

The Intercontinental Chemical Transport Experiment – Phase B (INTEX-B): Plans & update

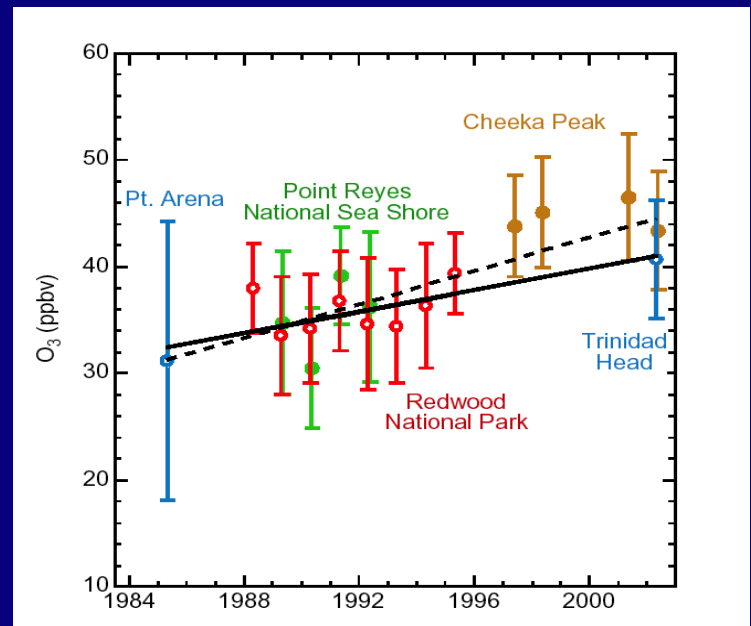
H. Singh, W. Brune, J. Crawford, H. Fuelberg and D. Jacob

(White paper <http://cloud1.arc.nasa.gov>)

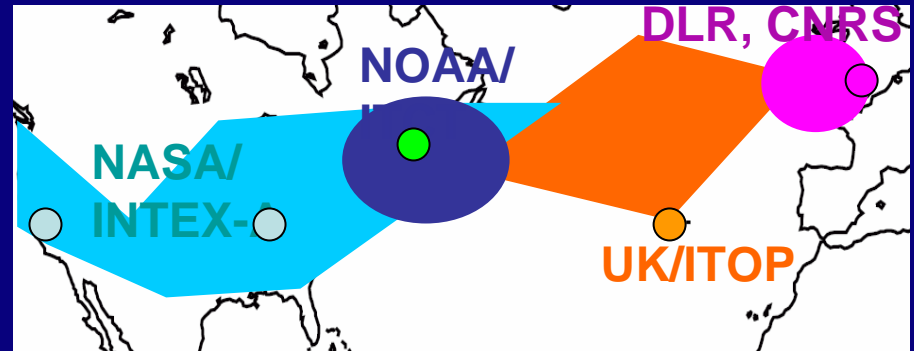
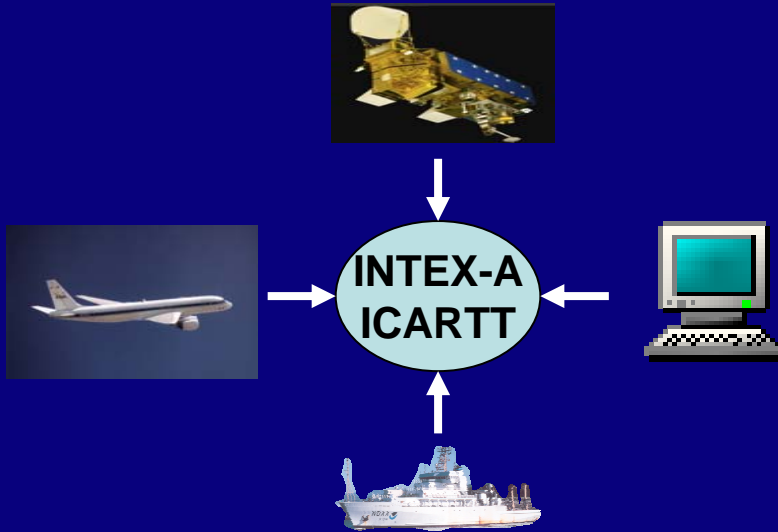
GOAL: To understand the transport, transformation, & impacts of gases & aerosols on air quality & climate on intercontinental scales

- **INTEX-A: Summer 2004**
 - large biosphere emissions
 - active photochemistry
 - max terrestrial carbon uptake
- **INTEX-B: Spring 2006**
 - maximum Asian inflow to NA
 - seasonal contrast

0.4-0.5 ppb/year



INTEX-A/ICARTT Plan & Coordination



US, Canada, UK, France, Germany

- **Outflow of gases/aerosols**
- **Source characterization**
- **Chemical evolution**
- **Carbon cycle**
- **Direct/indirect effects of aerosols**
- **Satellite validation**
- **Inter-comparisons**
- **Coordinated Science flights**
- **Sharing of forecasts & data**
- **Joint publications**

