# NASA INTEX-B/MILAGRO Campaign 2006

H. B. Singh & the INTEX-Science Team

(http://cloud1.arc.nasa.gov)

**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)

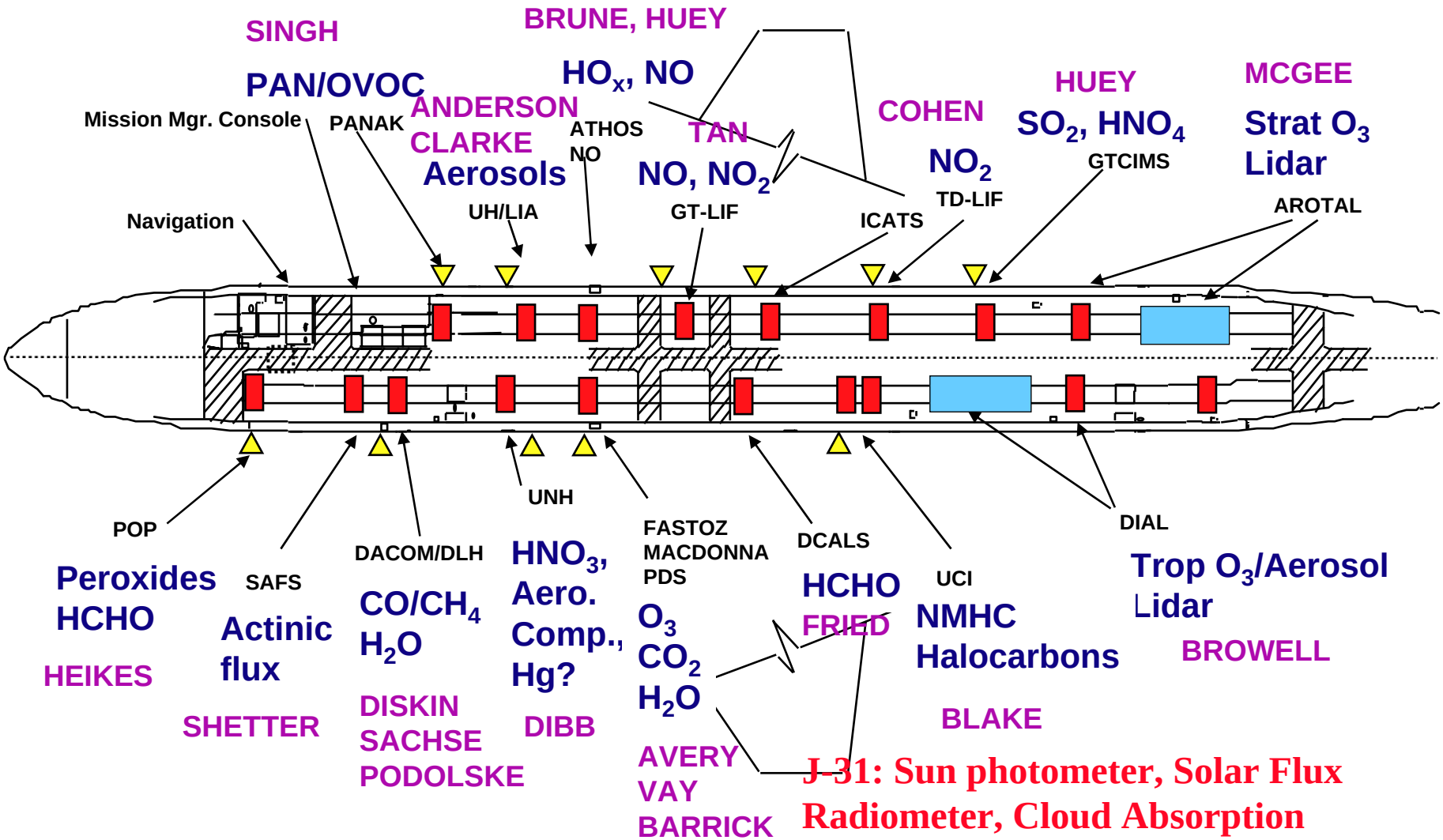
**Partners:**

**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: Validation of space-borne observations of tropospheric composition**

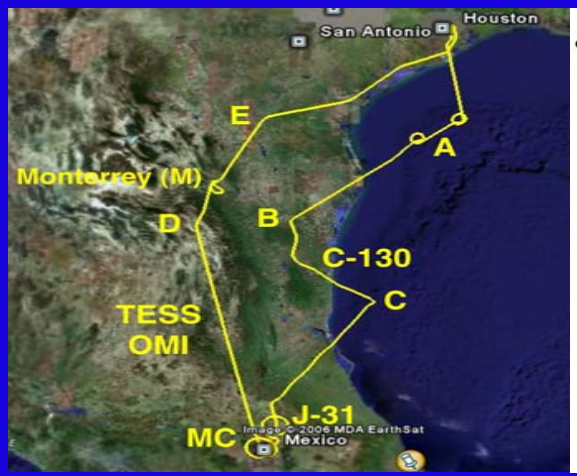
# DC-8, J-31 & B-200 INTEX-B Payload

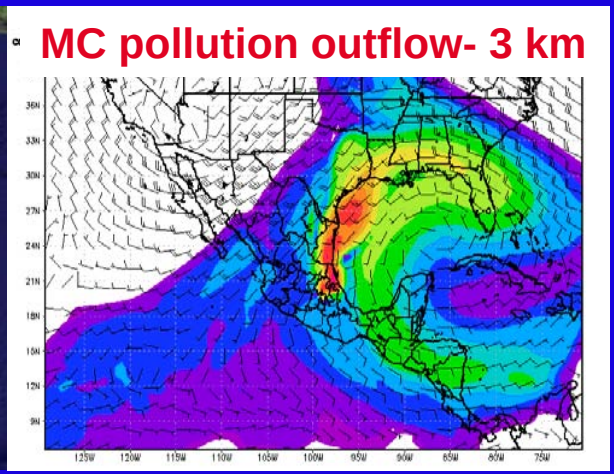



**J-31: Sun photometer, Solar Flux Radiometer, Cloud Absorption Radiometer, Scanning Polarimeter; B-200: HSRLidar, HySPAR, LAABS, Nadir digital camera**

