



DC-8 Science During the INTEX-B/MILAGRO Campaign

H. Singh, W. Brune, J. Crawford, D. Jacob & the INTEX-ST

(<http://cloud1.arc.nasa.gov>; <http://www.joss.ucar.edu/milagro/>)

GOAL: To understand the transport, transformation, & impacts of gases & aerosols on air quality & climate from local to global scales

- INTEX-B/MILAGRO: Spring 2006
 - Mexico City pollution (3/1-21)
 - Asian inflow to NA (4/17-5/15)

Partners:

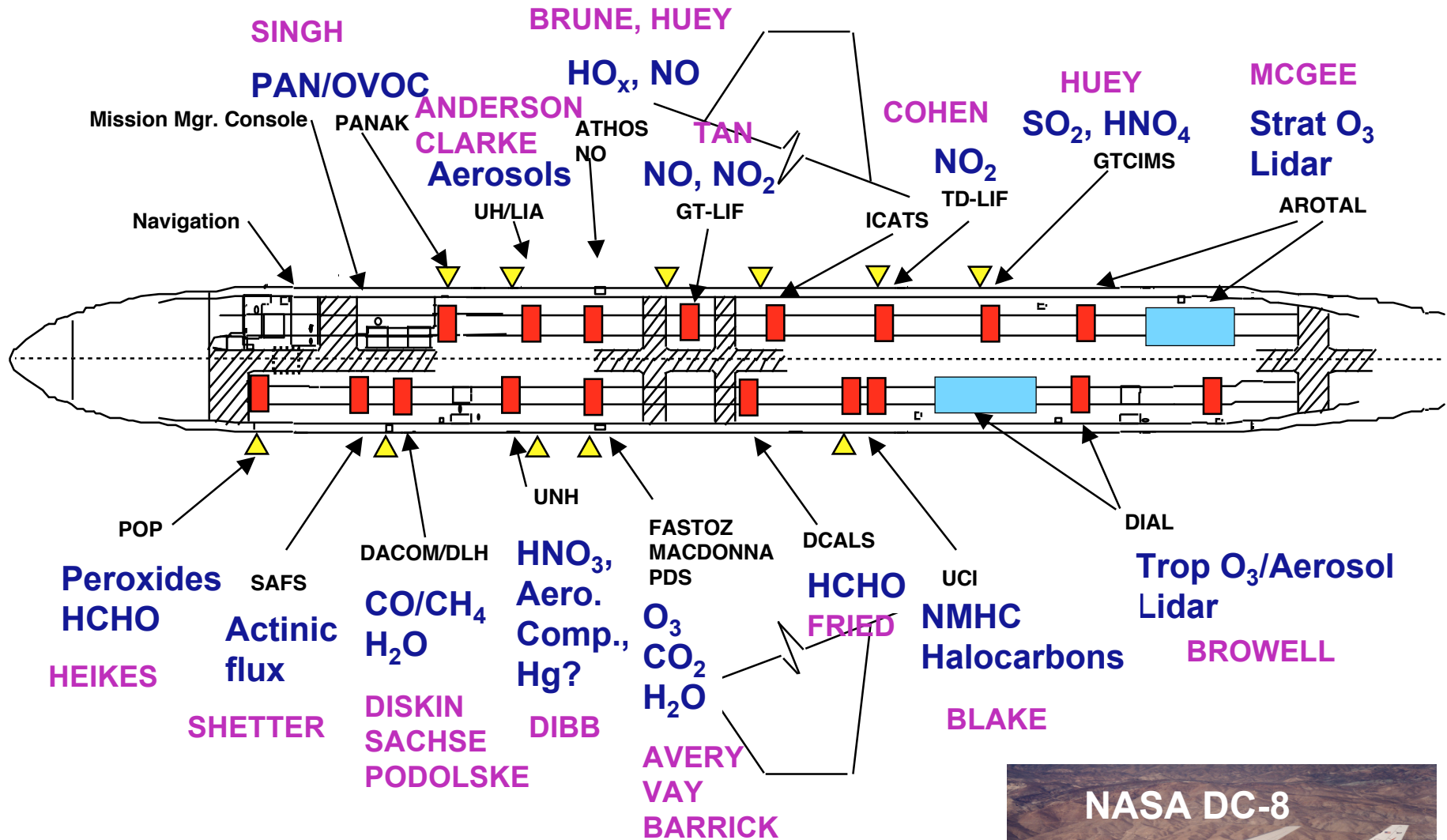
**U.S. (NASA, NSF, DOE),
MEX, CAN, GER**



INTEX-B OBJECTIVES

- **Continental Outflow: Extent & persistence of the outflow of pollution from Mexico**
- **Transpacific Pollution: Transport and evolution of Asian pollution & implications for air quality & climate**
- **Air Quality: Mapping of anthropogenic & biogenic emissions; relating atmospheric composition to sources & sinks**
- **Aerosol Radiative Forcing: Characterizing effects of aerosols on solar radiation over NA & Gulf of Mexico**
- **Satellite Validation: Validating space-borne observations of tropospheric composition**

DC-8 INTEX-B Payload



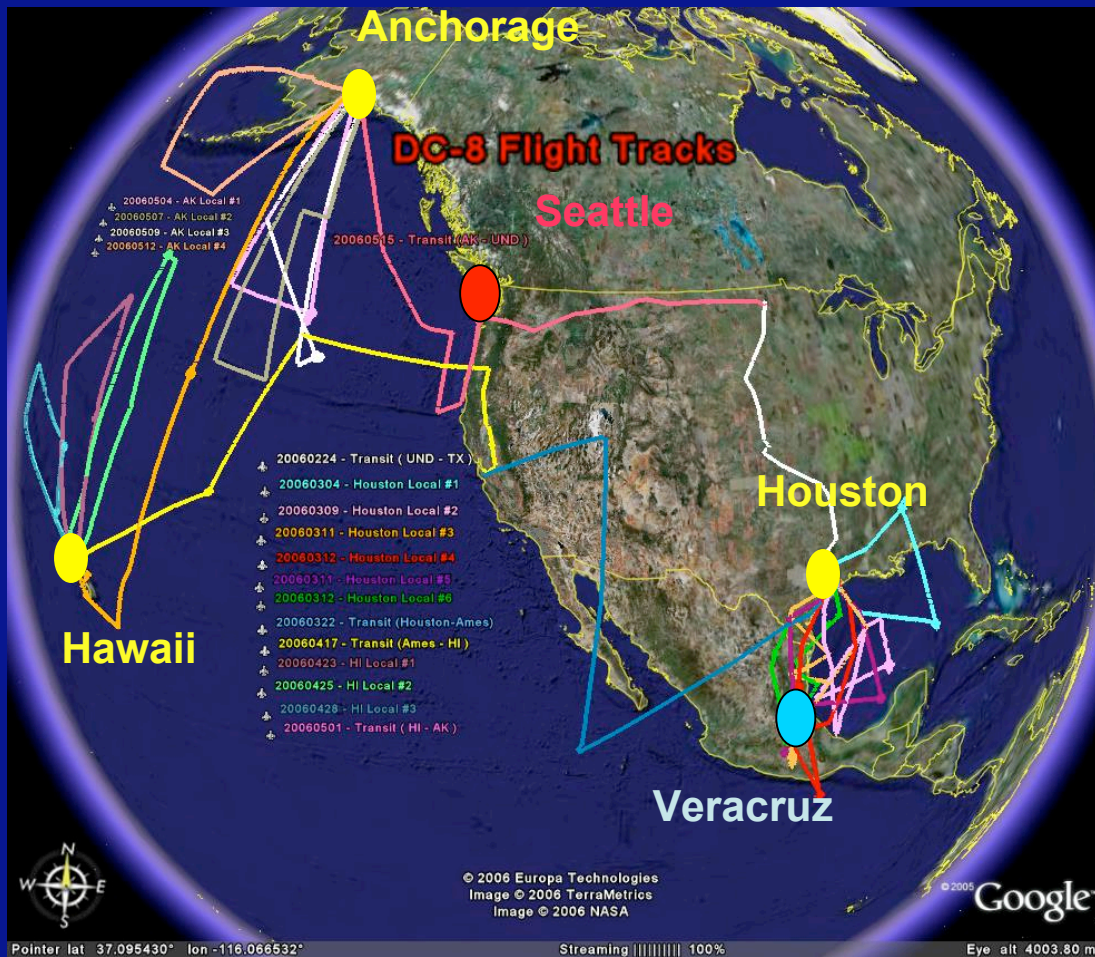
- █ EQUIPMENT RACK
- █ LASER SYSTEM
- ▲ PROBE