INTEX-B Intensive

- Major Partners: NASA, NSF, DOE, DLR
- Major Platforms:
 - DC-8: Large scale characterization, inflow/outflow, transport & evolution, satellite validation
 - C-130/G1/J-31: BL & regional characterization, BL/FT exchange, radiation
 - Falcon-20/WB-57: UT/LS processes & exchange, satellite validation
 - Satellites (Aura/Aqua/Envisat) : Global coverage of selected species
 - Ground based: Sondes, lidars, air quality stations

INTEX-B SCIENTIFIC GOALS

- **Transport & evolution of Asian pollution to NA and beyond & implications for regional air quality & climate**
- **Outflow & evolution of gases and aerosols from the Mexico City megaplex**
- **Validation of satellite observations of tropospheric composition**
- **Mapping of emissions & relating atmospheric composition to sources and sinks**

Selected Platforms During INTEX-B

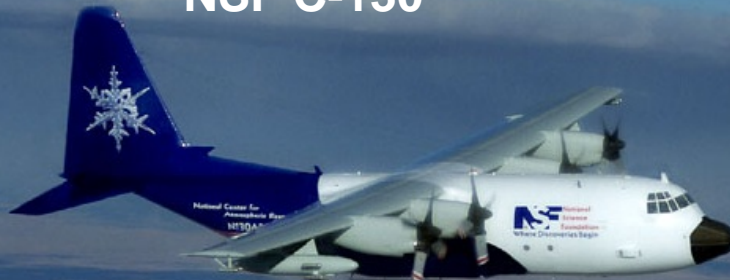
DLR FALCON



