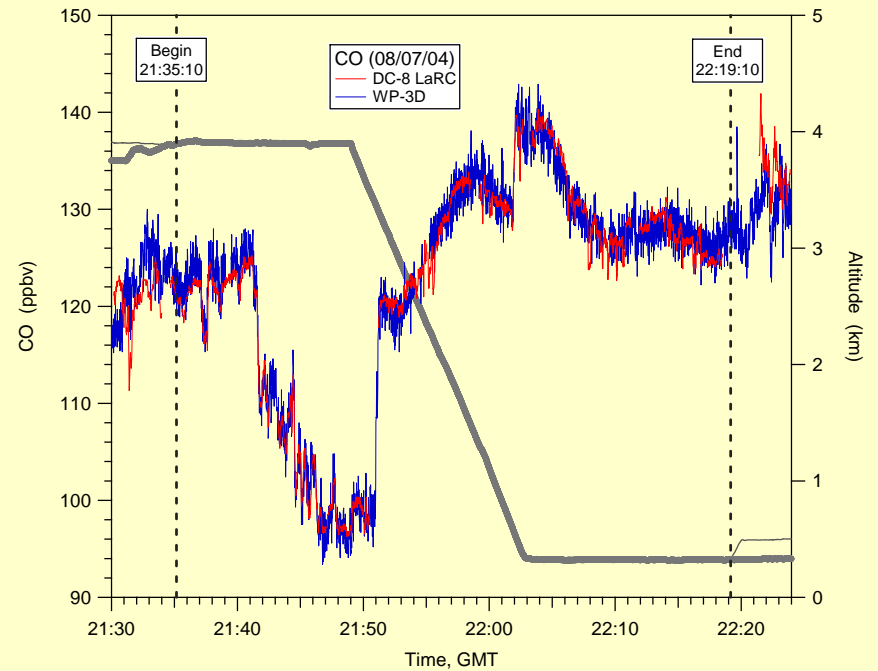
## DC-8 vs. WP-3D Regression

Flight	Slope	Intercept	R <sup>2</sup>
11	1.01	-0.71	0.92
14	0.79	8.8	0.92
17	1.00	2.4	0.99

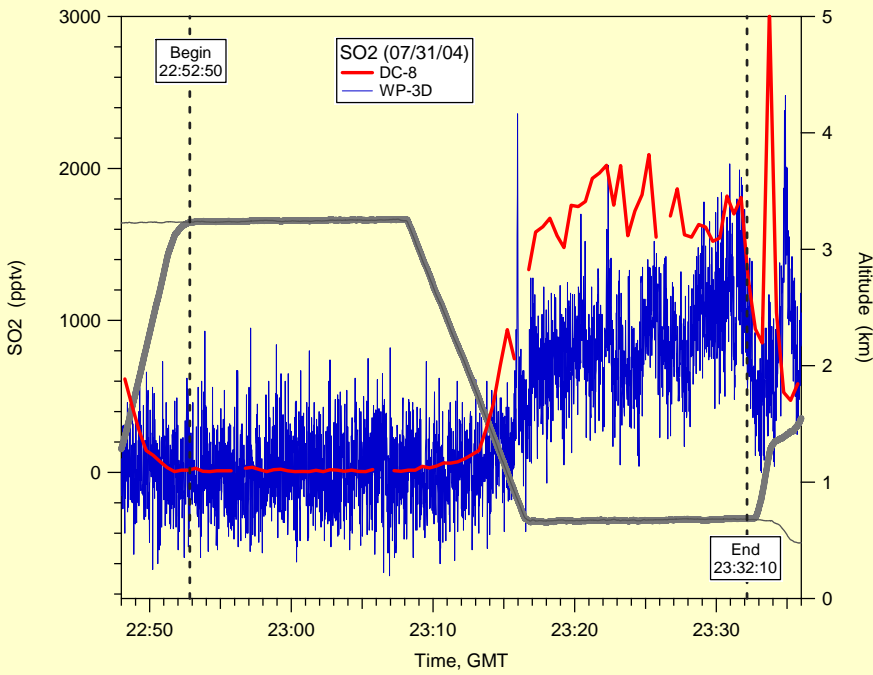
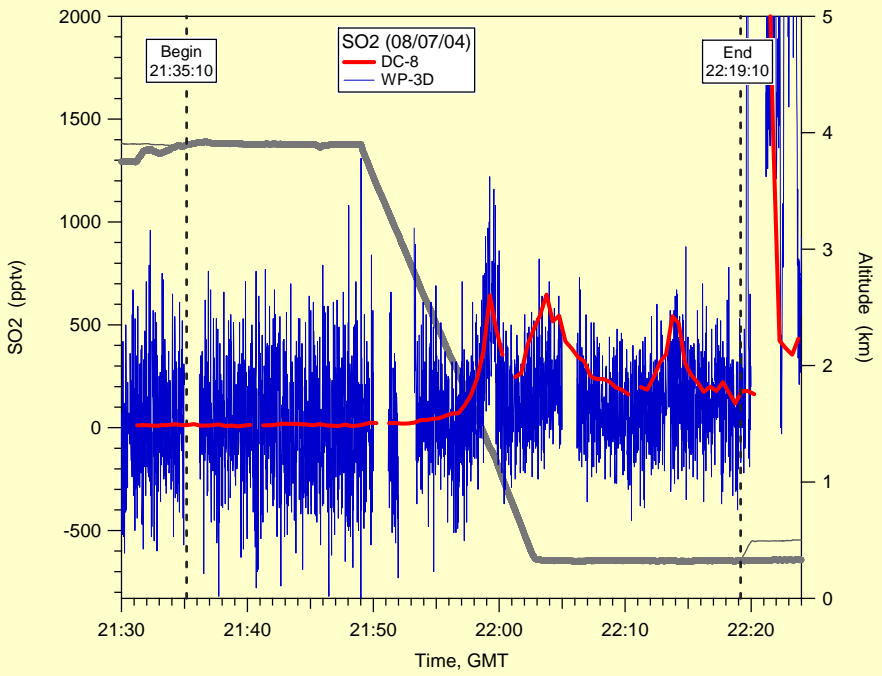
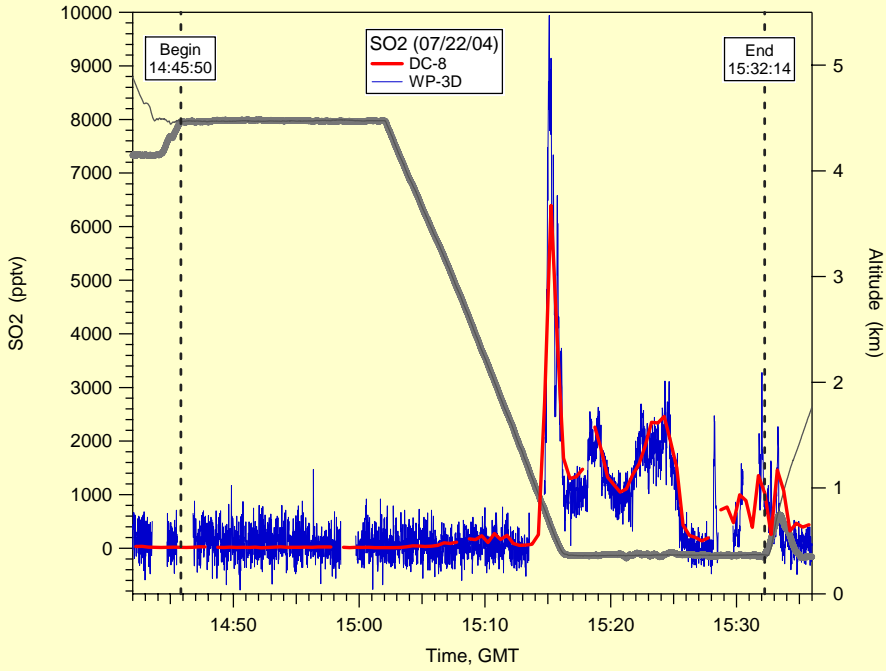
# CO Comparison