# INTEX-B Model Forecasts & Flight Planning

## Flight 8 (3/19)




MET data
Trajectories
Convective influences
Fires

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

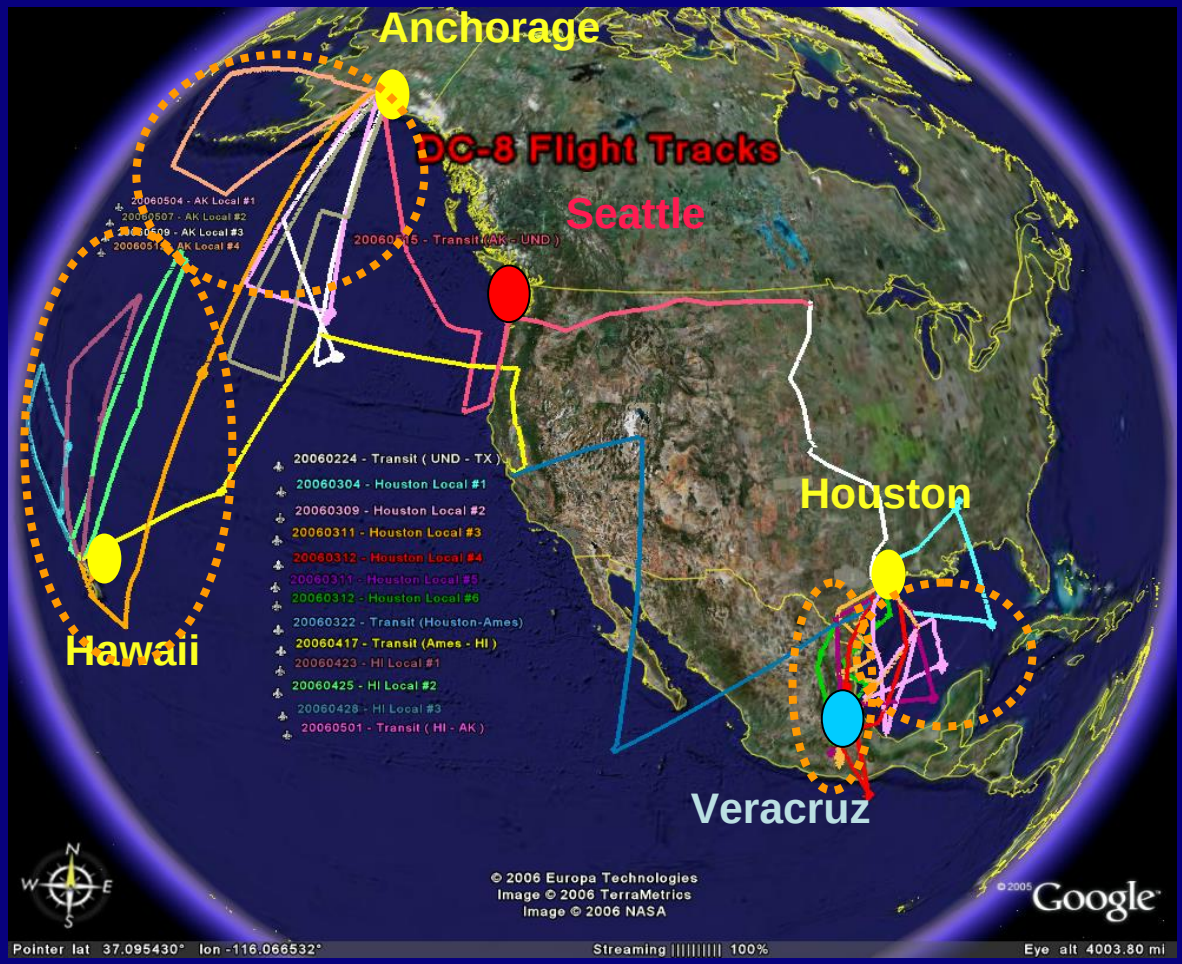
## DC-8 objectives:

- 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

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

# INTEX-B DC-8 Flight Tracks

**(DC-8 Bases: Houston, TX (3/1-21/2006) ; Honolulu, HI (4/17-30/2006); Anchorage, AK (5/1-15/2006)**




**INTEX-B:**
**DC-8: 145 Flight hrs;**
**17 science flights**
**(15 day + 2 night)**

**J-31: 43 Flight hours;**
**13 Science Flights**

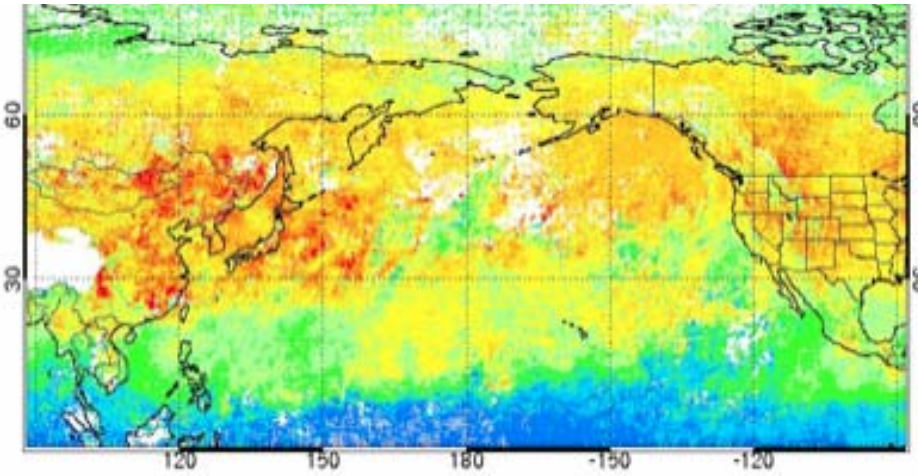
**B-200: 65 Flight hrs;**
**18 Science Flights**

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

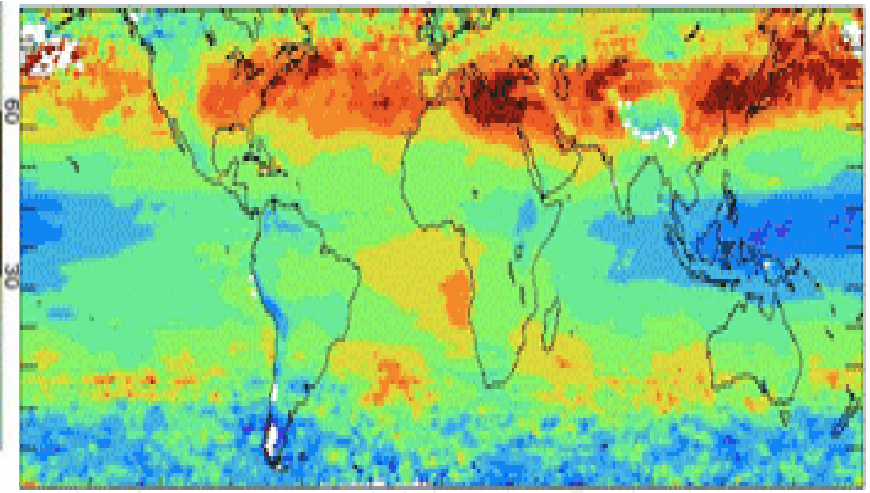
# INTEX-B Targeted Satellite Validation Activities

## (CO, $O_3$, HCHO, $NO_2$, $HNO_3$, $H_2O$, HCN, Aerosol)

MOPITT CO Spring 2006




$O_3$ Trop residual/OMI summer 2005



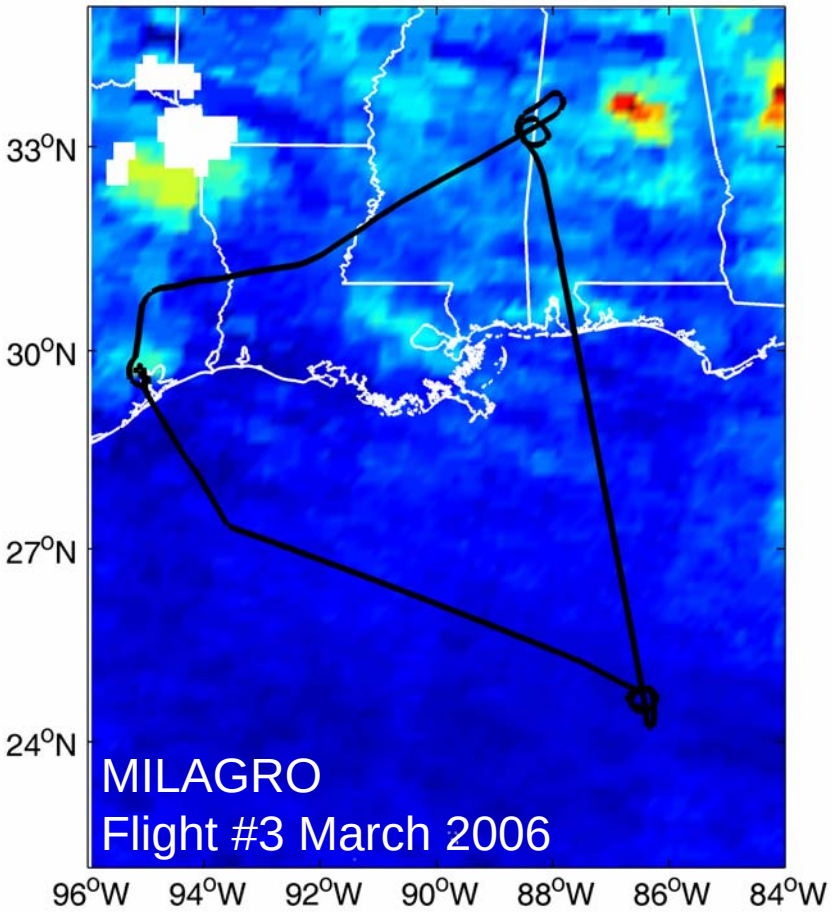
| Aura/ others | DC-8 | | | | | | | | | | | | | | | C-130 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3/4 | 3/9 | 3/12 | 3/16 | 3/19 | 3/21 | 4/17 | 4/23 | 4/25 | 4/26 | 4/30 | 5/4 | 5/7 | 5/9 | 5/12 | 4/24 | 4/28 | 5/1 | 5/3 | 5/8 | 5/11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