NASA DC-8



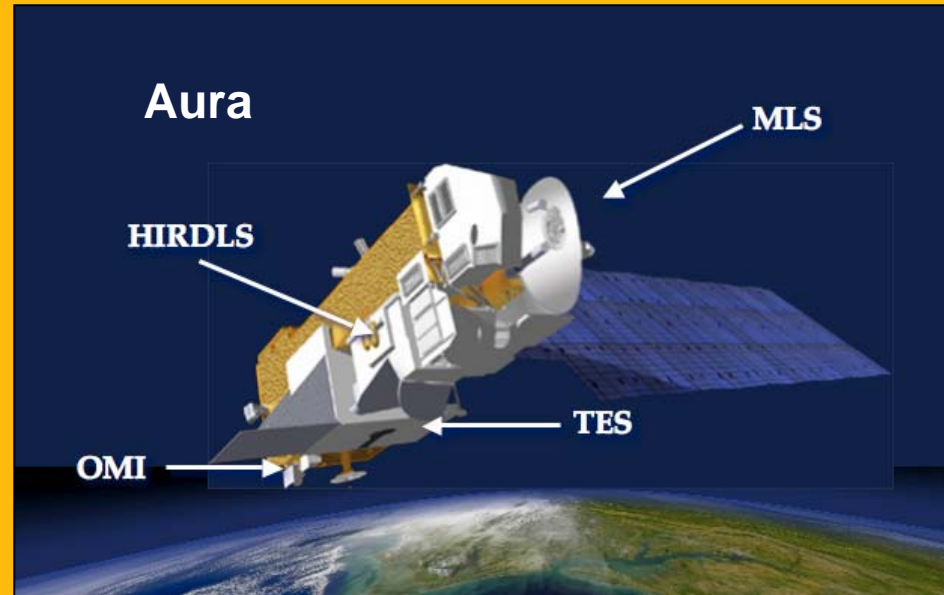
NSF C-130



DOE G1



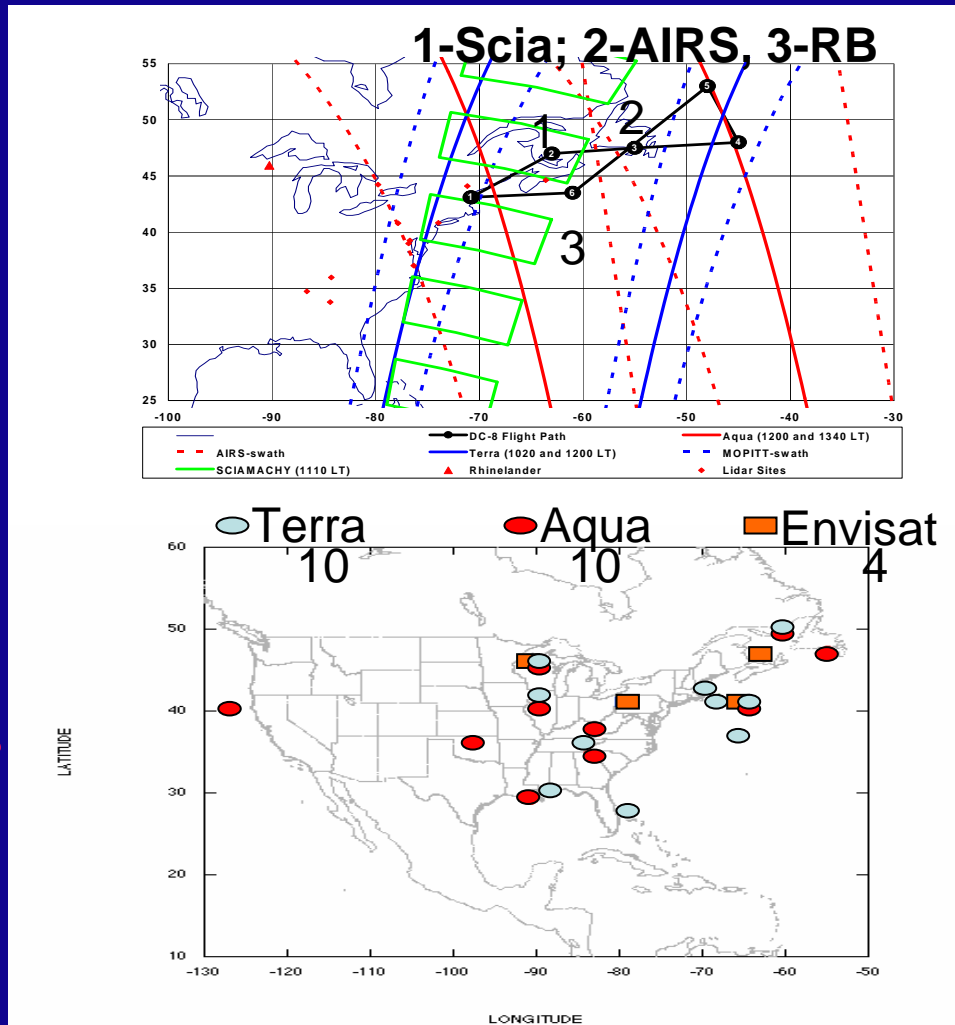
Satellites



Satellite Platform*	Instruments	Some key data products	Vert. resol.
Aura: http://eos-aura.gsfc.nasa.gov/	TES OMI MLS	CO, CH ₄ , O ₃ , HNO ₃ , NO ₂ O ₃ , NO ₂ , SO ₂ , HCHO H ₂ O, HCN	Trop col./4 km Trop column UT/LS
Aqua: http://eos-pm.gsfc.nasa.gov/	MODIS AIRS	Aerosol optical depth CO	Trop column Trop col./4 km
Terra: http://eos-am.gsfc.nasa.gov/	MOPITT MISR MODIS	CO Aerosol optical depth Aerosol optical depth	Trop col./4 km Trop column Trop column
Envisat: http://envisat.esa.int/	SCIAMACHY MIPAS	O ₃ , NO ₂ , CH ₂ O Trace organics	Trop column UT/LS
Calipso: http://www.calipso.larc.nasa.gov/	CALIOP	Aerosol distribution	High resolution

INTEX-A DC-8 Satellite Validations (Terra, Aqua, Envisat)

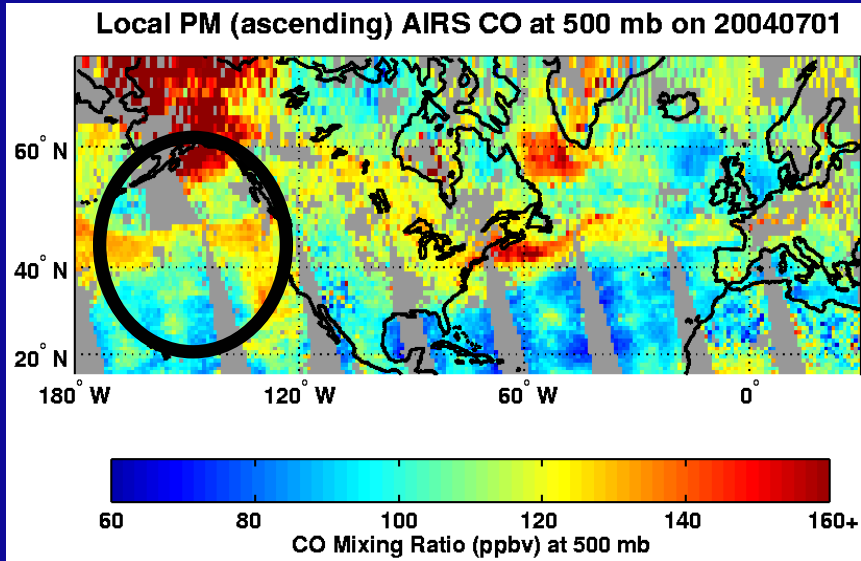
CO
HCHO
NO₂
SO₂
H₂O
HCN
O₃
Aerosol
Organics



