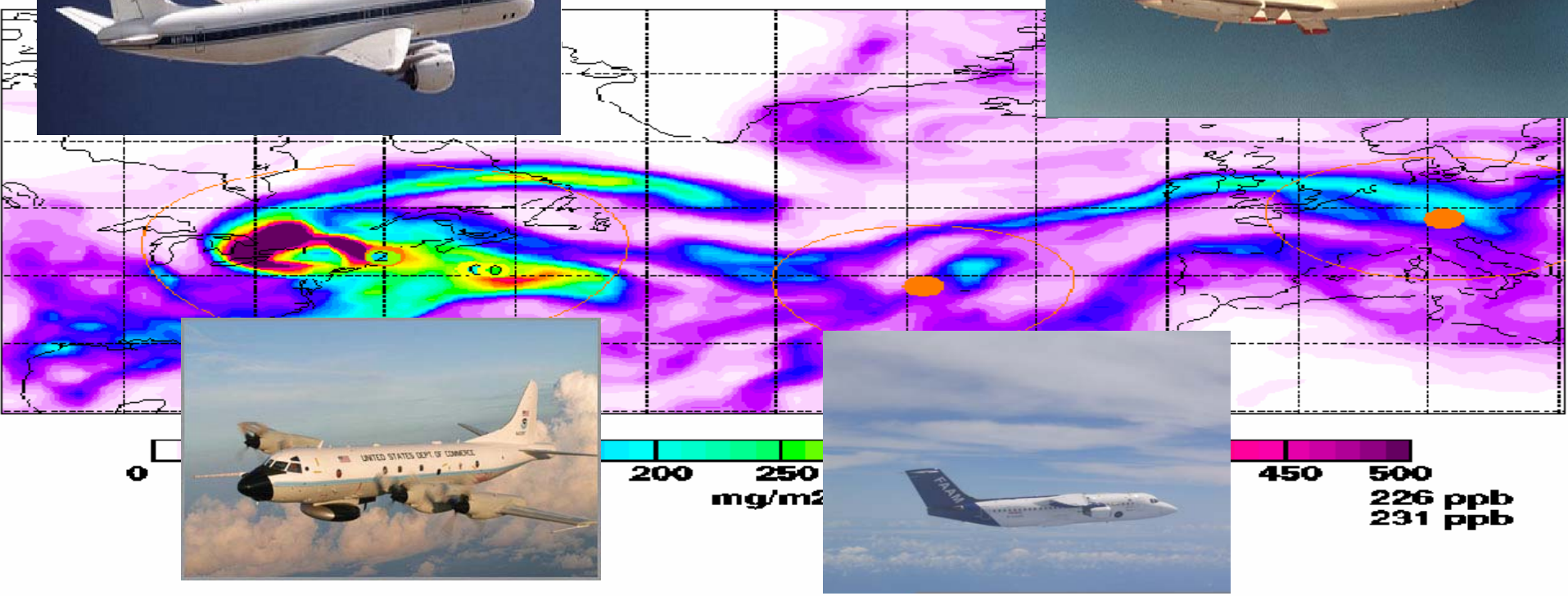
ITCT Lagrangian 2k4

An IGAC activity, including:

INTEX-A

NEAQS-ITCT

ITOP



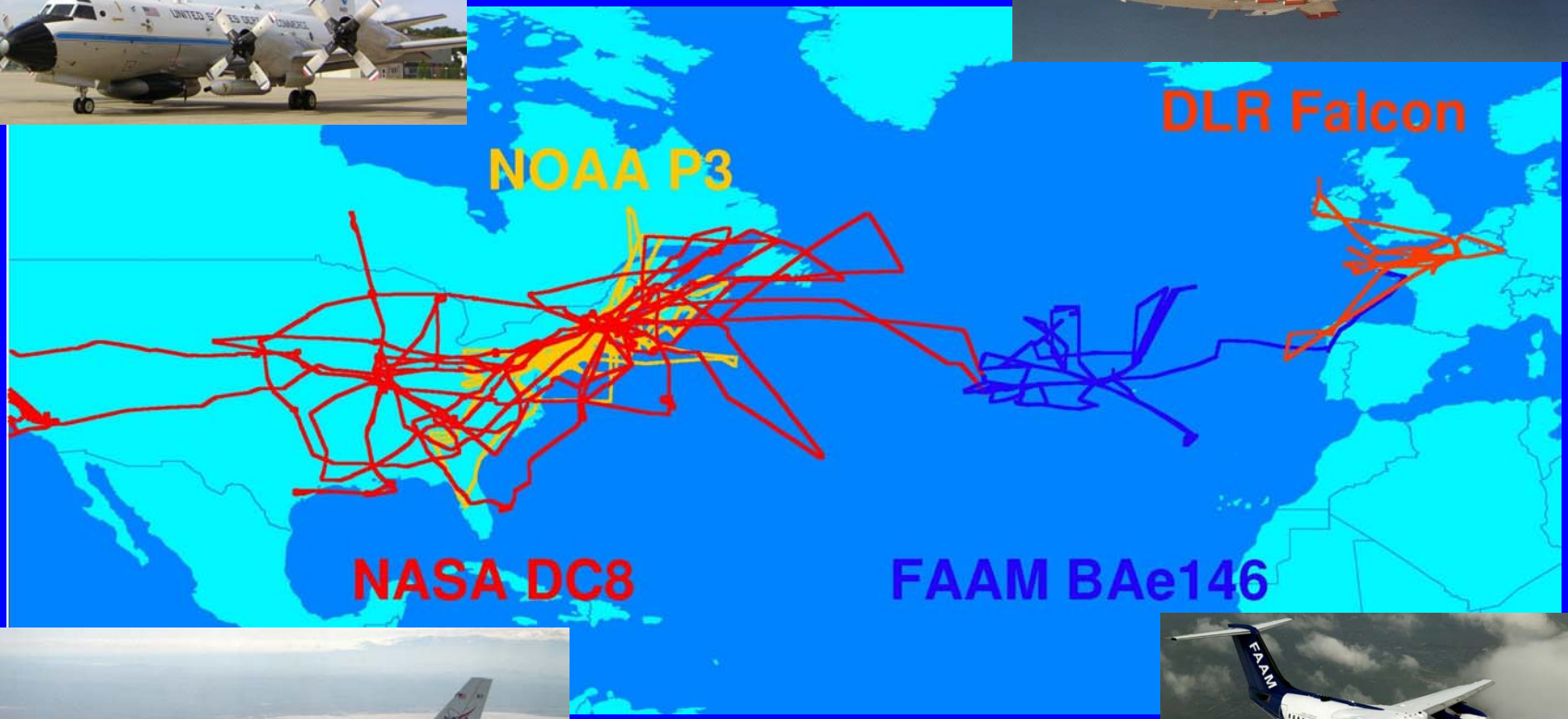
2k4 Quasi-Lagrangian Objectives

- Assess the photochemical oxidant and aerosol formation potential of air parcels (pollution) leaving North America
- Assess the contribution of these to the background and to the European boundary layer
- Study chemical transformation and removal during intercontinental transport
- Study dynamical processes responsible for transport and mixing

Coordinated Lagrangian Activities

- Instrument Intercomparison
- Flight Coordination (by Daily Telecon)
- Post-deployment Analysis

ICARTT Summer 2004 - Flight tracks of major aircraft



FAAM BAe146, based in Faial, Azores, flew 13 science flights ~70 hours including intercomparison flights with DLR Falcon and NASA DC8

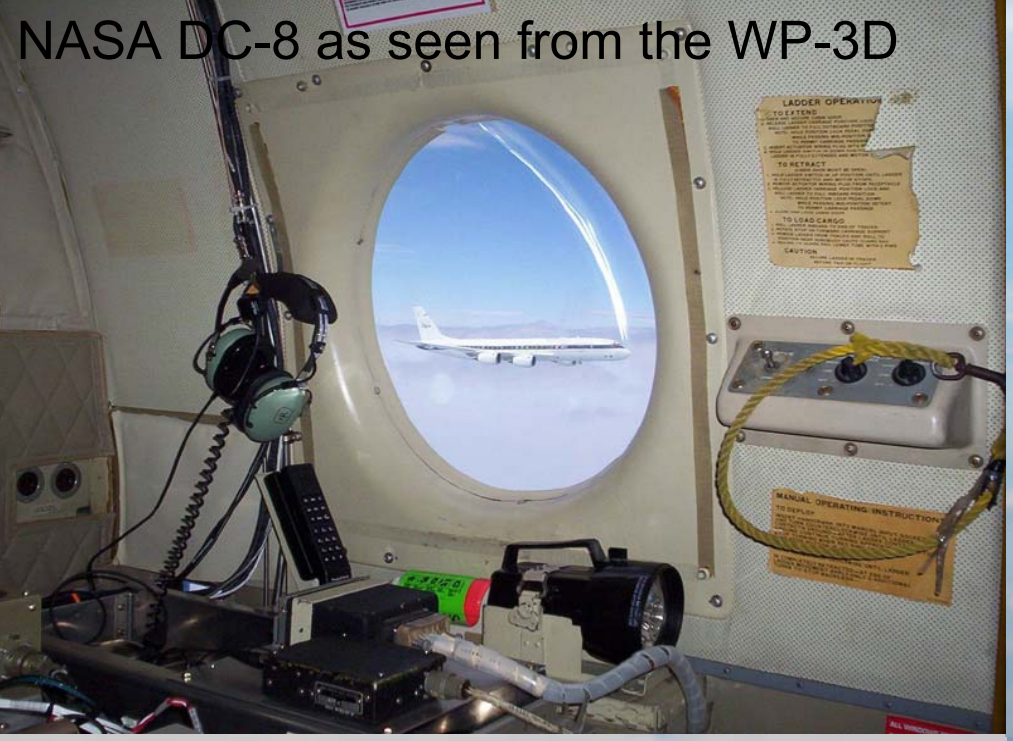
Slide: M Evans, Leeds

Other Platforms/Measurements

- COBRA King Air
- J-31 (AATS/14)
- Ron H. Brown
- Surface Stations: Appledore, Boston, Castle Springs, Cheboque, Mace Head, Martha's Vinyard, Mt. Washington, Pico, Thompson Farm
- Lidars: Potenza, Leipzig, Cheboque Point

Goal: Multiple, Sequential Sampling Flights into the Same Air Mass

- Photochemical transformation and aerosol formation happens while air mass is transported
- Largest uncertainty is mixing
- Exact vertical match is difficult
- Tracer change must be larger than instrument error and variability in air mass of origin
- “Sameness” of air mass needs to be determined by tracer correlations as well as by careful met analysis