NASA Dryden Flight Research Center Photo Collection
<http://www.dfrc.nasa.gov/gallery/Photobank.html>
 NASA Photo #C000-0000-1 (Rev. February 2000)

DC-8 Airborne Laboratory in Flight

INTEX-B DC-8 Flight Tracks

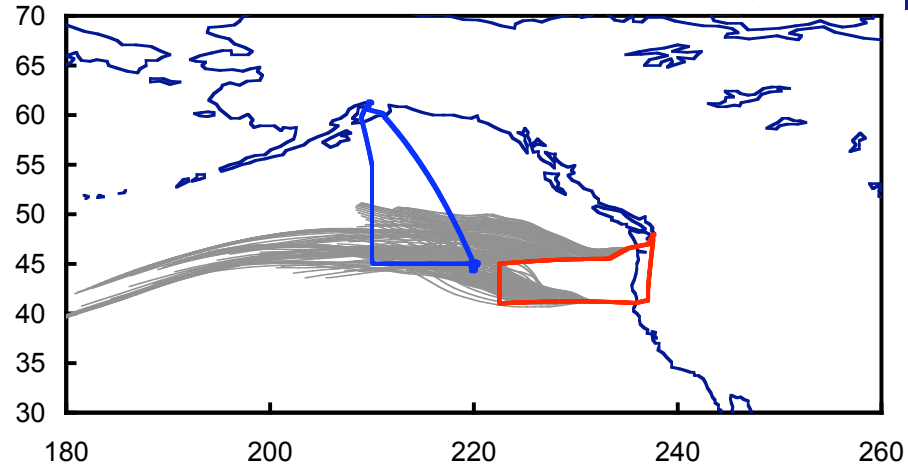
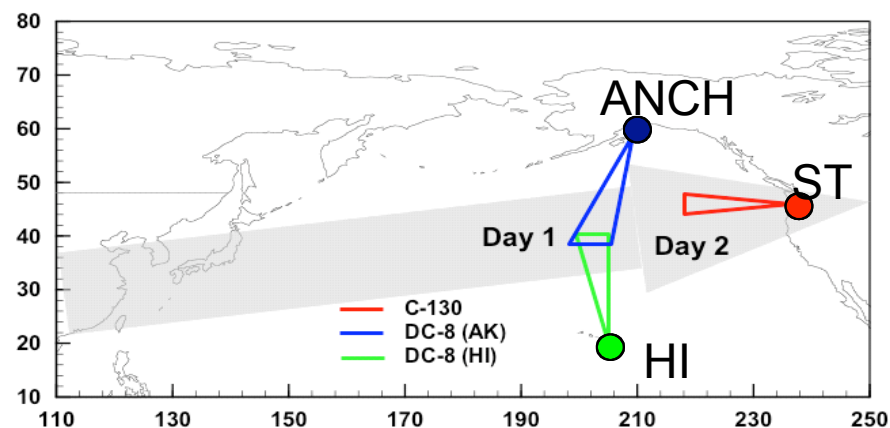


**DC-8: 145 Flt hrs;
17 science flights**

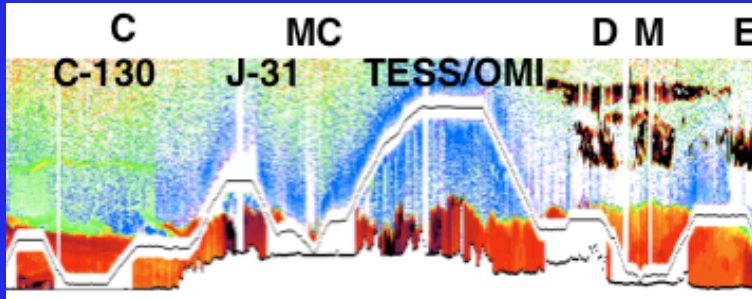
**Houston: 6
Hawaii: 3
Alaska: 4
Transit: 4**

- DC-8**
- C-130**
- C-130+J-31+B-200+G-1**

DC-8 & C-130 Coordination in INTEX-B

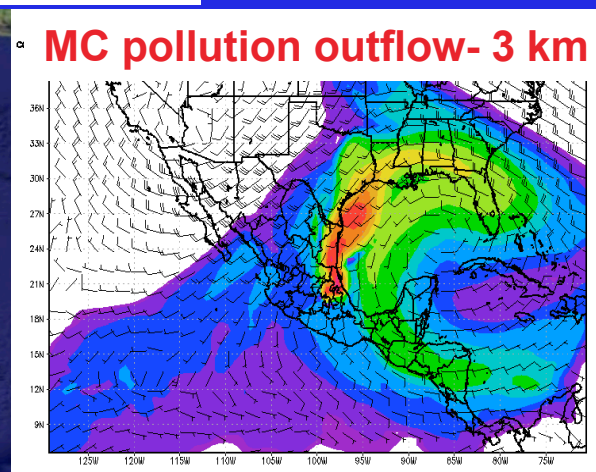
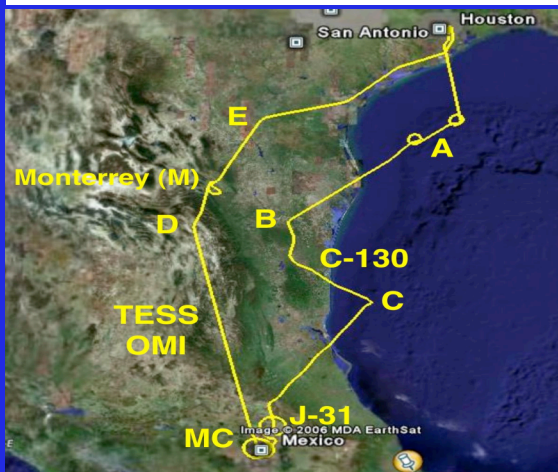