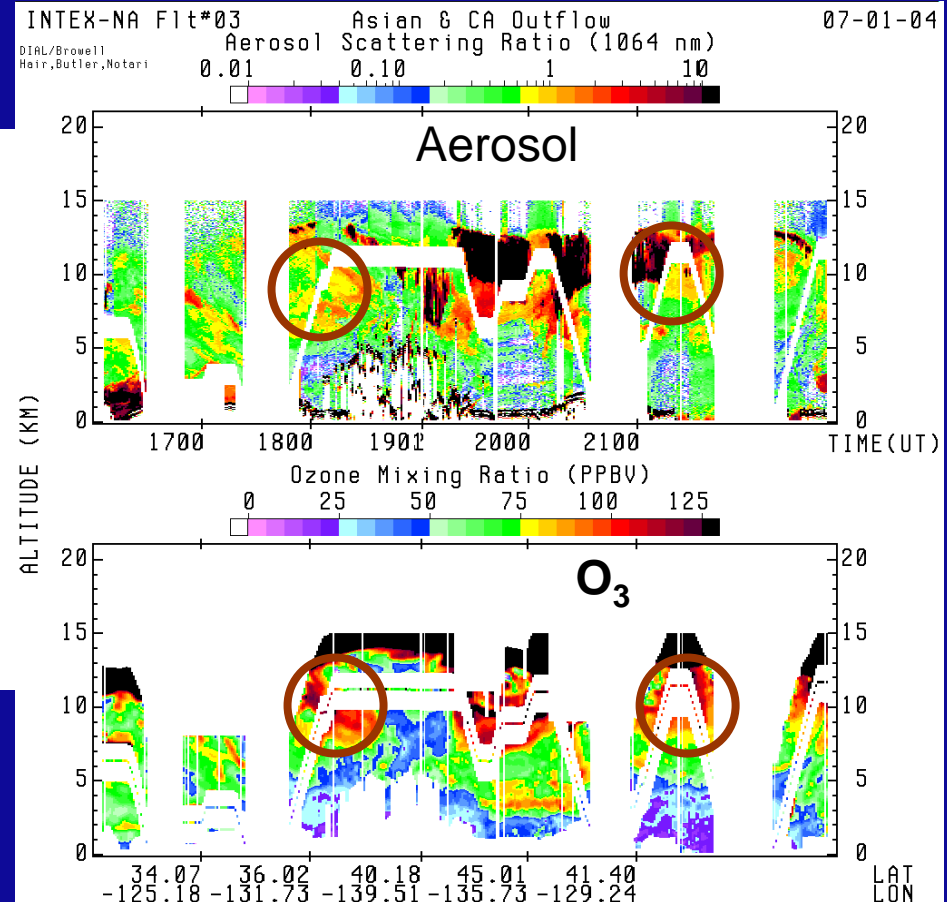
- DC-8/J-31/RB:
- MOPITT
- MISR
- AIRS
- SCIAMACHY