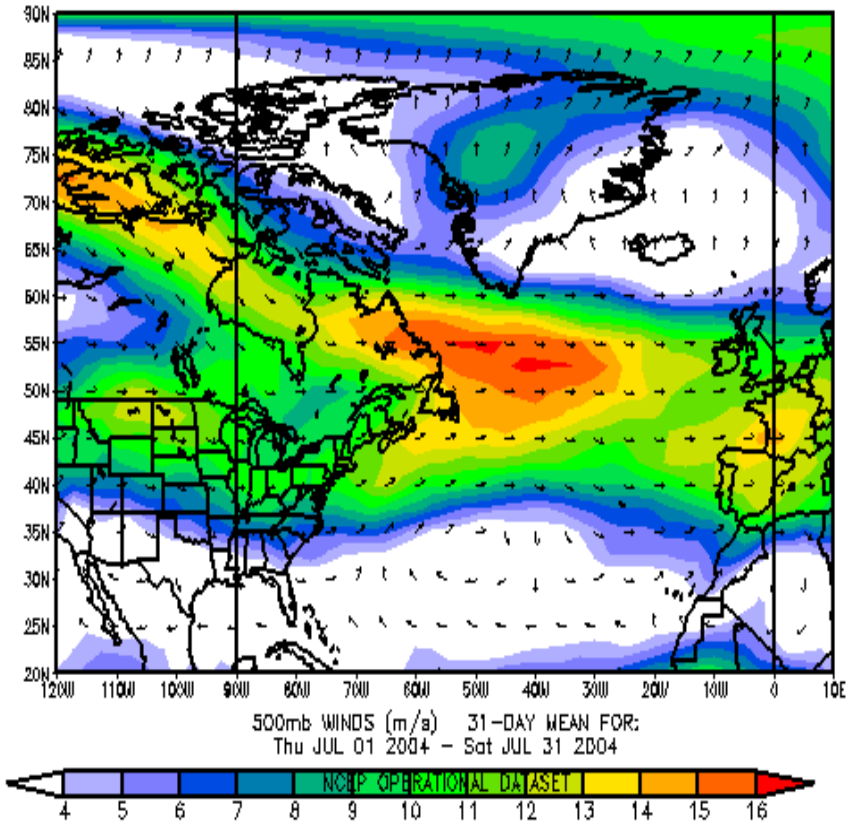

NASA DC-8 as seen from the WP-3D
LADDER OPERATION
TO EXTEND
TO RETRACT
TO LOAD CARGO
CAUTION
MANUAL OPERATING INSTRUCTIONS

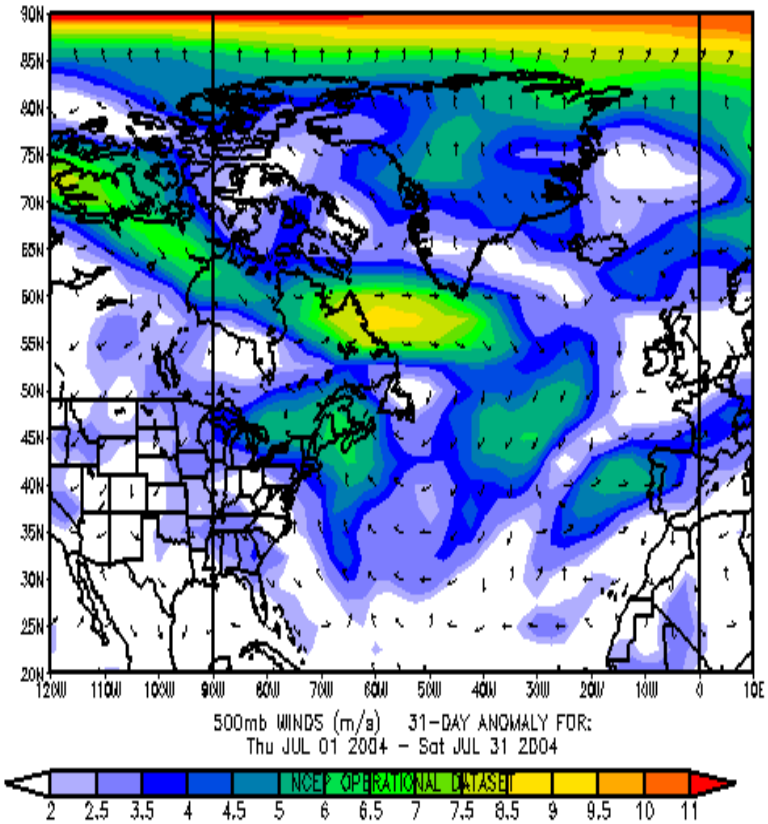
NOAA WP-3D as seen from the DC-8
N42RF
UNITED STATES DEPT. OF COMMERCE
Photo Credit: E. Browell