## DC-8 vs. WP-3D Regression

Flight	Slope	Intercept	R <sup>2</sup>
11	1.02	-1.25	0.99
14	1.01	2.60	0.96
17	0.97	3.01	0.97



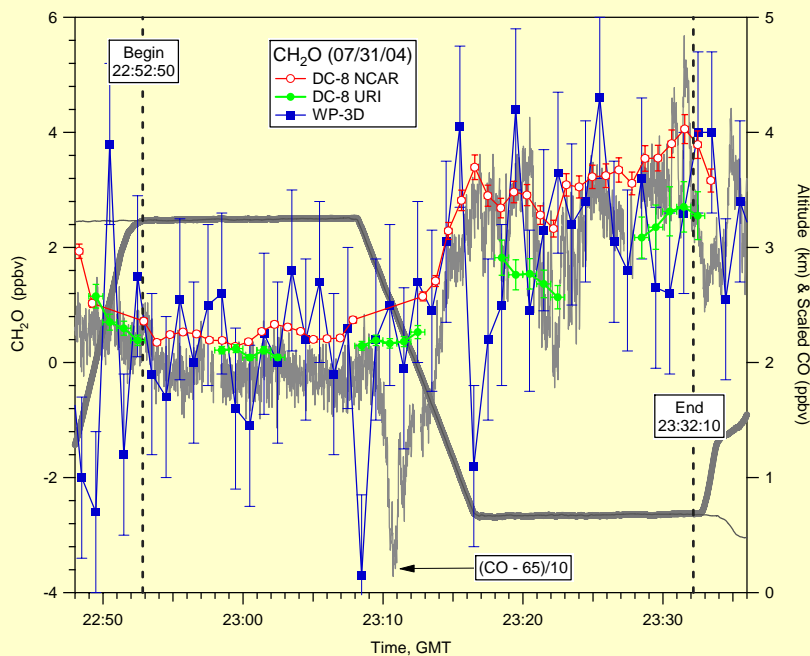
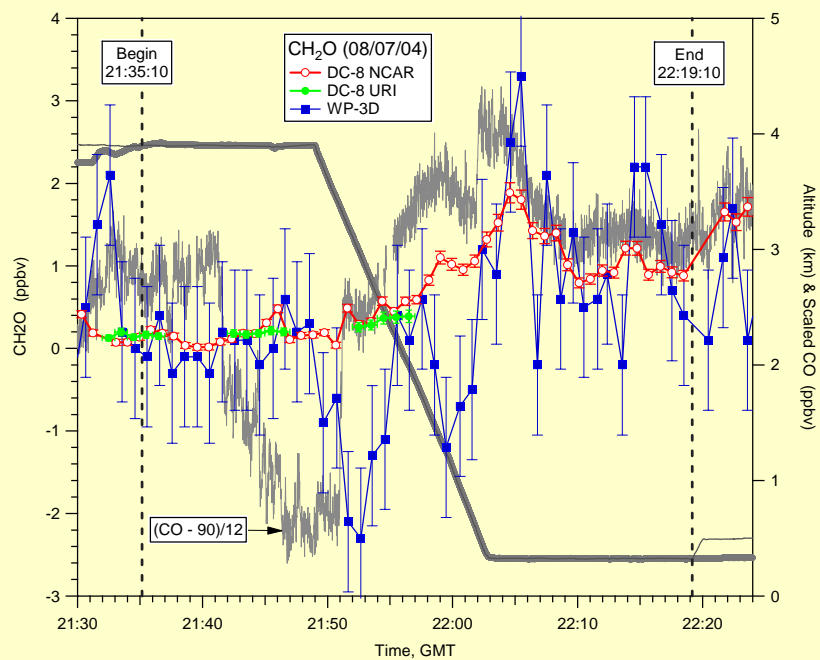
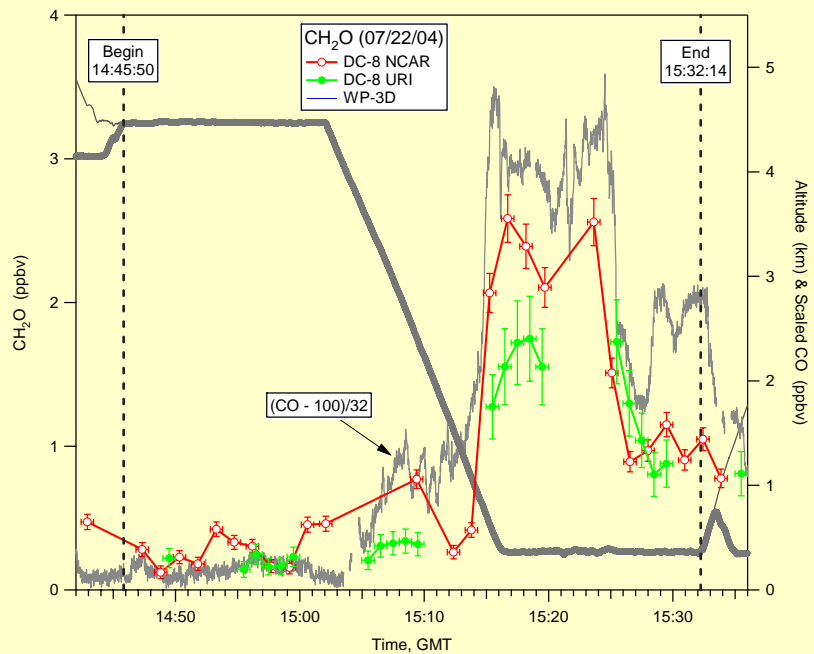
# SO<sub>2</sub> Comparison



