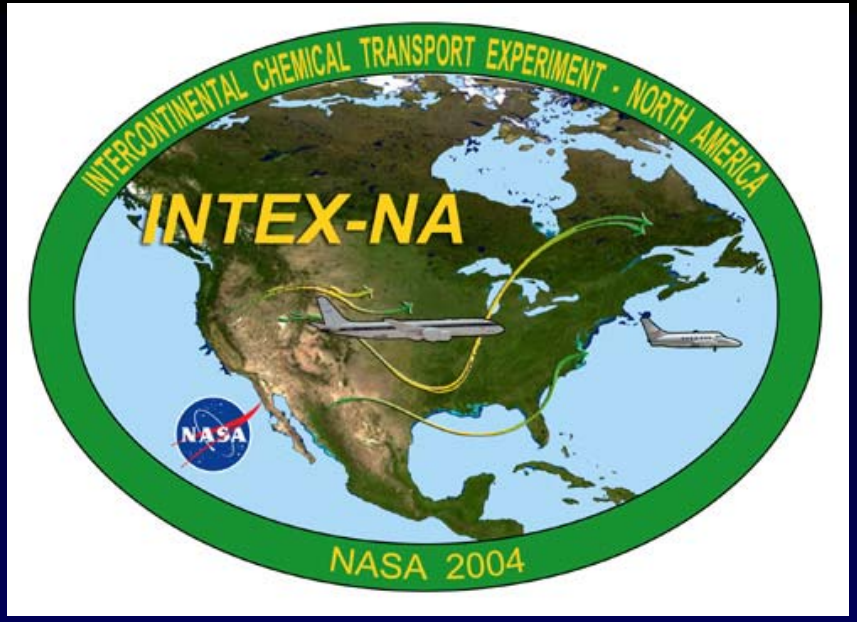
Airborne observations of gaseous elemental mercury, CO, O_3 and aerosol scattering over the coastal northwestern USA during INTEX-B

Duli Chand, Jaffe Group and collaborators

UNIVERSITY OF WASHINGTON

INTEX-A



INTEX-B

UNIVERSITY OF WASHINGTON

Main Goal of INTEX-B:

- Quantify the transpacific transport and evolution of Asian pollution to North America;
- Quantify the outflow and evolution of gases and aerosols from the Mexico City;
- Investigate the transport of Asian and North America pollution to the eastern Atlantic
- Validate and refine satellite observations of tropospheric composition;
- Map emissions of trace gases and aerosols and relate atmospheric composition to sources and sinks

UNIVERSITY OF WASHINGTON

INTEX-B: North America Platforms

C-130 Aircraft

- NCAR, NOAA;
- U. Nevada, U. Miami, Texas A&M, Scripps, U. Hawaii, U. Colo., GA Tech, CA Tech
- Droplet Measurement Technologies

Canadian Cessna 207

- Dalhousie University, UBC
- Environment Canada

DC-8 Aircraft

- NASA Langley, Dryden, Wallops, Goddard & Ames; NCAR
- UND, UC-Irvine, PSU, U. Hawaii, UC-Berkeley, URI, GA Tech, UNH

Duchess 76

- **University of Washington Bothell**

J-31 Aircraft

- NASA Ames & Goddard
- Sky Research, Inc.
- UC-Boulder, Columbia Univ.

B-200 Aircraft

- NASA Langley

Surface Stations & Satellites

UNIVERSITY OF WASHINGTON

Observations using Duchess 76

2.5 Min

- Gaseous Elemental Mercury (Hg0)

<10 sec

- Carbon Monoxide (CO)
- Ozone (O_3)
- Aerosols light scattering
  (Total and Back Scattering at 450, 550 , 700 nm)
- GPS (Lat, Lon, Alt)
- Temperature
- Pressure
- Relative Humidity

UNIVERSITY OF WASHINGTON

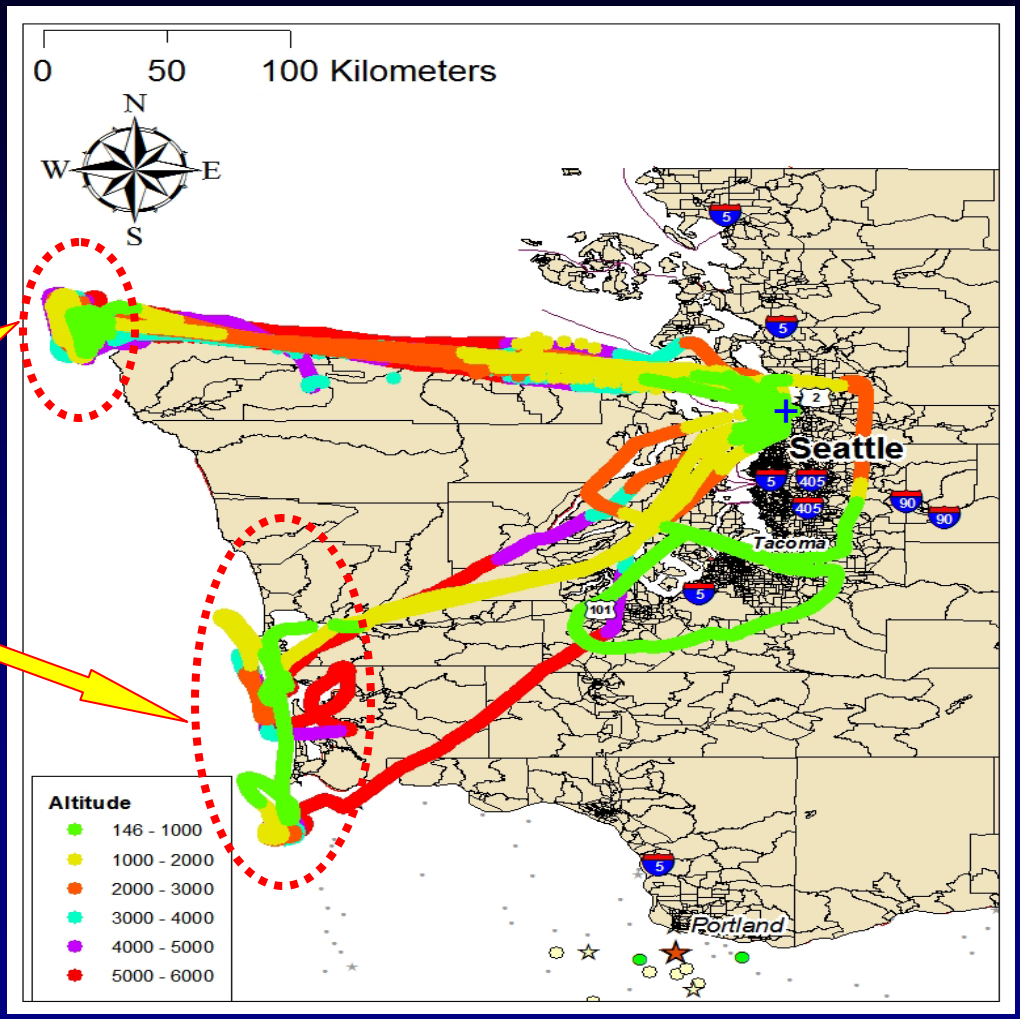
Observations: Flight Tracks

Total flights = 8

April 12, 18, 19, 30
May 4, 8, 9, 15

Vertical Profiles

Note: Flight #5 (May 4th) was a local flight sampling in vicinity of Seattle up to altitude of 2800 m (680 mb)