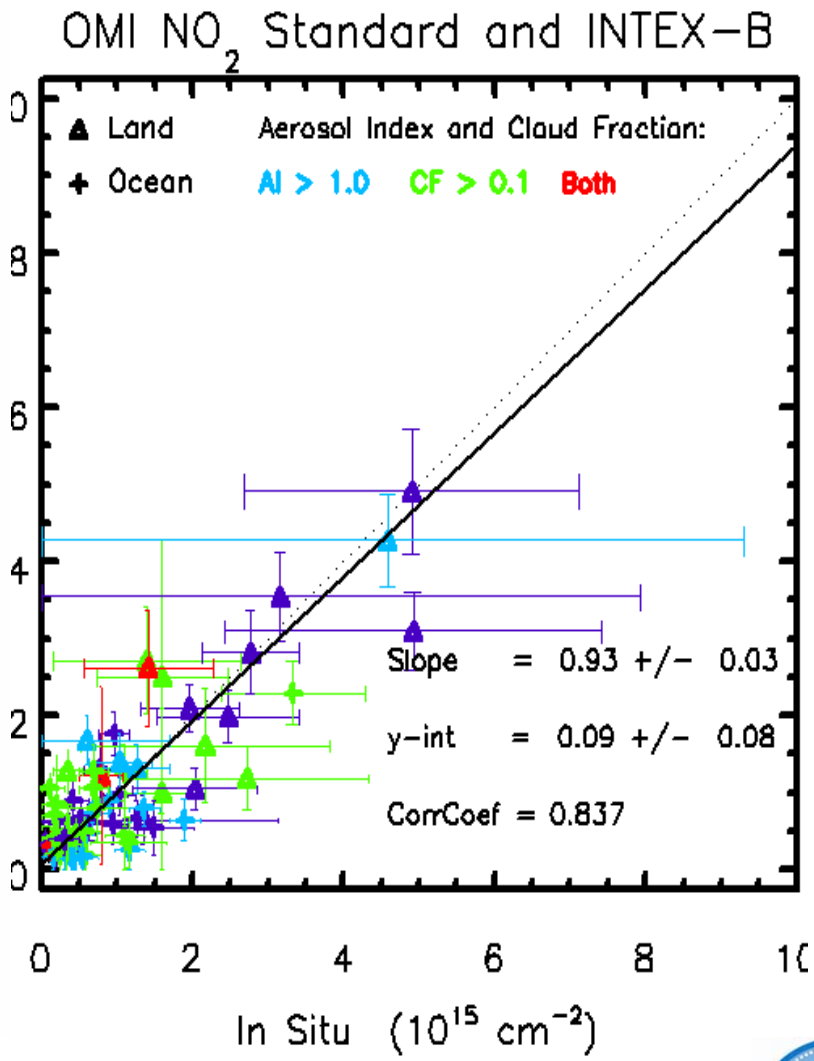
*** TES validation for Nadir & Limb measurements over land and water**

**# Night flights required for HIRDLS validation**

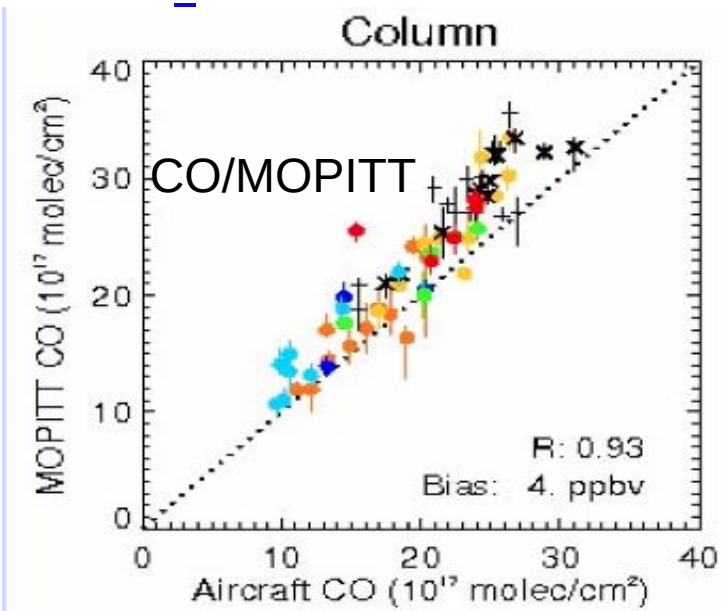
**** Mainly AIRS, SCIAMACHY, and MODIS**

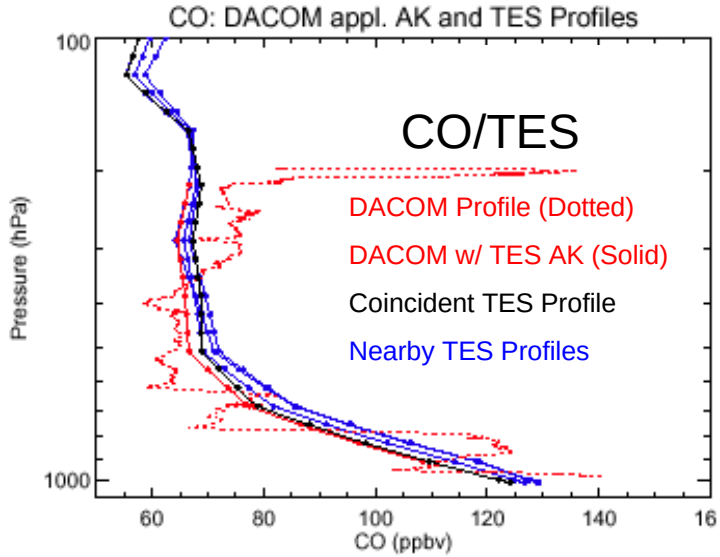
# $NO_2$ Satellite Comparison



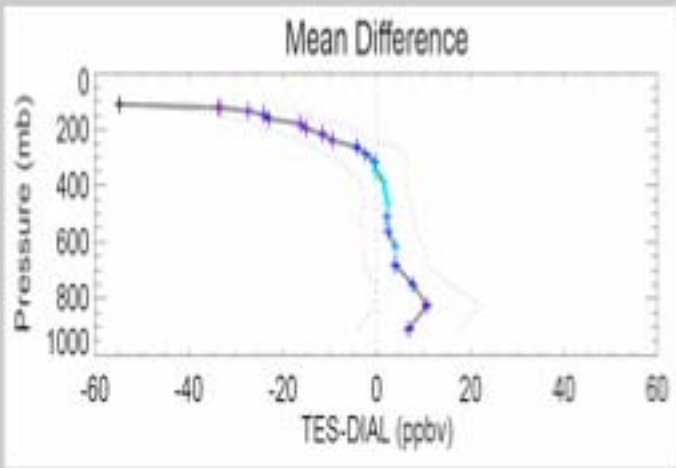
# $O_3$, CO Comparisons: TES, MOPITT & DC-8