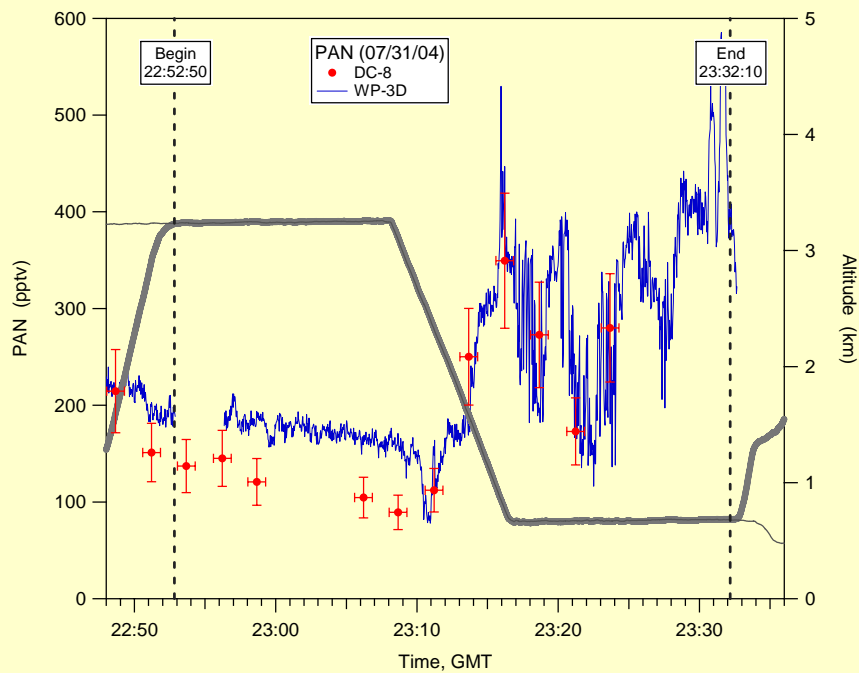
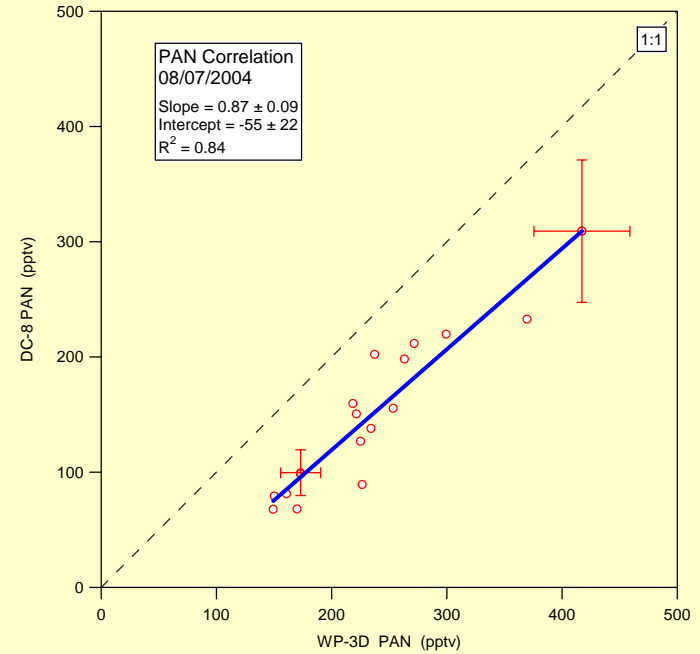
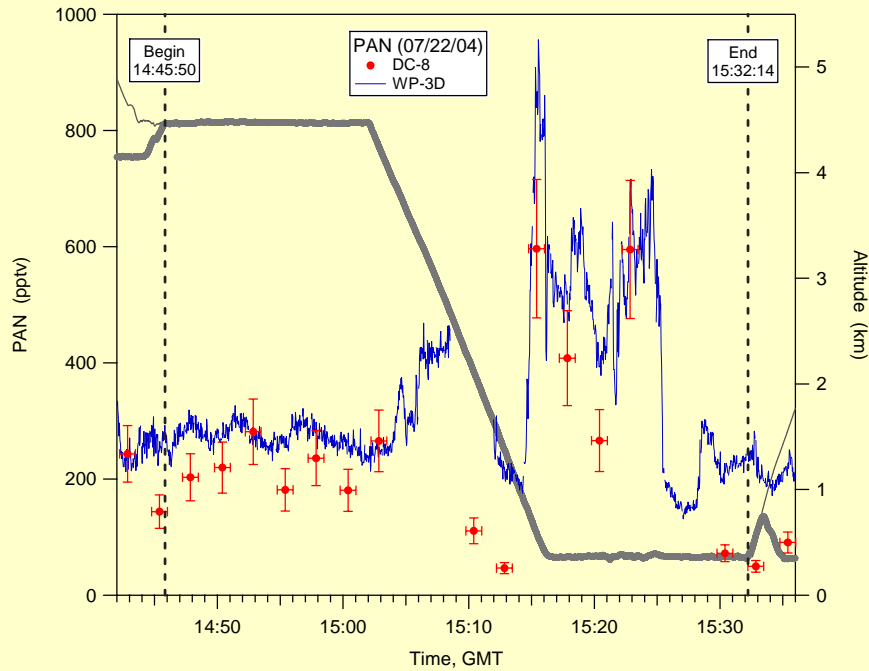
## DC-8 vs. WP-3D Regression

Flight	Slope	Intercept	R <sup>2</sup>
11	0.95	59	0.96
14	1.75	115	0.88
17	1.23	59	0.56

# CH<sub>2</sub>O Comparison



# PAN Comparison



## DC-8 vs. WP-3D Regression

Flight	Slope	Intercept	$R^2$
11	0.94	-61	0.84
14	1.17	-58	0.80
17	0.87	-55	0.84

# Total Peroxynitrates Comparison

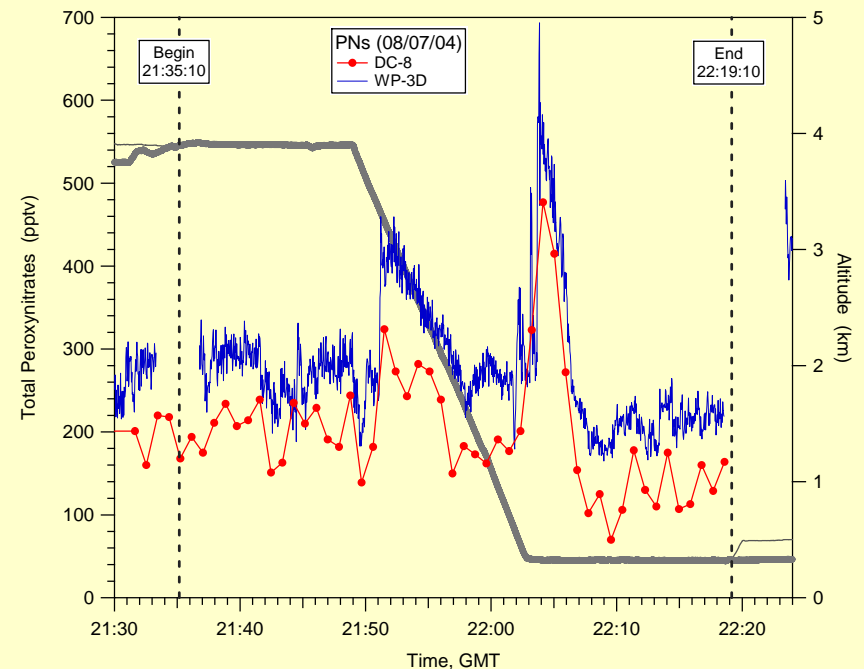
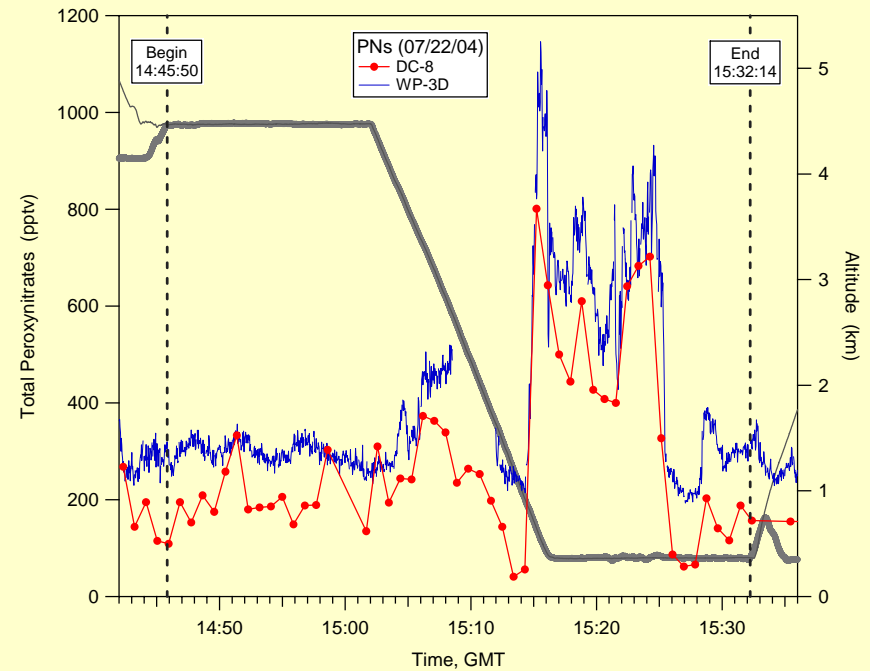
## DC-8 vs. WP-3D Regression

Flight	Slope	Intercept	R <sup>2</sup>
11	0.96	-103	0.88
14	0.93	-26	0.91
17	0.94	-64	0.86