Bae-146 as seen from the DC-8
FAAM

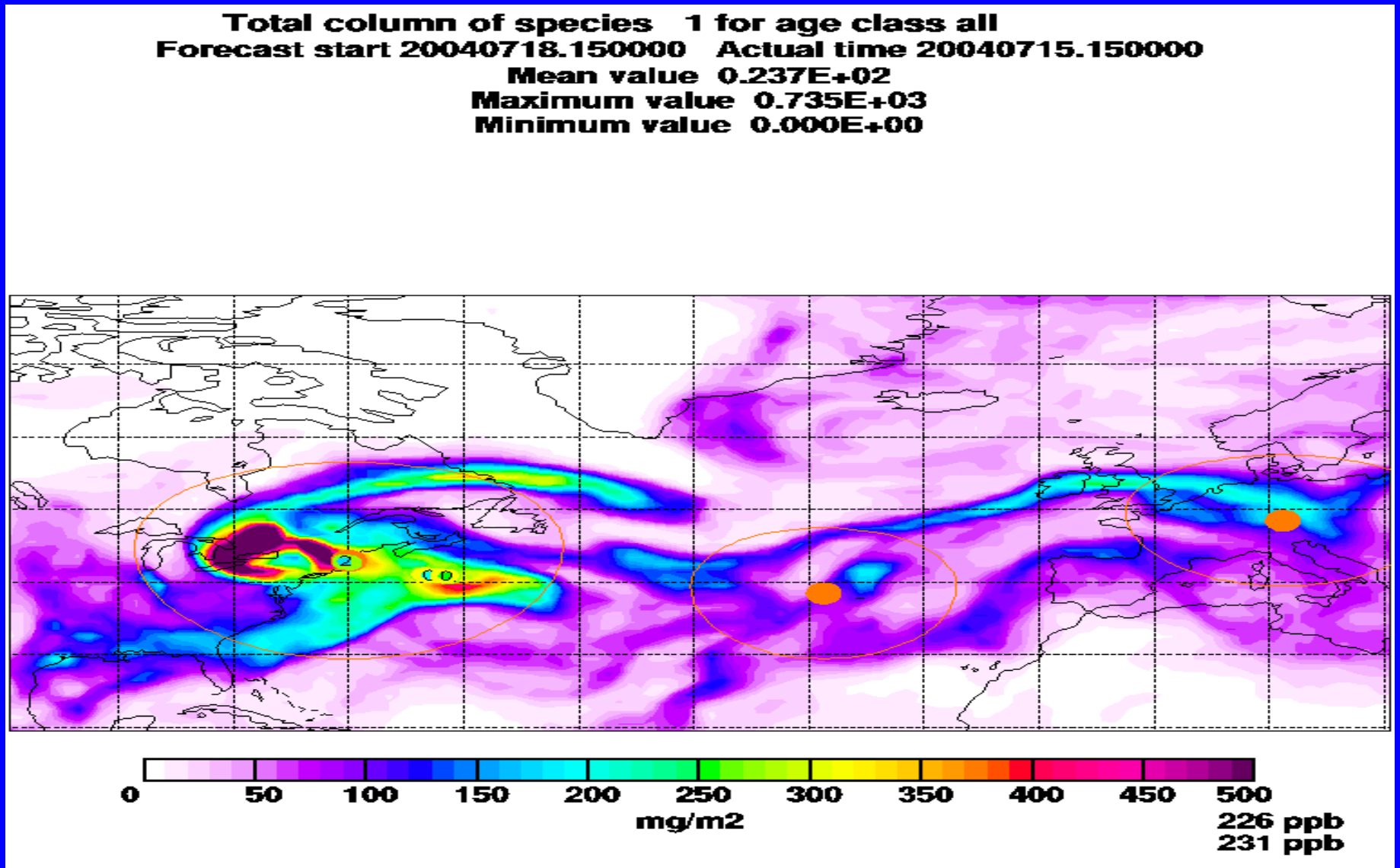
DLR Falcon as seen from the 146

Prevailing Winds





Overview movies of the CO tracer coming into Europe

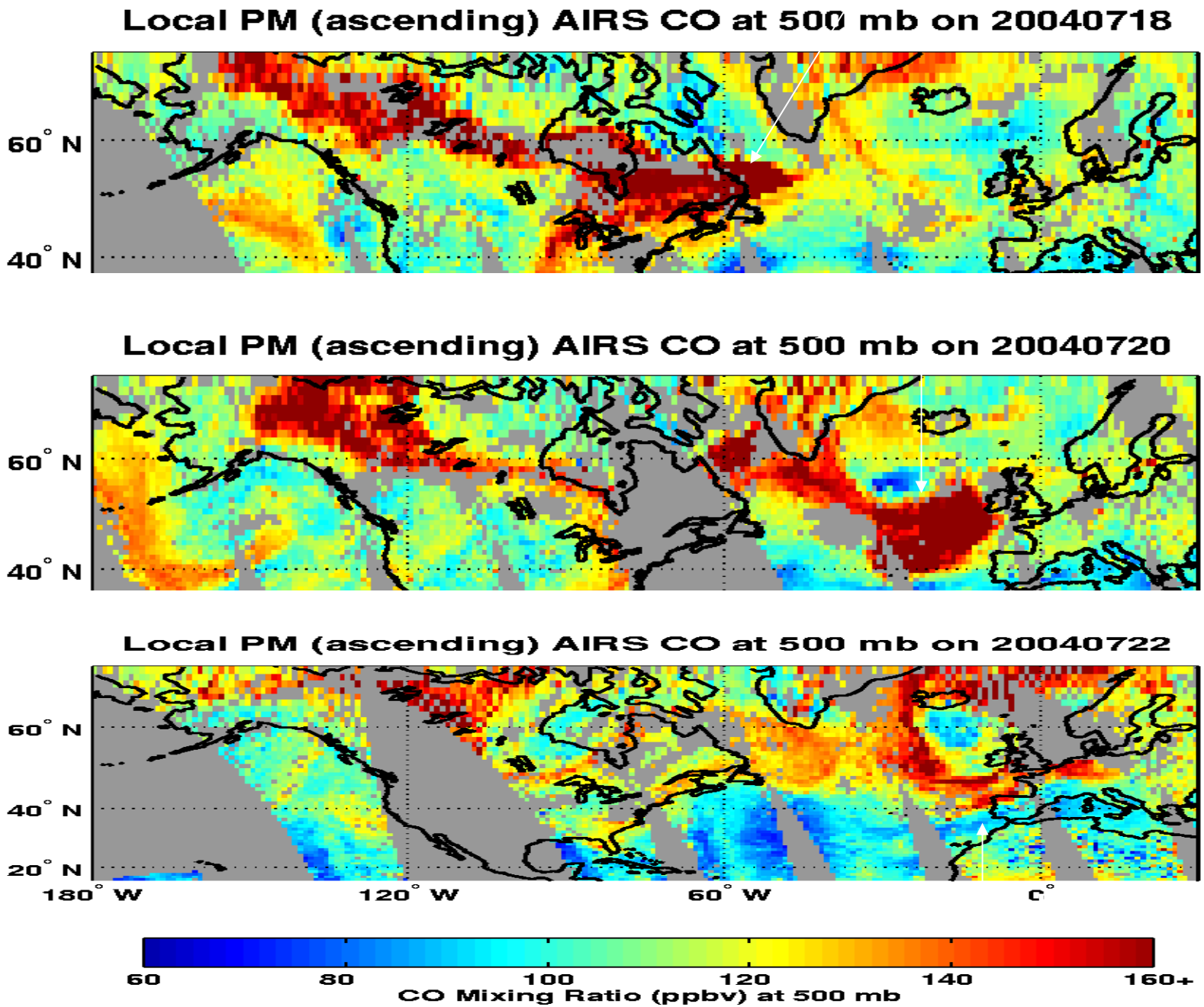


3 Major Cross-Atlantic Features Sampled:

- Alaskan/Canadian Fire Plume (07/18-07/22/2004)
- New York/Boston Megacity Plume (07/20-07/26/2004)
- Pre-frontal transport (warm conveyor belt 07/27-08/01/2004)