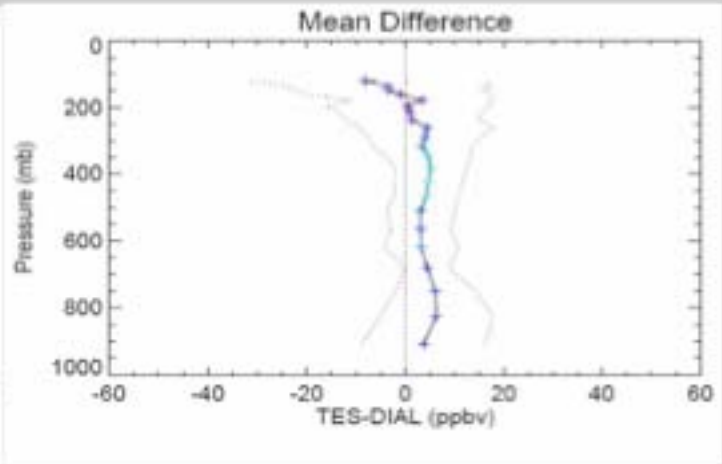


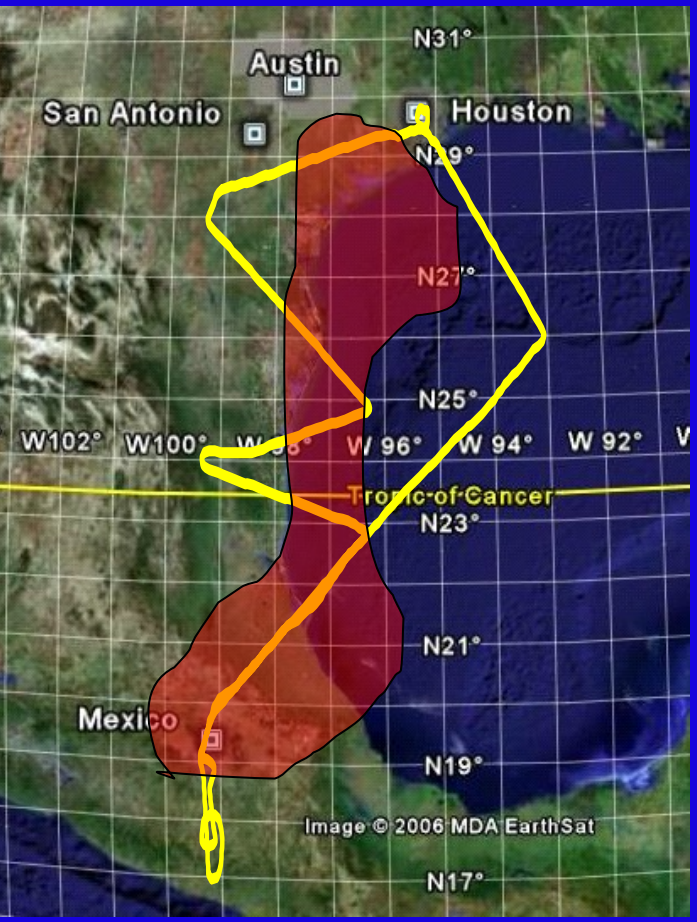

## 3459 (March 16th)

**Version 2** — **$O_3$ (TES-DIAL)** — **Version 3**

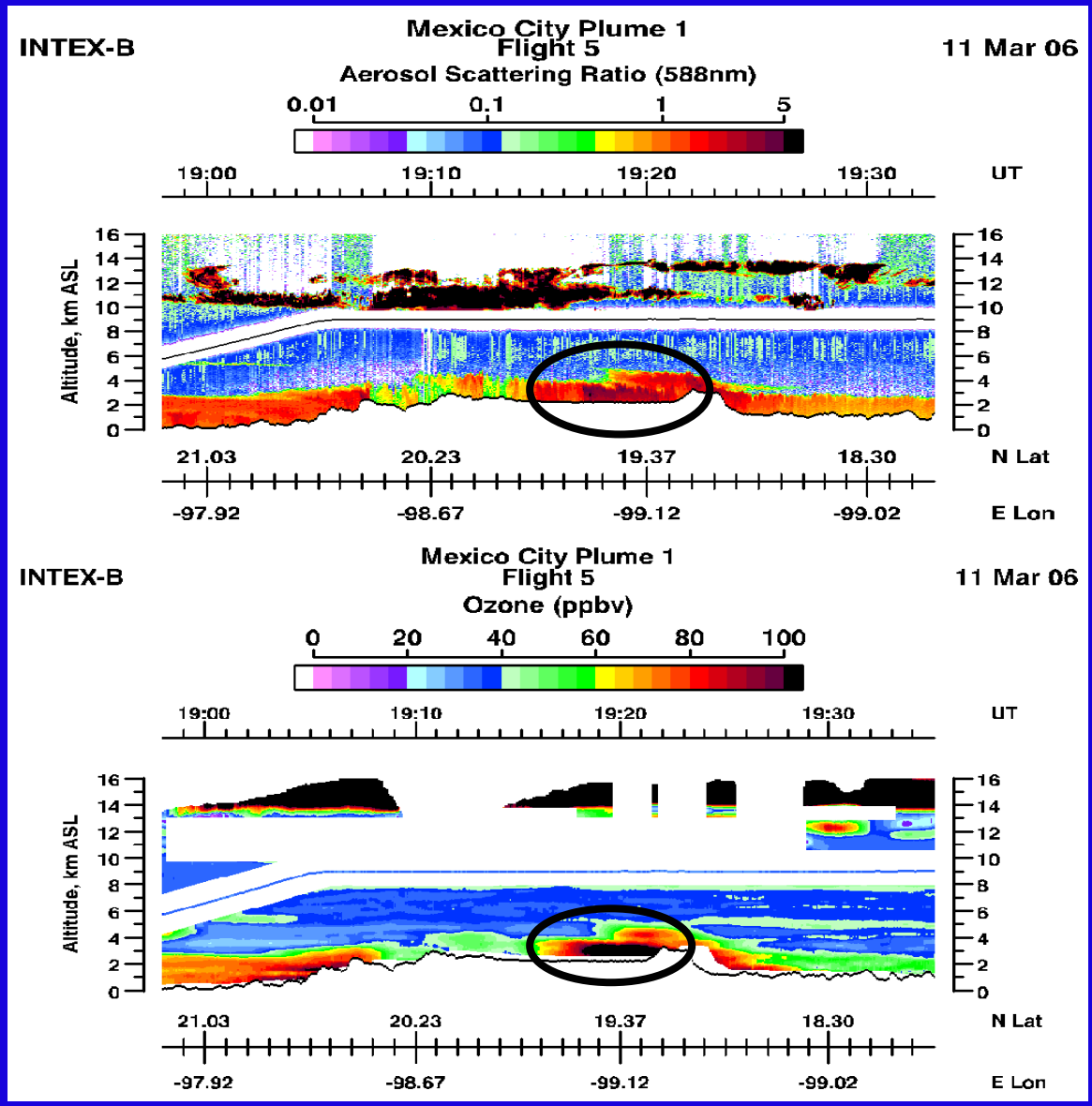


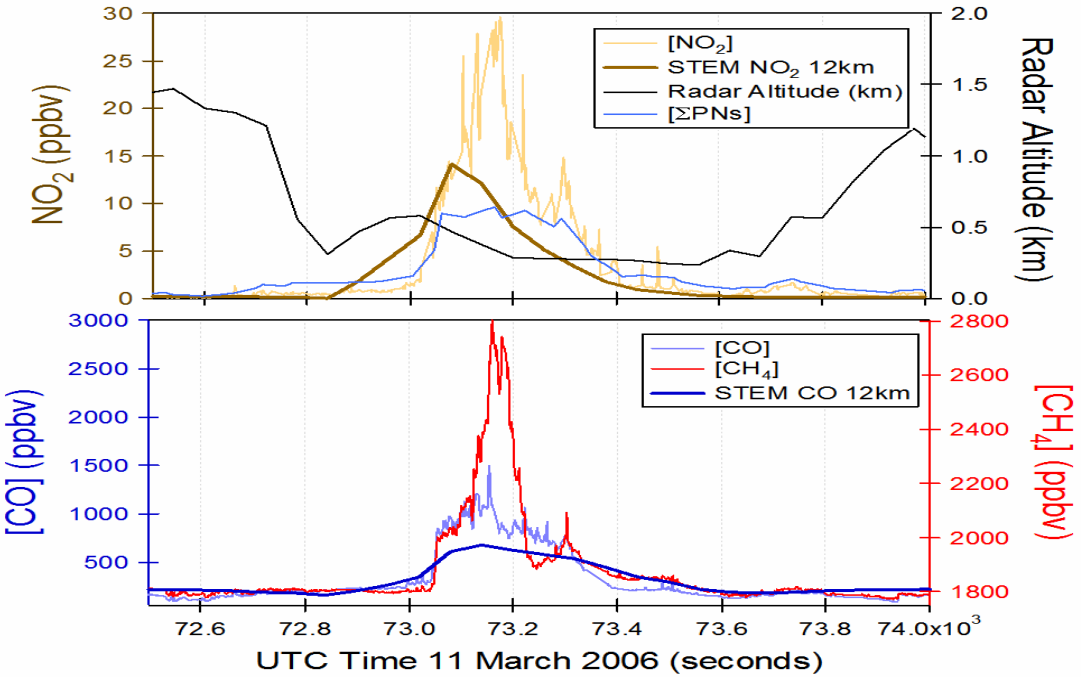
# Pollution over Mexico City: March 11 DC-8 Flt 5