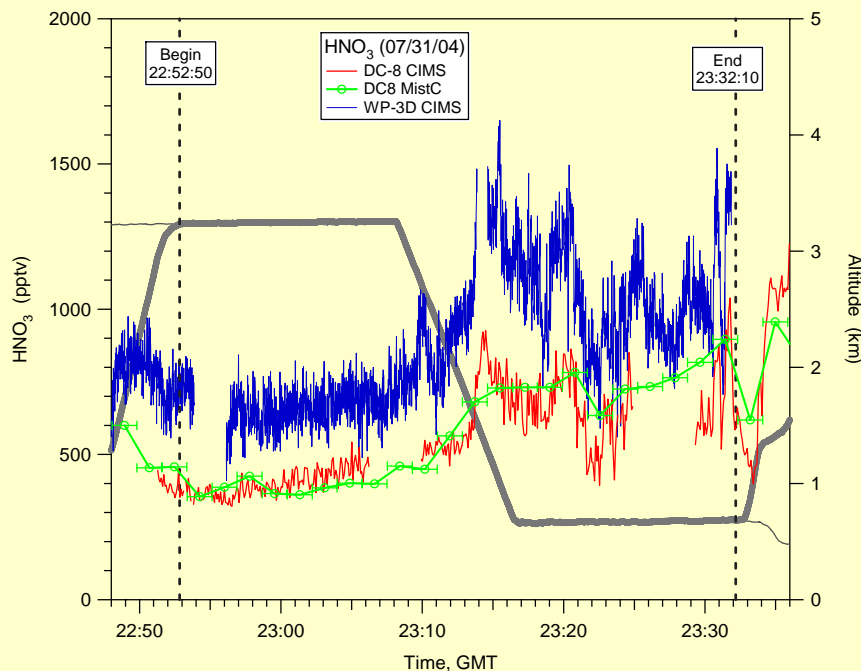
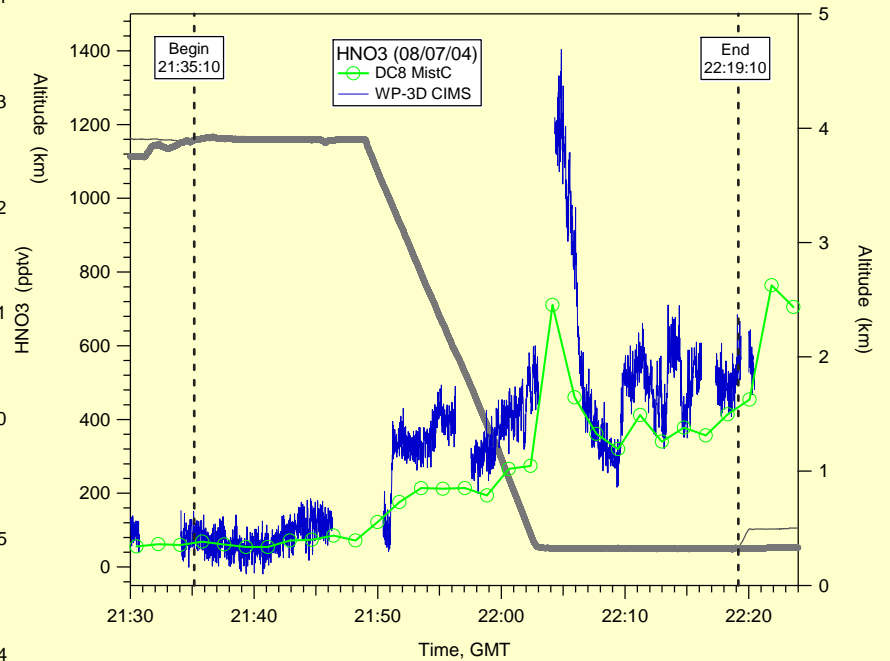
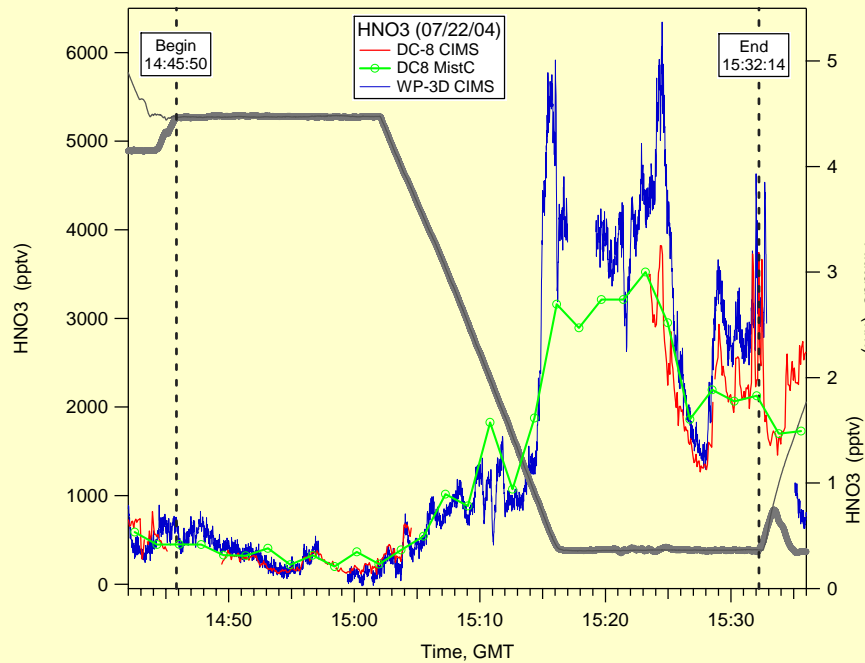
WP-3D PNs = PAN + PPN + others

Including, PBN, APAN, MoPAN, PBzN, MPAN, PPeN

DC-8 PNs = 200°C channel - unheated channel



# HNO<sub>3</sub> Comparison



DC-8 CIMS vs. WP-3D CIMS:

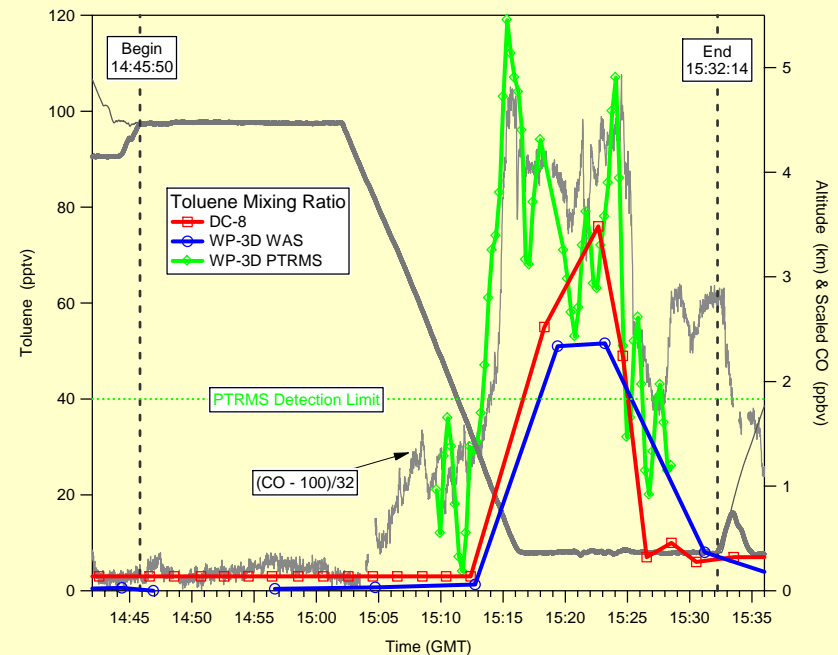
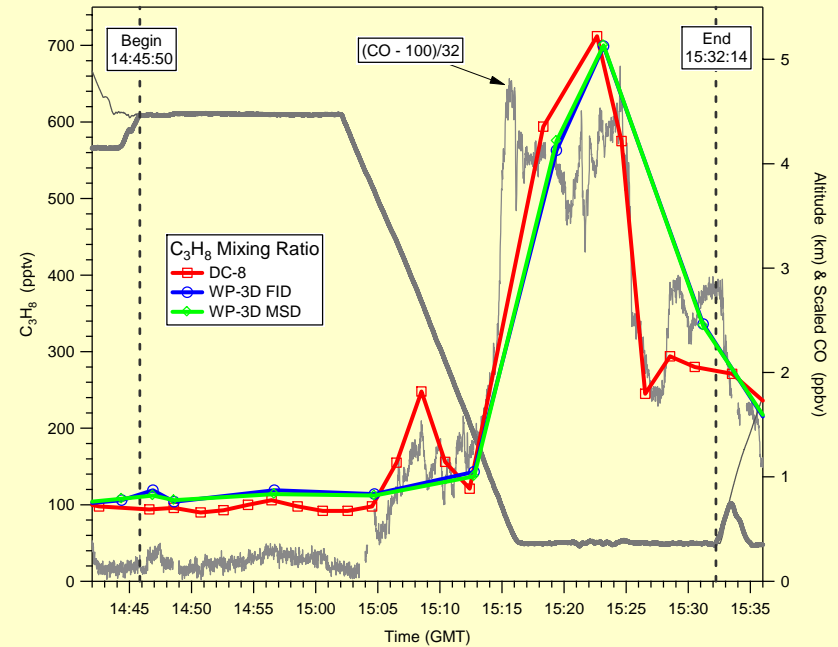
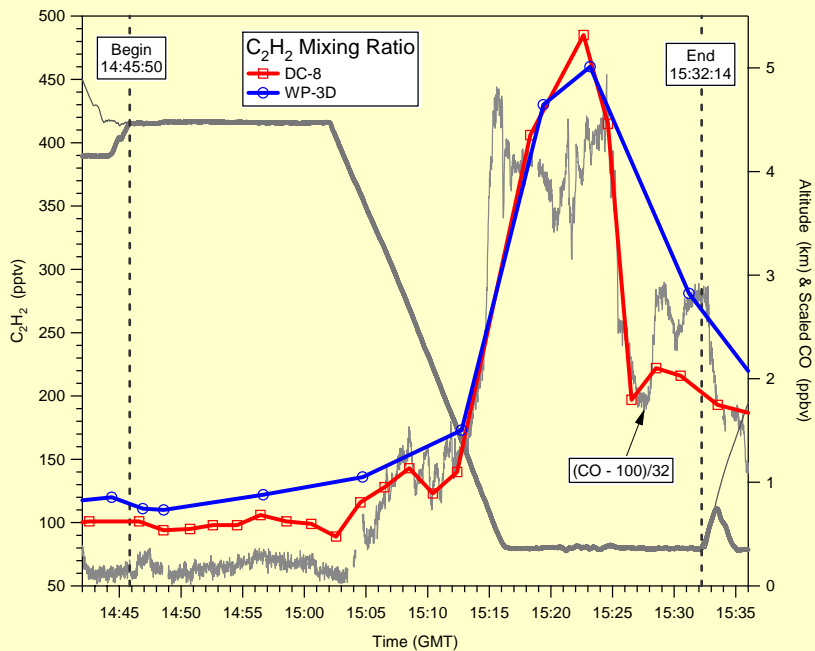
$R^2 = 0.8 - 0.95$ , slope =  $\sim 0.6$

