CO from AIRS during INTEX-A

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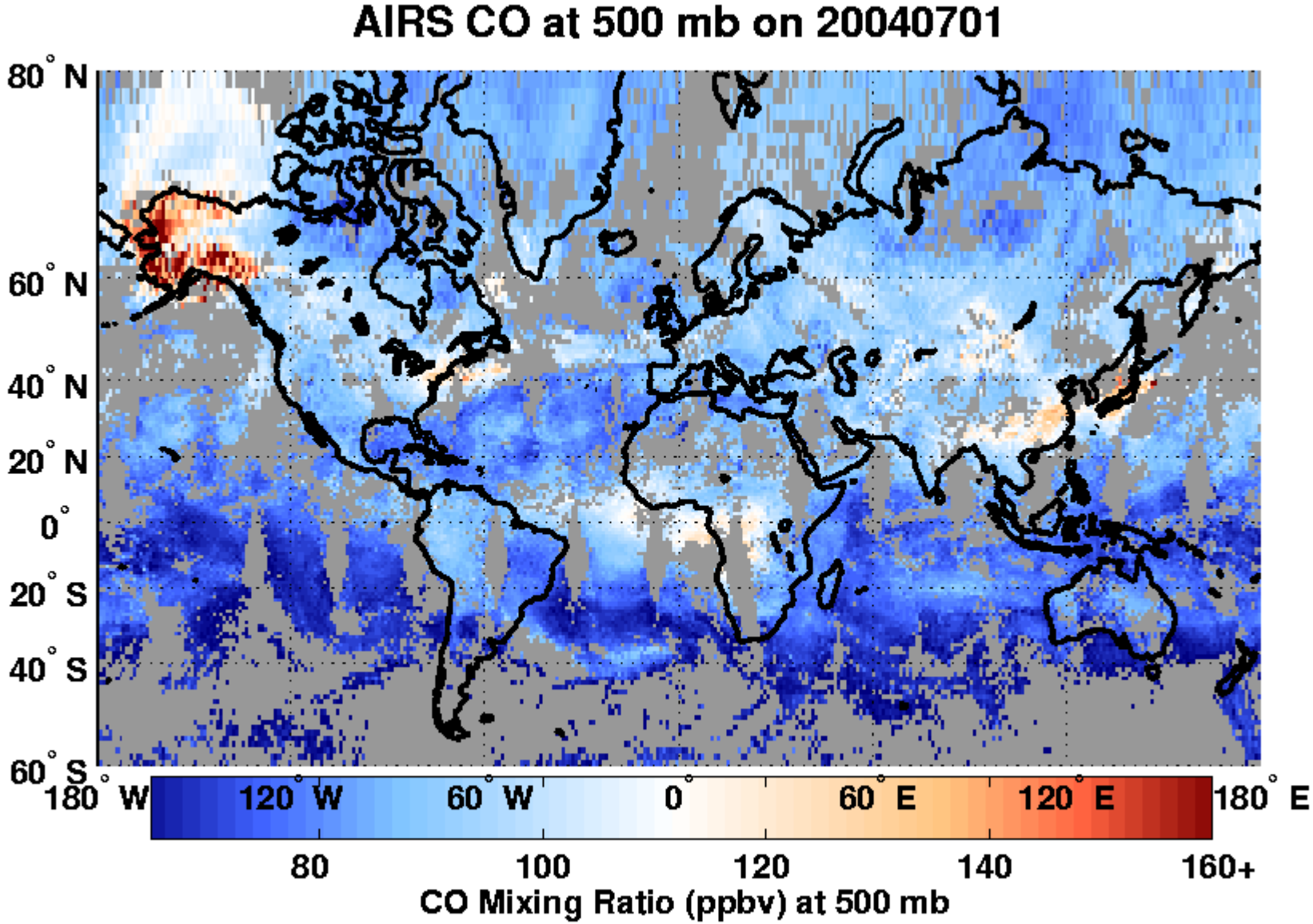
Thanks to the entire AIRS Team!

AIRS CO Data Status

- Quick-look field data still available via website for INTEX-A period
  - 1°x1° grid 500mb CO and total column CO
- Reprocessed CO retrievals expected May 1
  - improved quality control (lower yield)
  - AIRS v4.0 standard retrievals (T, H2O, etc.)
  - pre-launch CO retrieval
  - CO verticality (vertical distribution of sensitivity)
  - 1°x1° grid and individual retrievals available
- Improved CO retrievals expected August 1
  - upgraded AIRS standard retrievals w/CO
  - maybe CO2 and CH4???