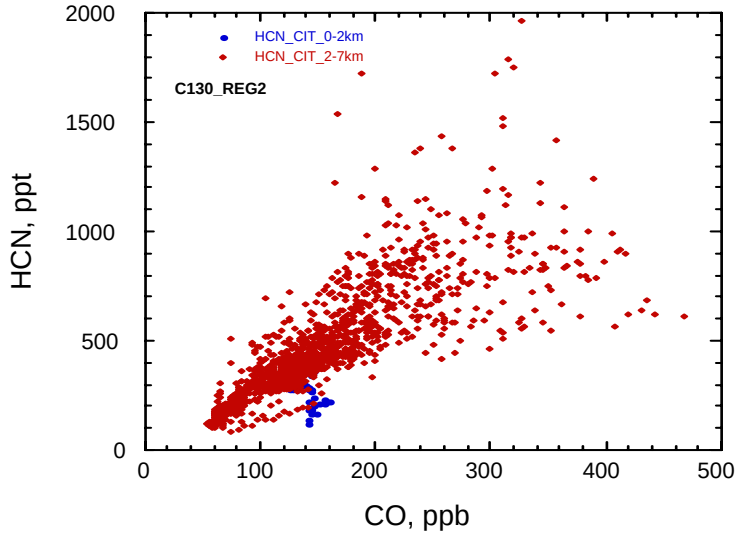


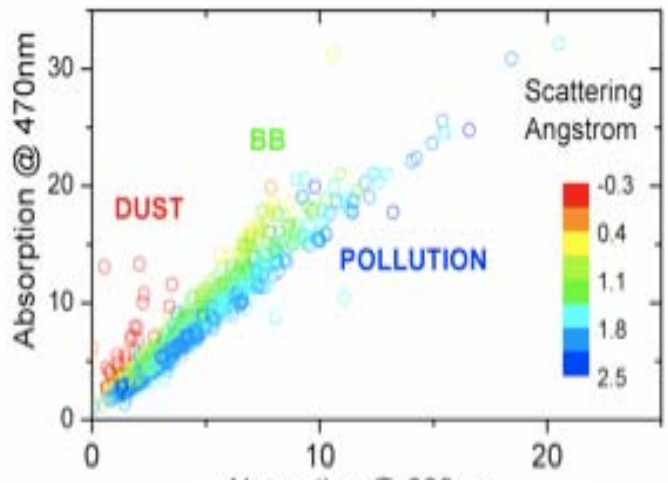

- Sample aged MC plume
- Sample the MC BL
- Compare with T0, T1, T2



# Mexico City Close Approach [11 March 2006]



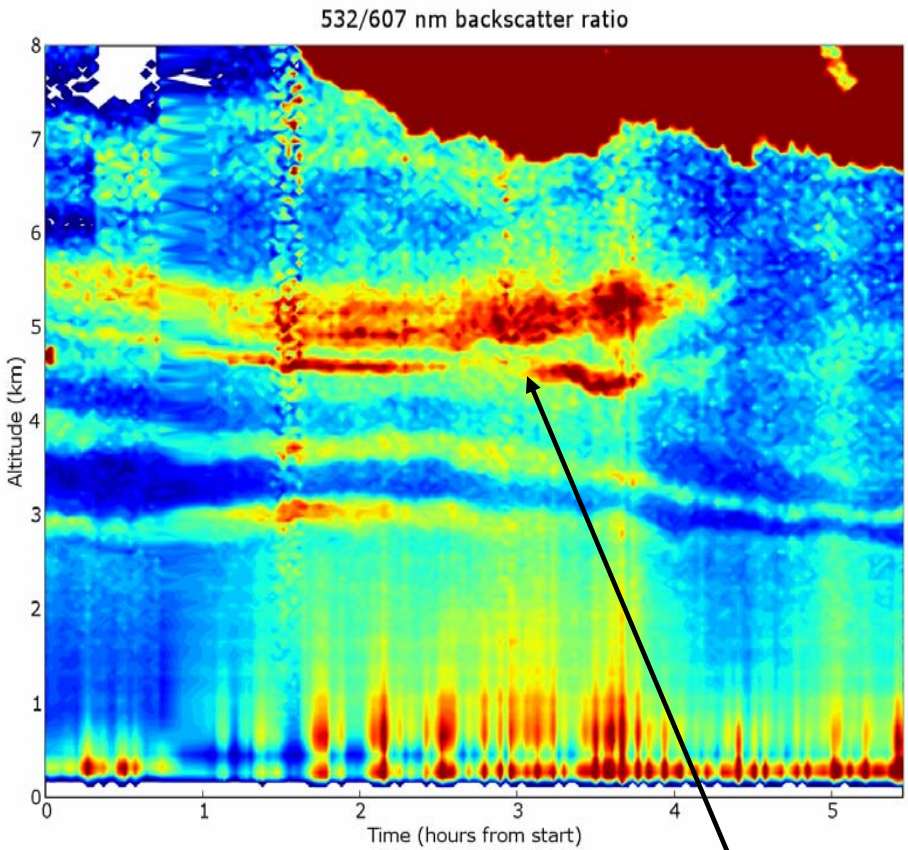




**Source indicators: $\Delta CH_4/\Delta CO$; $\Delta N_2O/\Delta CO$**

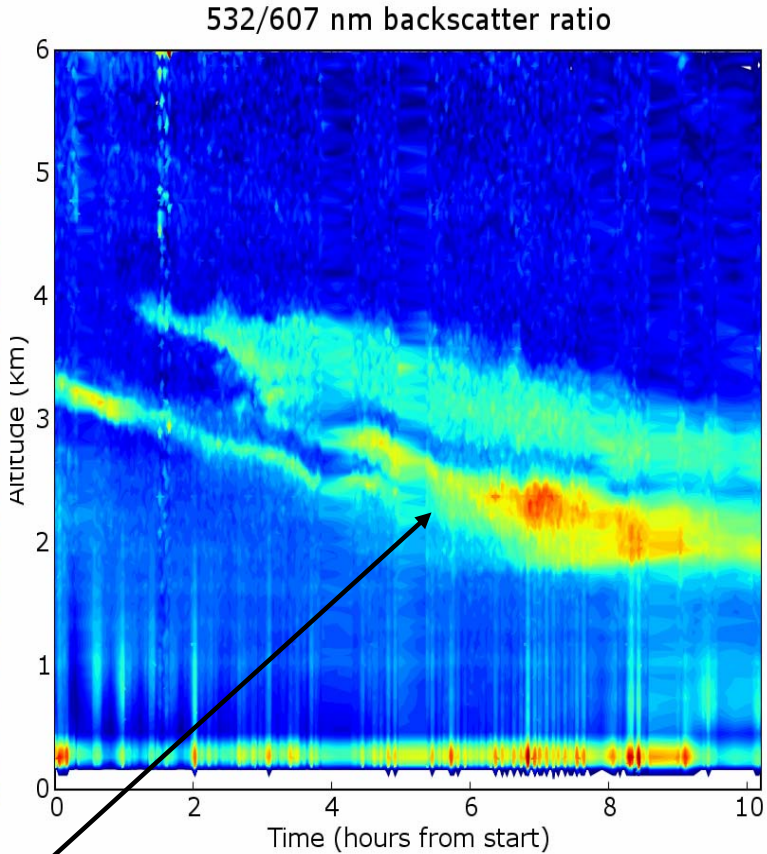
# LIDAR Observations of Aerosol Plumes Near Whistler

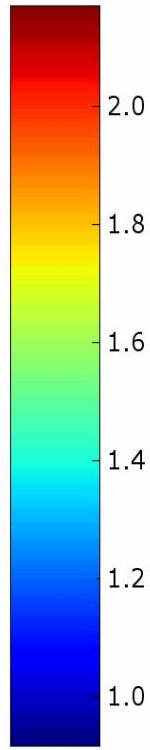
Airborne measurements reveal enhanced O3, CO & sulfate

