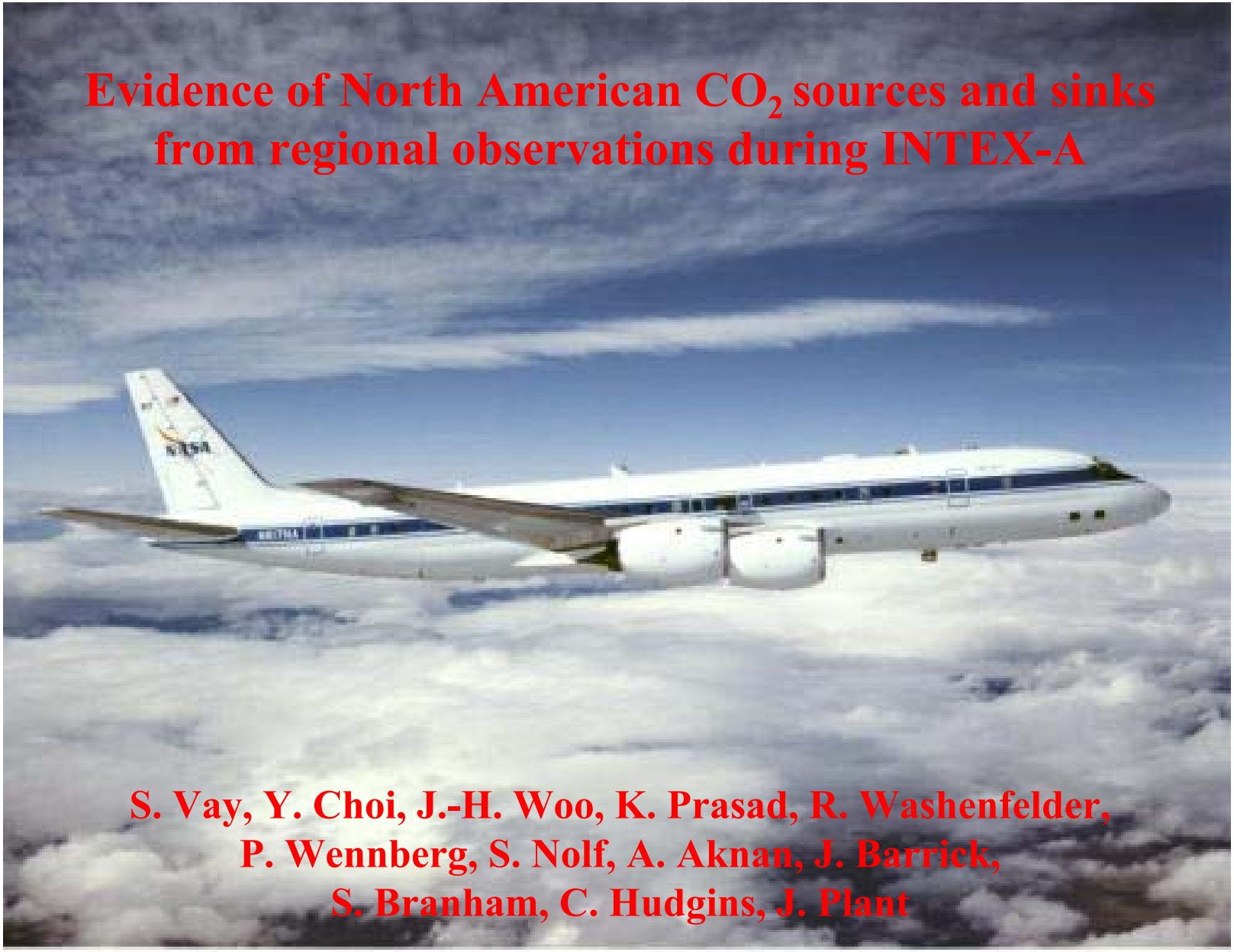
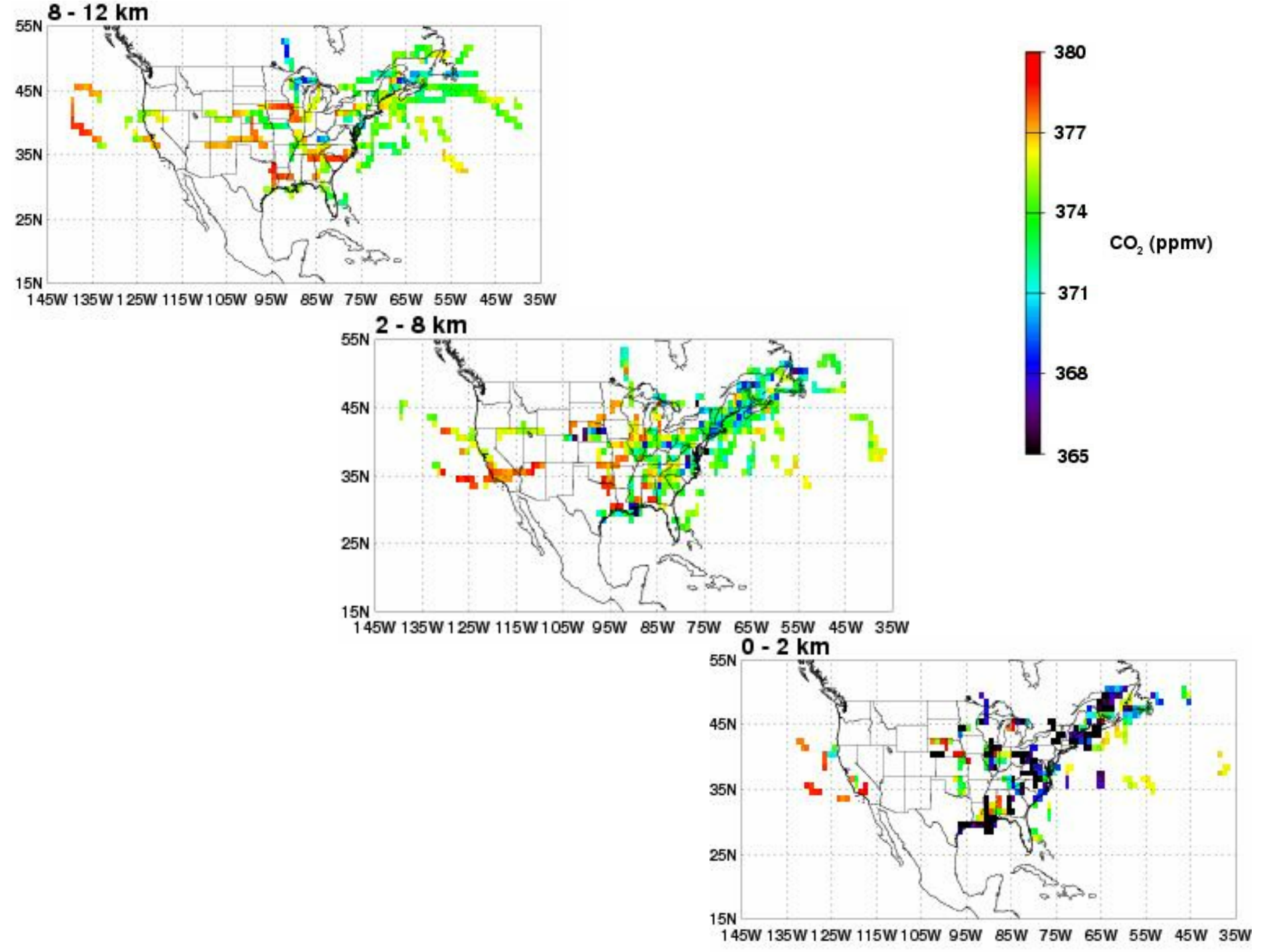
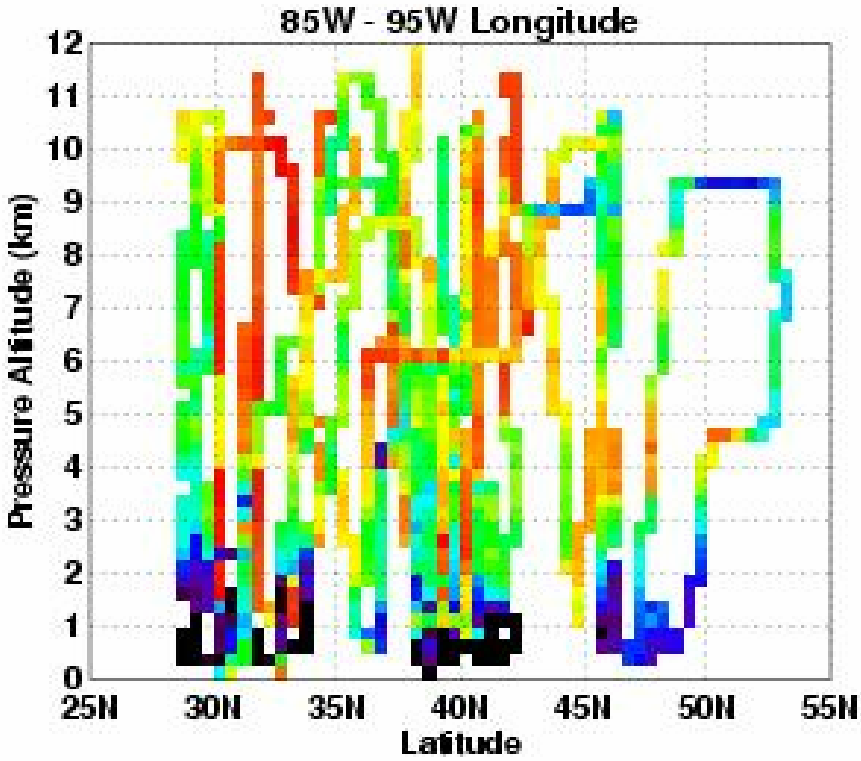
Evidence of North American CO_2 sources and sinks from regional observations during INTEX-A