- Profiles:
- to 11 km
 - cloud free
 - 15 mi spiral
 - 1 hr window

Asian Outflow Seen by AIRS Sampled by DC-8



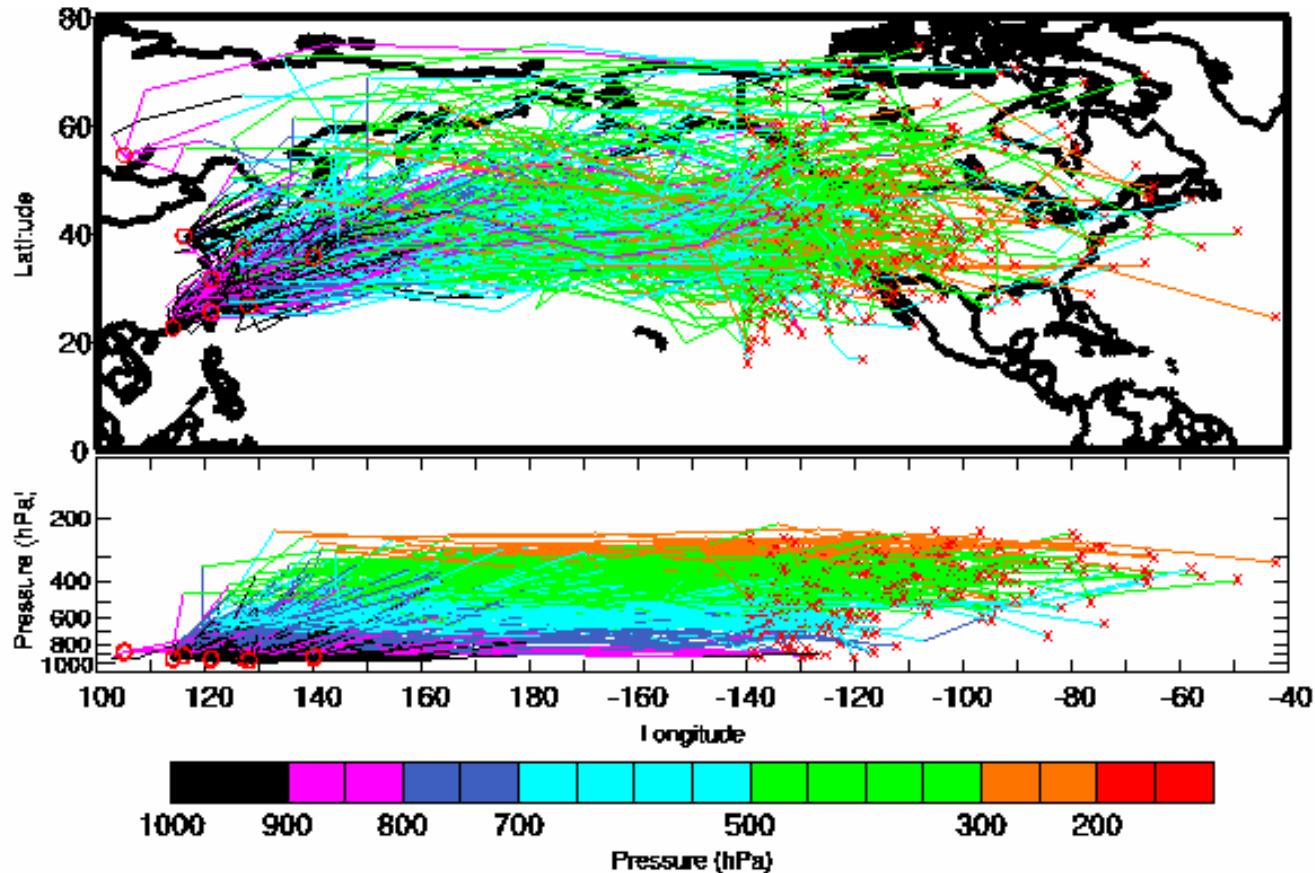
July 01, 2004



E. Browell et al.

7-day Forward Asian Trajectories (past 140W)

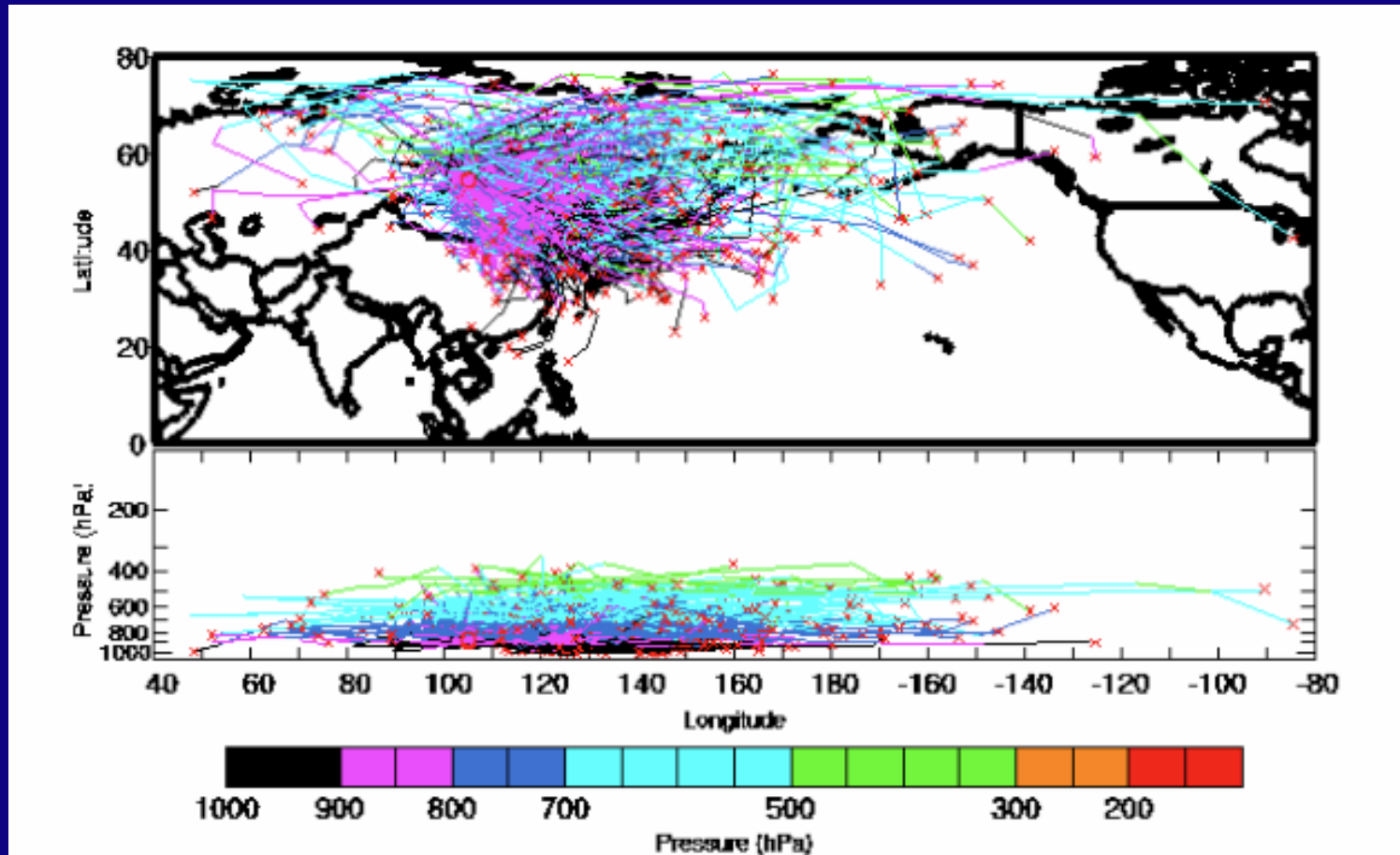
April Data for 15 years 344 trajectories ~ 10%