July 2004 AIRS Daily Global CO



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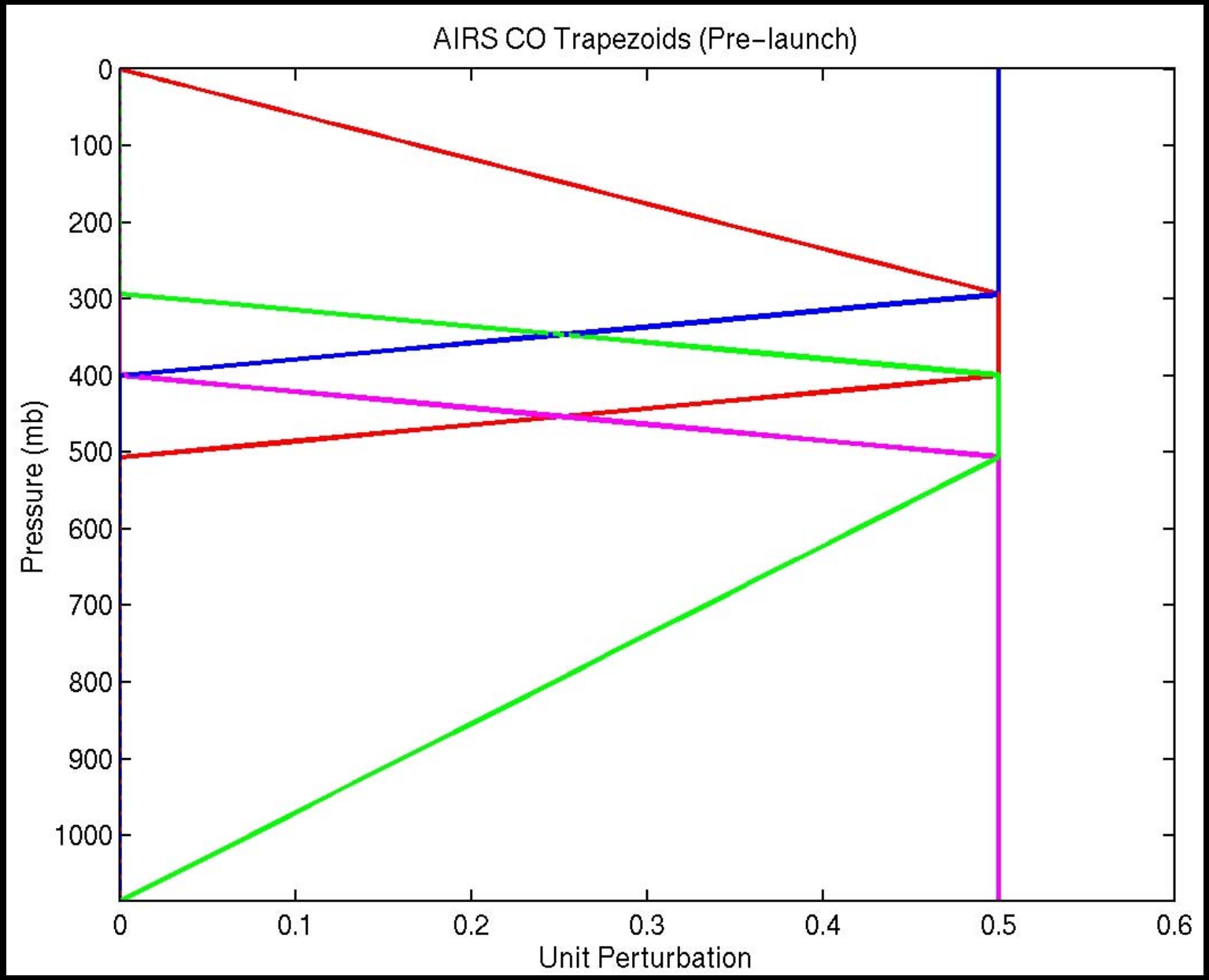
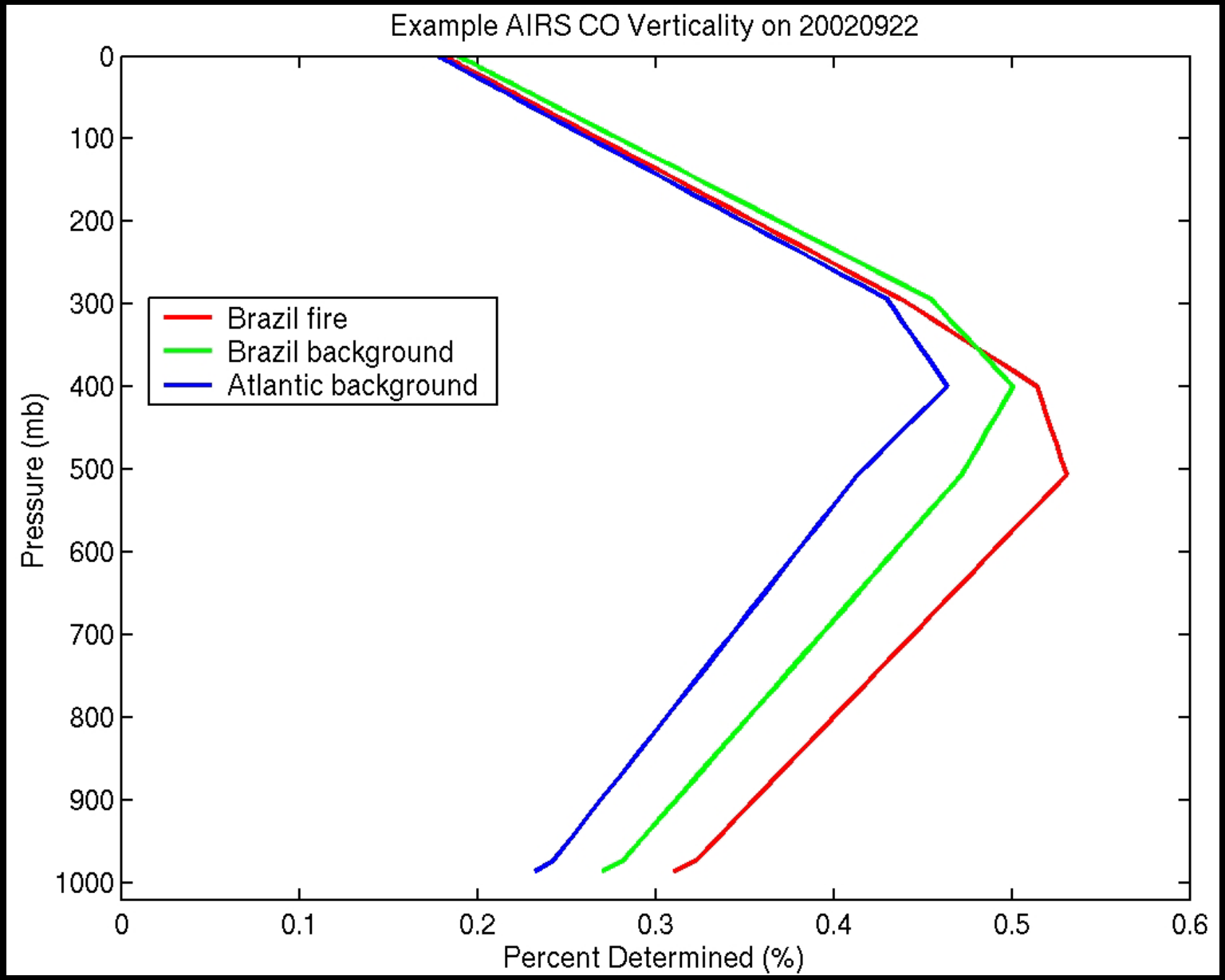
Outline

- AIRS CO retrieval and verticality
- AIRS CO – convolved DACOM ≈ -9%
  - Not the latest DACOM data
- July 12-22, 2004 Alaska-Yukon Fires
  - AIRS CO vs. MODIS Aqua AOD
    - Plume evolution (changes in correlations)
  - Forward trajectories and plume injection height
  - AIRS sees some CO in the lower troposphere
- Papers: AIRS v MODIS, AIRS validation, AIRS v MOPITT, AIRS in models, more??