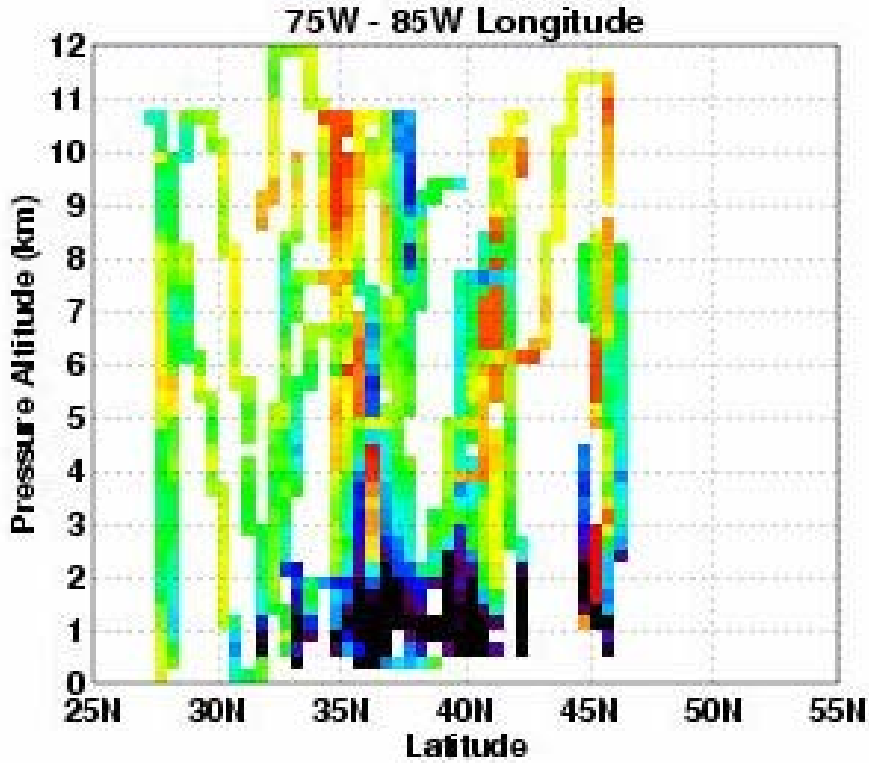


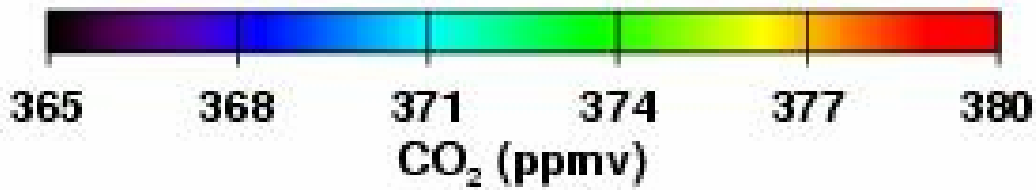
S. Vay, Y. Choi, J.-H. Woo, K. Prasad, R. Washenfelder,
P. Wennberg, S. Nolf, A. Aknan, J. Barrick,
S. Branham, C. Hudgins, J. Plant

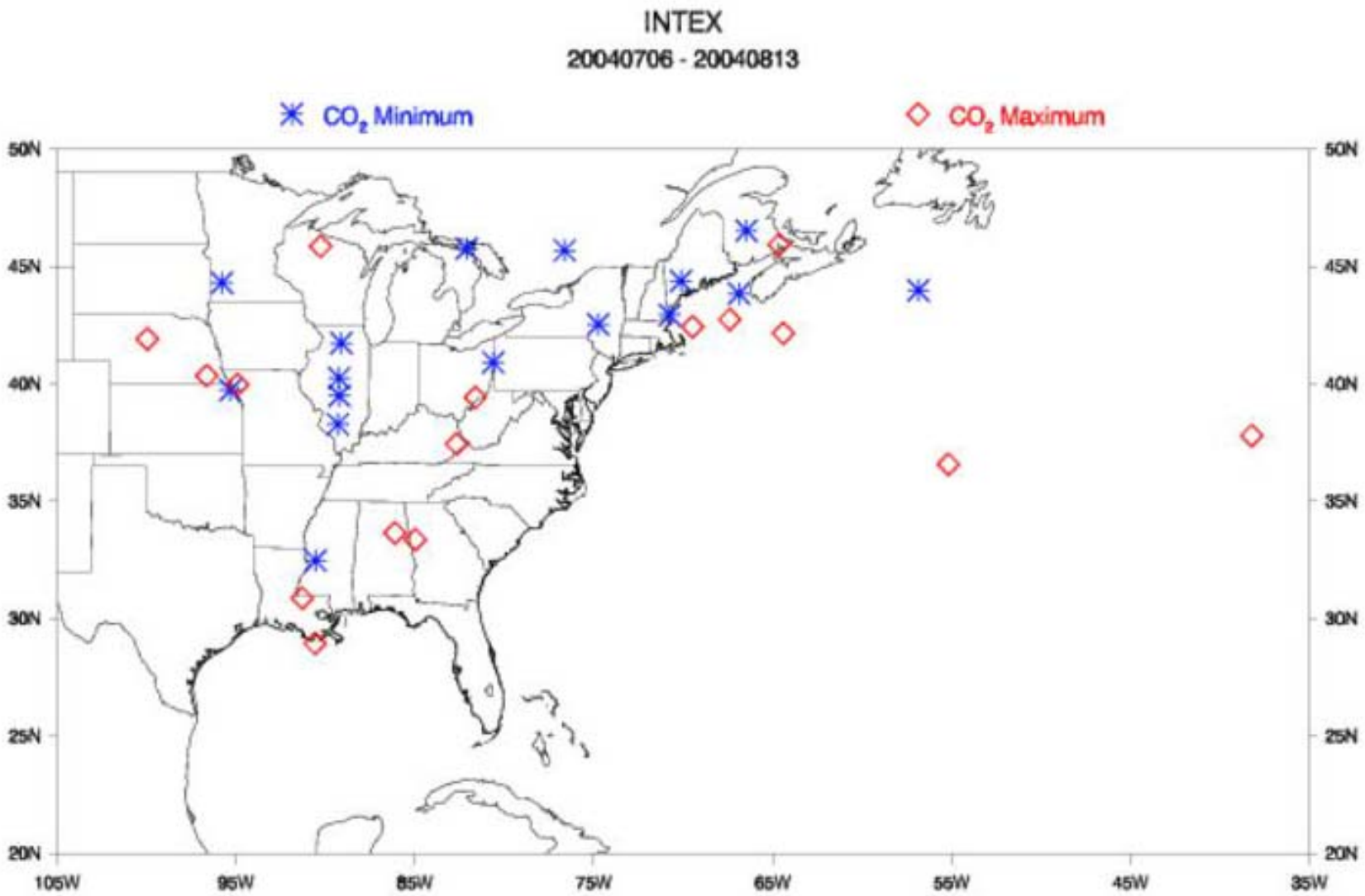

8 - 12 km
2 - 8 km
0 - 2 km
55N
45N
35N
25N
15N
145W 135W 125W 115W 105W 95W 85W 75W 65W 55W 45W 35W
380
377
374
371
368
365
CO2 (ppmv)