WP-3D CIMS vs. DC-8 MC:

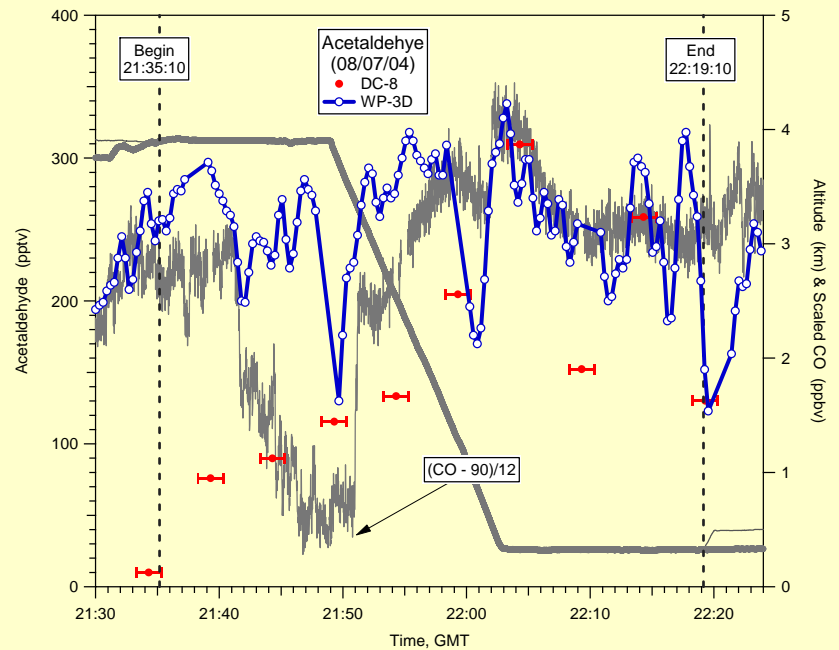
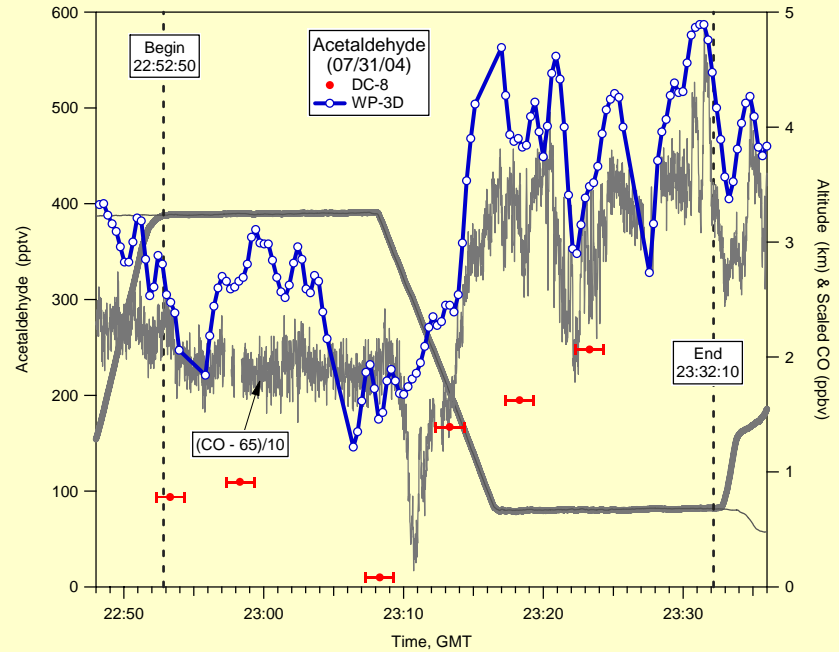
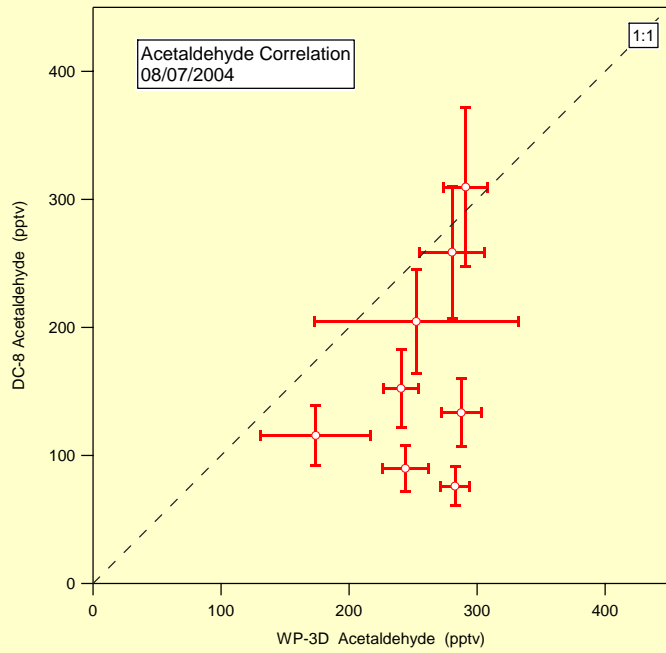
$R^2 = 0.8 - 0.94$ , slope =  $1.1 - 1.6$