One Trajectory per day released from 500 meters AGL from 8 Asian cities (red circles). Data set by Eckhardt et al. (2004)

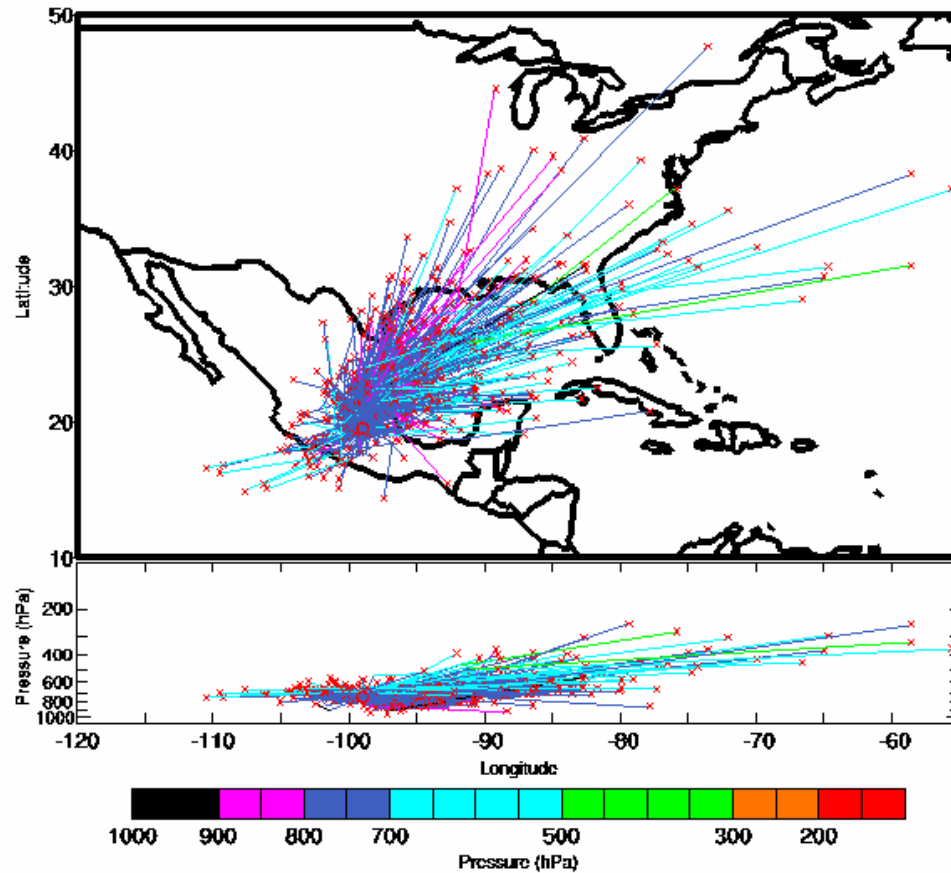
Siberian Fires: 7-Day Forward Trajectories