AIRS CO Retrieval Vertical Functions



AIRS CO Retrieval Verticality

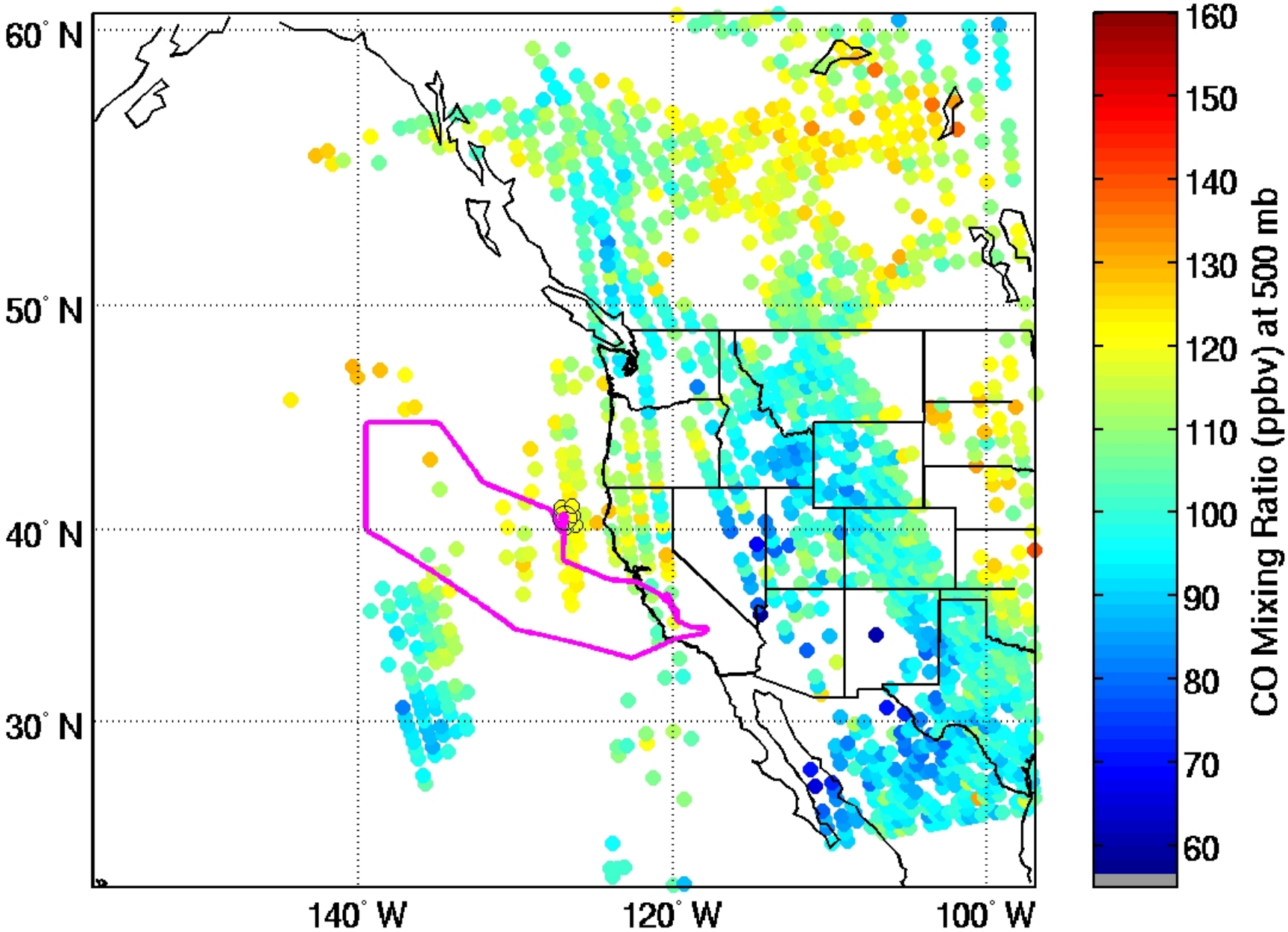


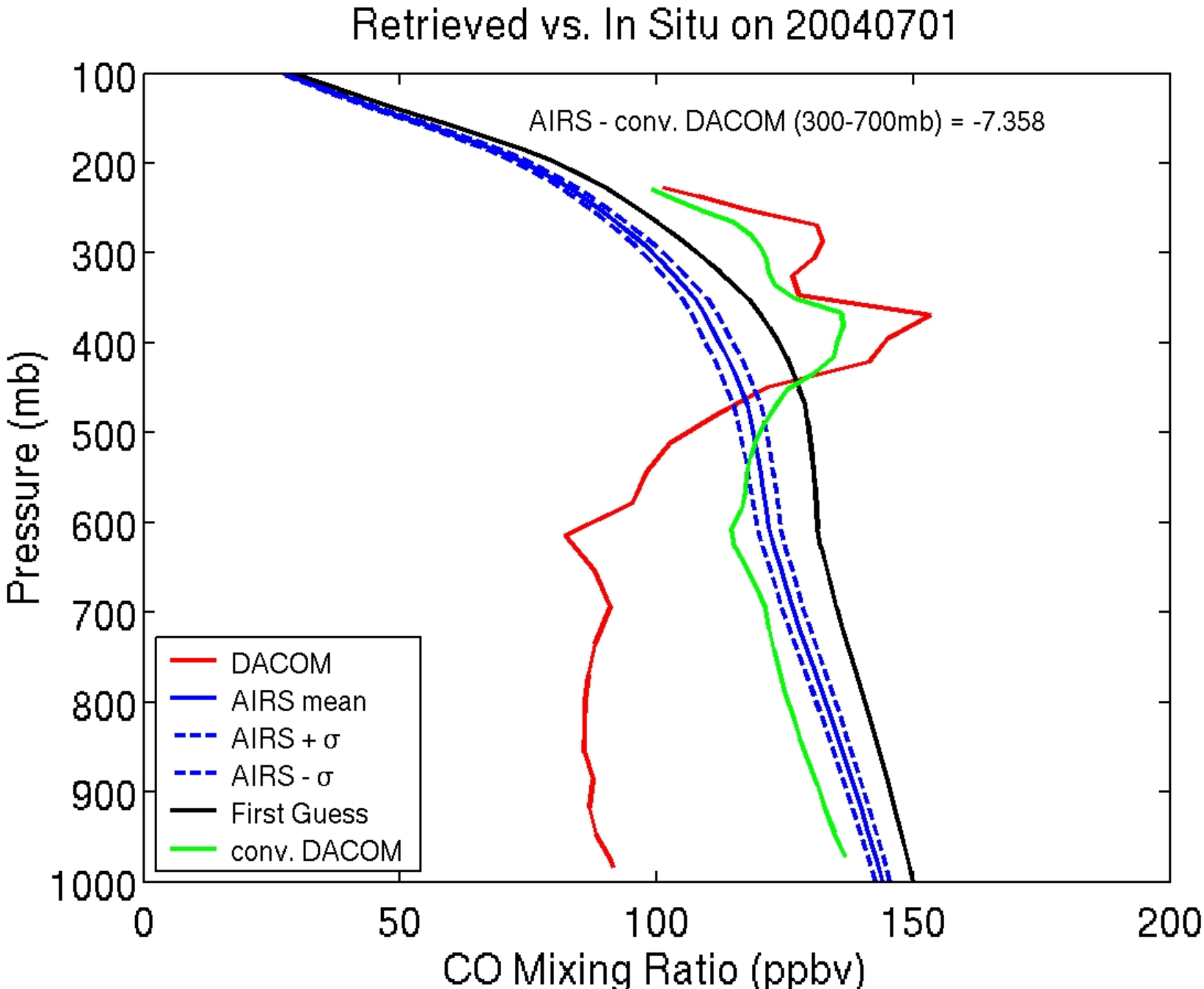
INTEX-A Profile Summary

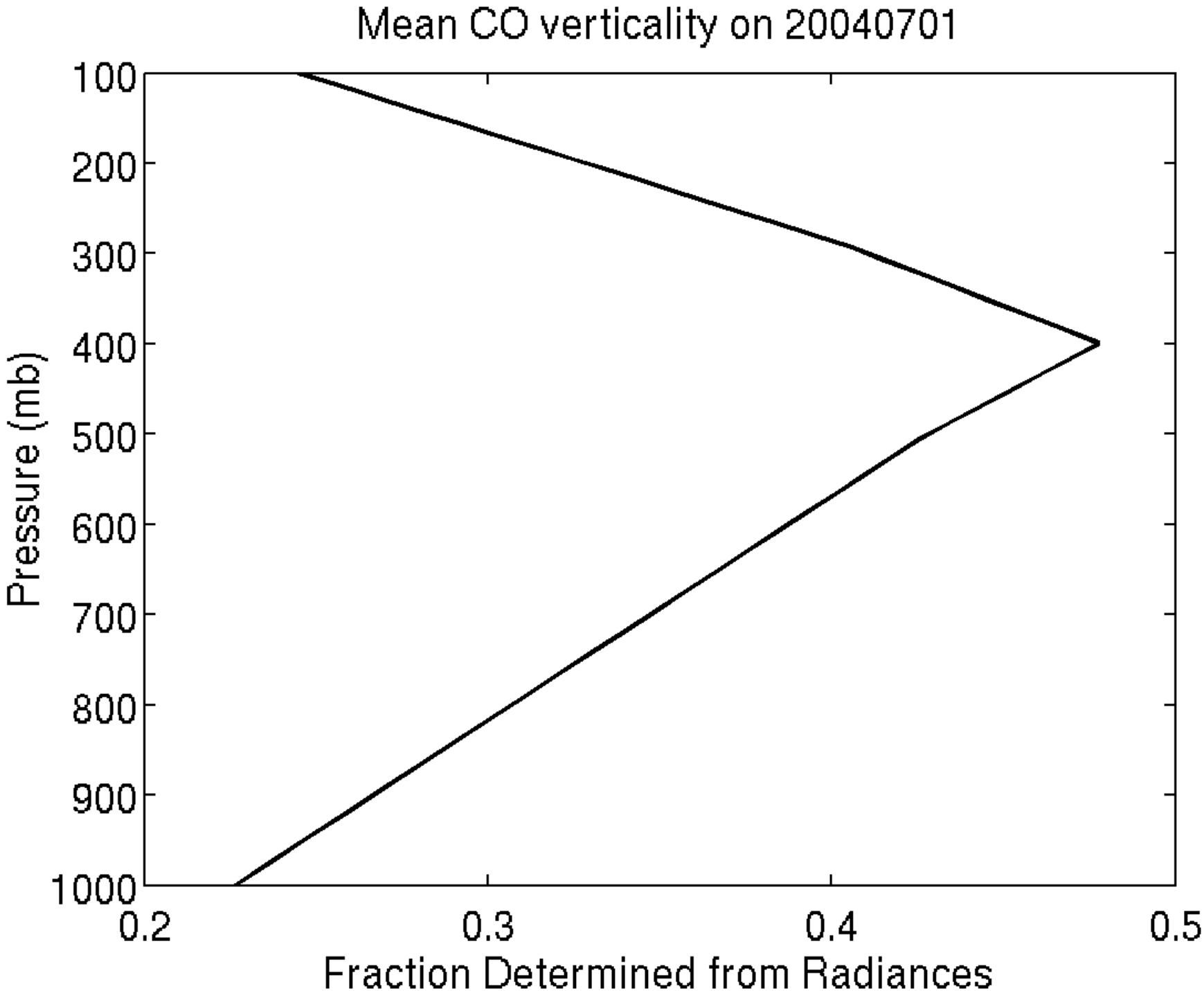
DATE	LOCATION	TIMING	TIME (AIRS)	DATA STATUS	AIRS-DACOM (%)
7/1	Pacific	Coincident	21.81 UTC	Good	-6.4
7/6			18.85 UTC	No AIRS < 100 km	
7/8	Illinois	1 hour	18.63 UTC	Good	-15.4
7/10	South Carolina	Coincident	18.39 UTC	Good	-12.5
7/12	Oklahoma	Coincident	19.83 UTC	Good	-13.3
7/15	Wisconsin	1 hour	18.75 UTC	Good	-6.62
7/18	Atlantic	0.5 hours	15.98 UTC	Good	-6.91
7/20	Illinois	Coincident	19.03 UTC	Good	-3.07
7/22	Gulf of Maine	1 hour	17.19 UTC	Good	-5.67
7/25				No AIRS < 100 km	
7/28		3.5 hours	18.22 UTC	No CO data	
8/2	St. Lawrence	0.1 hours	16.90 UTC	Good	-17.4
8/6		1.5 hours	19.74 UTC	No AIRS < 100 km	
8/7		1.7 hours	17.18 UTC	1.7 hours	
8/11	Kentucky	0.1 hours	18.40 UTC	Good	-1.61
8/13		0.75 hours	19.80 UTC	Cloudy area	
8/14		2 hours	20.59 UTC	2 hours	