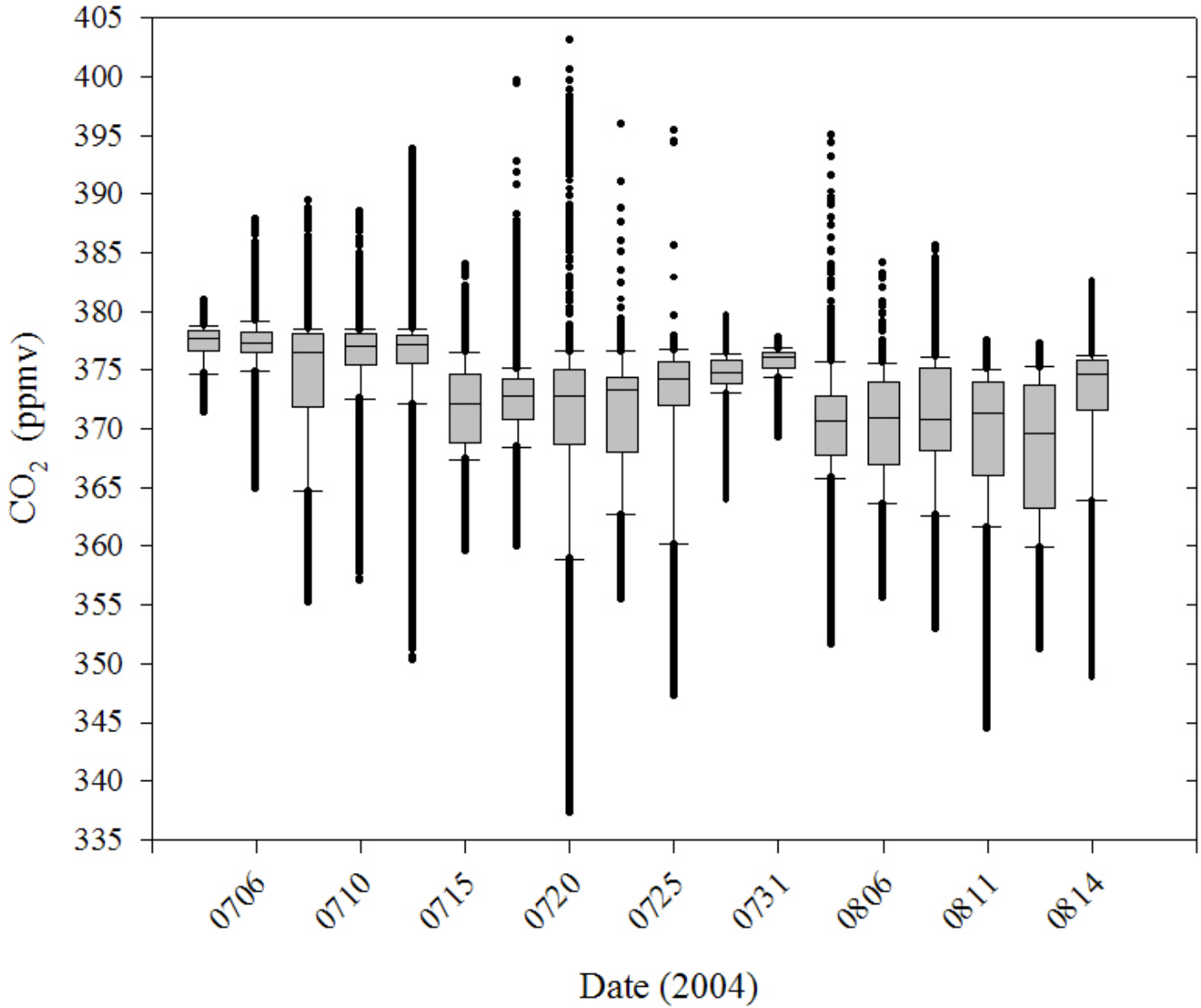
INTEX (20040701 - 20040814)



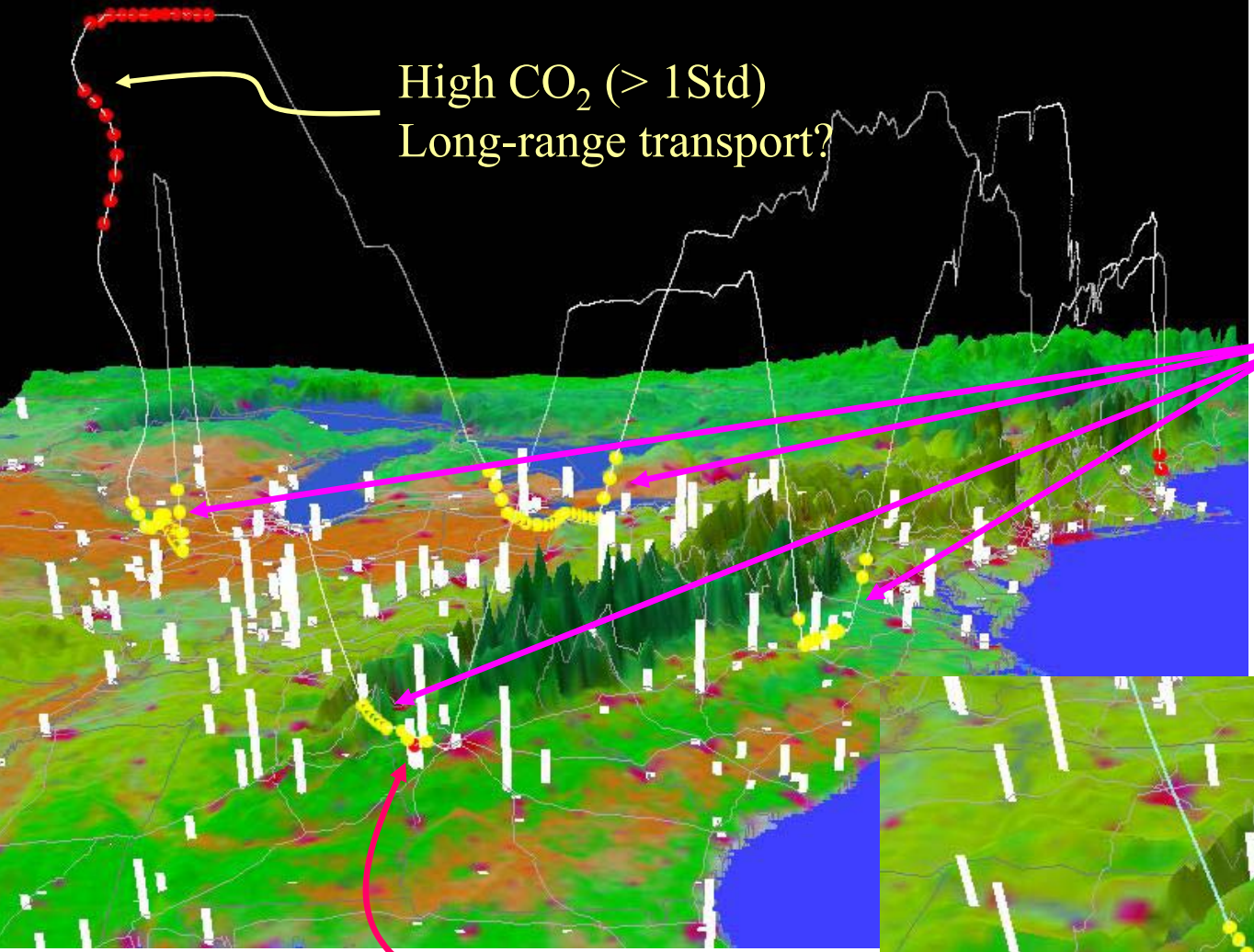





INTEX
20040706 - 20040813
CO2 Minimum
CO2 Maximum
50N
45N
40N
35N
30N
25N
20N
105W
95W
85W
75W
65W
55W
45W
35W

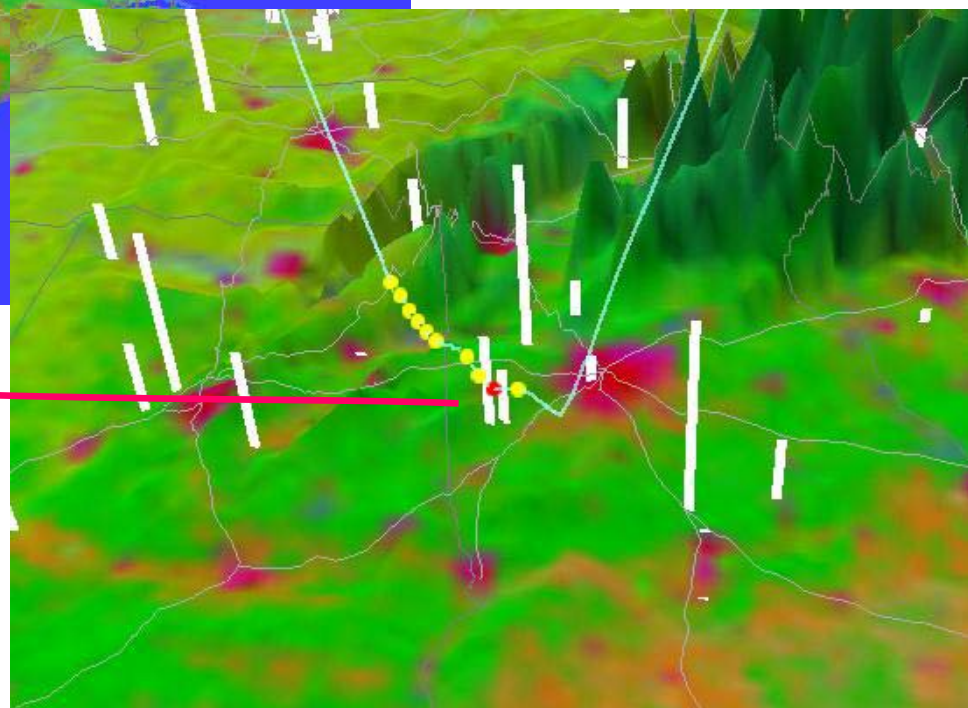

INTEX-A
1 July - 14 August 2004
405
400
395
390
385
380
375
370
365
360
355
350
345
340
335
CO_2 (ppmv)
0706
0710
0715
0720
0725
0731
0806
0811
0814
Date (2004)

DC-8 (2004/07/20)