UNIVERSITY OF WASHINGTON

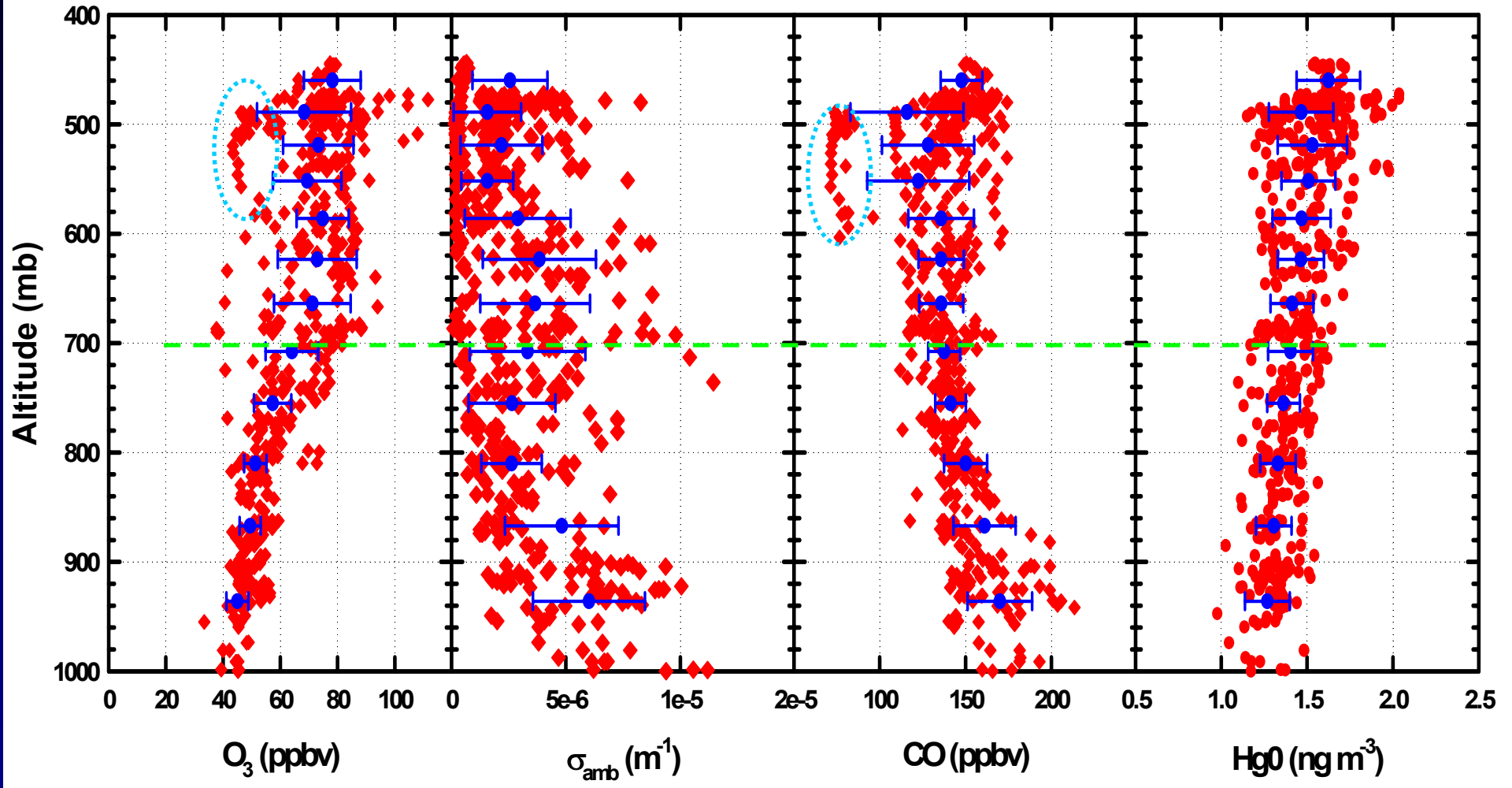
Observations: Inter-comparison flights

Duchess 76 inter-comparison flights with C-130 (May 9, 2006) and DC-8 (May 15, 2006)