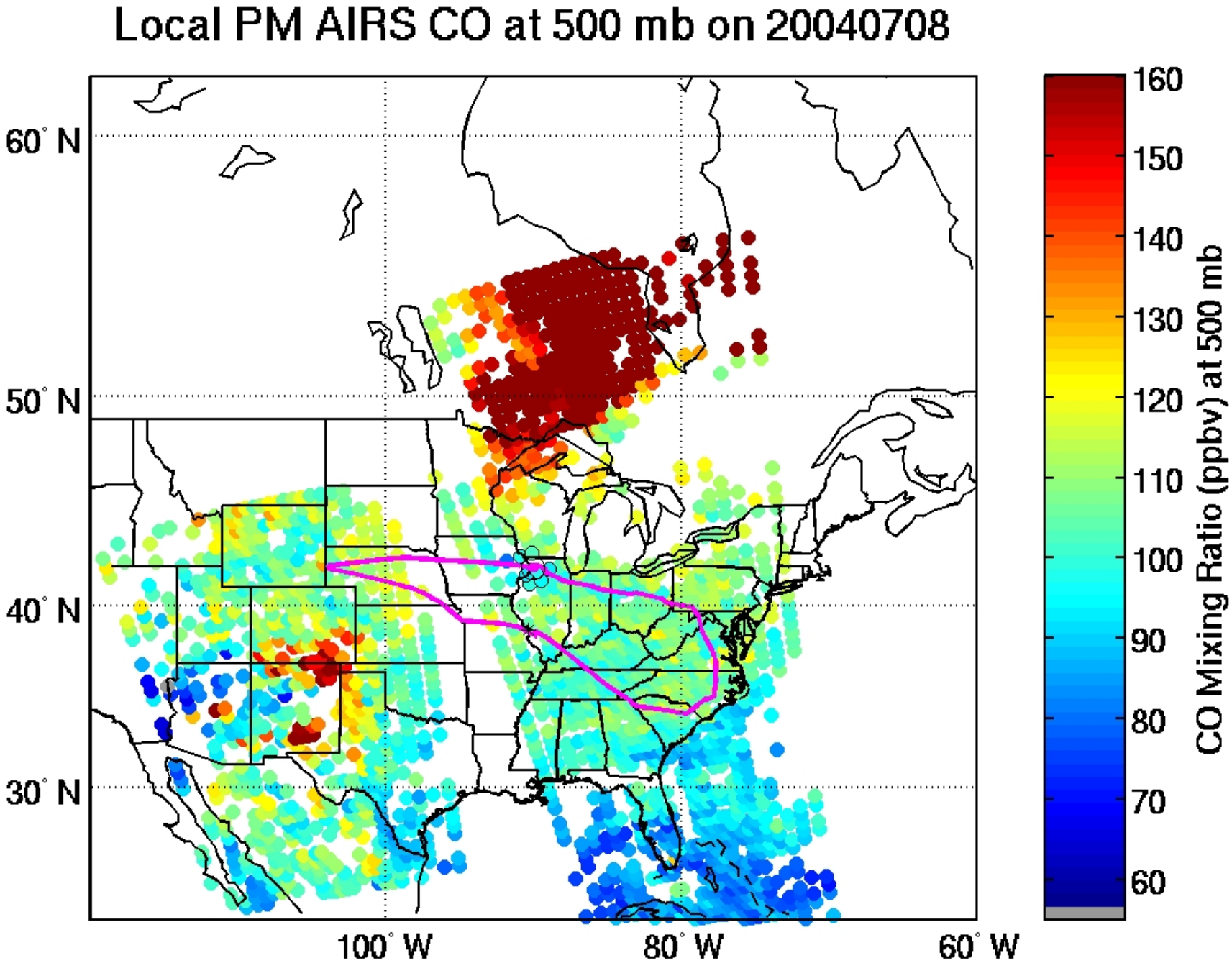
-8.88

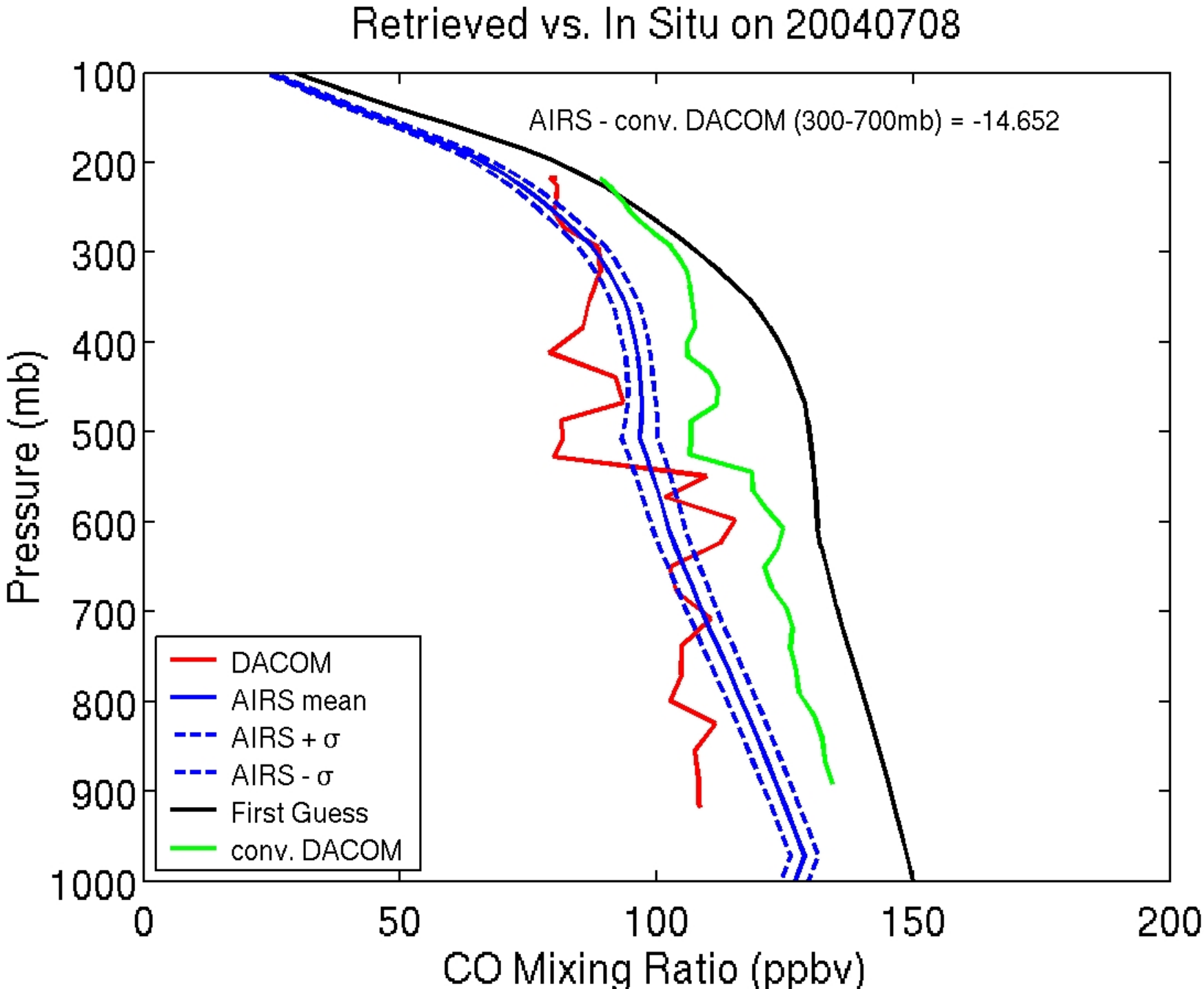
Local PM AIRS CO at 500 mb on 20040701

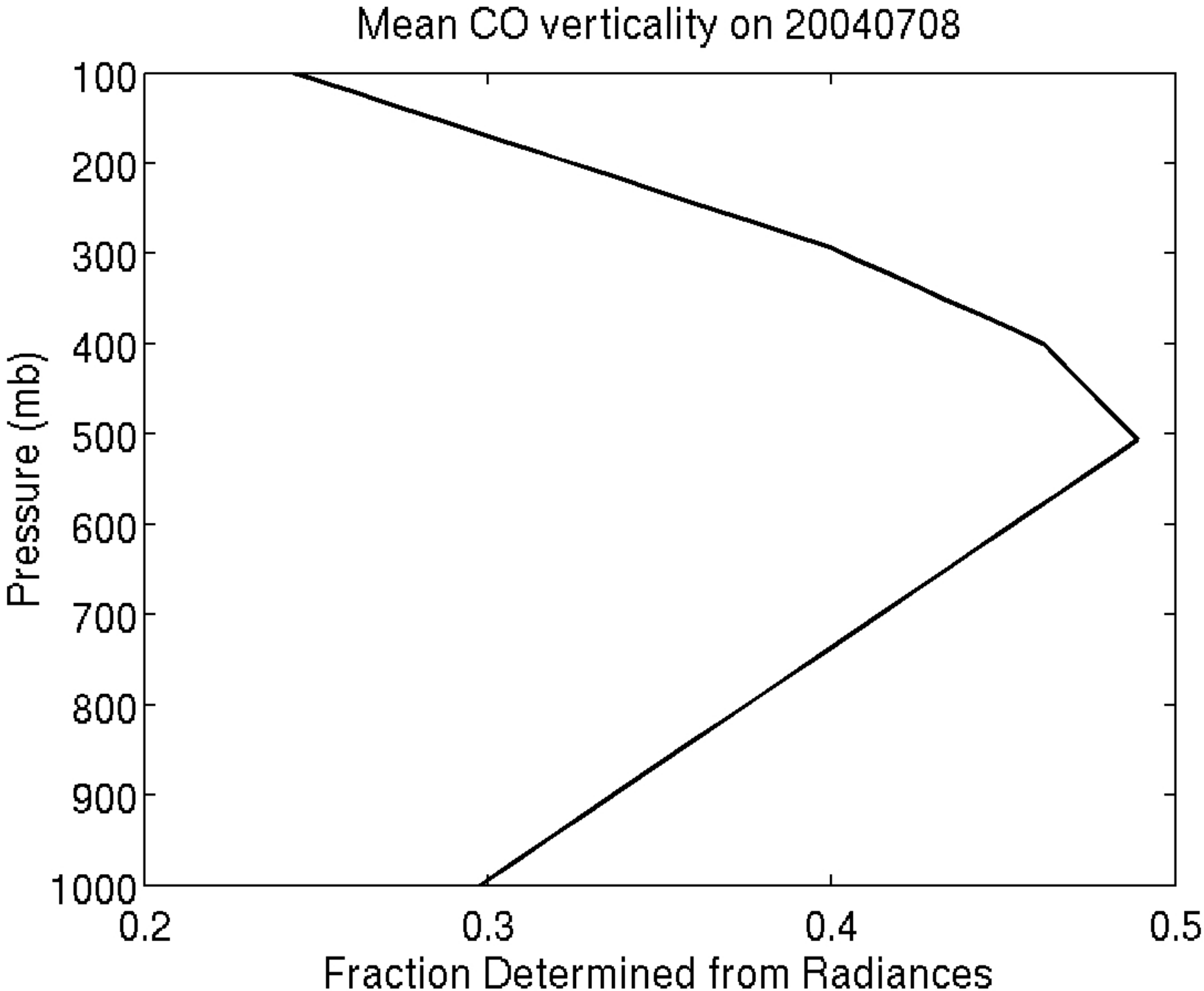