April Data for 15 years - 450 trajectories



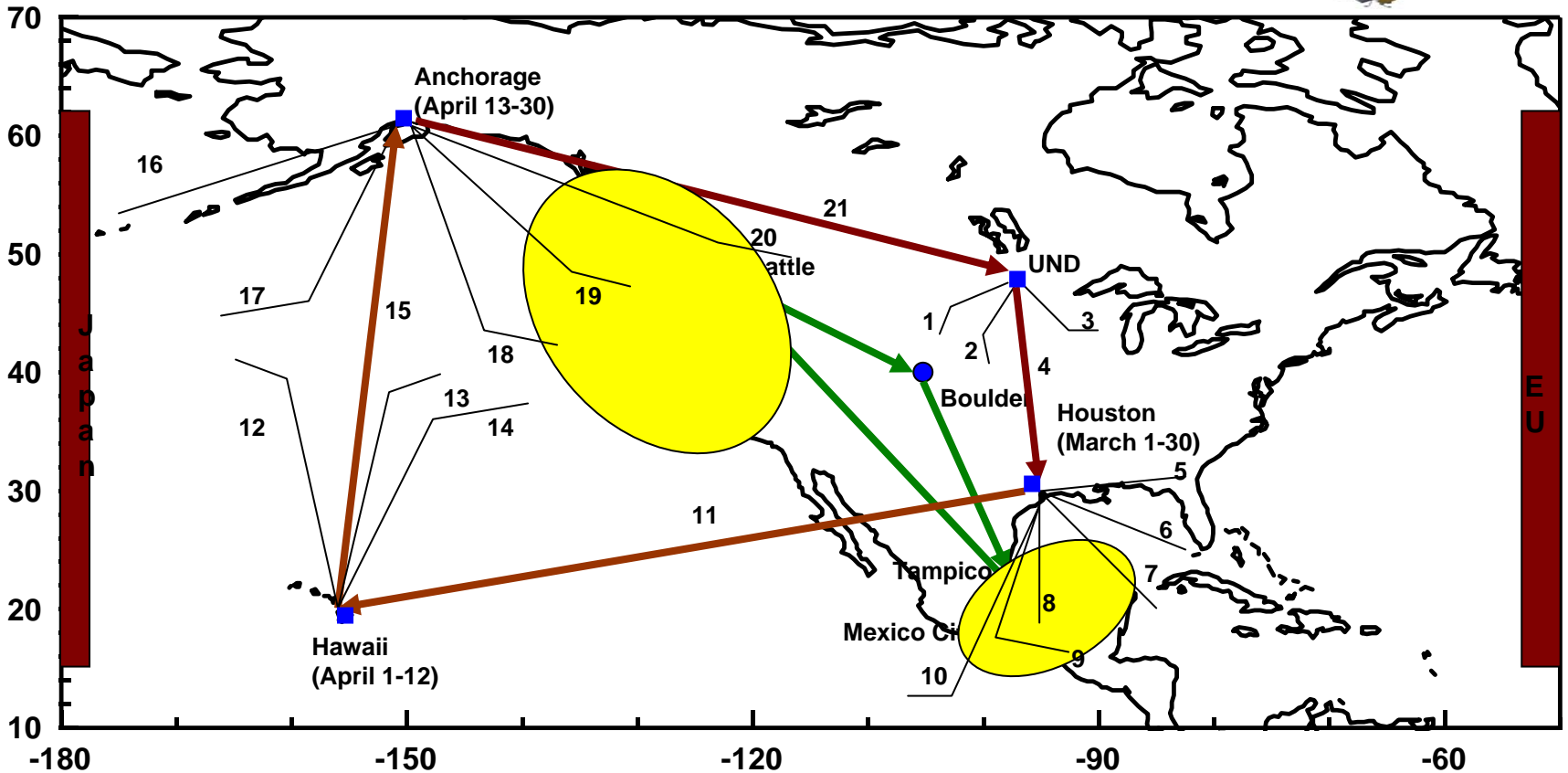
3-Day Forward Mexico City Trajectories

March Data for 15 years; 33% over US





INTEX-B Nominal Flight Tracks for Spring 2006



- DC-8 transits
- C-130 transits
- DC-8 locals

- Nominal C-130 operations
- Operations of foreign partners (DLR/Falcon-20)

21 flights (180 flight hours):
 UND (3 test flights)
 Houston (6 local flights)
 Hawaii (3 local flights)
 Anchorage (5 local flights)
 4 transit flights

INTEX-B DC-8 Measurements

Gas Phase/in-situ:

Nitrogen - NO, NO₂, PANs, HNO₃, RONO₂, HNO₄, NO_y (?), NH₃ (?)

Carbon - CO₂, CO, CH₄, NMHCs

Oxidants - O₃, OH/HO₂, H₂O₂, ROOH

Oxidized organics - CH₂O, CH₃CHO, (CH₃)₂CO, CH₃OH, others

Sulfur - SO₂

Others- H₂O, VOCs, tracers

Aerosol/in-situ:

Fine/ultra-fine CN : CN- volatile (>3 nm), CN- nonvolatile (>10 nm)

Size distribution (3-20,000 nm), surface area etc.