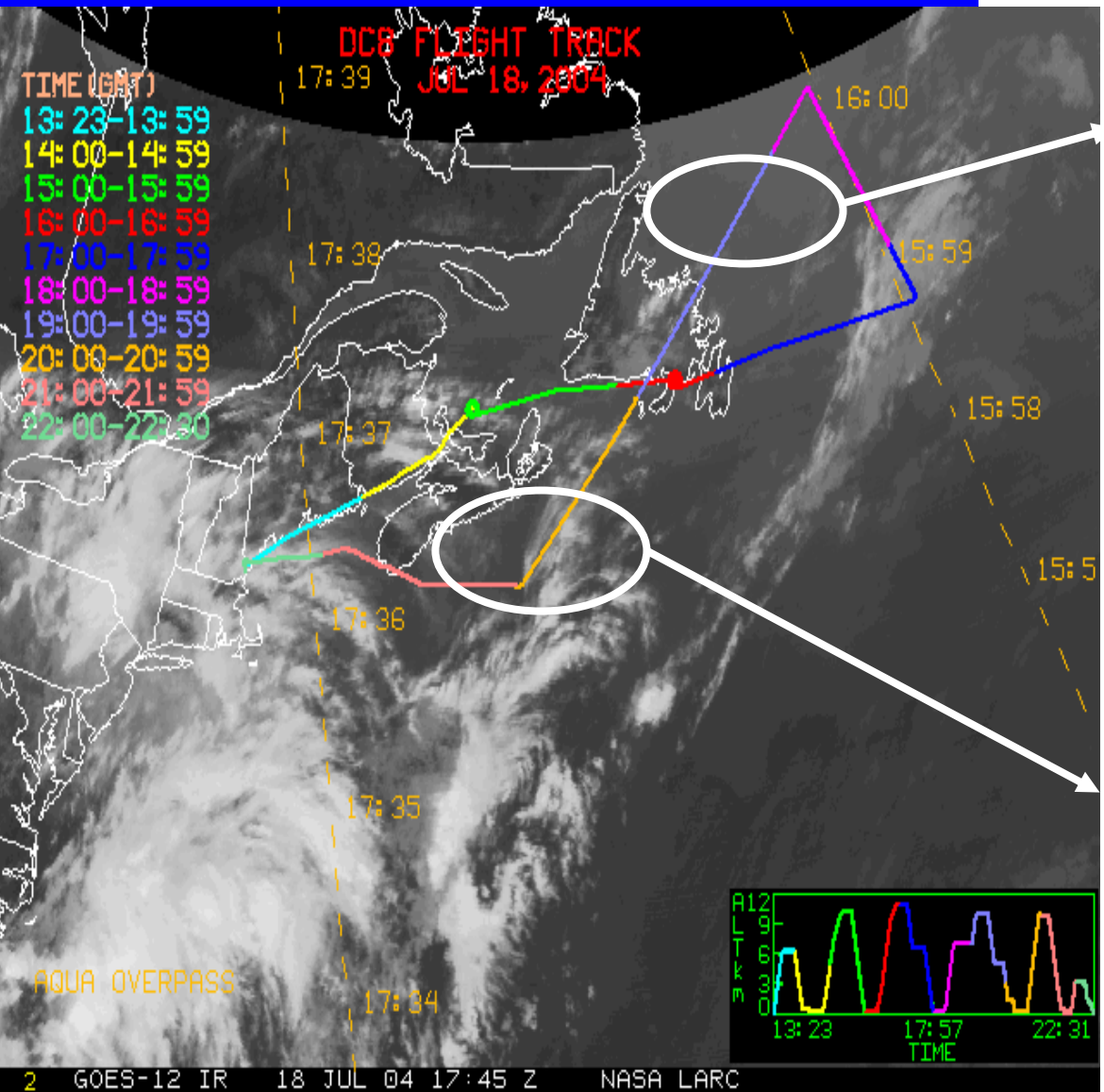
ICARTT Lagrangian Opportunities

	DC8 (NASA)	P3 (NOAA)	BAe-146 (UK)	Falcon (DLR)
05/07/04		Transit		
06/07/04	INTEX 2: transit to St Louis			
07/07/04			B027: Comparison	Comparison
08/07/04	INTEX 3: St Louis to East Coast			
09/07/04		Boston and Canadian fires		
10/07/04	INTEX 4: South East US			
11/07/04		Boston at night		
12/07/04	INTEX 5: South East US and Mid-West		B028: Transit (Alaskan plume)	
13/07/04				
14/07/04				
15/07/04	INTEX 6: Penn State and transit	New York plume (1) and meet with balloons	B029: Low level and fires	
16/07/04				
17/07/04			B030: First good lagrangian opportunity	
18/07/04	INTEX 7: Newfoundland			
19/07/04			B031: New York plume (2)	
20/07/04	INTEX 8: South East US	New York City (1)	B032: Alaskan fires	
21/07/04		New York City (2)		
22/07/04	INTEX 9: Comparison and East Coast	New York City (3) and comparison	B033: Low level pollution and ENVISAT underpass	New York plume (3) (West of Portugal)
23/07/04				Fire plume and low level
24/07/04				
25/07/04	INTEX 10: South East US and East Coast	Montour power plant	B034: Out of Africa	New York City (4) (West of Ireland)
26/07/04				New York City (5) (English Channel)
27/07/04		Warm conveyor belt (1) and thunderstorms		
28/07/04	INTEX 11: Comparison + upp. level warm conveyor belt (1)	Warm conveyor belt (2) and fire	B035: Comparison	
29/07/04			B036: Upper level warm conveyor belt (2)	
30/07/04				Ship emissions
31/07/04	INTEX 12: Comparison and Bermuda High	Comparison and New York City at night	B037: Low level warm conveyor belt (1)	Upper level warm conveyor belt (3)
01/08/04			B038: Low level warm conveyor belt (2)	
02/08/04				
03/08/04		New England at night	B039: Transit and comparison	Comparison