INTEX-B Model Forecasts & Flight Planning



Flight 8 (3/19)

MET data
Trajectories
Convective influences
Fires



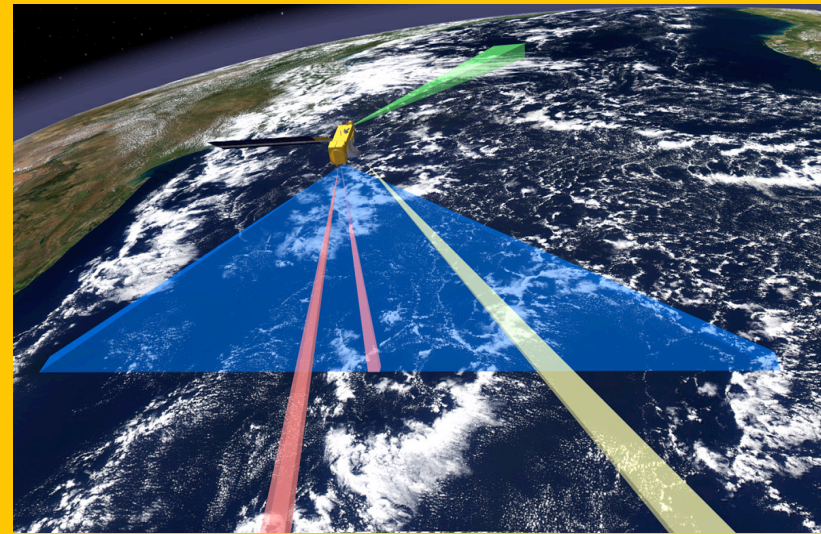
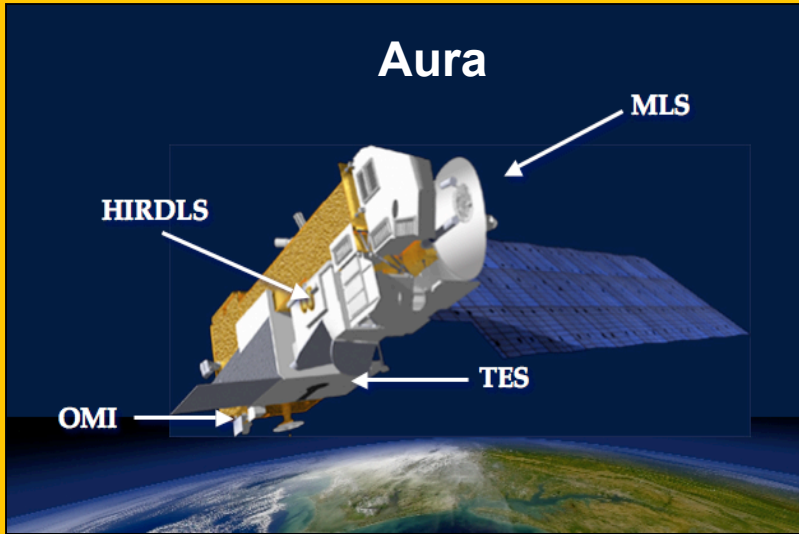
DC-8 objectives:

- Inter-comparison with the C-130
- J-31 coordinated spiral over MC
- validation of TES & OMI
- Characterization of MC & Monterrey pollution
- Sampling of aged MC pollution outflow

AIRS- CO
MOPITT- CO
MODIS- Aerosol
SCIA- NO2
GOES- clouds

GEOS-Chem (Harvard)
MOZART (NCAR)
RAQMS (Langley)
STEM (U. Iowa)
PNL (Milagro)

INTEX-B Targeted Aura Satellite Validation Activities (CO, O₃, HCHO, NO₂, HNO₃, H₂O, HCN, Aerosol)



Aura/ others	DC-8															C-130					
	3/4	3/9	3/12	3/16	3/19	3/21	4/17	4/23	4/25	4/26	4/30	5/4	5/7	5/9	5/12	4/24	4/28	5/1	5/3	5/8	5/11
TES*	●	●	●	●	●		●	●	●	●	●		●	●	●						
OMI	●	●	●	●	●		●	●				●				●	●		●	●	●
HIRDLS#						●					●										
MLS									●				●								
Others**	●	●		●	●	●	●	●		●	●	●	●		●			●		●	●