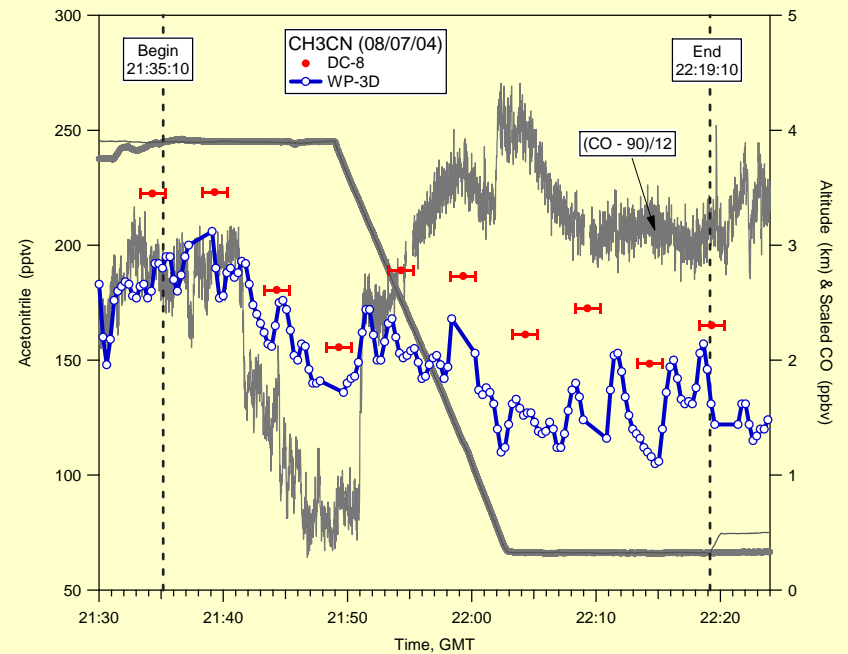
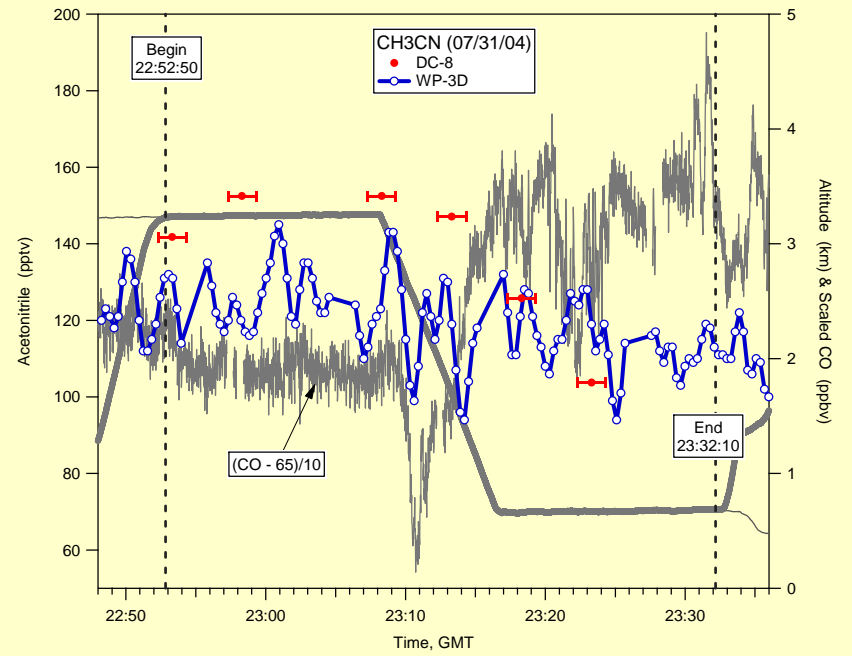
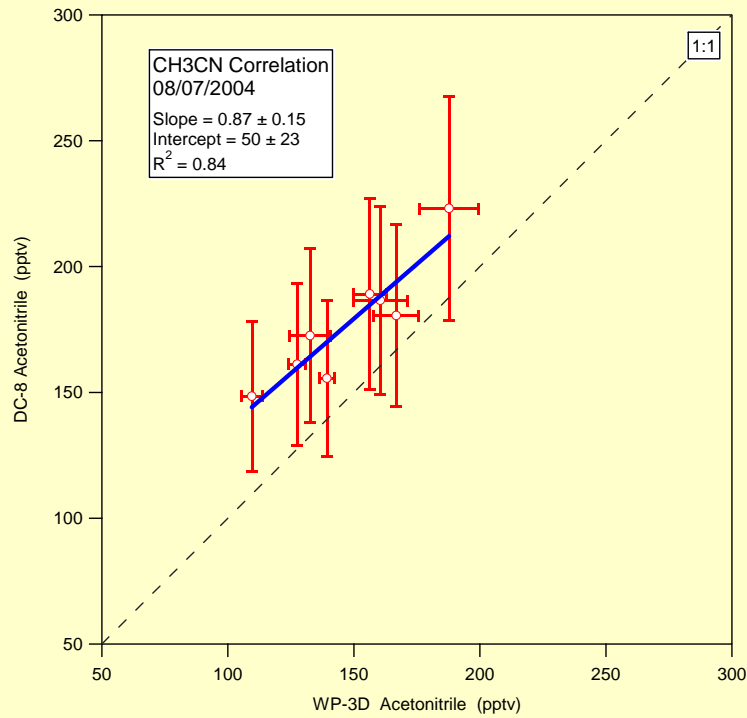
# NMHC Comparison 07/22/2004