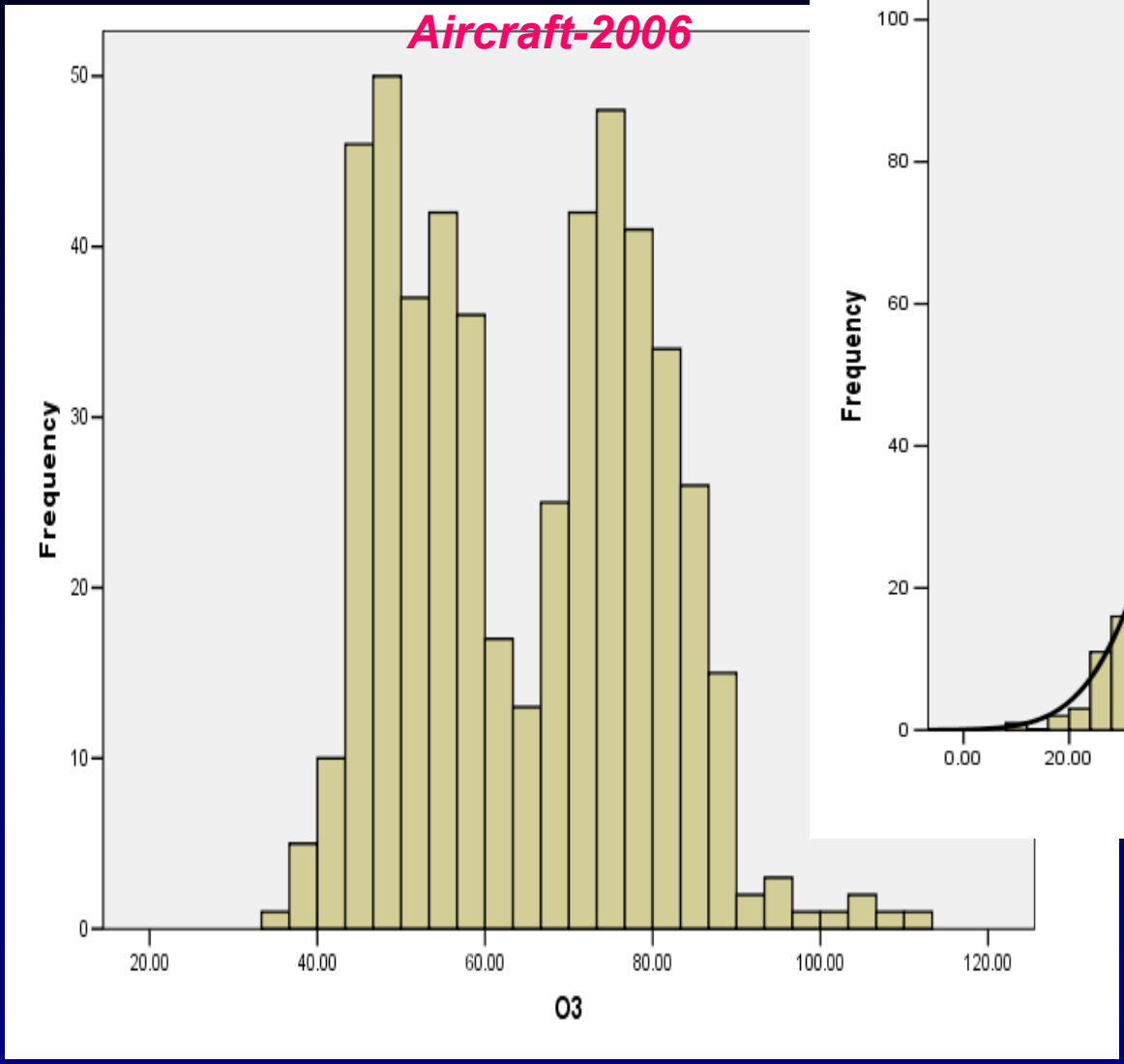
UNIVERSITY OF WASHINGTON

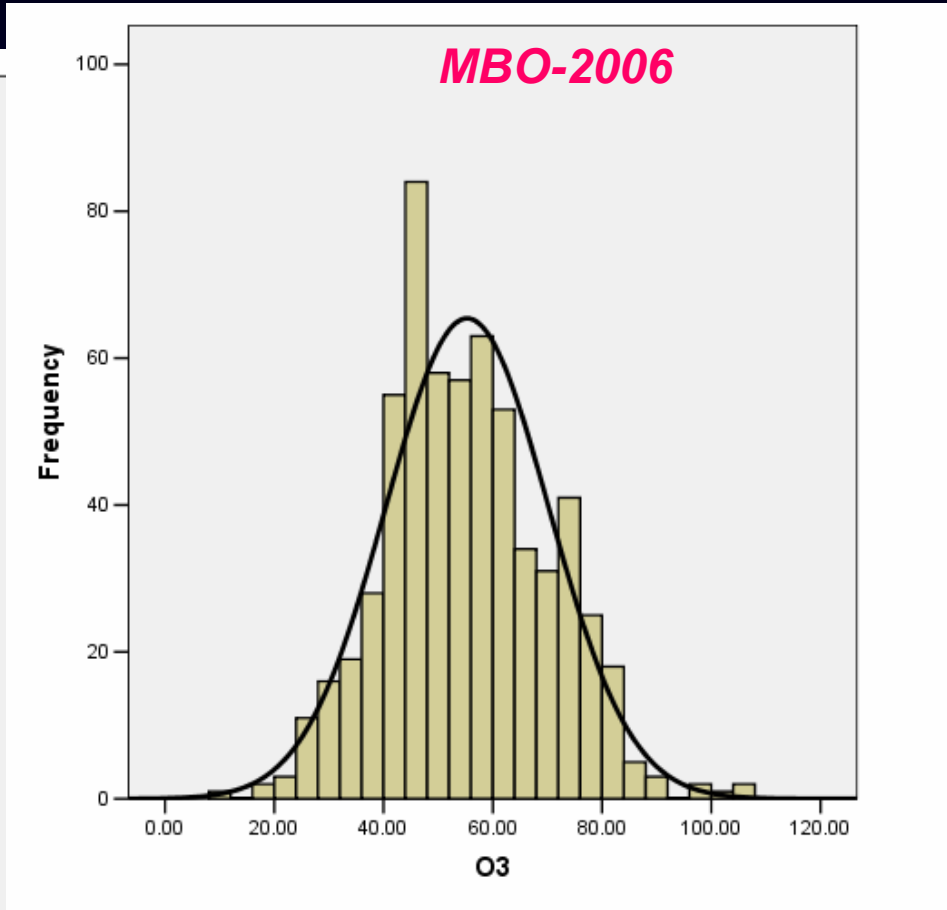
Results from Duchess 76 Aircraft

Vertical Profiles (All 8 flights)