* TES validation for Nadir & Limb measurements over land and water

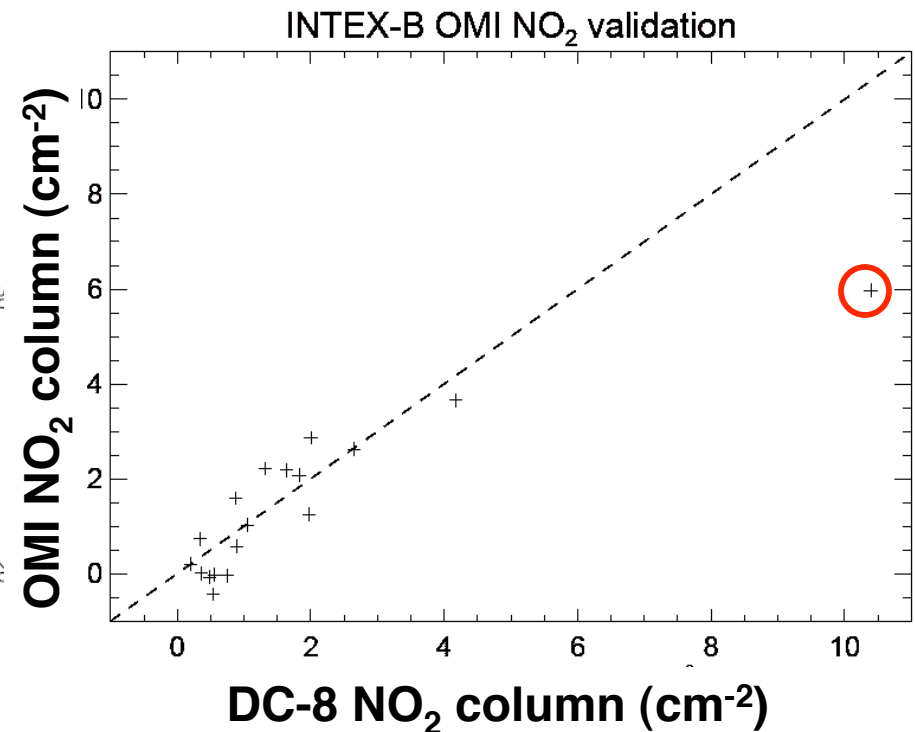
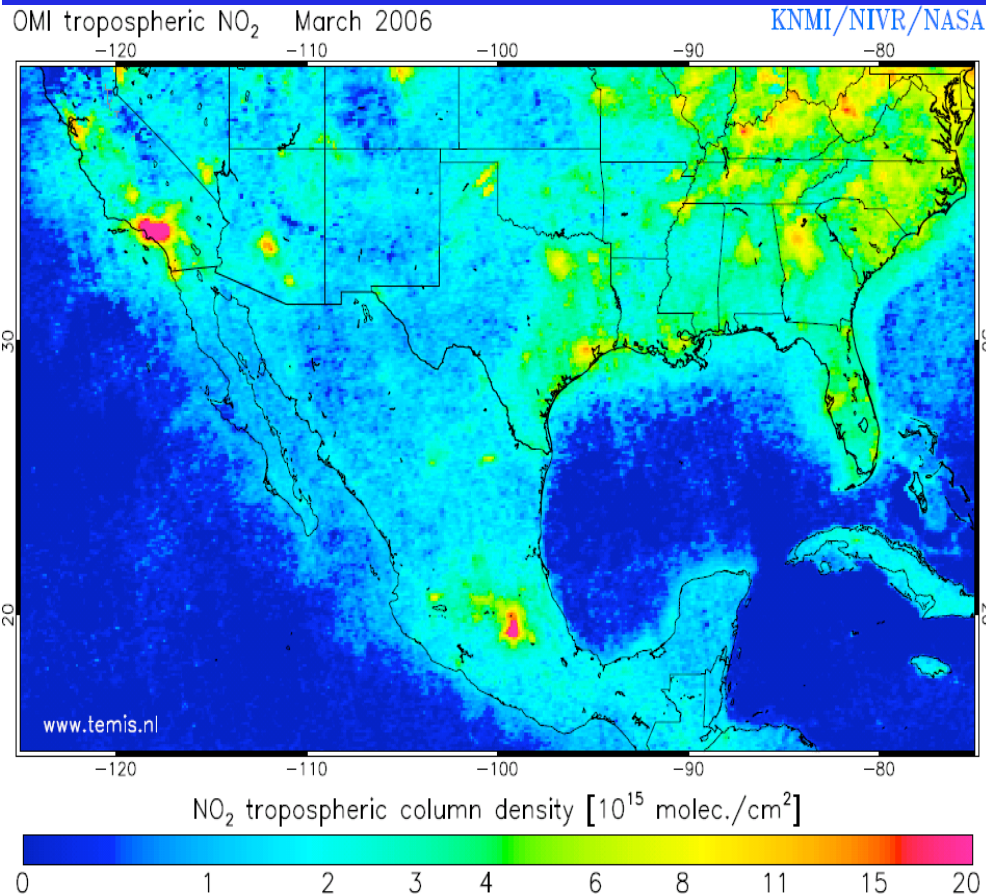
Night flights required for HIRDLS validation

** Mainly AIRS, SCIAMACHY, and MODIS

Validation of OMI tropospheric NO₂ during MILAGRO / INTEX-B

March 2006 OMI tropospheric NO₂

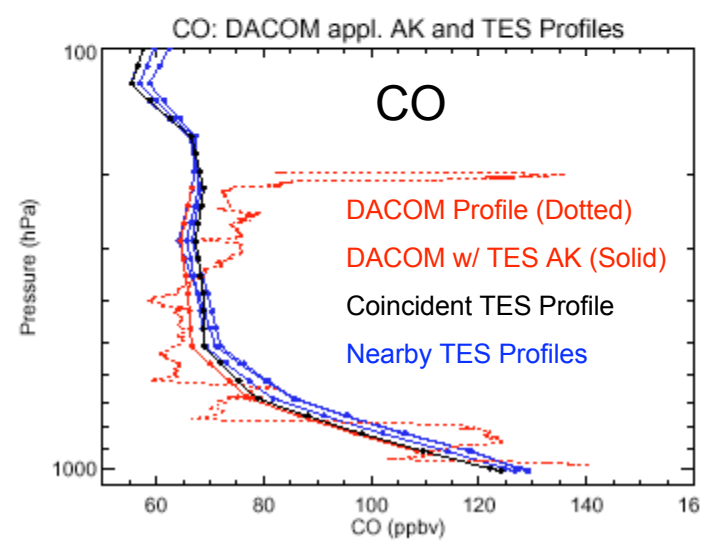
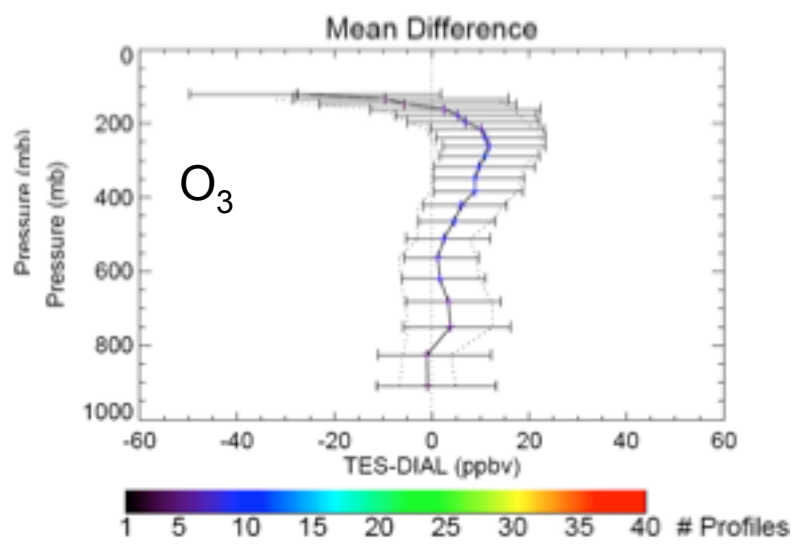
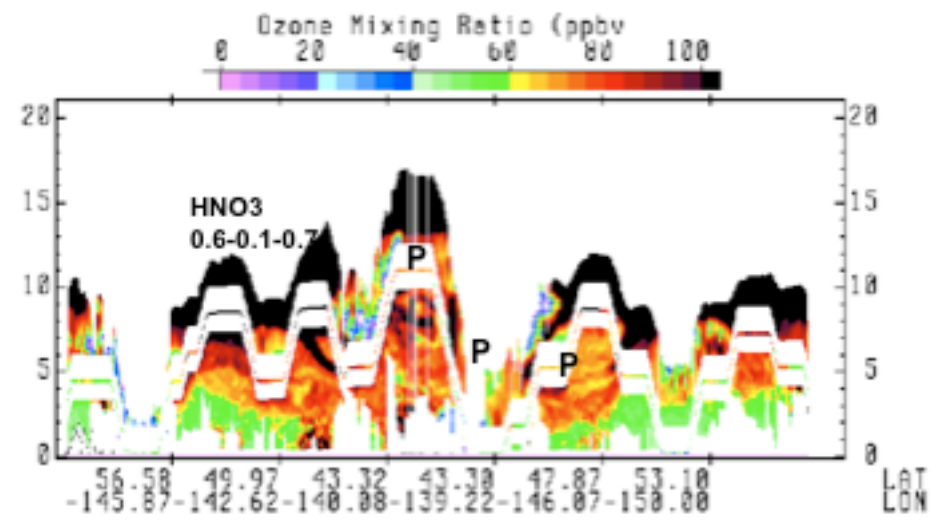
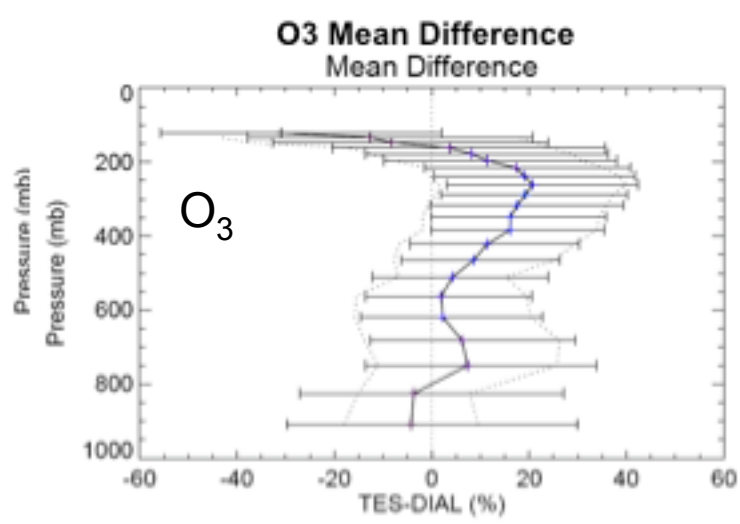
Validation w/aircraft profiles