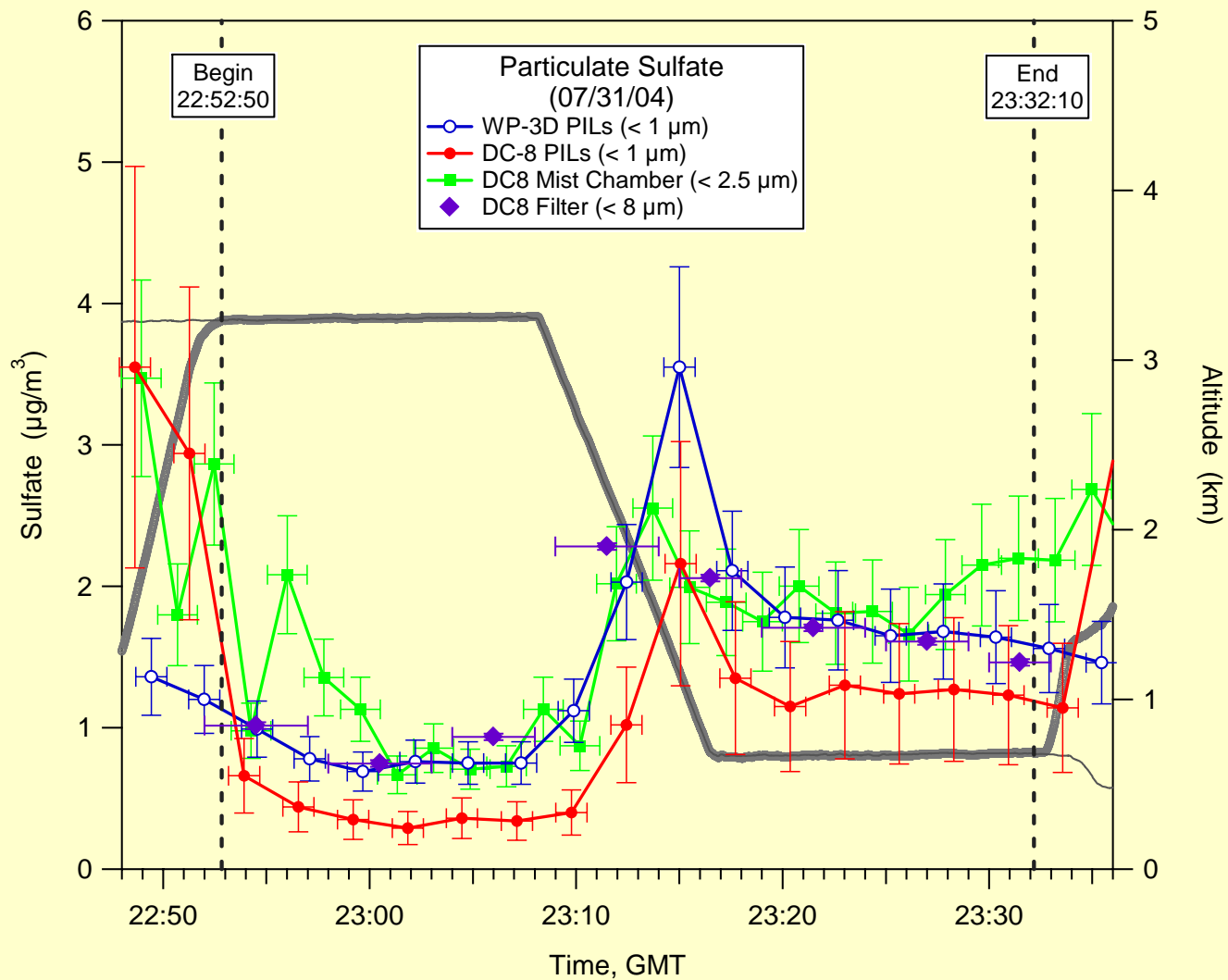
# Acetaldehyde Comparison



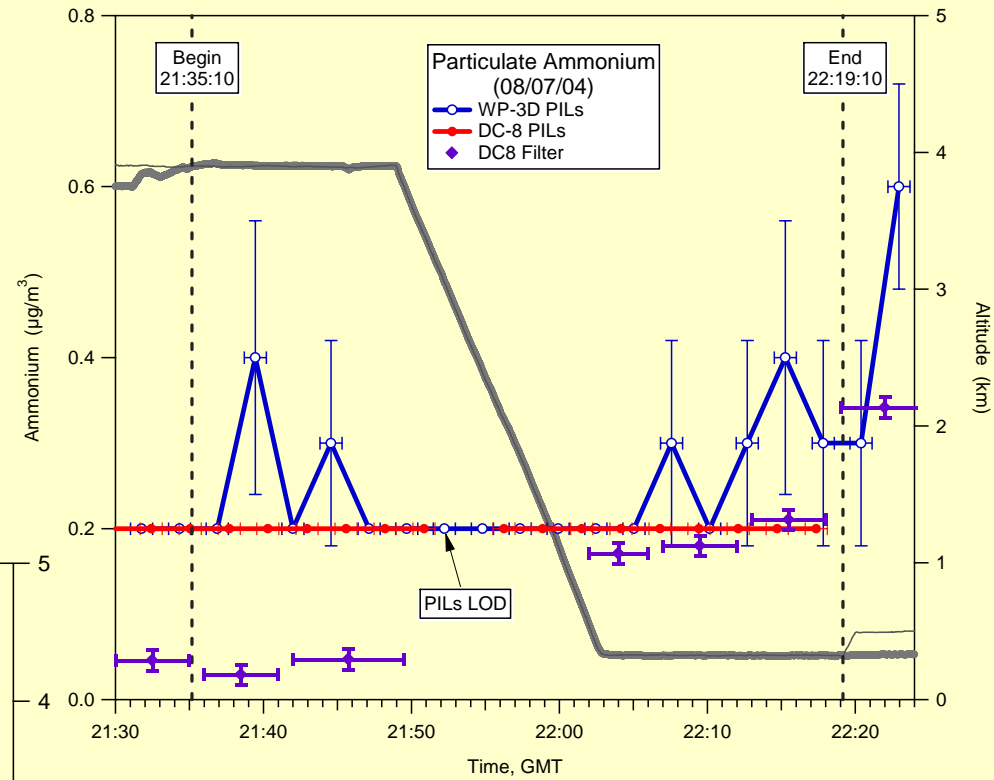
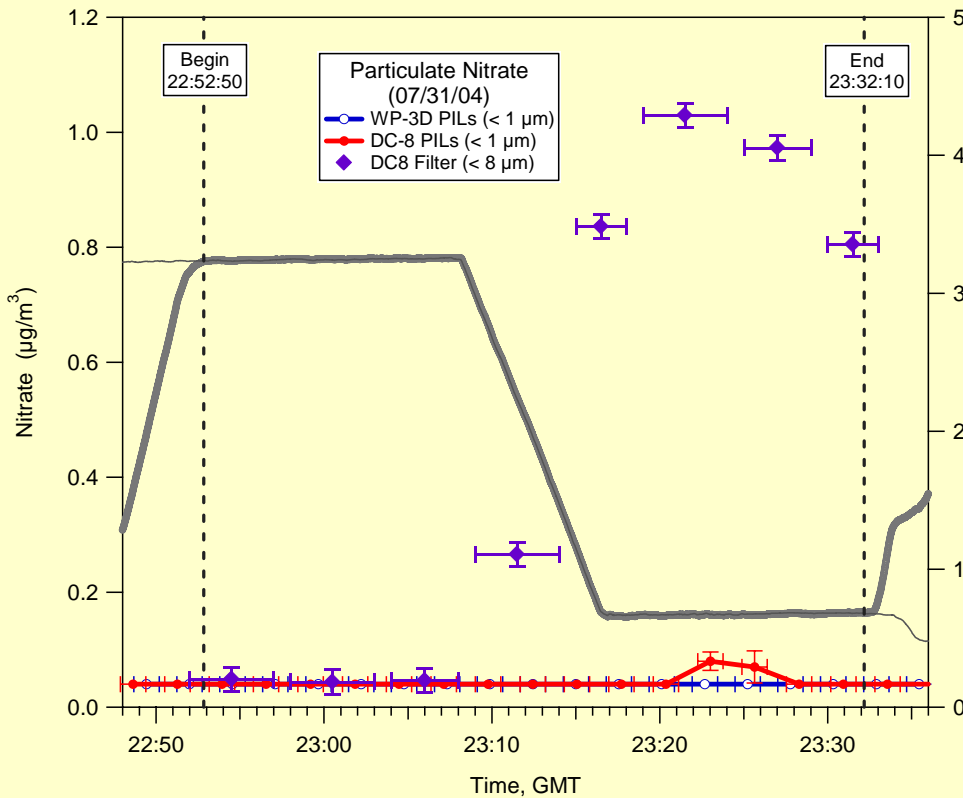
# Acetonitrile Comparison