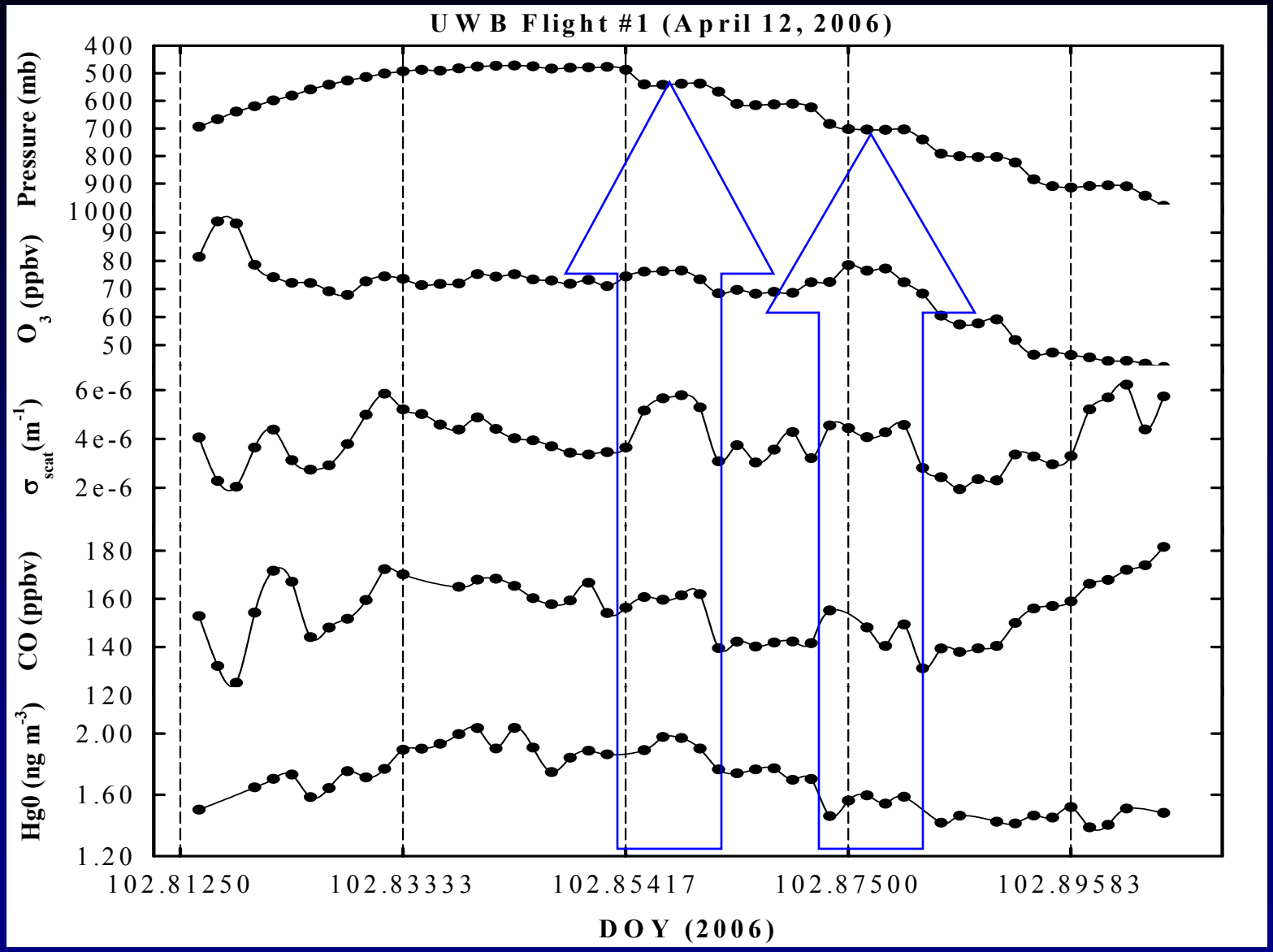
Frequency distribution O_3





UNIVERSITY OF WASHINGTON

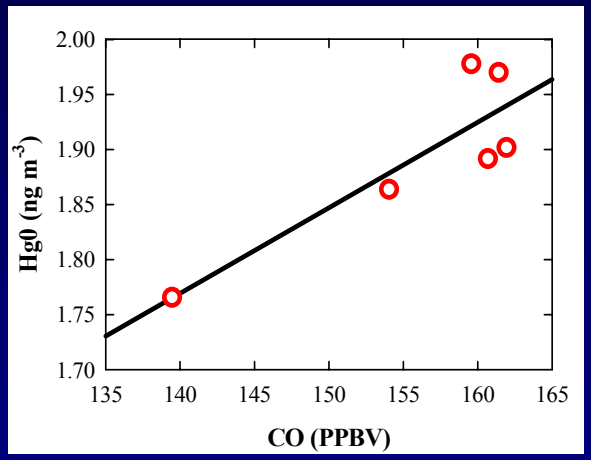
Time Series Vertical Profile Flight #1



UNIVERSITY OF WASHINGTON

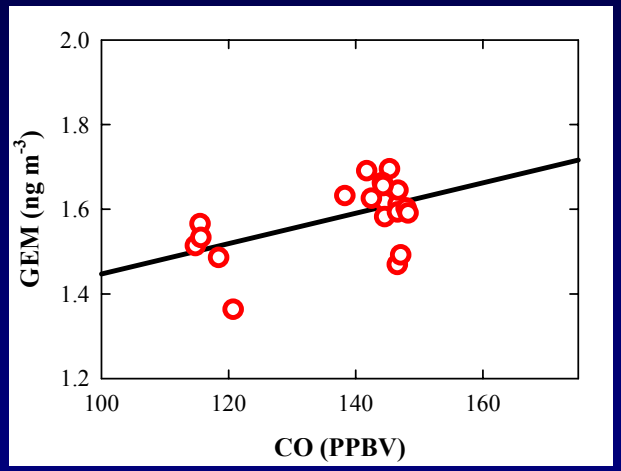
Events based correlation of Hg0 and CO

Flight #1
b[0]=0.68
b[1]=7.8e-3
r ²=0.75



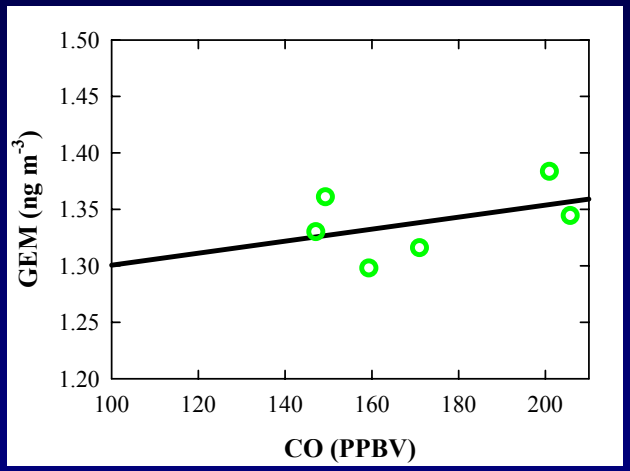
FT [LRT (Asian)]

Flight # 3
b[0]=1.0877
b[1]=3.6-3
r ²=0.29



FT [LRT (Asian)]