Preliminary data, not for public use

K. Folkert Boersma (Harvard)

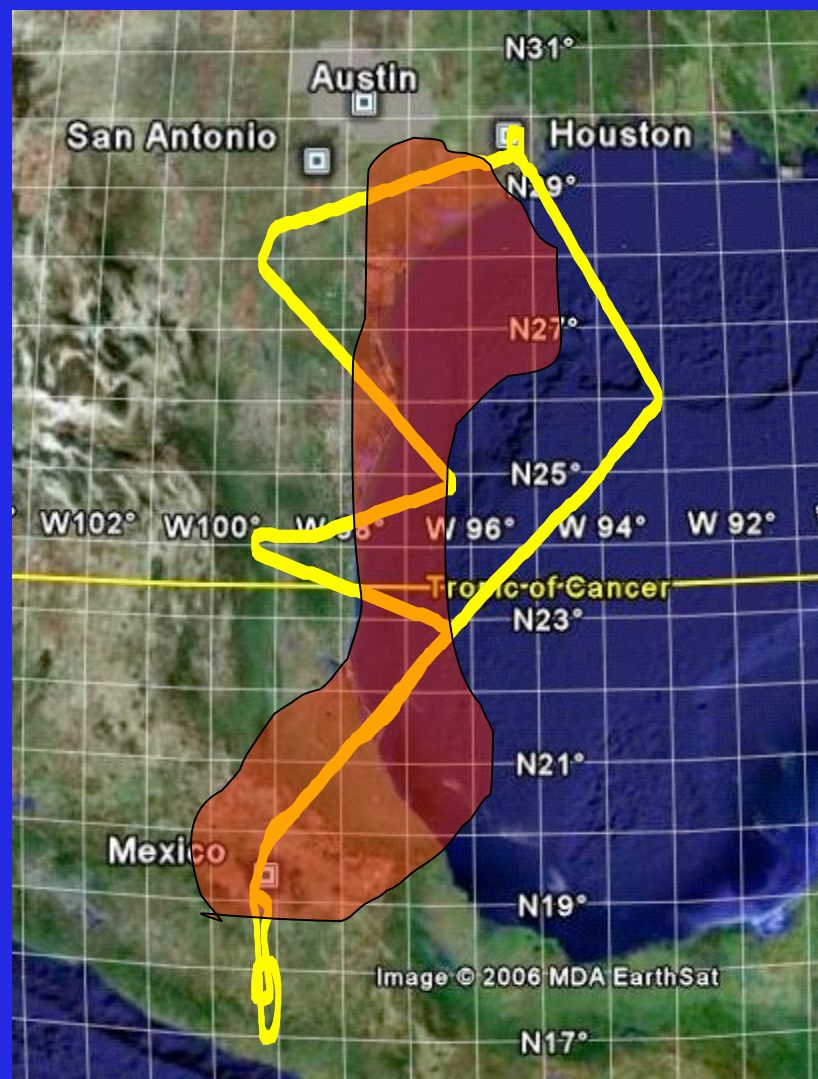
O₃, CO, & HNO₃ Comparisons Between TES & DC-8



Example of DC-8 observations: 11 March

The objectives:

- Sample aged MC plume previously sampled by the C-130 near MC on 10 March
- Sample the MC boundary layer both remotely (DIAL) & *in situ* to set up C-130 for 12 March
- compare with T0, T1, T2 by low overpass