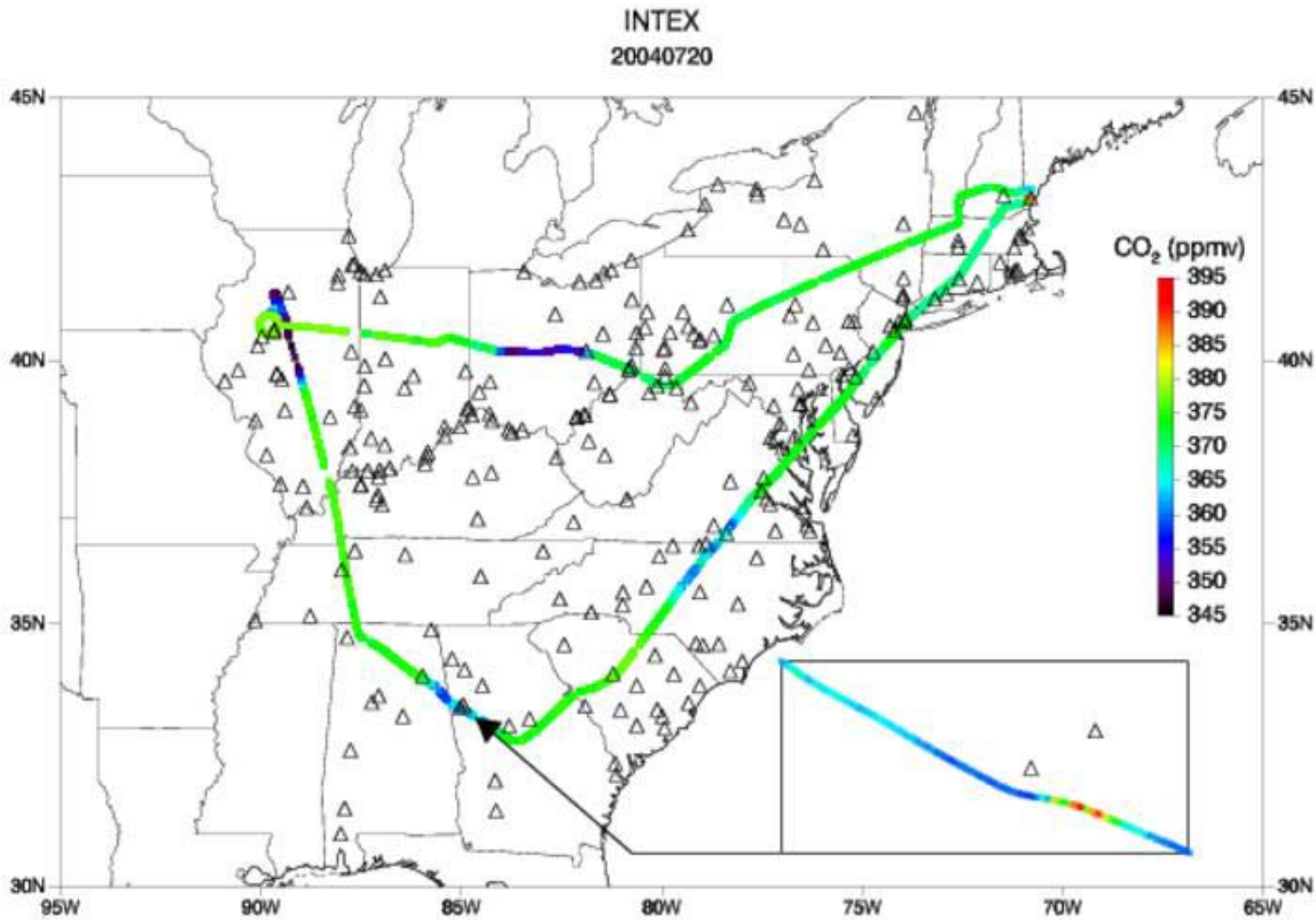
Low CO_2 (< 1Std)
Uptake from vegetation?

The white bar : Point sources extruded by July CO2 emission

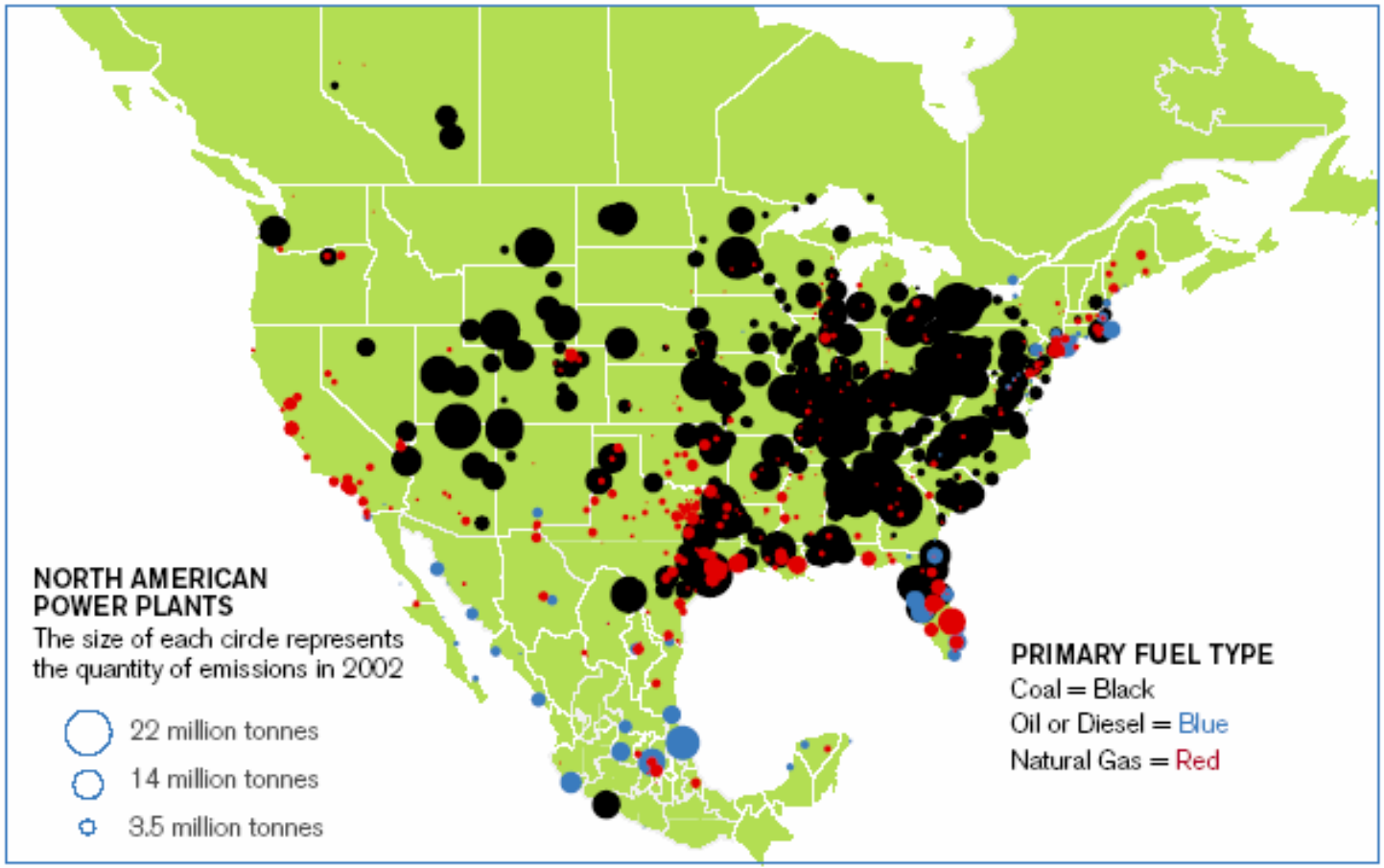


A narrow point source plume was captured by high resolution CO_2 sensor

(403.15 ppm CO_2 @ 1Hz)