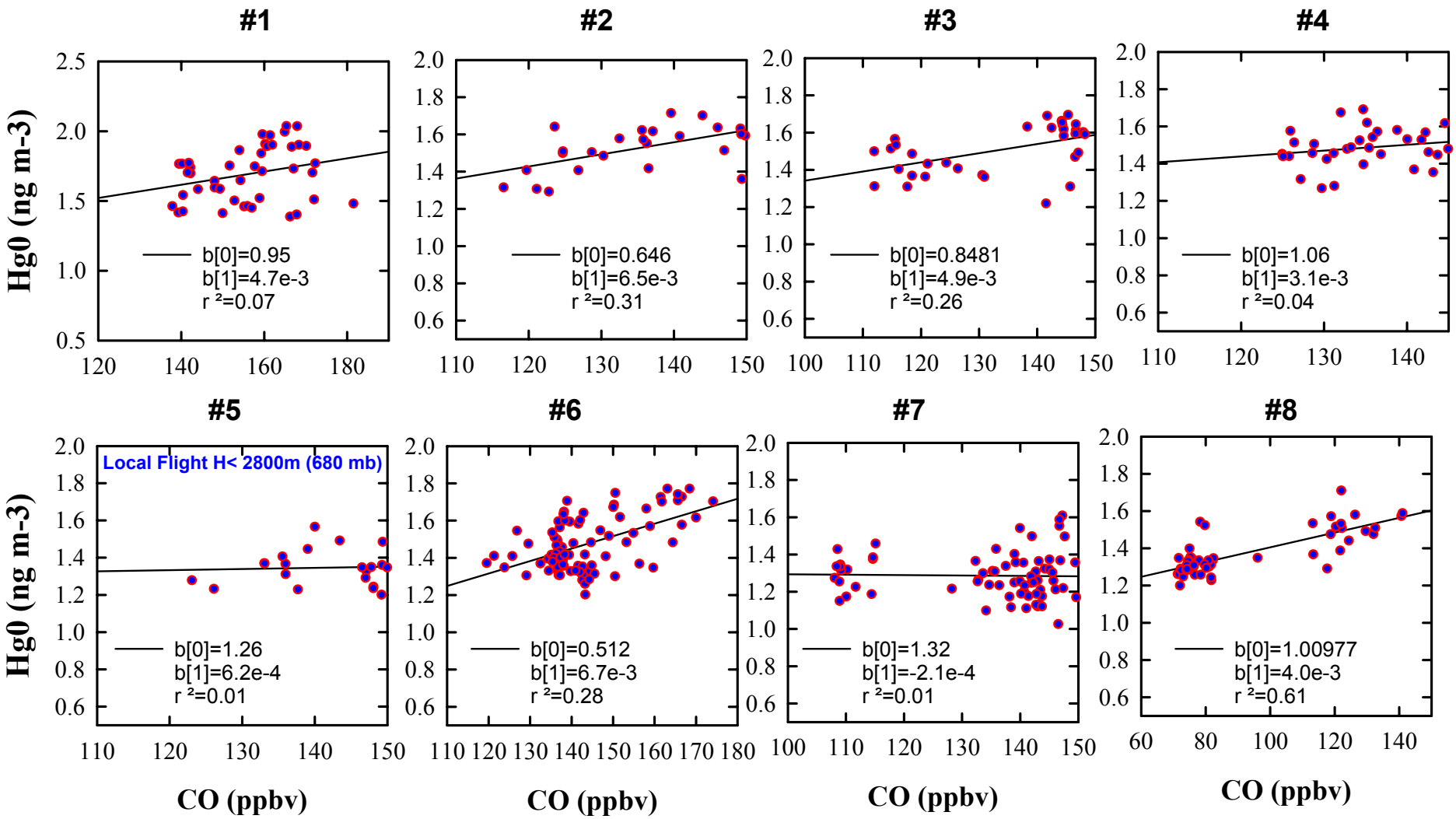
Flight # 5
b[0]=1.247
b[1]=5.3e-4
r ²=0.19



BL [Local (USA)]