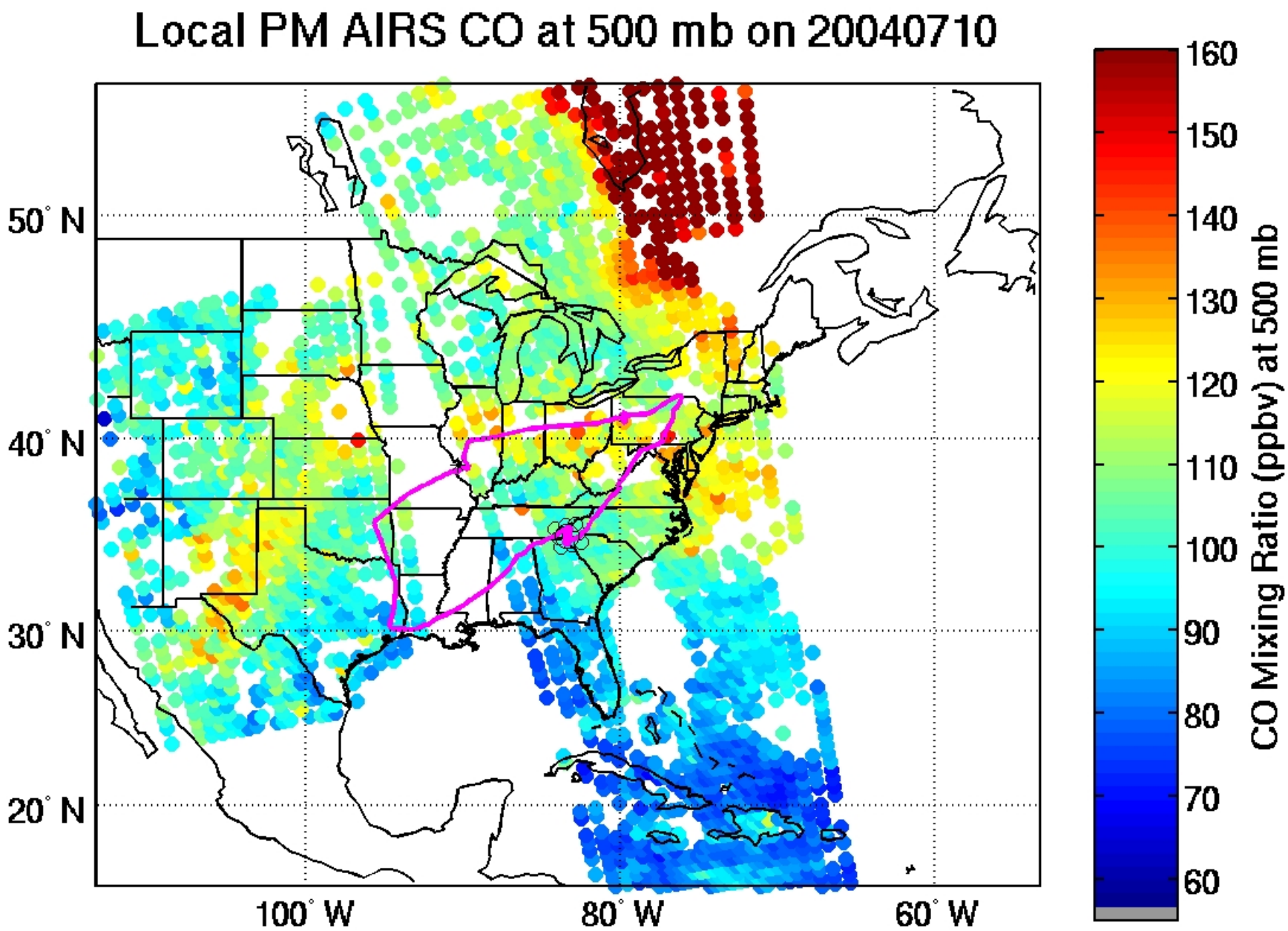

Retrieved vs. In Situ on 20040701
AIRS - conv. DACOM (300-700mb) = -7.358
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