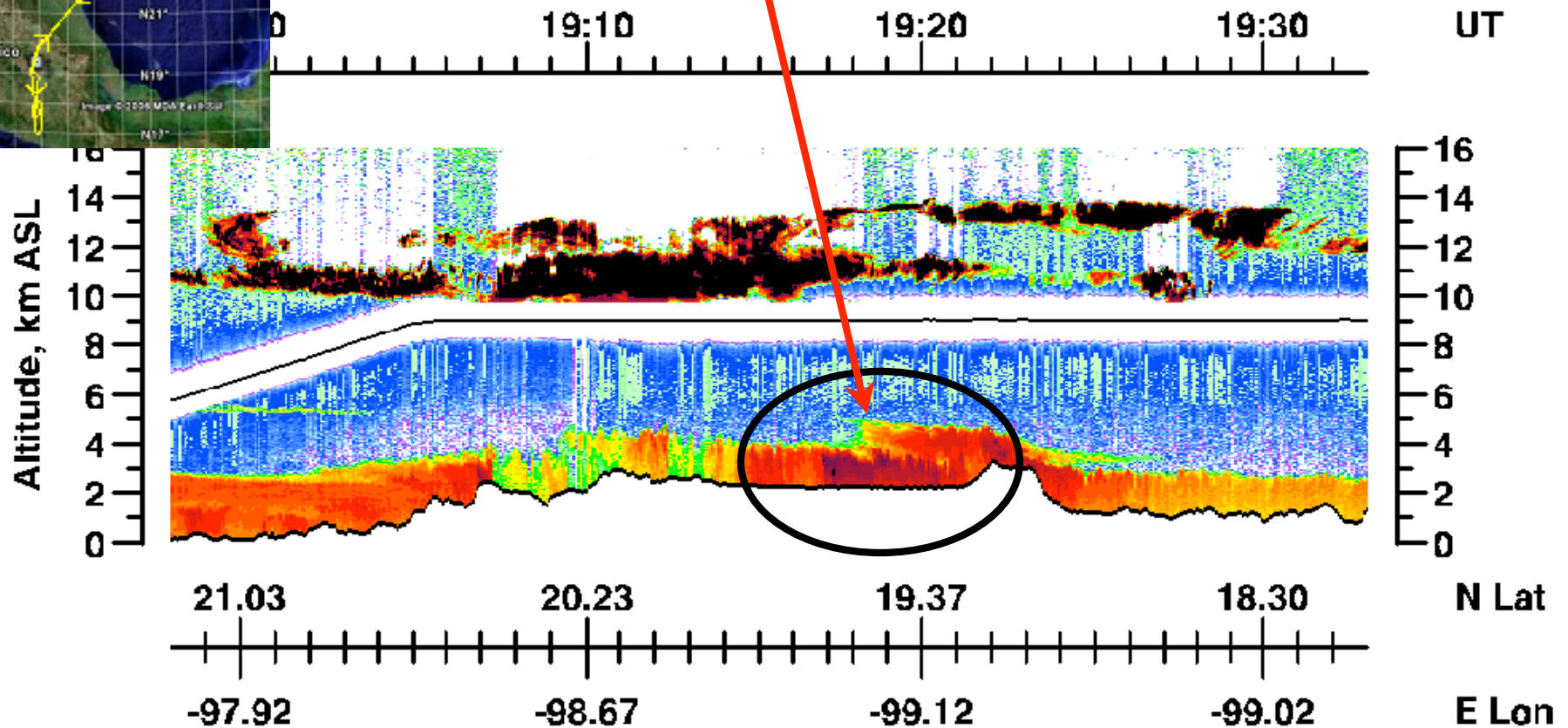
Small particle pollution over Mexico City



Mexico City Plume 1
Flight 5

11 Mar 06

Aerosol Scattering Ratio (588nm)

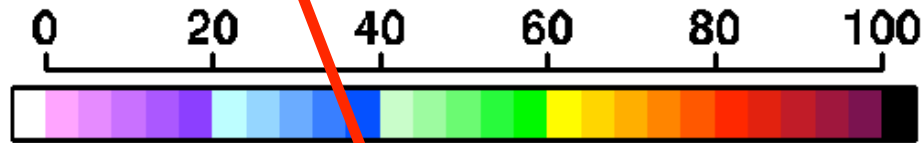


Ozone pollution over Mexico City



Mexico City Plume 1
Flight 5
Ozone (ppbv)