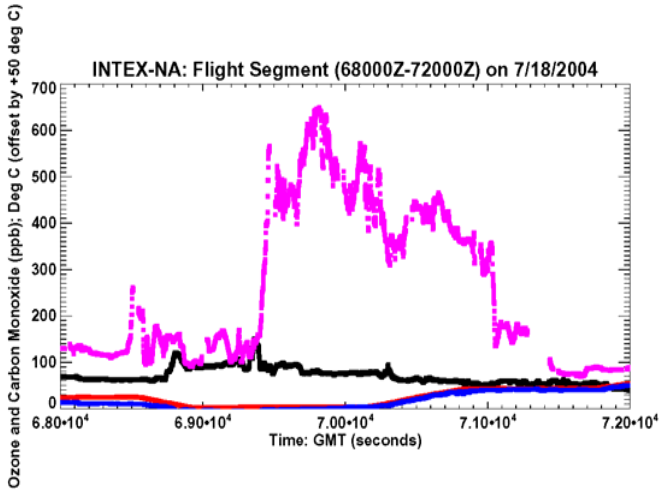

Local PM (ascending) AIRS CO at 500 mb on 20040718
60° N
40° N
Local PM (ascending) AIRS CO at 500 mb on 20040720
60° N
40° N
Local PM (ascending) AIRS CO at 500 mb on 20040722
60° N
40° N
20° N
180° W
120° W
60° W
0°
60
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