INTEX
20040720
45N
40N
35N
30N
95W
90W
85W
80W
75W
70W
65W
CO2 (ppmv)
395
390
385
380
375
370
365
360
355
350
345

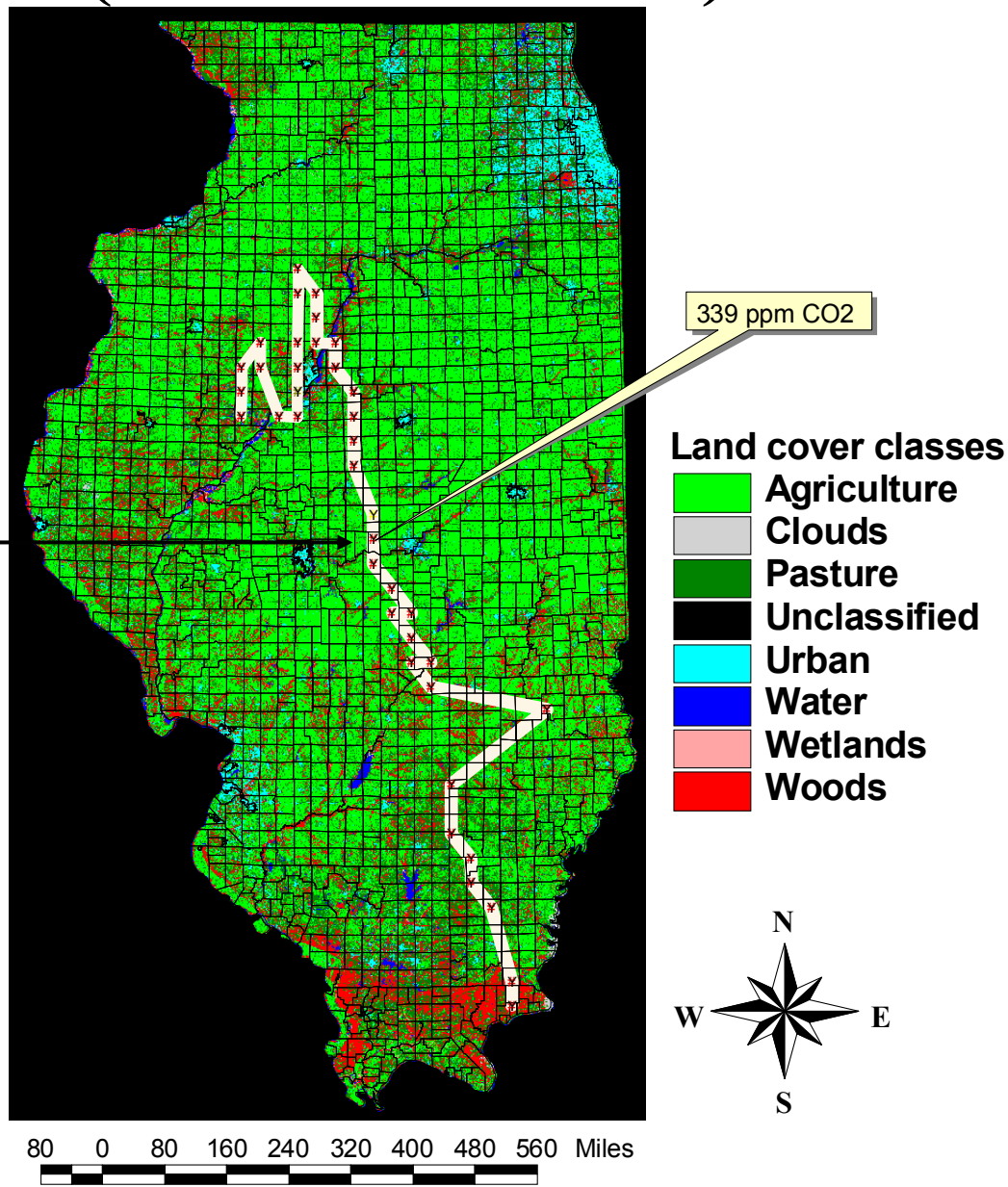
GEOGRAPHIC DISTRIBUTION OF POWER PLANT CO_2 EMISSIONS*



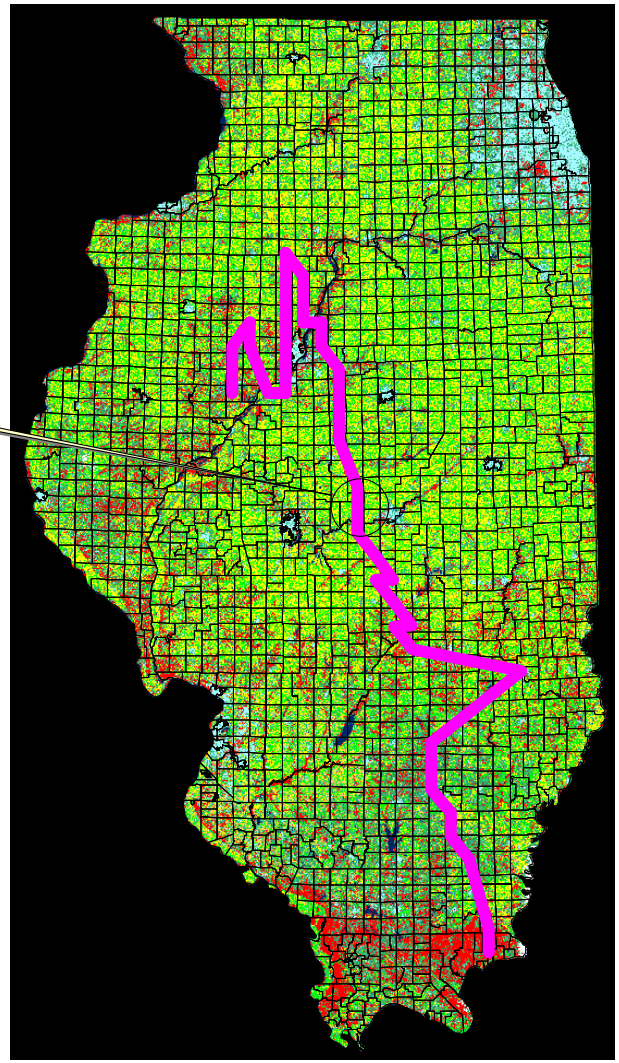
* In general, CO_2 emissions data were not available for individual Canadian power plants. Data were available for the major facilities in the Province of Ontario from Ontario Power Generation's *Towards Sustainable Development: 2002 Progress Report*. In Alberta, the map reflects only a subset of the major power plants in the province. CO_2 emissions data were only available for facilities included in ATCO Power's *Environment, Health and Safety Review* 2002. All other facilities without public CO_2 emissions data for 2002 are not shown on the map.

CO2 ANALYSIS AT LEVEL 1 CLASSES (AG. vs NON-AG)

Flight path overlay on LANDSAT map and Aircraft based CO2 data aggregated at 7.5 minute Quadrangles for LEVEL 1 classes.



CO2 ANALYSIS AT LEVEL II CLASSES

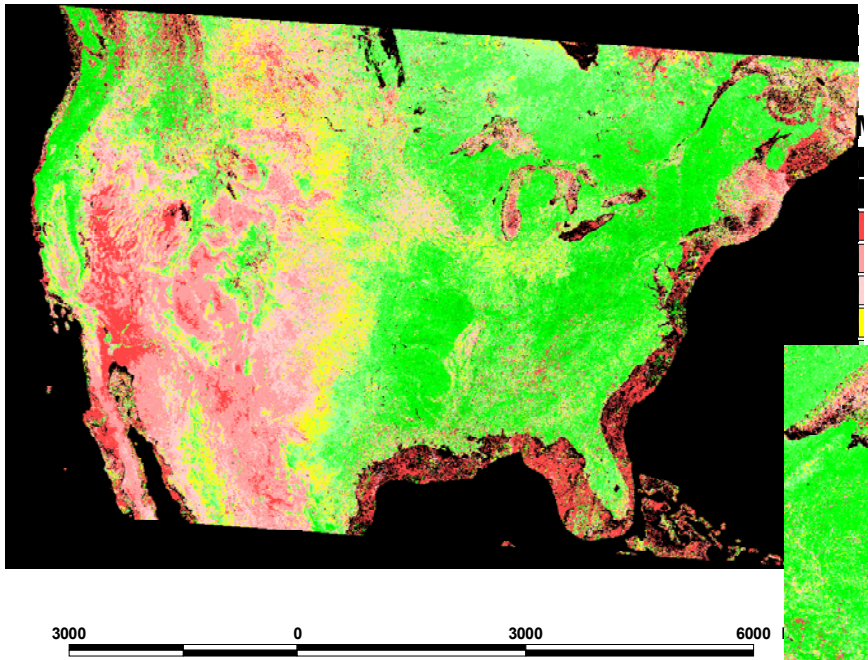


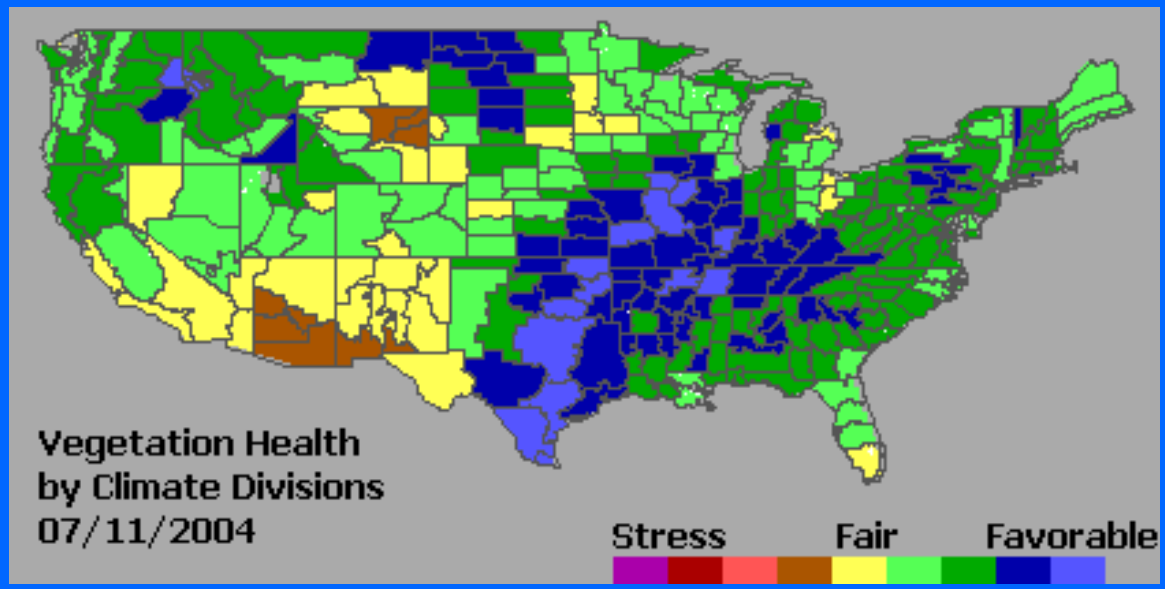
Flight path overlay and Aircraft based CO2 data aggregated at 7.5 minute Quadrangles for LEVEL II classes.