11 Mar 06

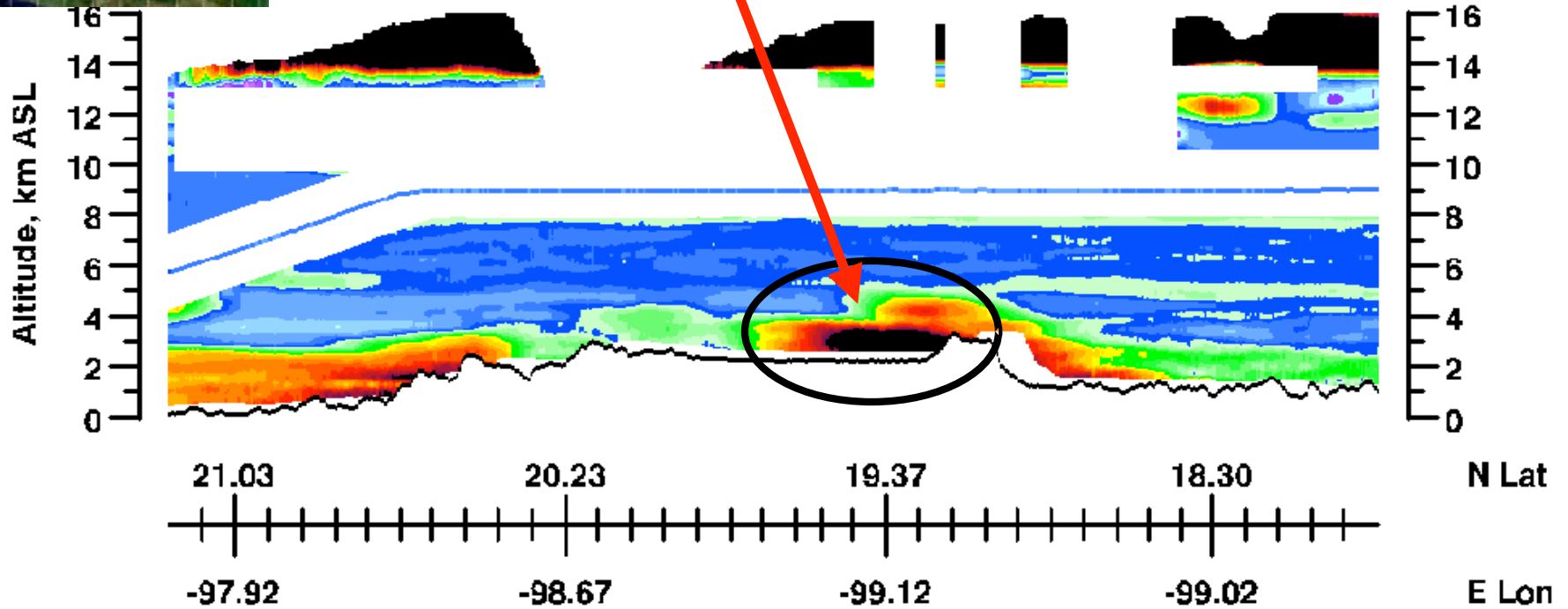


19:10

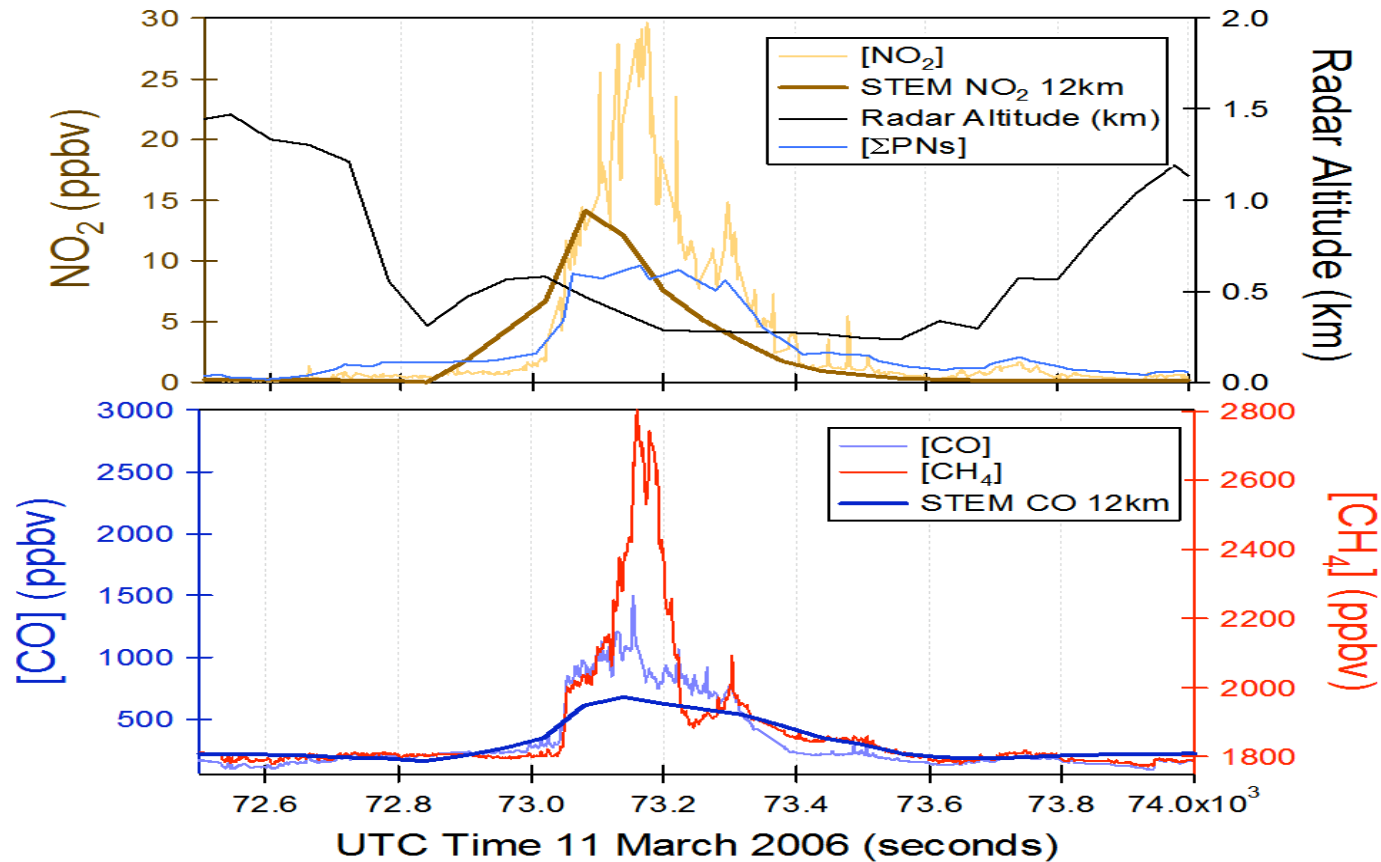
19:20

19:30

UT

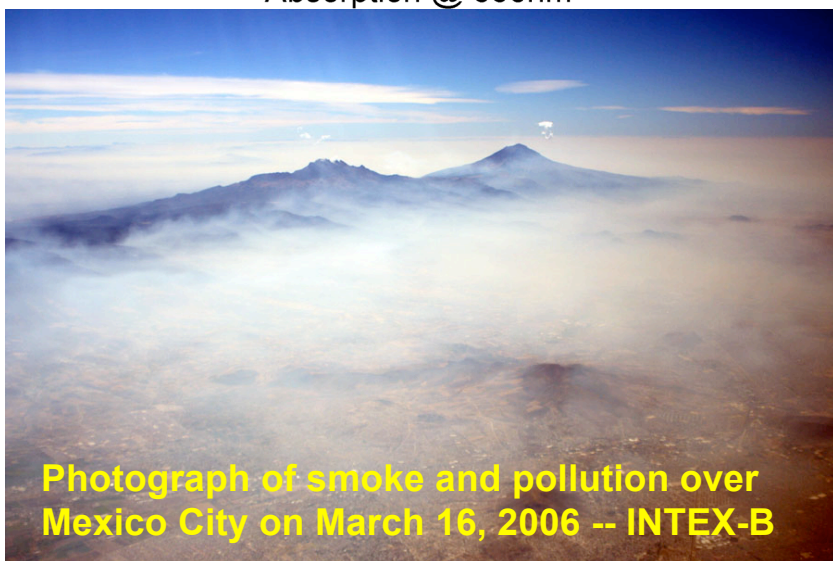
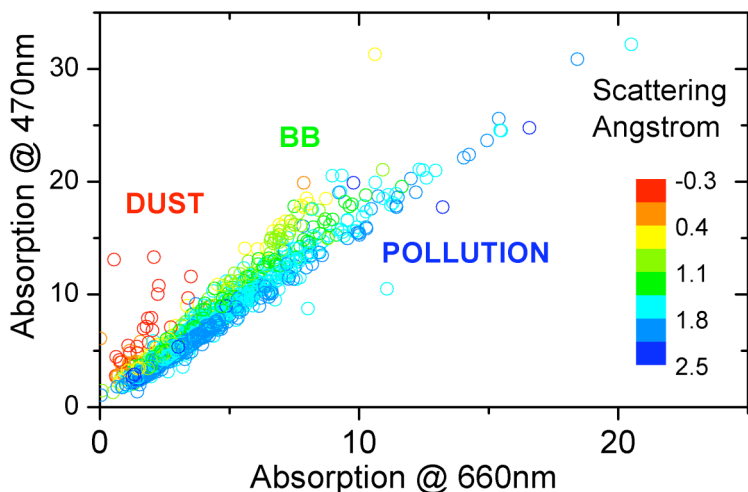


Mexico City Close Approach [11 March 2006]

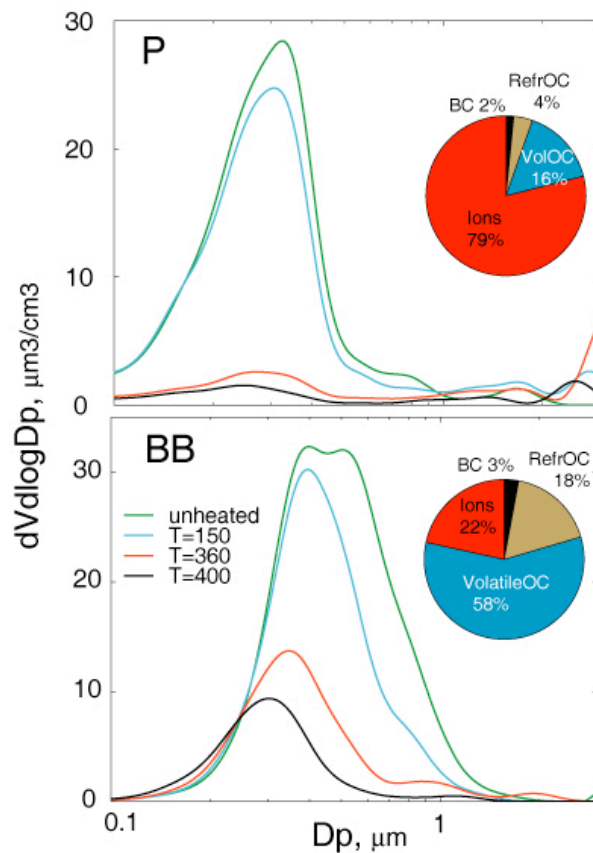


Source indicators: $\Delta\text{CH}_4/\Delta\text{CO}$; $\Delta\text{N}_2\text{O}/\Delta\text{CO}$

New DC-8 measurements of spectral light absorption (470nm and 660nm) and light scattering help resolve POLLUTION (P) and BIOMASS BURNING (BB) and DUST aerosol types during INTEX/MIRAGE phase of experiment in and around Mexico City. Possible application to remote sensing.