May 11




May 14



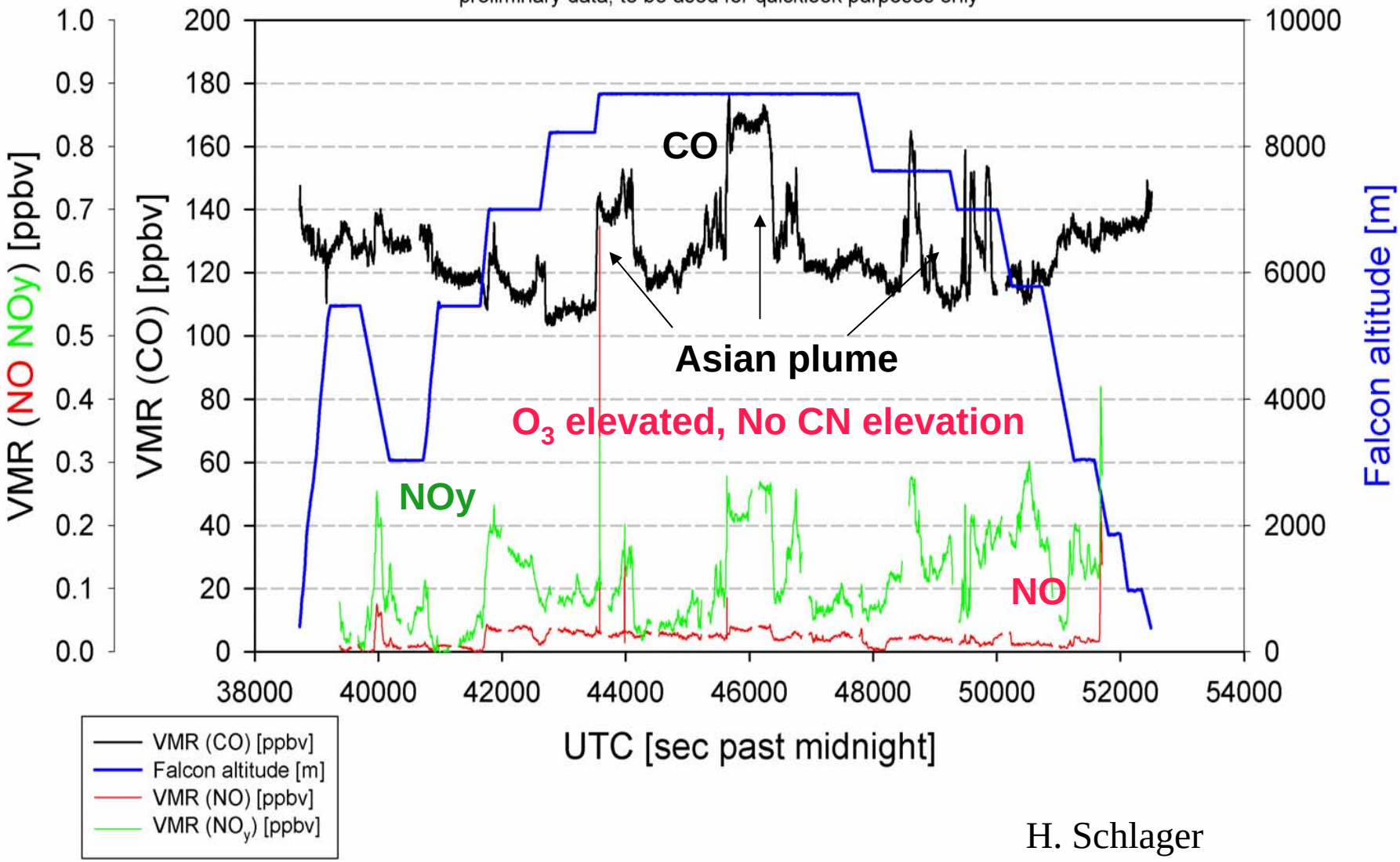

Aerosol Plumes

Tom Duck

DLR

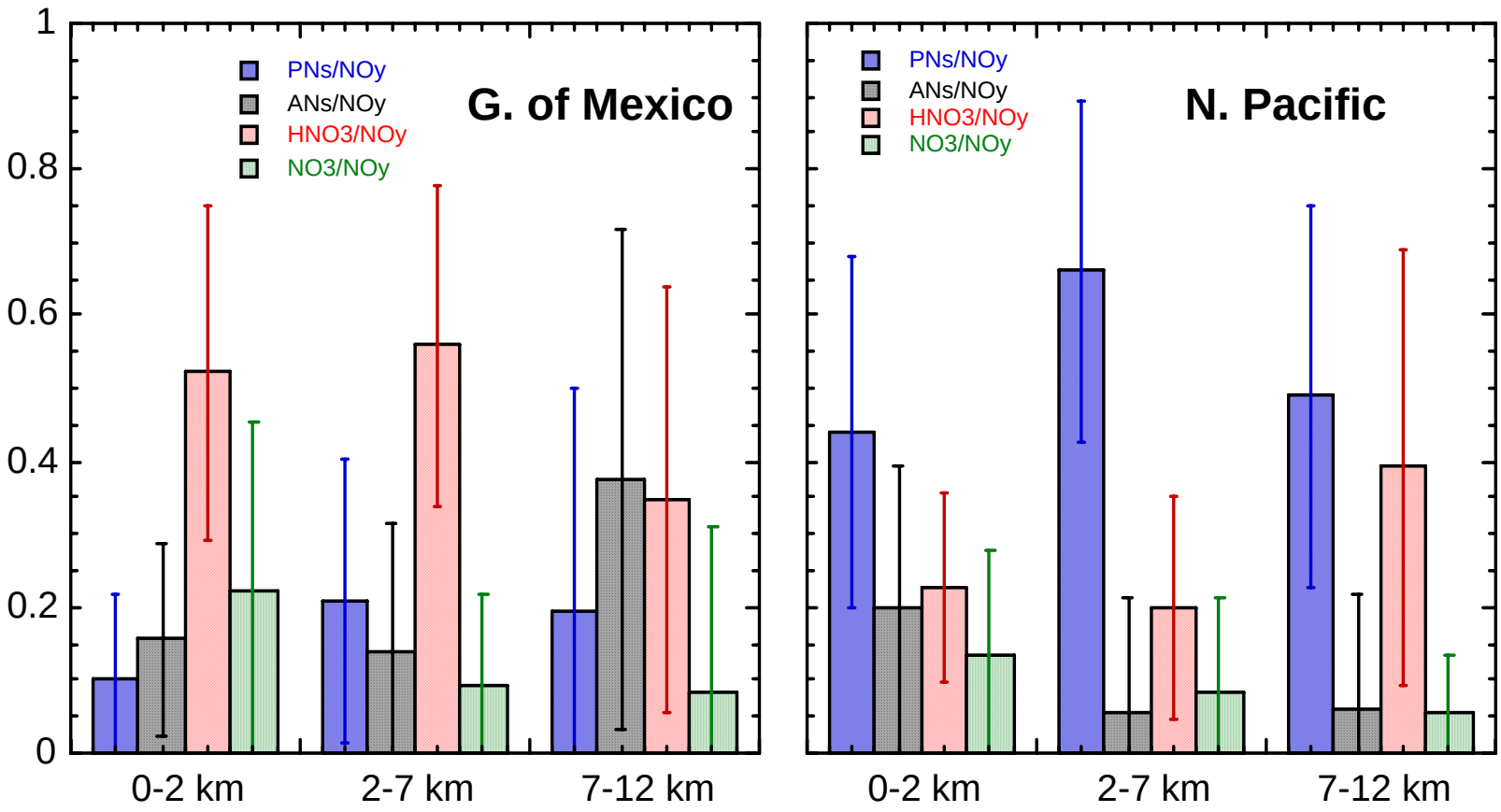
# Falcon CO NO NOy Quicklook
# INTEX-B flight f060324b