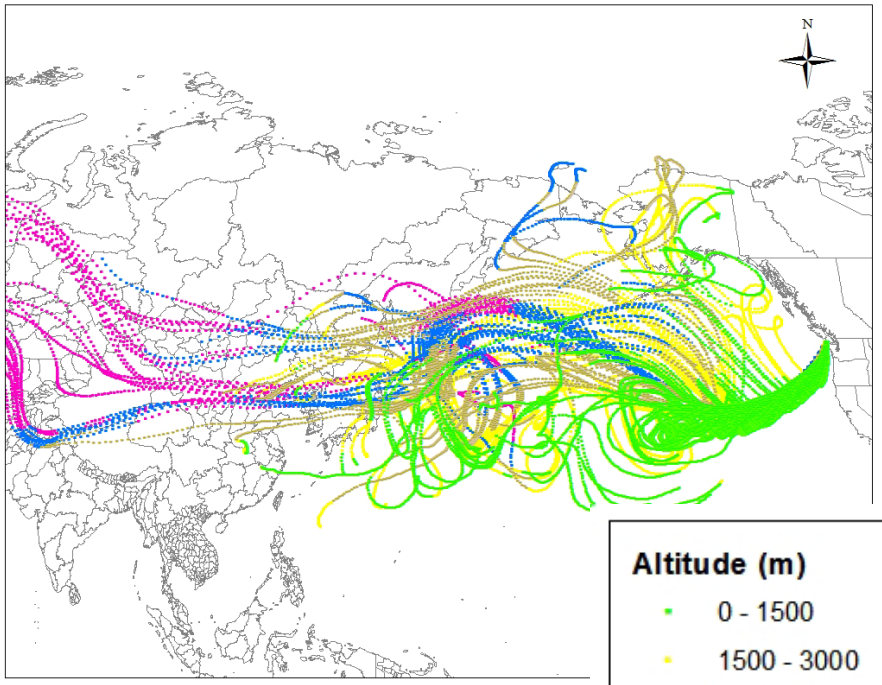
UNIVERSITY OF WASHINGTON

Correlation of Hg0 and CO

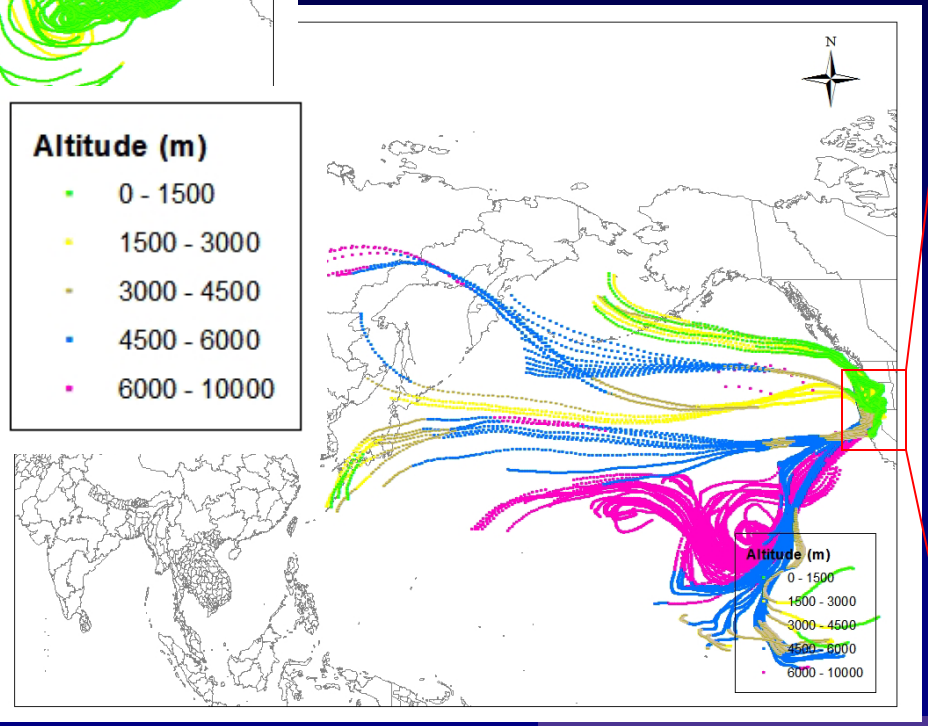


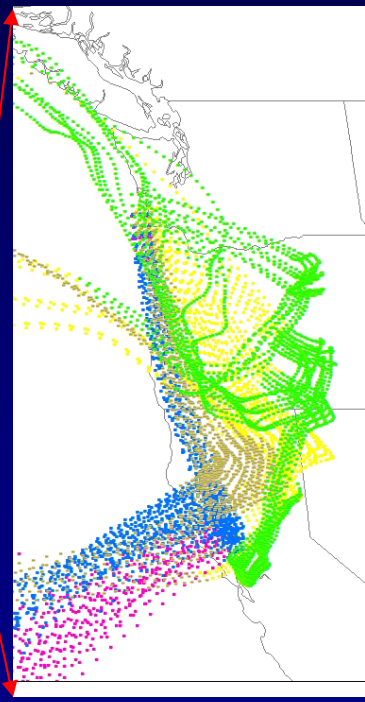
UNIVERSITY OF WASHINGTON

HYSPLIT BTs



Transport from Asia, NW USA and Pacific Ocean (Flight #8 May 15)



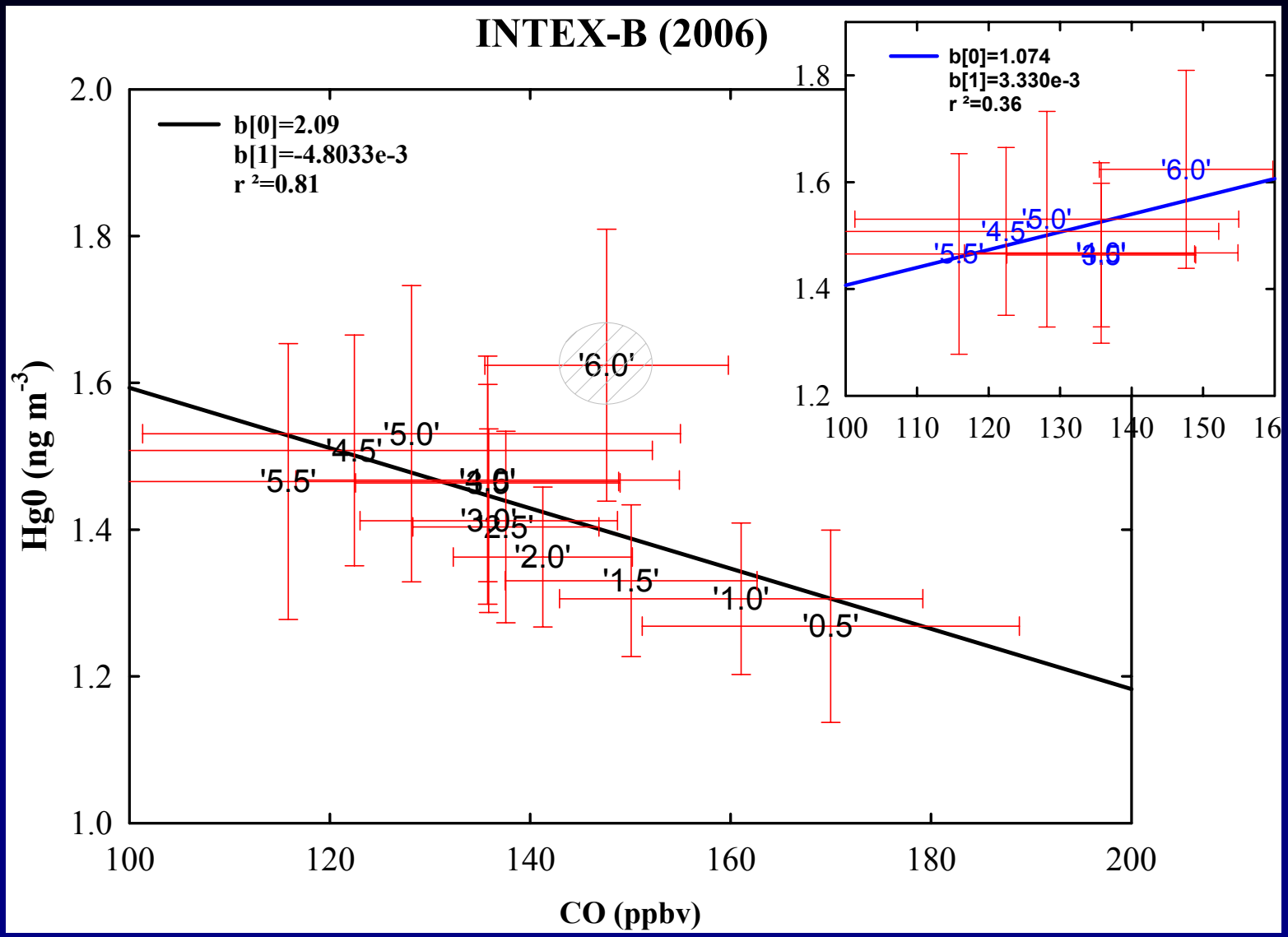


Transport from Asia (Flight #3 April 19)