# Particulate Sulfate Comparison 07/31/2004

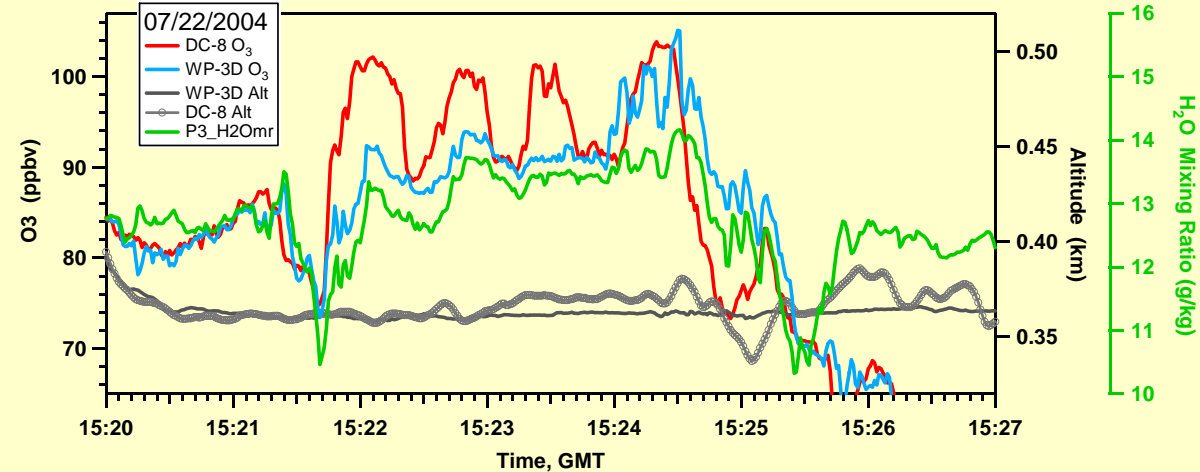
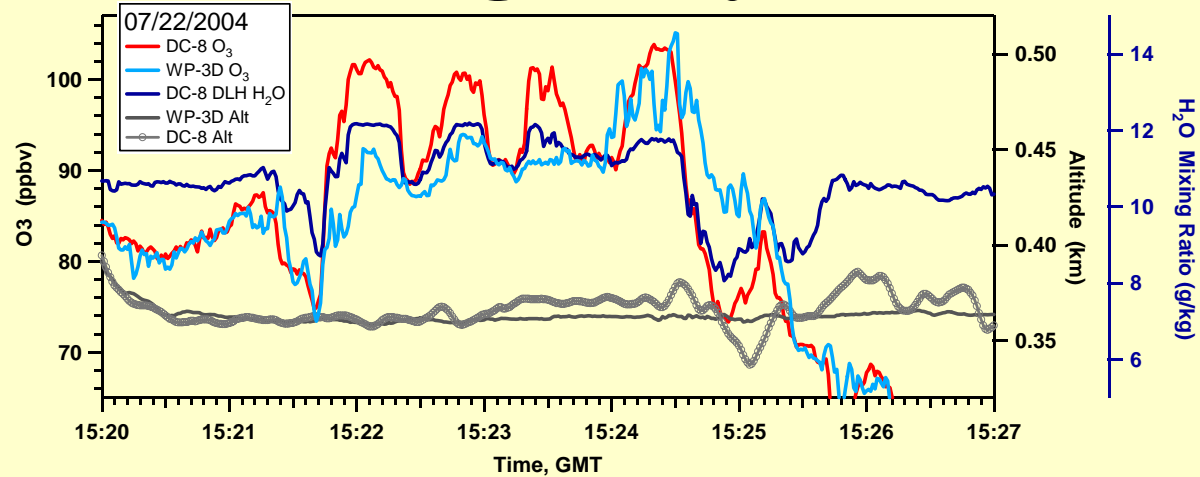
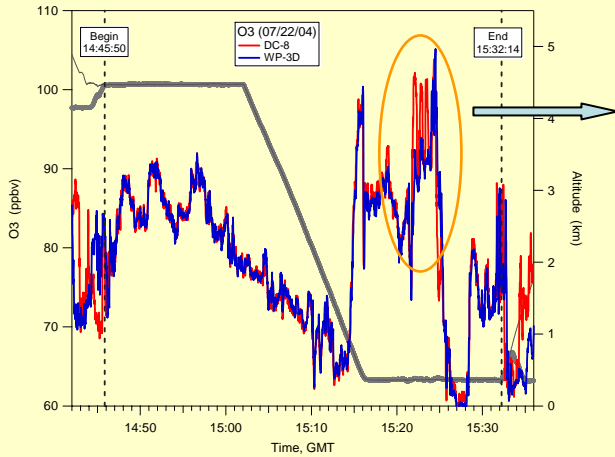


# Comparison of Particulate Ammonium and Nitrate



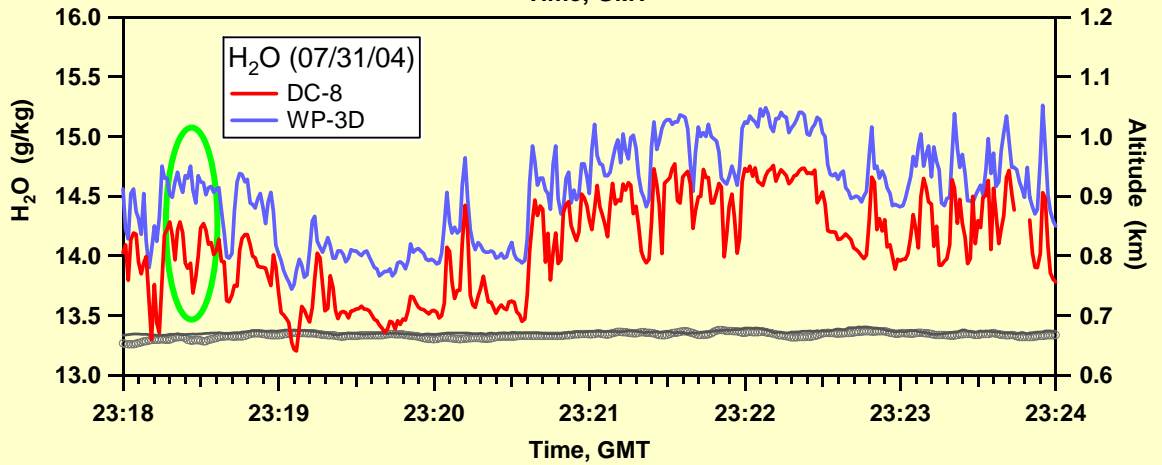
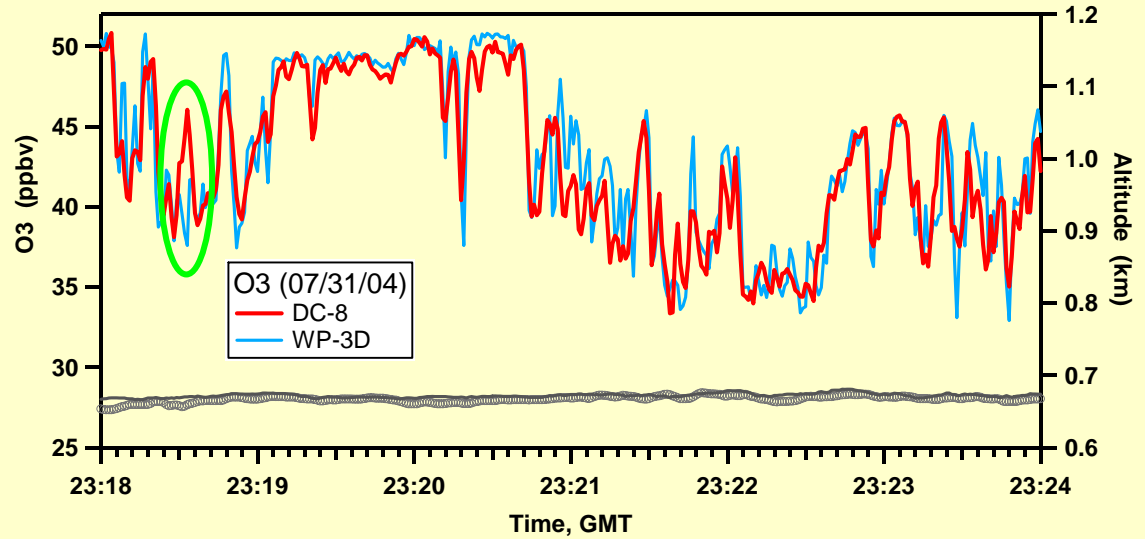
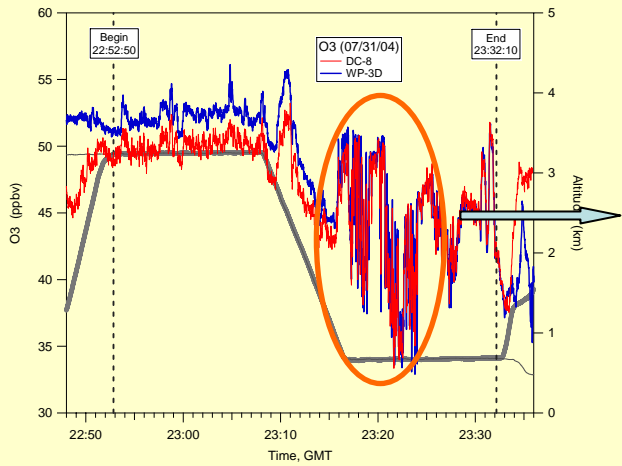
PILs Sampling Size Cut: < 1  $\mu\text{m}$   
Filter Sampling Size Cut: < 8  $\mu\text{m}$

# Effect of Inhomogeneity



- DC-8  $O_3$  is highly synchronized with fast DLH  $H_2O$  observations; While WP-3D  $O_3$  is correlated with WP-3D  $H_2O$ .
- The difference between DC-8 and WP-3D may be largely due to the inhomogeneity in the airmass.

# Airmass Inhomogeneity ?



# Summary

- Intercomparison process is still on-going, some final data are not submitted yet.
- High level of consistency is seen for many species with respect to their uncertainties.
- Some of the differences likely reflect air mass inhomogeneity and/or difference in sampling frequency and integration time.
- Intercomparisons are useful and necessary for future field mission involving multi-platforms.