Flight 9 on July 18, 2004: DC-8 Ozone, CO, Dewpoint and T data

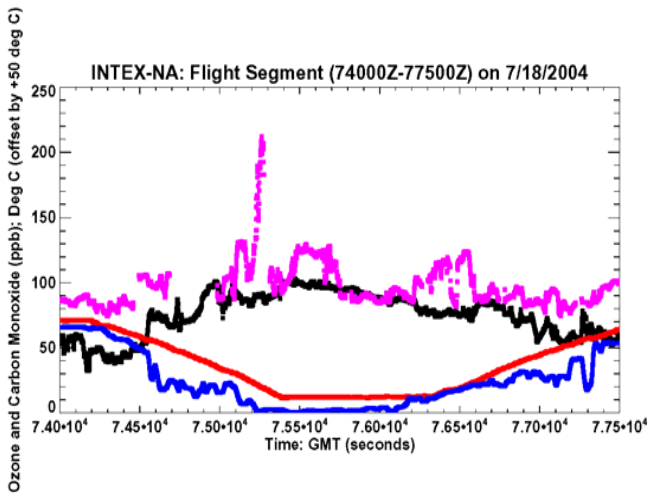
Sachse, Avery, Barrick



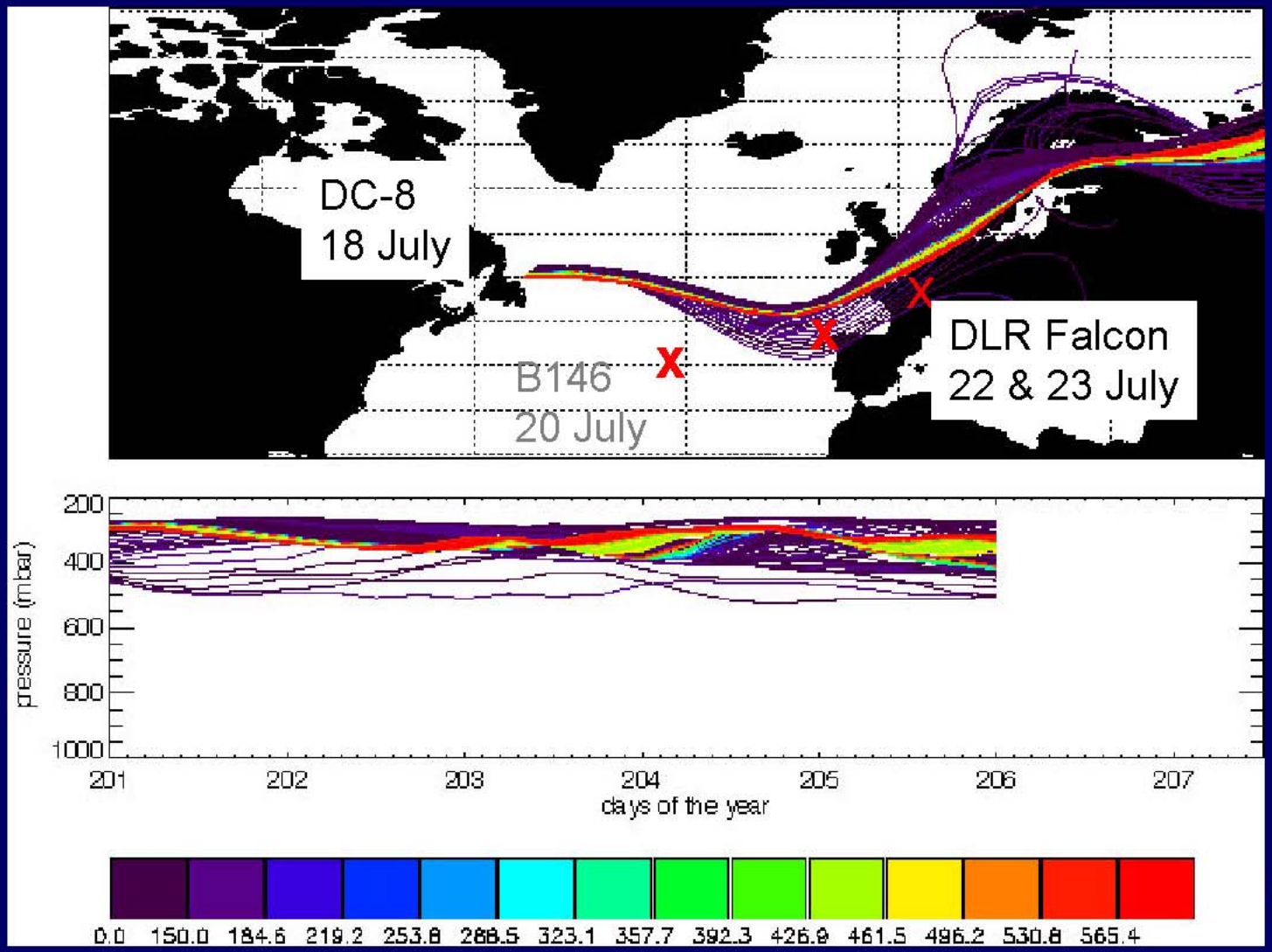
Alaskan Fire Smoke



Asian Outflow, Convective and Stratospheric Influenc



Forward trajectories from DC-8 flight on18 July 04 from flight segment 19.00 - 19.25 UT (high CO)

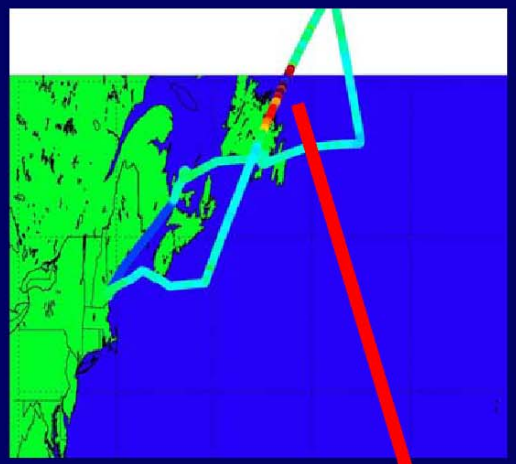


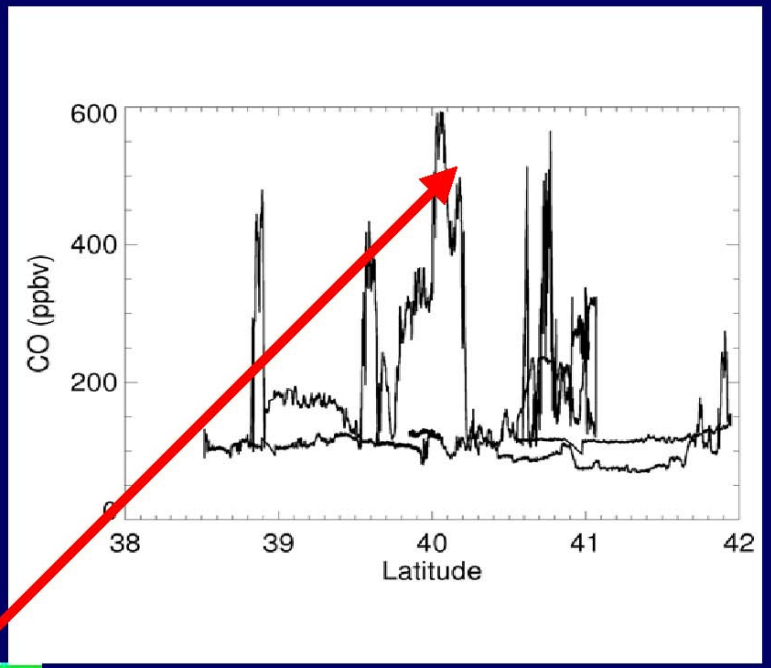
CO (ppbv)