BT Levels: 1500, 3000, 4500, 6000, 10000 m

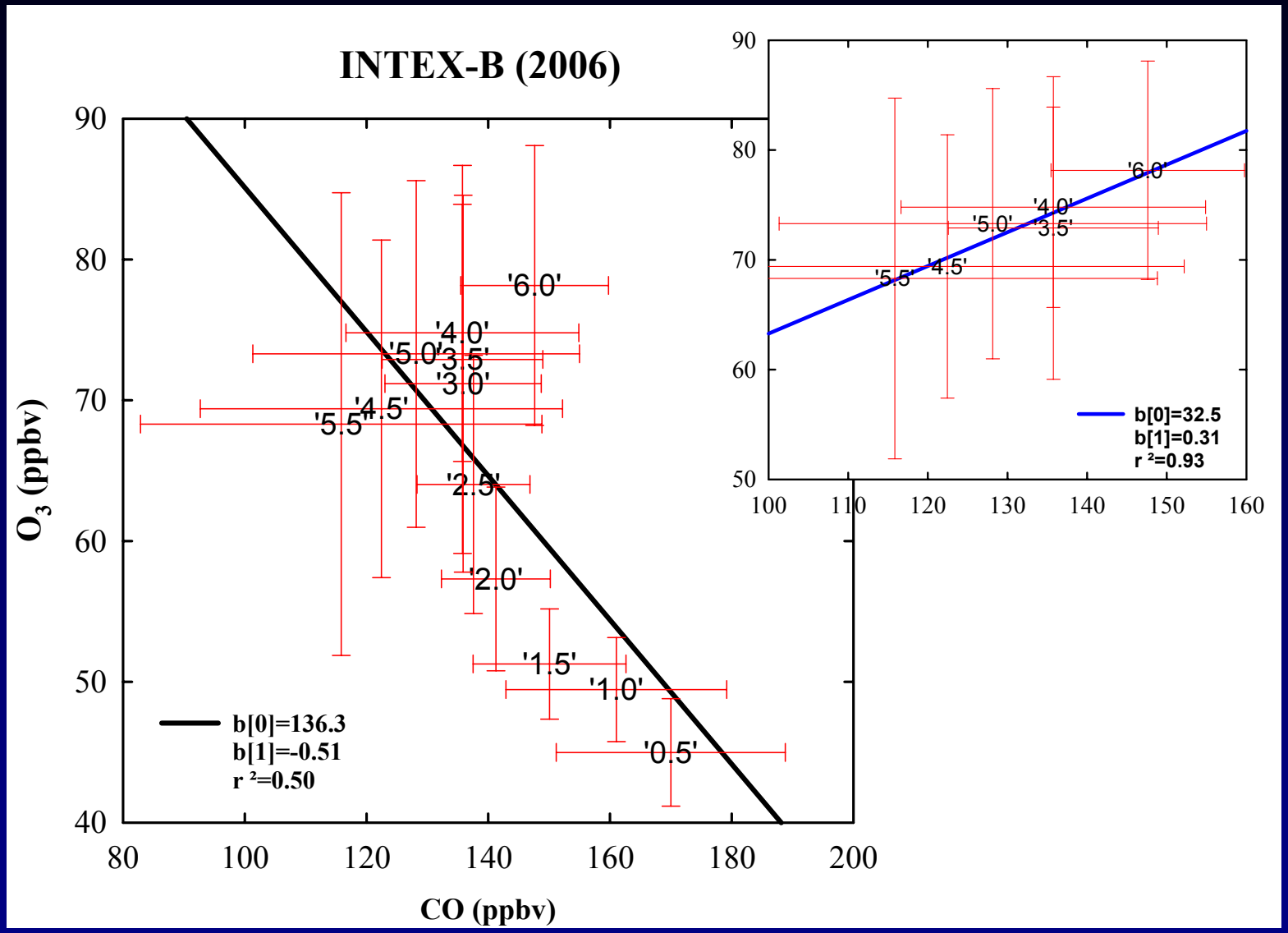
UNIVERSITY OF WASHINGTON

Correlation of Hg0 and CO (Integrated data)