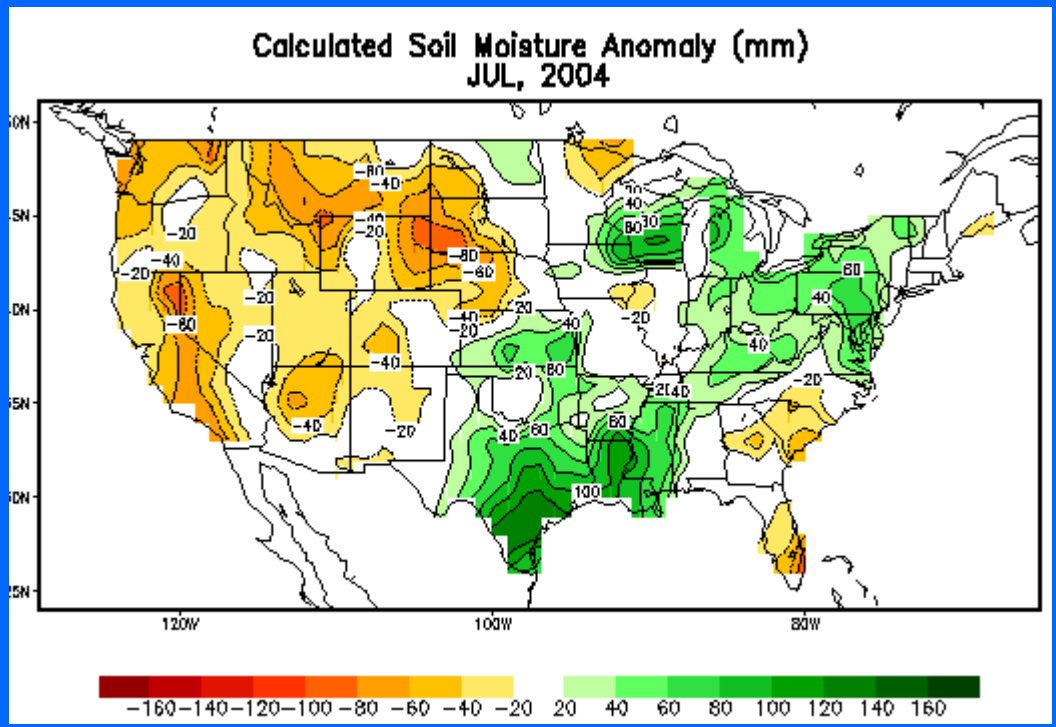
N

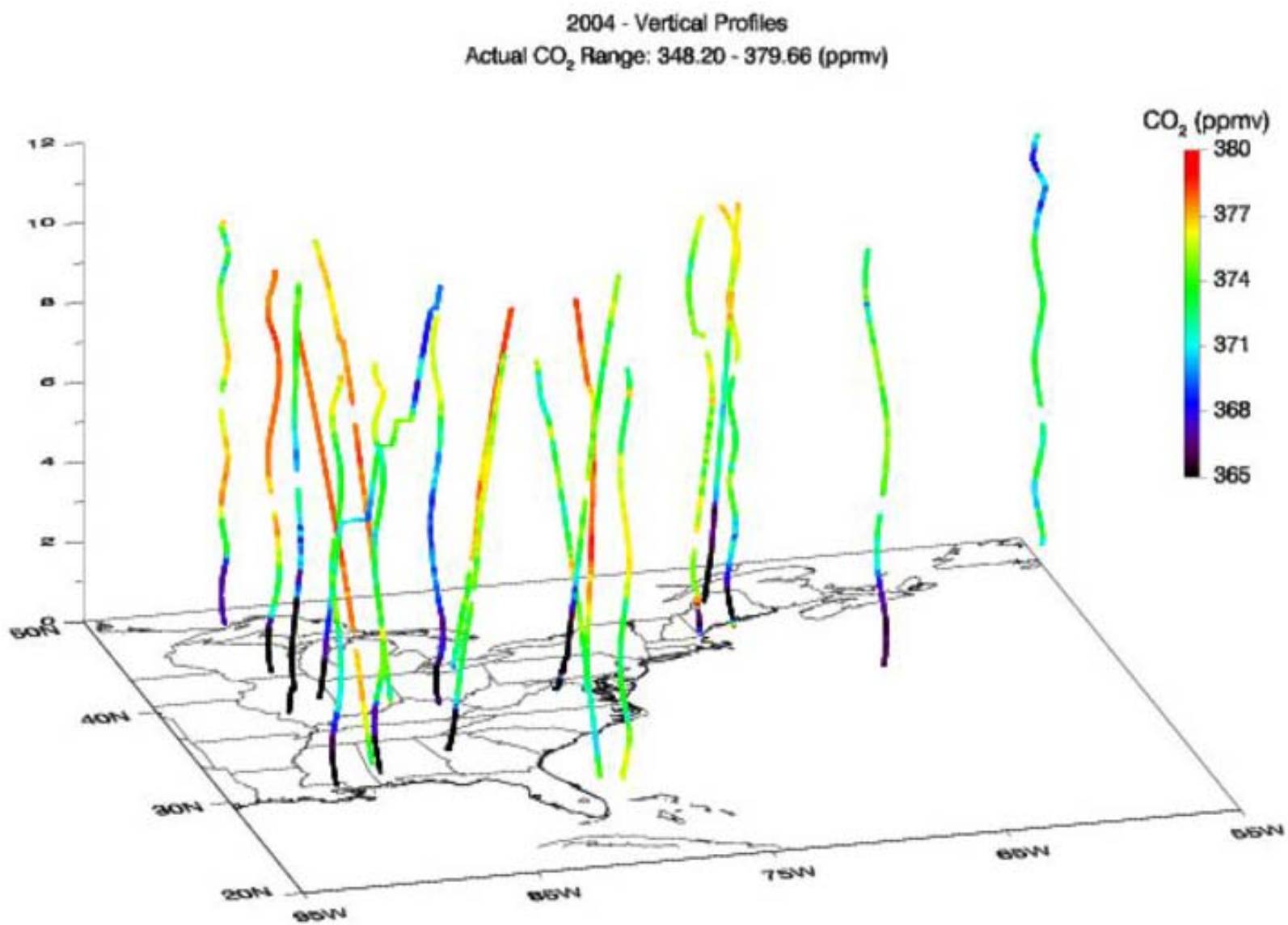
Land cover classes
- Alfalfa
- Clouds
- Corn
- Cotton
- Double crop WW/Soybeans
- Oats
- Other crops
- Other small grains / hay
- Pasture
- Pasture/ Grass / Non-Ag
- Pasture/Grassland/Non-Ag
- Potatoes
- Pumpkins
- Rice
- Snap beans
- Sorghum
- Soybeans
- Unclassified
- Urban
- Water
- Wetlands
- Winter Wheat
- Woods

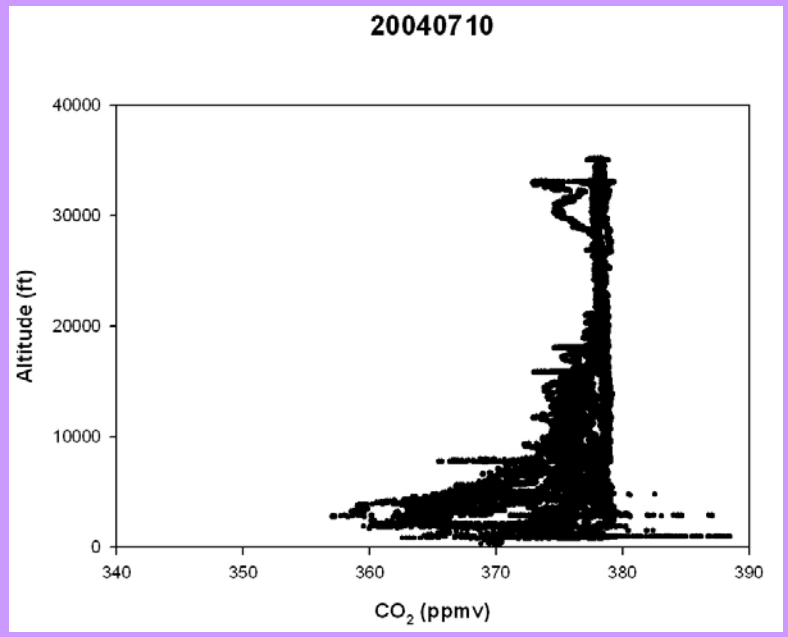
RELATING MODIS_NDVI DATA (7/04) TO CO_2 VMR