Thermal volatility of size-resolved aerosol at 40, 150, 360 and 400C can combine with ions (J.Dibb) and absorption (BC) to get volatile and refractory organic components (pie charts) for Pollution and Biomass Burning

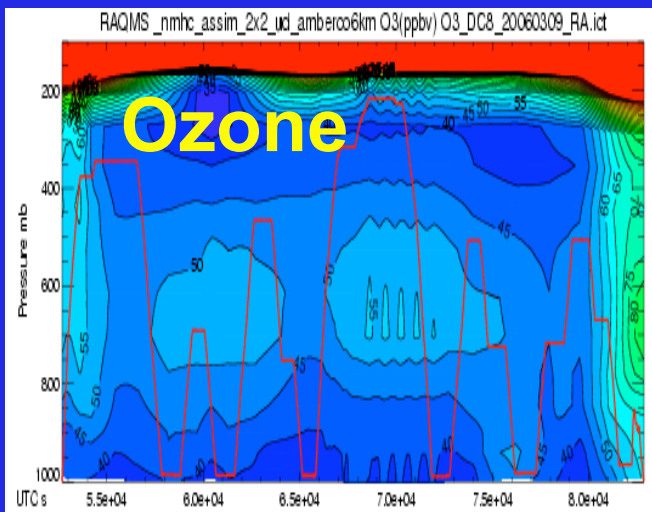


HiGEAR

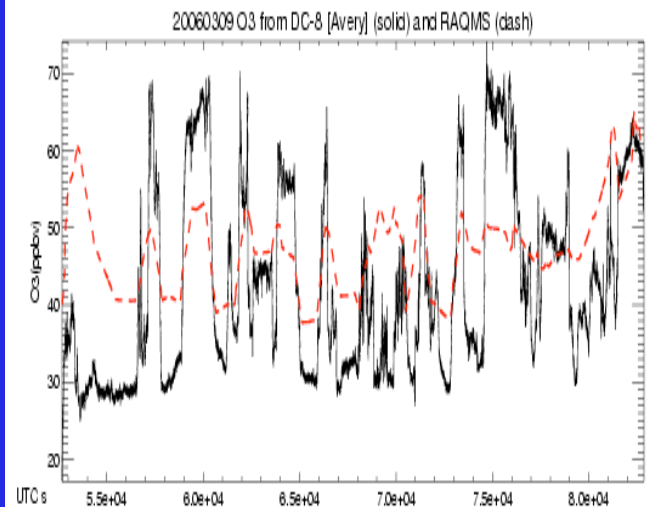
Hawaii Group for Environmental Aerosol Research

A. Clarke, V. Kapustin, S. Howell, J. Zhou, C. McNaughton, Y. Shinozuka University of Hawaii

How well did models do? RAQMS vs DC8 (3/9/06)

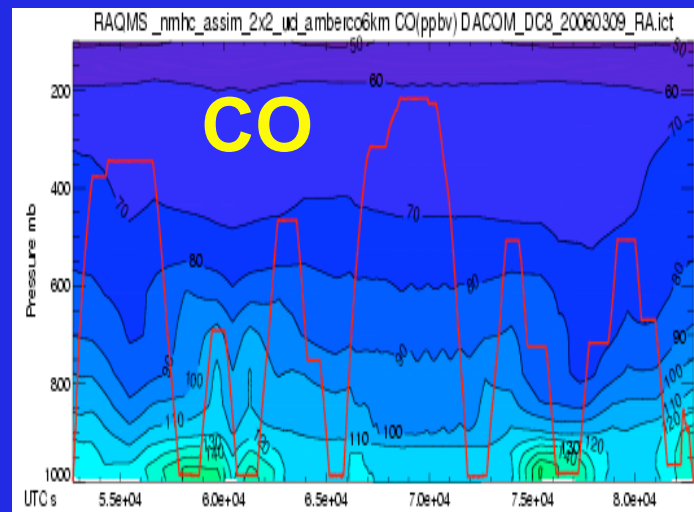


Lon	-96.4	-95.6	-93.1	-91.0	-95.5	-93.2
Lat	28.7	19.5	25.4	23.2	22.3	26.7

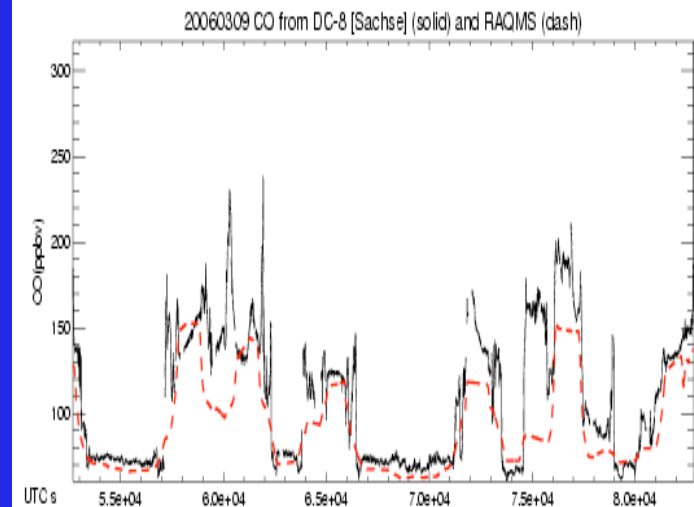


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Fri Mar 10 13:37:48 2006



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Fri Mar 10 16:02:01 2006

Preliminary Concluding Observations

- **INTEX-B/Milagro has completed all of the planned tasks to achieve its objectives of:**
 - **Providing a comprehensive and unified data set to determine the composition of MC & Asian pollution plumes, their persistence, & transformation**
 - **Validating satellite observations of tropospheric composition**
 - **Relating atmospheric composition to anthropogenic & biogenic emissions**
 - **Testing chemical transport models & their forecasts**
- **Final data due by March 1, 2007 (preliminary data are submitted)**
- **First INTEX-B workshop March 5-9, 2007**