Black carbon/organic carbon

Aerosol composition

Microphysical and optical properties

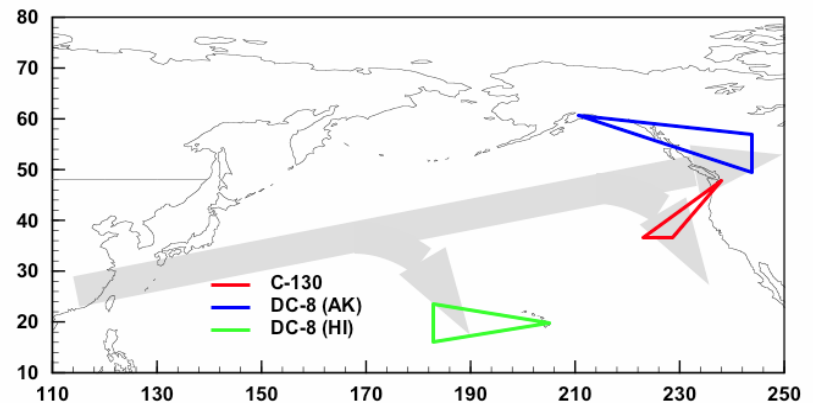
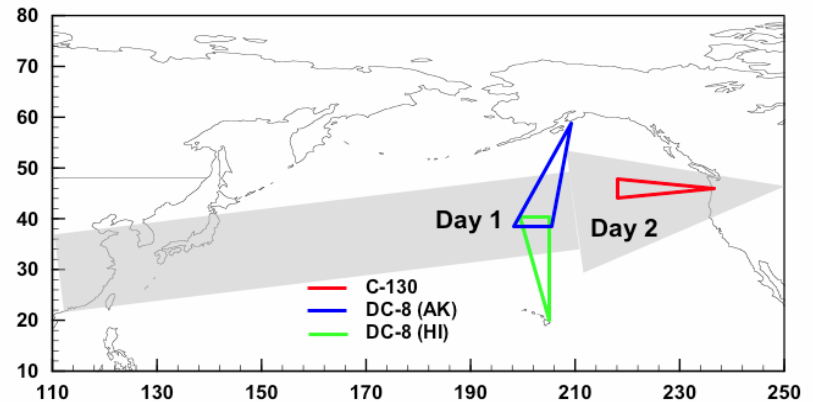
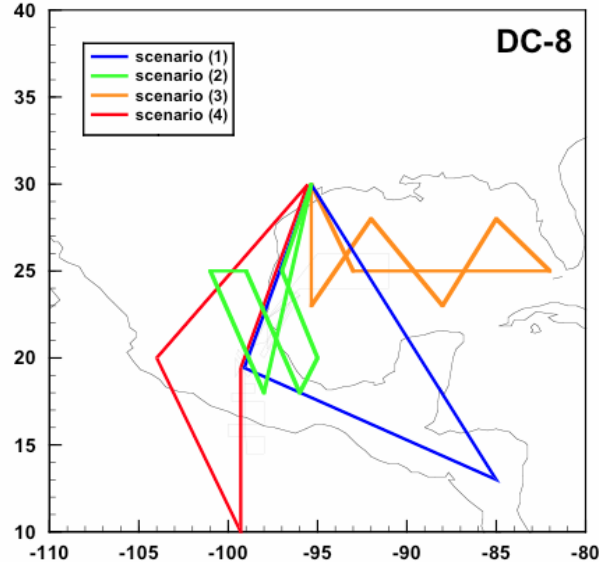
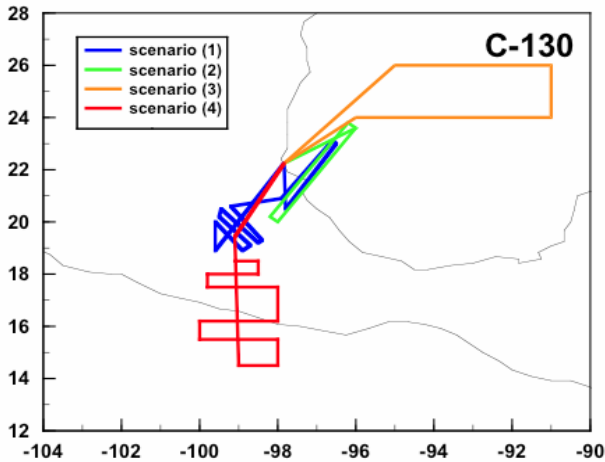
Remote:

O₃ lidar, aerosol lidar, aerosol optical depth, T

Physical:

Spectral irradiances, Meteorological measurements (T, P, u, v, w)

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



Falcon Instrumentation

Chemical Measurements:

Nitrogen:	NO, HNO₃, NO_y (DLR)
Carbon:	CO, CO₂, CH₄ (MPI-C)
Oxidants:	O₃ (DLR), RO₂ (Uni Bremen)
Sulphur:	SO₂, H₂SO₄ (MPI-K)

Aerosols:

Black carbon (DLR)

Aerosol size distribution (0.004 - 20 µm) (DLR)

Aerosol volatility (DLR)

Chemical analysis of filter samples (Uni Munich)