preliminary data, to be used for quicklook purposes only



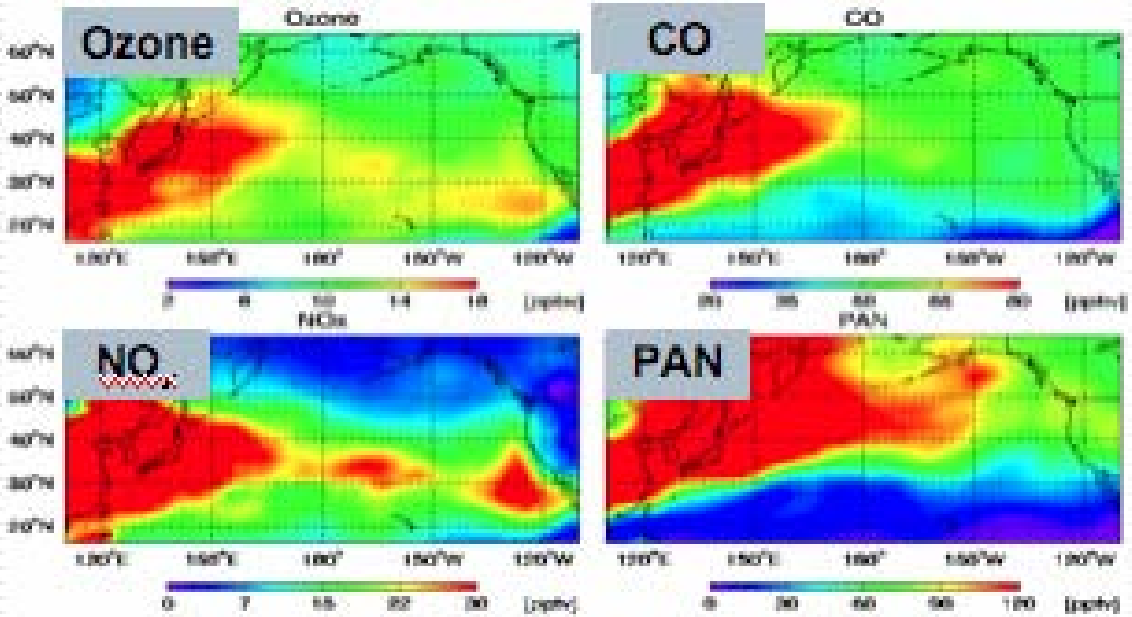

H. Schlager

# Reactive nitrogen distribution over the Gulf of Mexico and northern Pacific

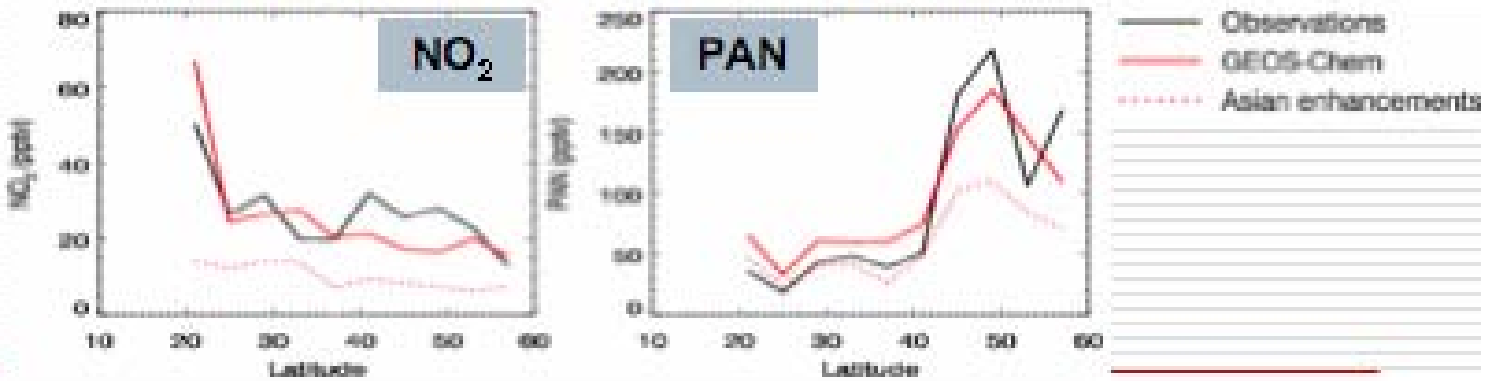


# Conversion from PAN to $NO_x$ in the subtropics

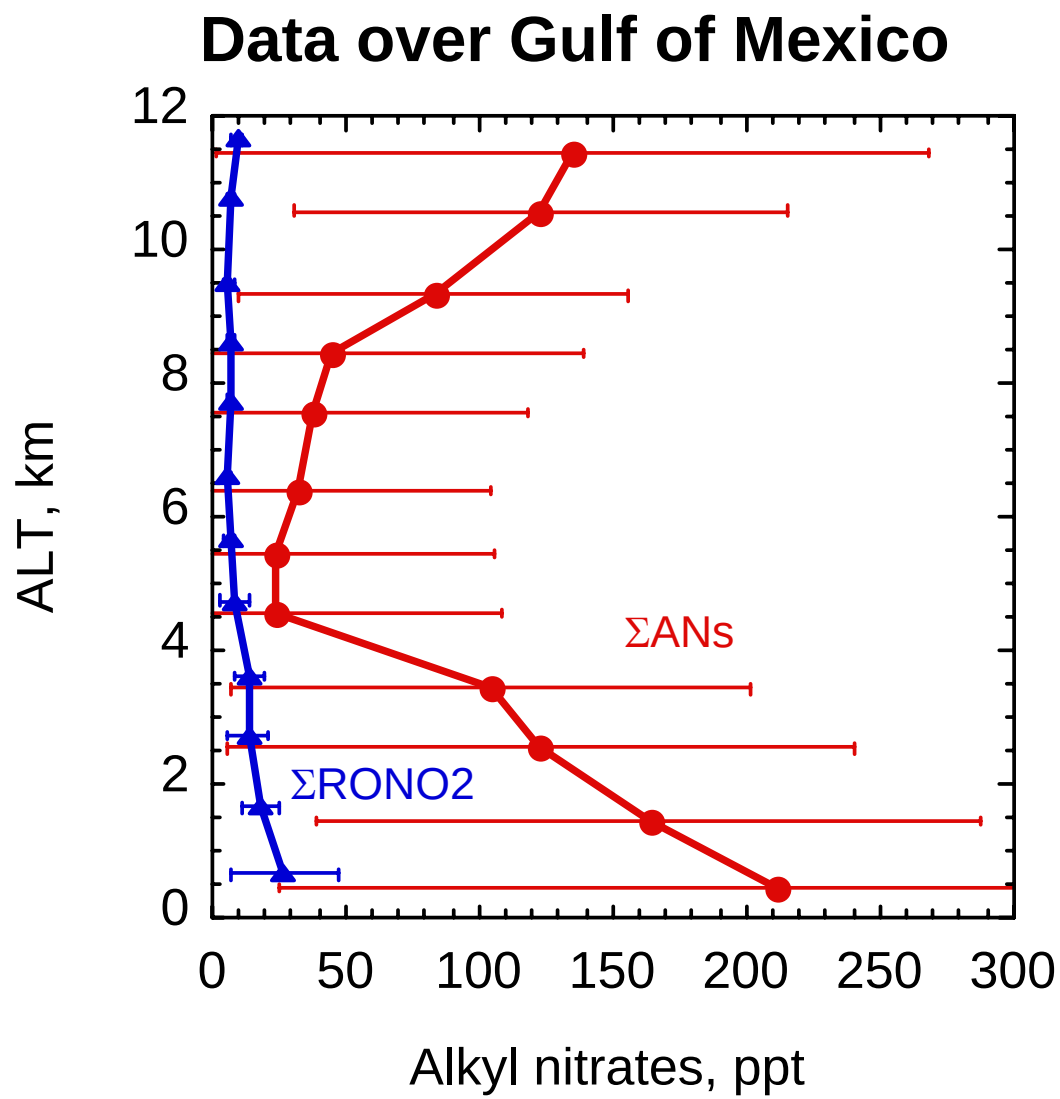
The mean Asian ozone, CO, NOx, and PAN enhancements over the North Pacific at 800 hPa during the INTEX-B period




Latitudinal distribution of $NO_2$ and PAN below 4 km

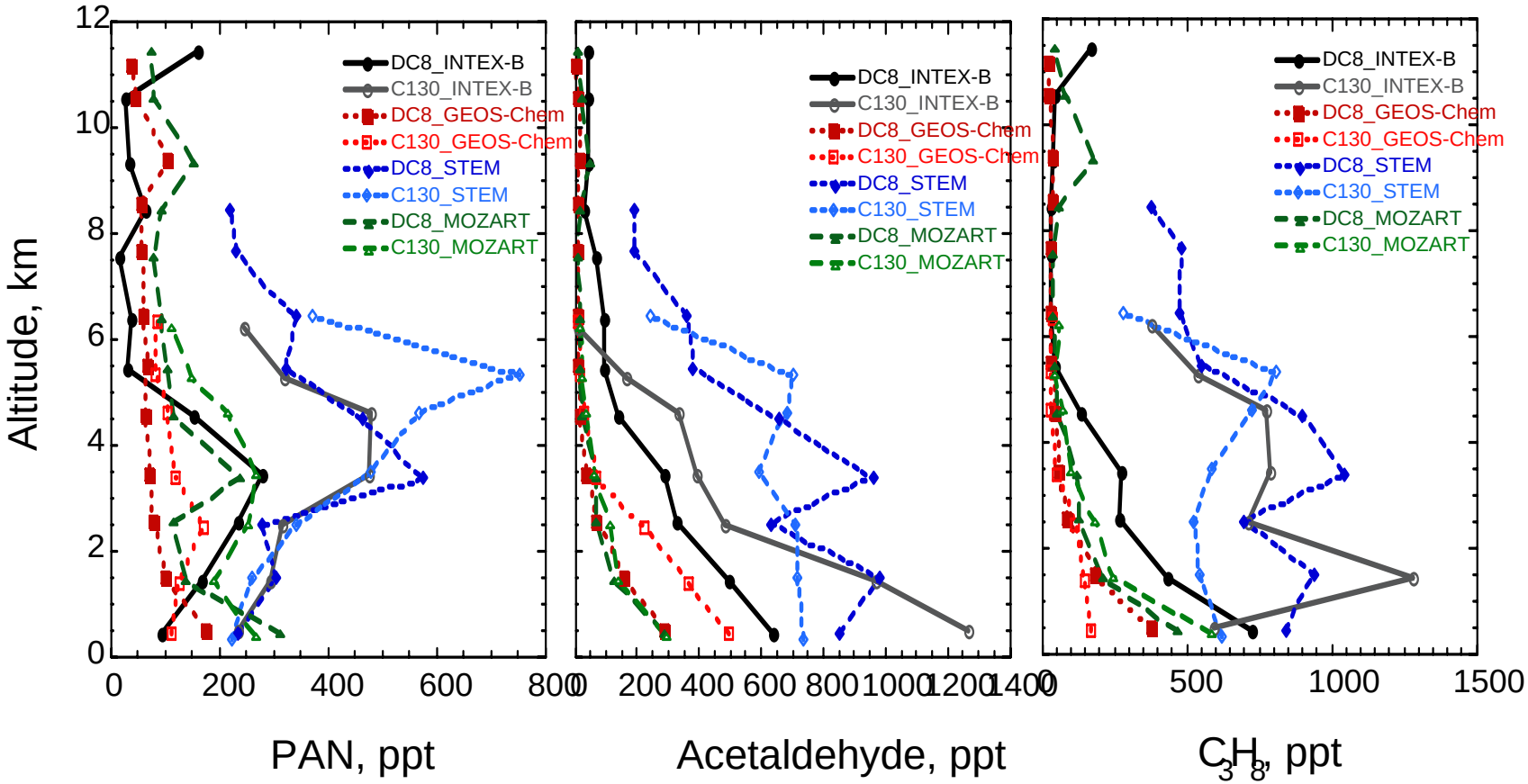


# Alkyl and Multifunctional nitrates vs. Altitude




- **None of the models used to describe the DC-8 observations accurately reproduce ΣAN abundances & the ΣAN fraction of NOy**

# DC-8 & C-130 observations and model simulations over the Gulf of Mexico



# Preliminary Observations: INTEX-B/MILAGRO

- Completed tasks to achieve 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
- Multiple platforms (mainly DC-8 & C-130) appear to have sampled different air masses
- Large disagreements among models persist
- Further analysis continues