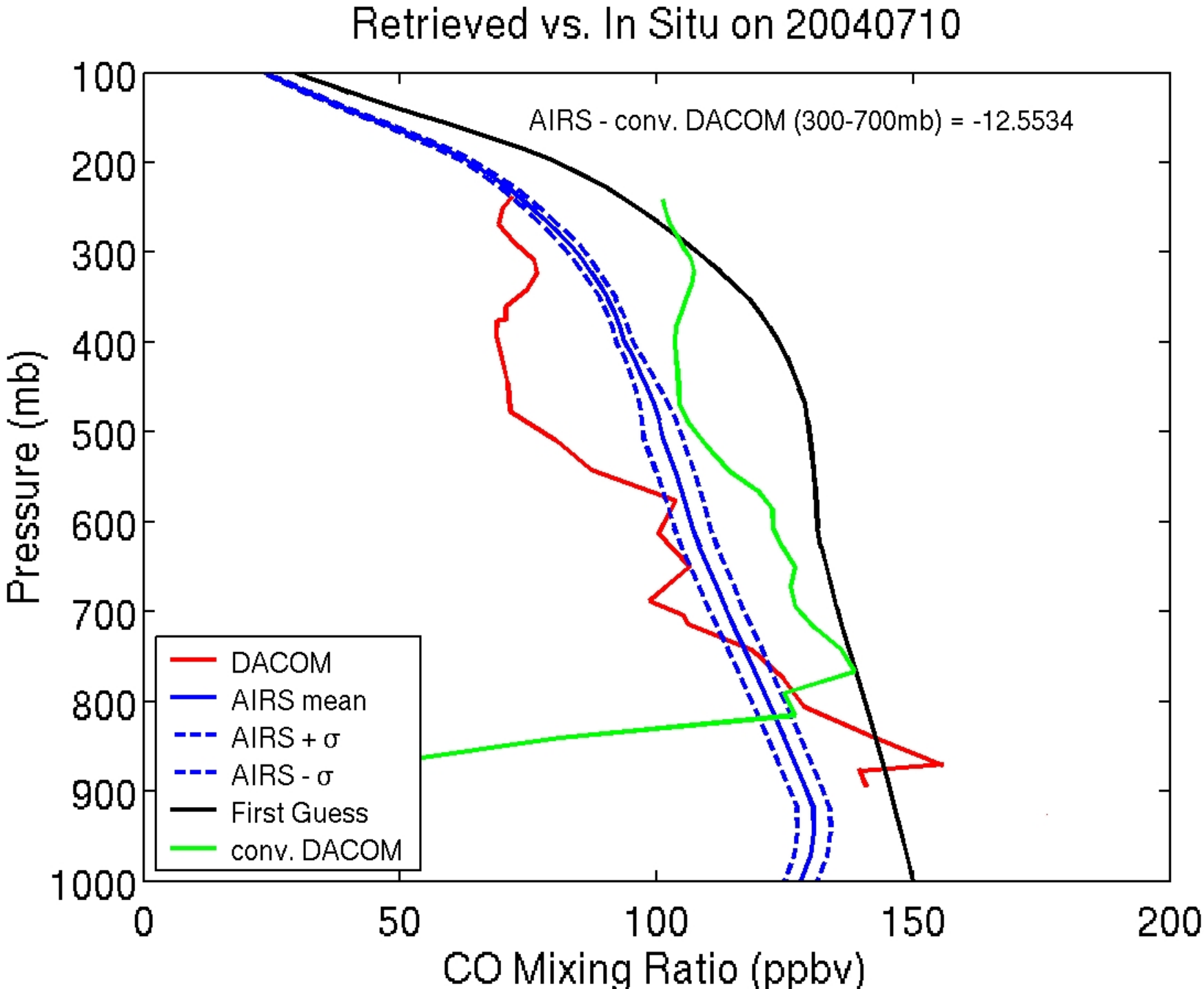

Mean CO verticality on 20040701
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

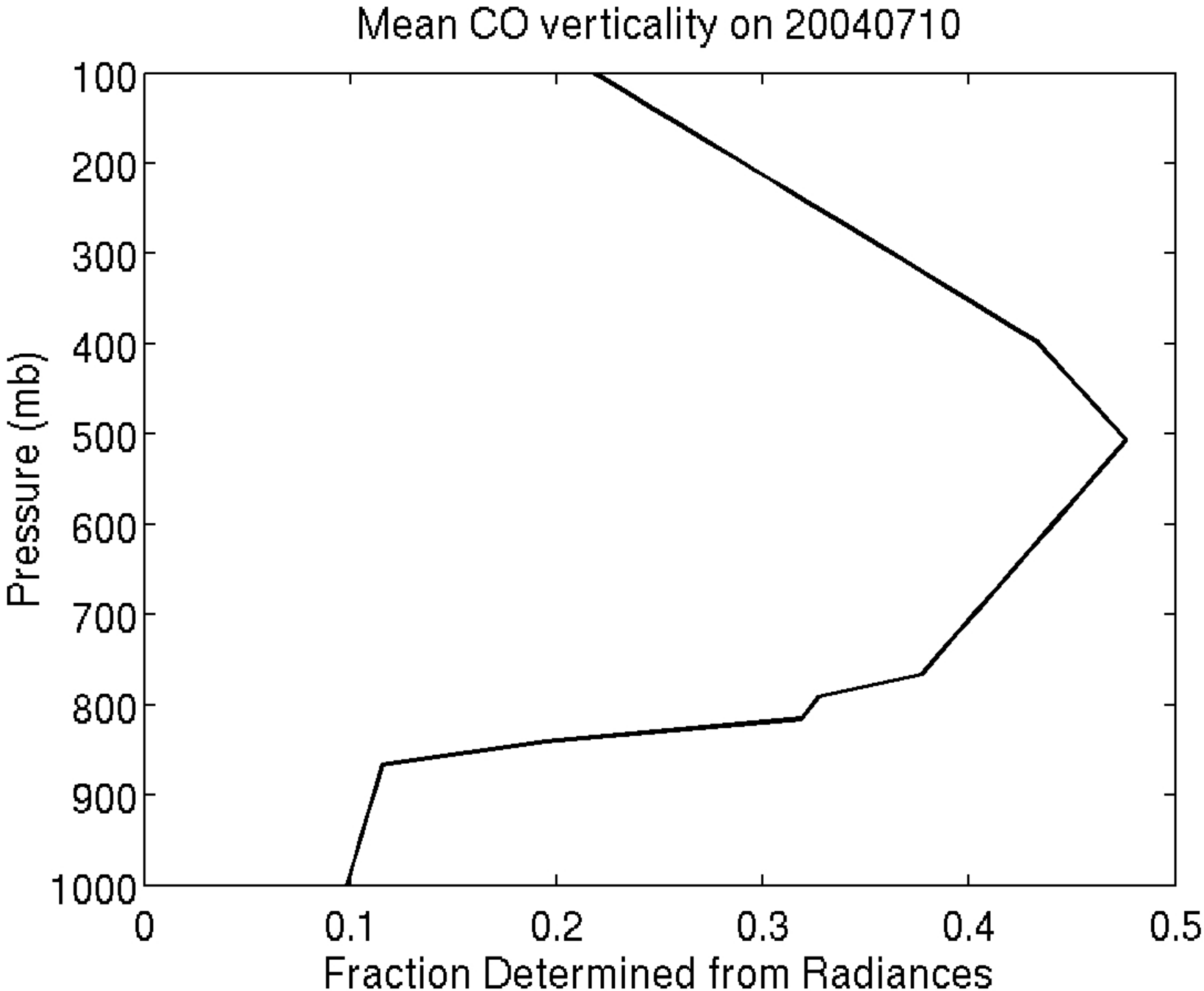

Local PM AIRS CO at 500 mb on 20040708
60° N
50° N
40° N
30° N
100° W
80° W
60° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