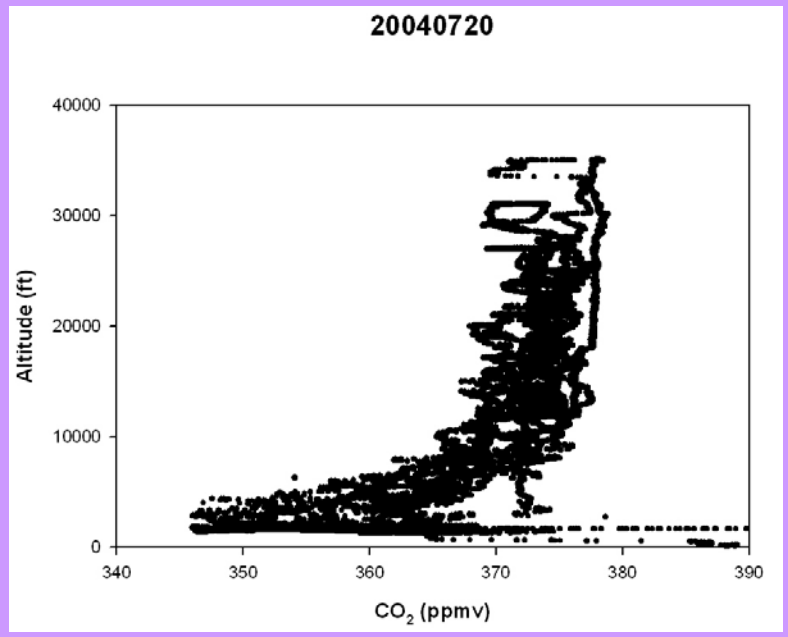


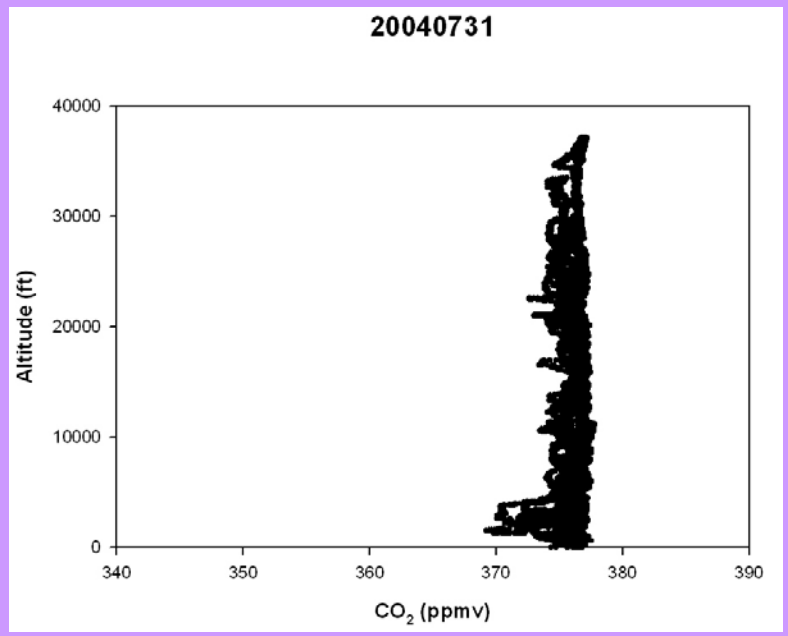

Vegetation Health
by Climate Divisions
07/11/2004
Stress
Fair
Favorable

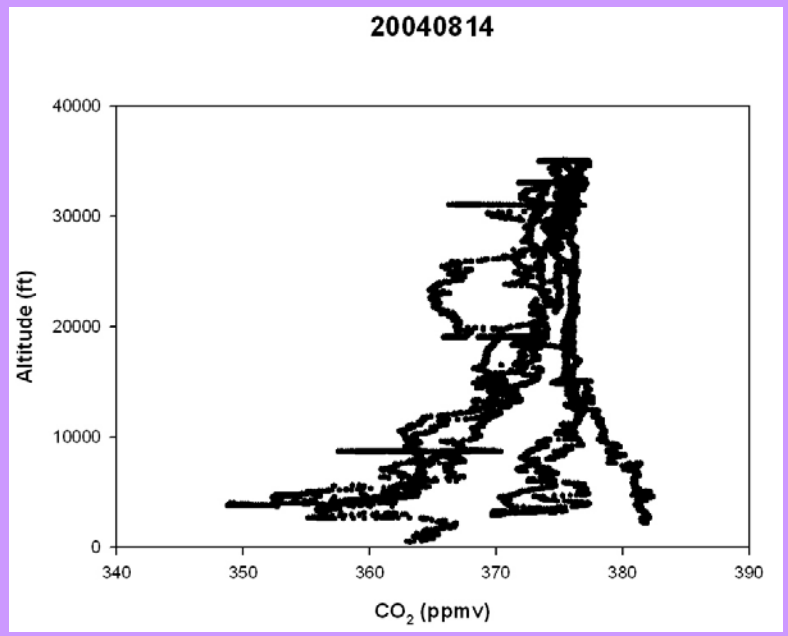

Calculated Soil Moisture Anomaly (mm)
JUL, 2004
120W
100W
80W
-160 -140 -120 -100 -80 -60 -40 -20 20 40 60 80 100 120 140 160


2004 - Vertical Profiles
Actual CO2 Range: 348.20 - 379.66 (ppmv)
CO2 (ppmv)
380
377
374
371
368
365
12
10
8
6
4
2
0
60N
40N
30N
20N
95W
85W
75W
65W
55W


20040710
Altitude (ft)
40000
30000
20000
10000
0
340
350
360
370
380
390
CO2 (ppmv)


20040720
Altitude (ft)
40000
30000
20000
10000
0
340
350
360
370
380
390
CO2 (ppmv)


20040731
Altitude (ft)
40000
30000
20000
10000
0
340
350
360
370
380
390
CO2 (ppmv)


20040814
Altitude (ft)
40000
30000
20000
10000
0
340
350
360
370
380
390
CO2 (ppmv)

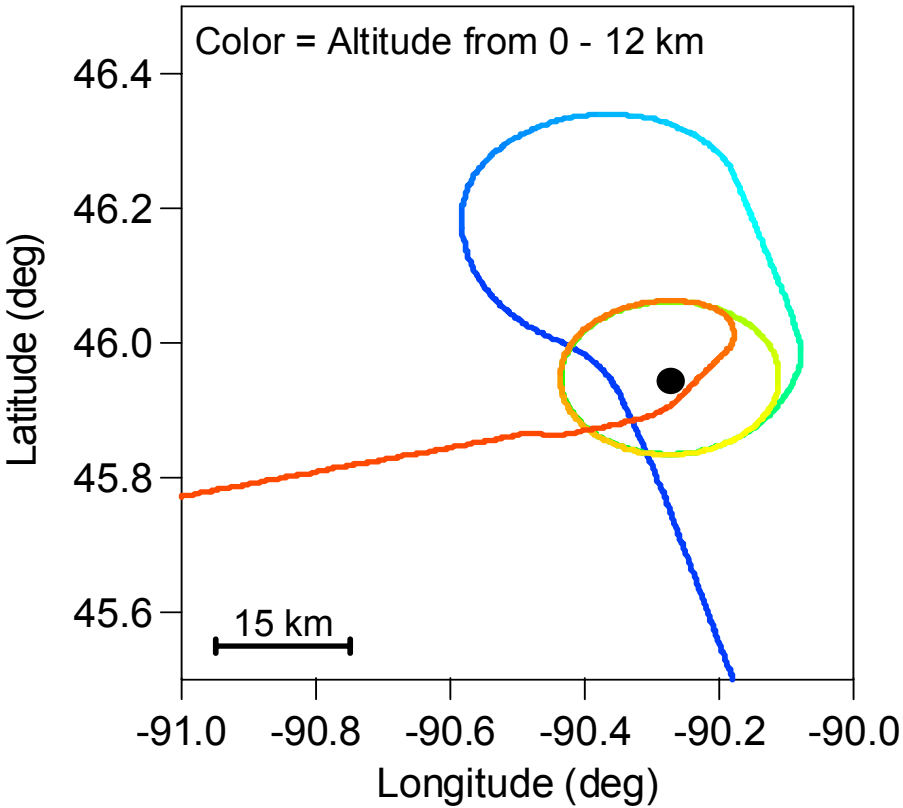
Calibration of Absolute Column CO_2 Using Aircraft Data

Intercontinental Chemical Transport Experiment – North America (INTEX-NA)

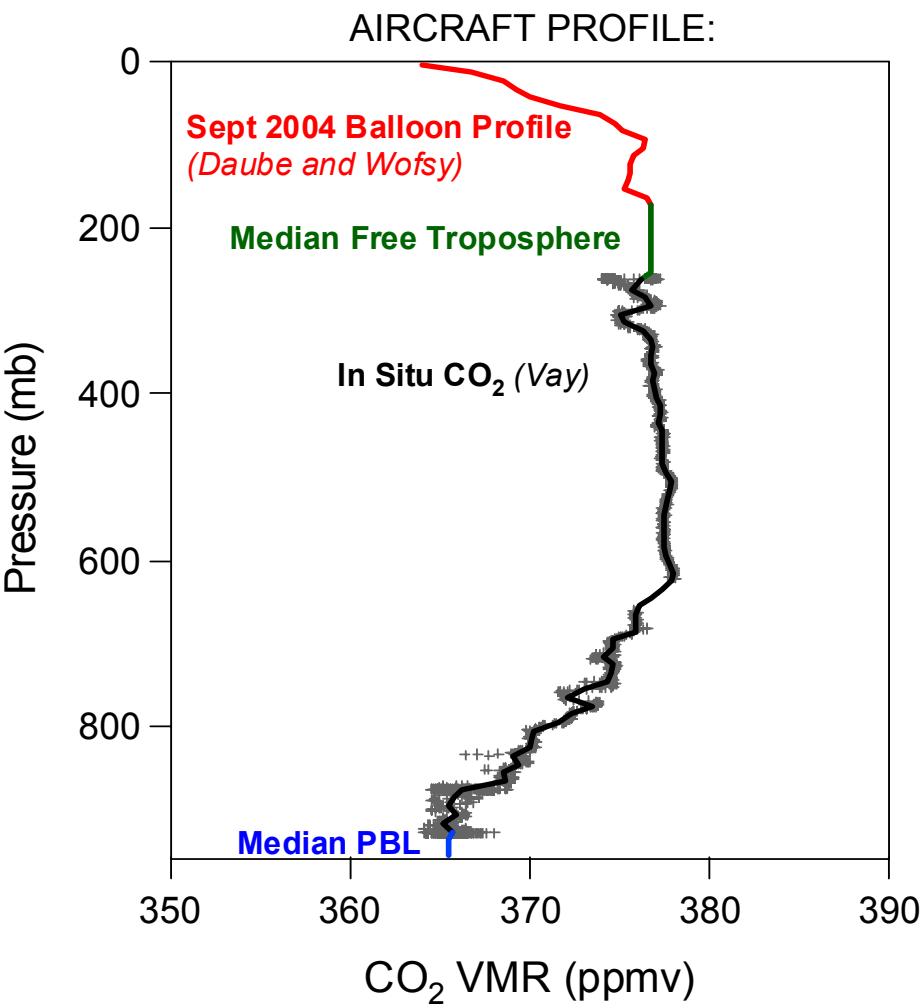
- NASA DC-8 and King Air measured in situ CO_2 during tower profiles
- Eight unique aircraft profiles:
  DC-8: **July 12, July 15** (twice)
  King Air: **July 14, July 15, August 14, August 15** (twice)