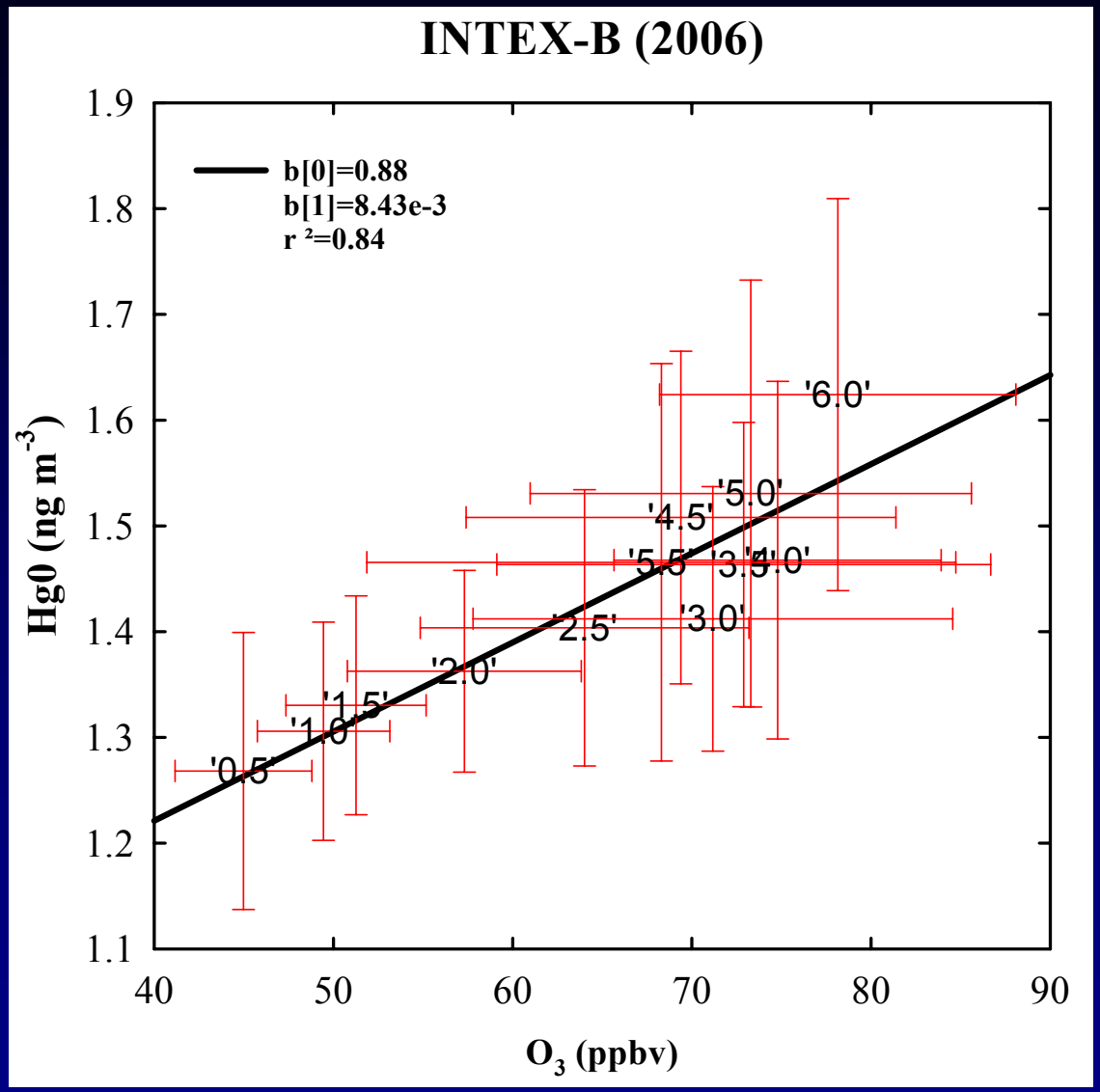
UNIVERSITY OF WASHINGTON

Correlation of O_3 and CO (Integrated data)



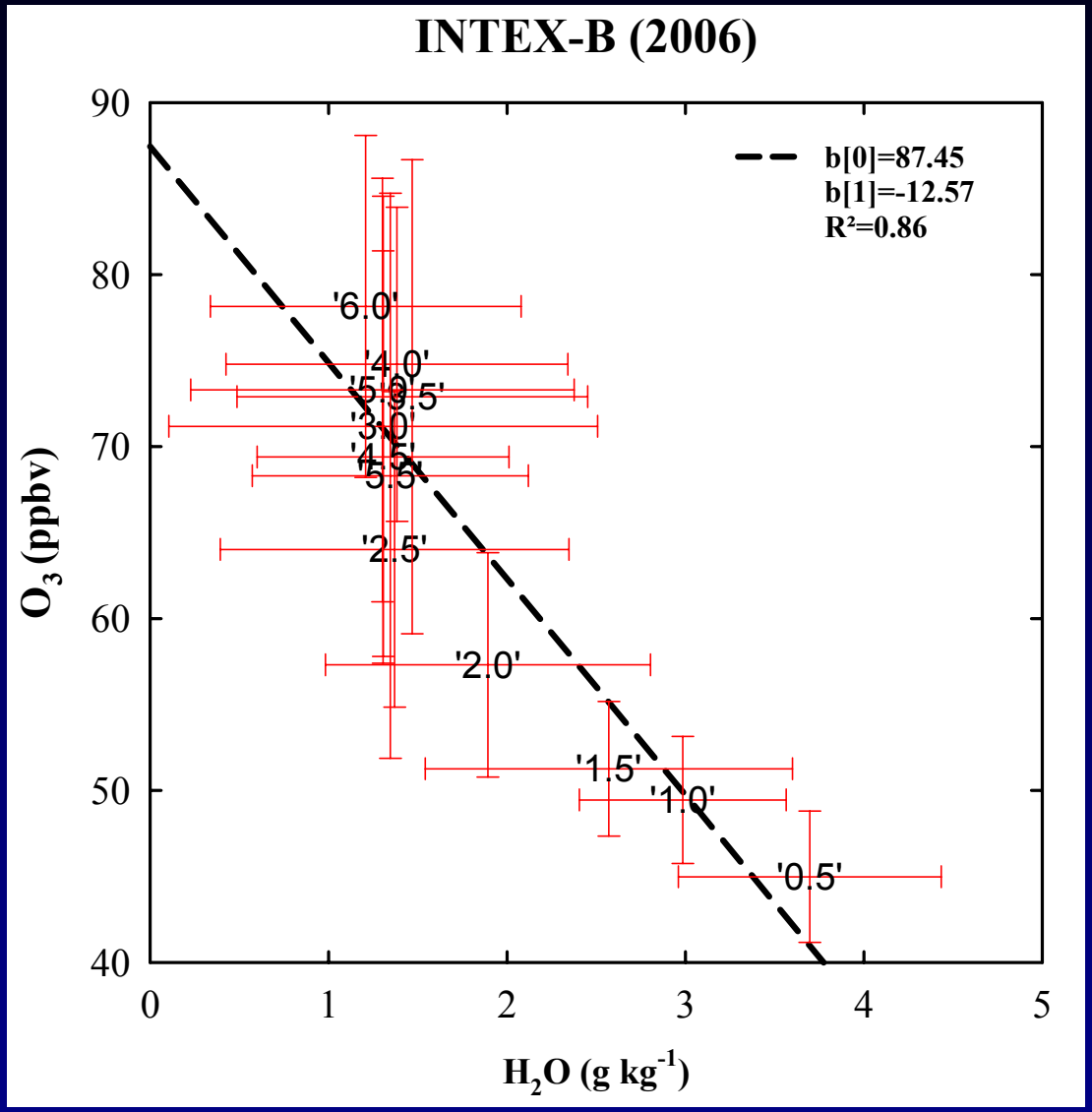
UNIVERSITY OF WASHINGTON

Correlation of Hg0 and O_3 (Integrated data)



UNIVERSITY OF WASHINGTON

Correlation of O_3 and H_2O (Integrated data)



UNIVERSITY OF WASHINGTON

Conclusions:

- Most of the LRT events are observed above 700 mb.
- The observed Hg0 to CO enhancement ratios (ΔHg0/ ΔCO) are very similar to our previously detected LRT events (Jaffe et al 2005; Weiss et al 2006).
- The ΔHg0/ ΔCO of FT above 700mb (all from Asia?) is much higher (10x) than USA plumes.
- Negative ΔHg0/ΔCO and strong positive correlation of Hg0 and O_3 below 3000m indicates that mixing layer (surface) is likely a sink of Hg0 and its life time is lower in BL compared to the troposphere.

UNIVERSITY OF WASHINGTON

Future work

- Complete the analysis and get micro details on LRT for individual flights.
- Expand the analysis for different meteorological conditions using NCEP reanalyzed data and HySPLIT Trajectories.
- Integrate satellite observation and model runs into analysis.
- Tie with MBO observations…to see if the LRT is confined to Northwest and/or further south.
- Use and inter-comparisons of our data with other aircraft and surface observations for INTEX-B period.
- Use of our aircraft data from previous aircraft campaigns and compare/quantify LRT and its role on local AQ.
- More Ideas…?

UNIVERSITY OF WASHINGTON


Questions?
Northway Aviation