Courtesy: John Methven, Glenn Sachse, Elsa Real

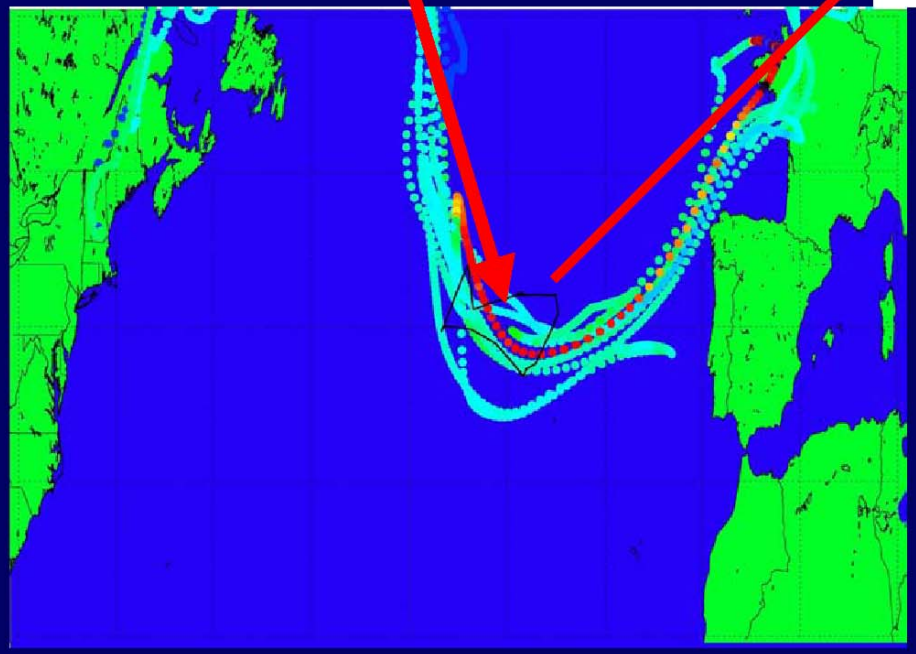
British Lagrangian flight 3

NASA flight on July 18th





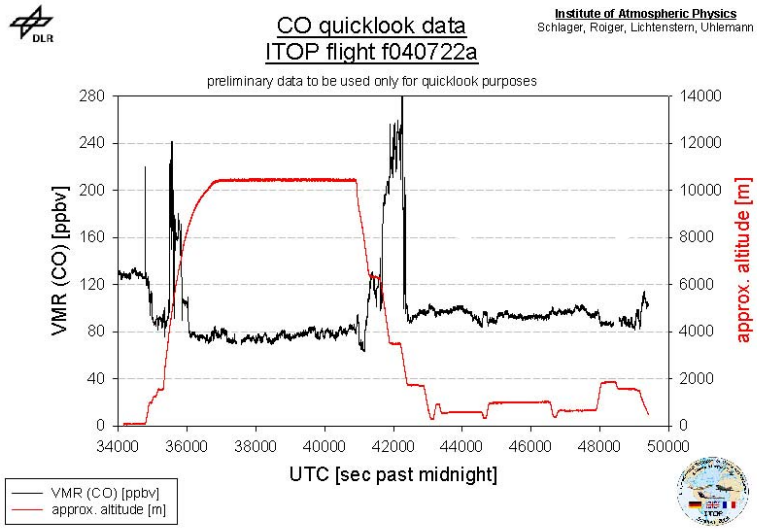
UK flight on July 20th

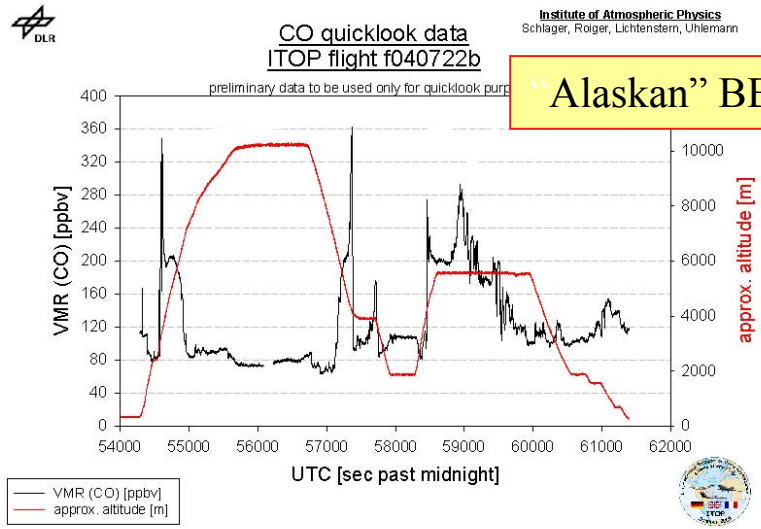


CO & O_3 observations from DLR Falcon 22 July

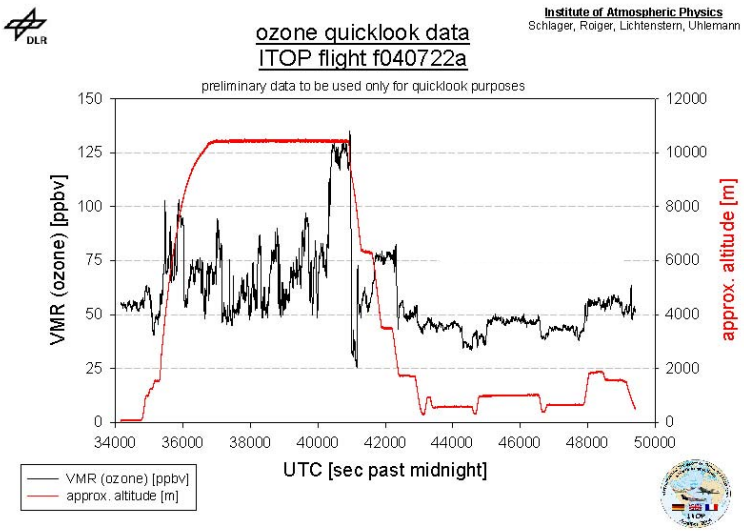
Creil to Santiago

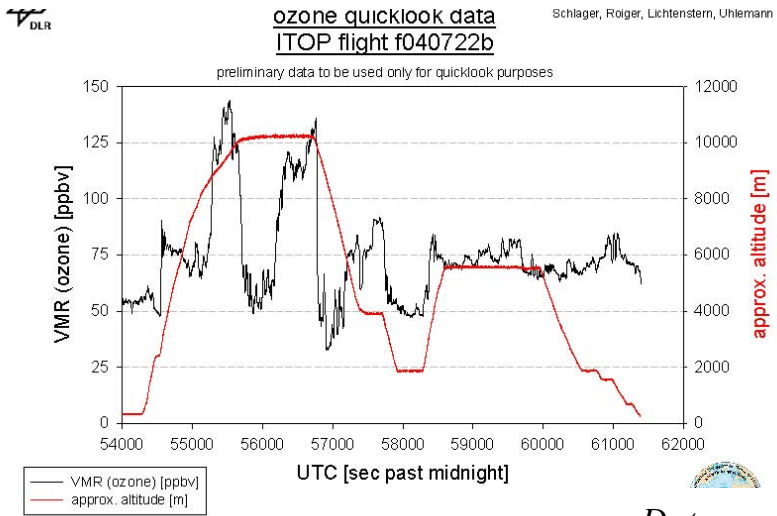
Santiago to Creil





"Alaskan" BB plumes??





Polluted air observed off Spain/ Portugal

Data courtesy Hans Schlager

Next Steps…

- Meeting in Austria at the EGU this April to discuss analysis and share notes
- Trajectory and dispersion model matches available to all ICARTT science teams
- Tracer/tracer correlations and analysis of whole air samples and other “signature” tracers
- Many potential cases exist – plenty of data to look at!