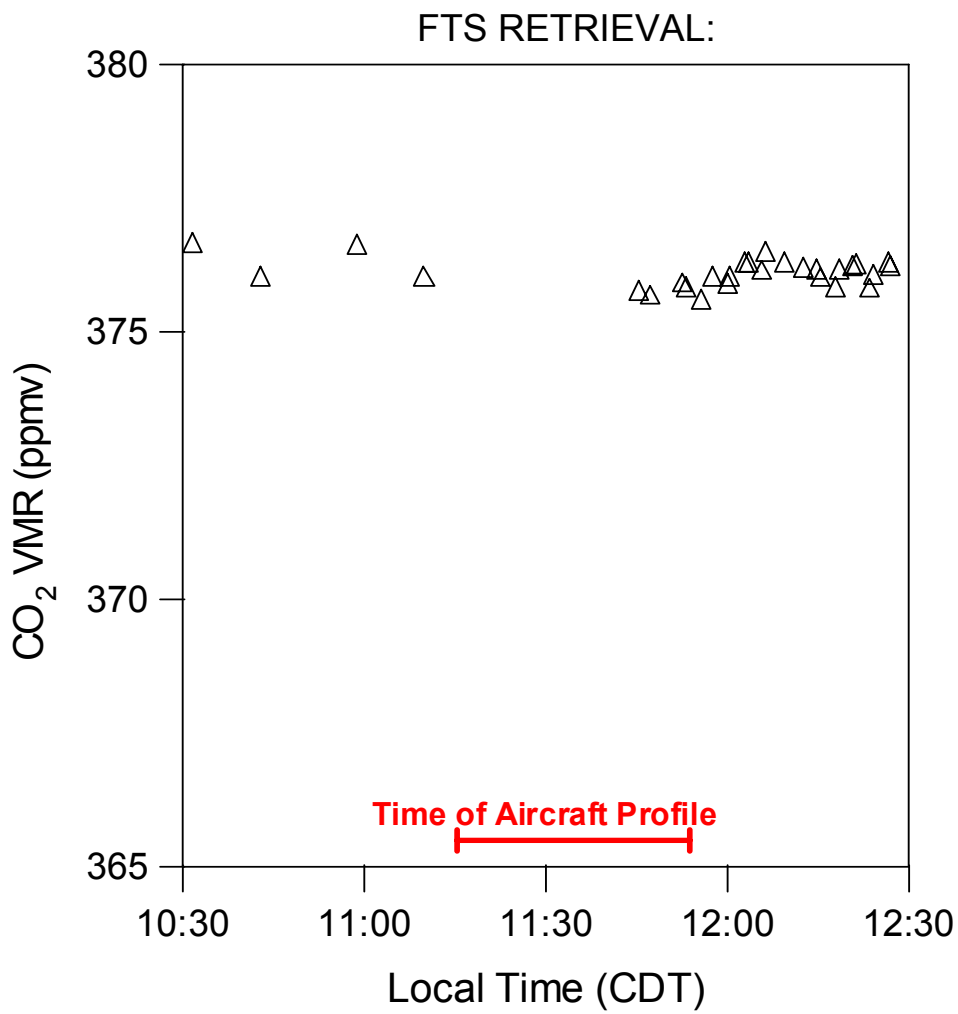
Allows us to place our column CO_2 retrievals on the same scale as the in situ network.

DC-8 Flight Path and Photograph from 12 July:



FTS Column and Aircraft In Situ Data – 12 July 04

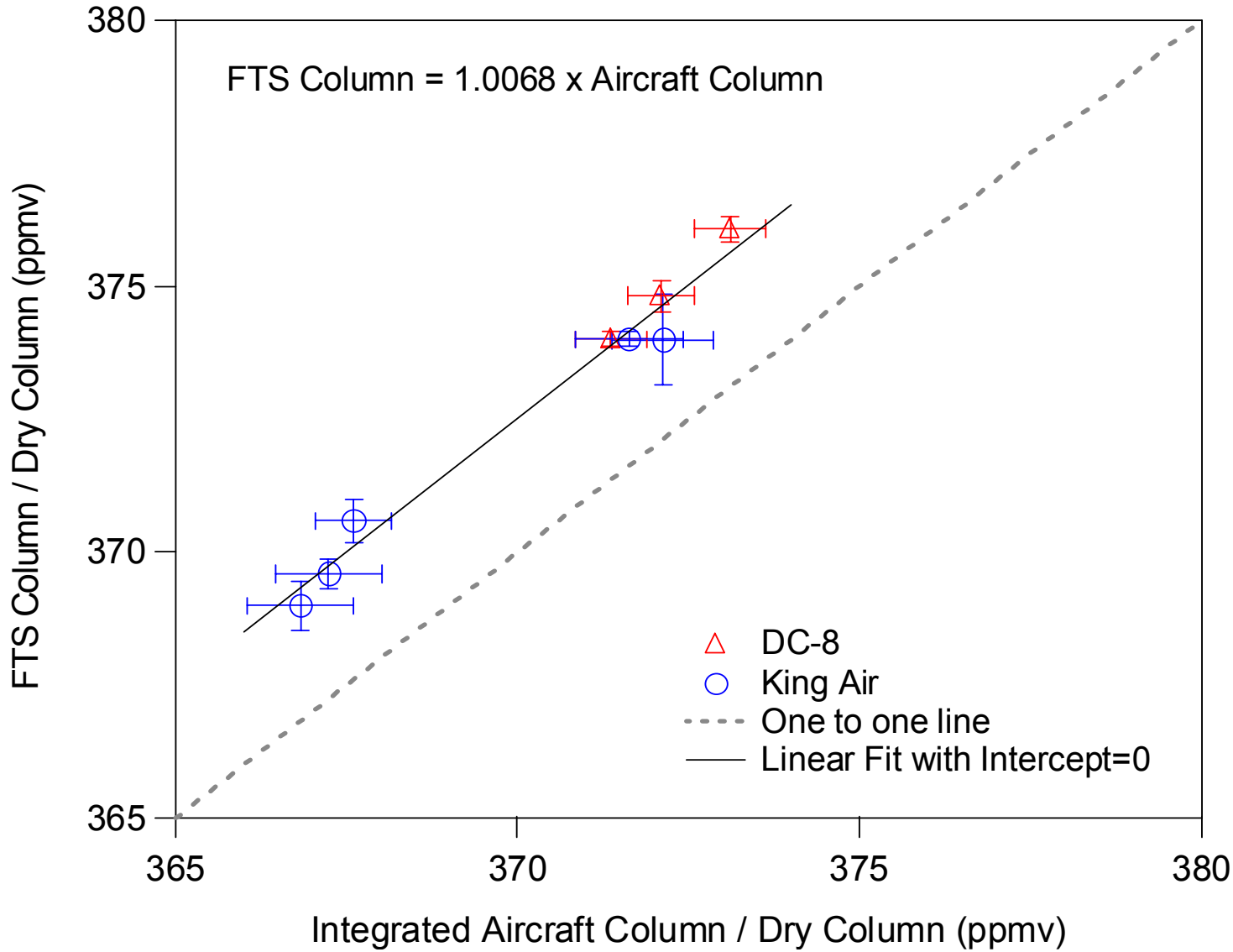


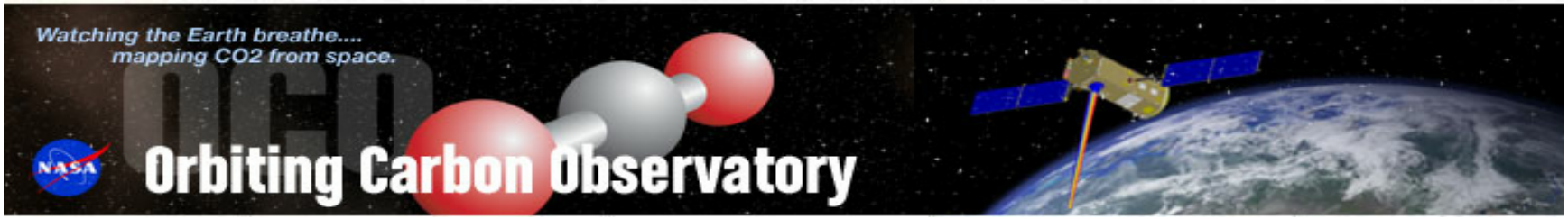


Aircraft Column / Total Dry Column =
373.11 ± 0.52 ppmv

FTS Column / Total Dry Column =
376.07 ± 0.24 ppmv

Comparison of FTS Column and Integrated Aircraft CO_2





- OCO – S. Denning (CSU); H. Boesch (JPL)
- AIRS – C. Crevoisier (LSCE); M. Chahine (JPL)
- SCIAMACHY – M. Buchwitz (U. Bremen); I. Aben (SRON)