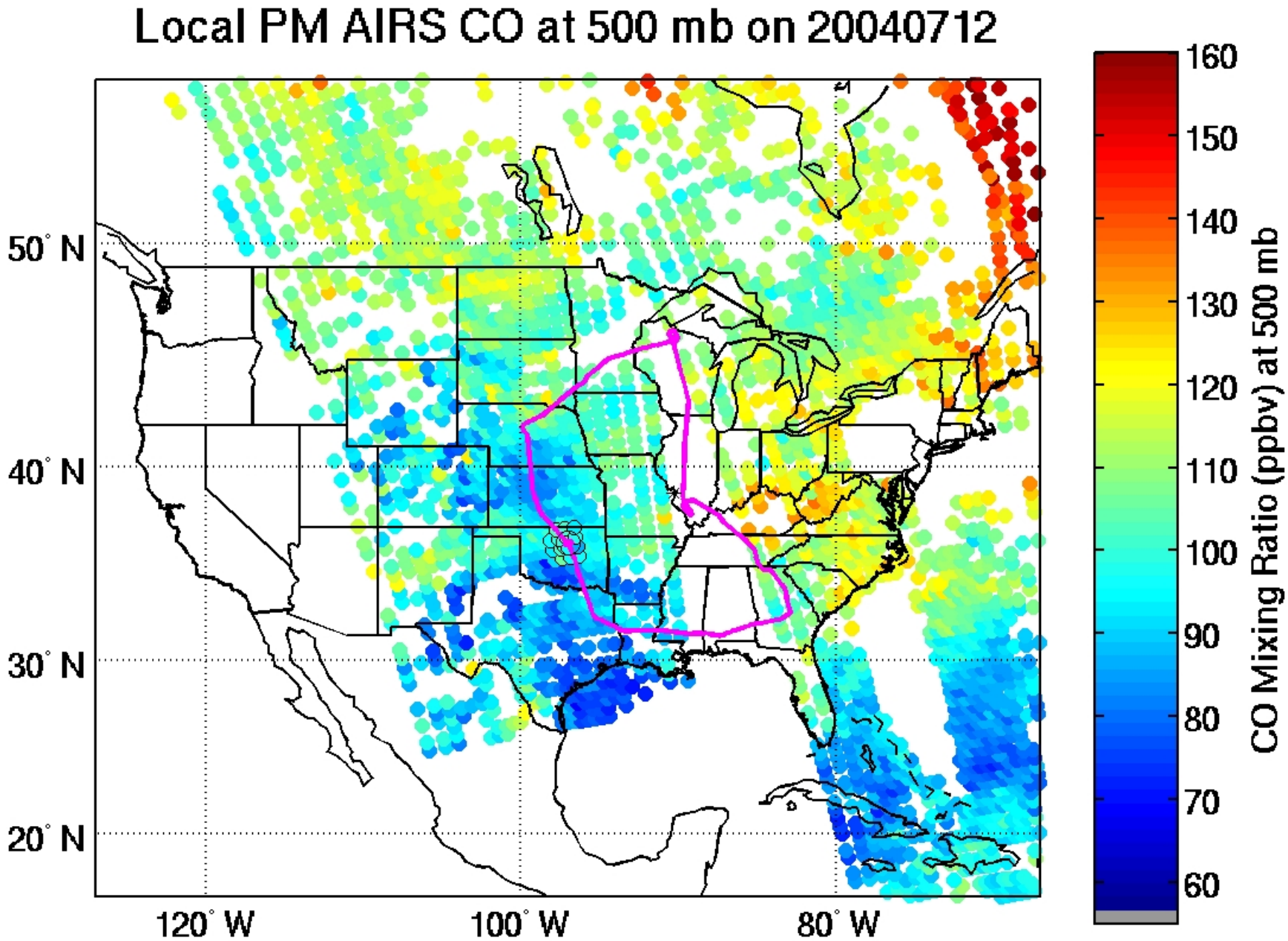

Retrieved vs. In Situ on 20040708
AIRS - conv. DACOM (300-700mb) = -14.652
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

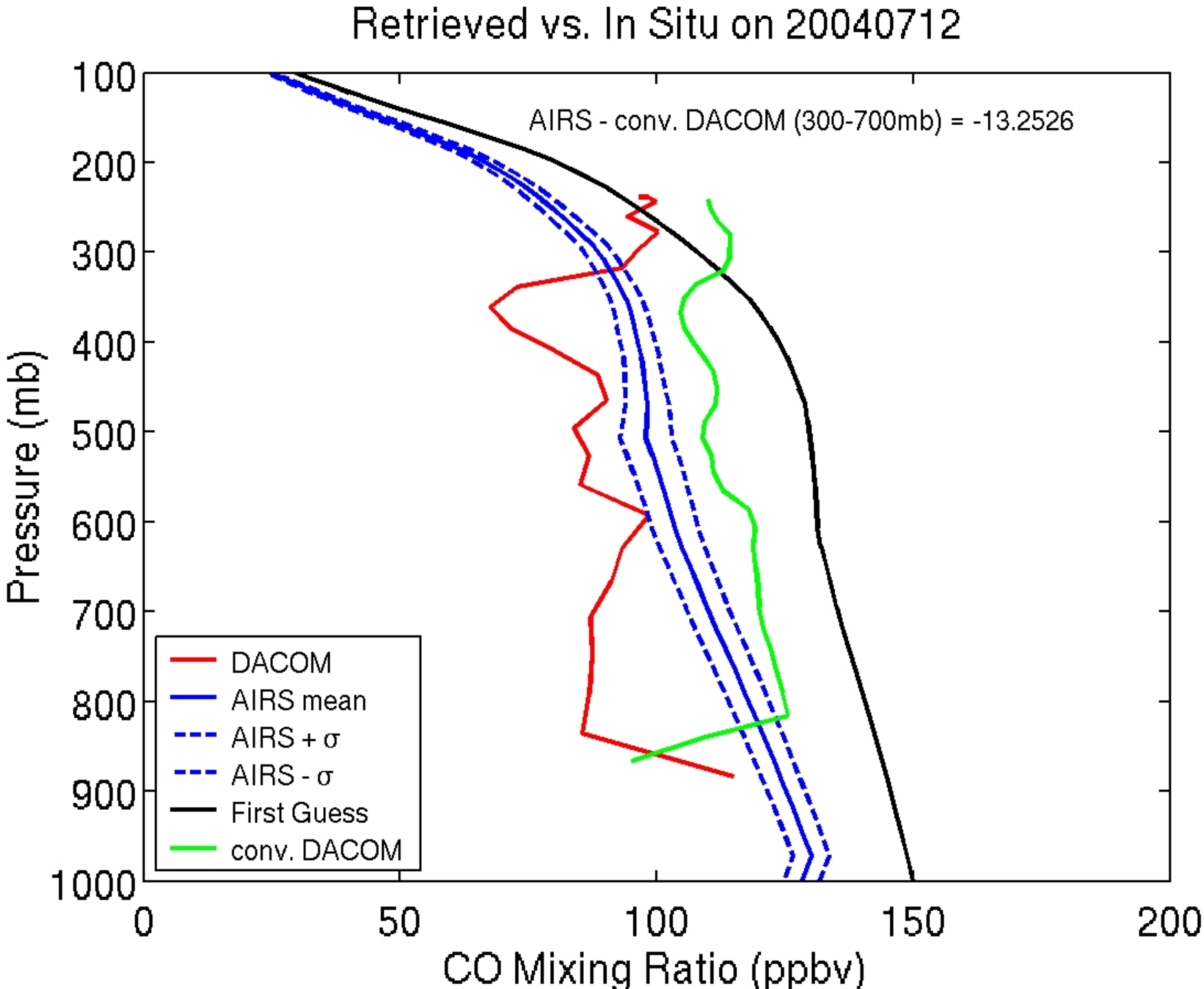

Mean CO verticality on 20040708
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances


Local PM AIRS CO at 500 mb on 20040710
50° N
40° N
30° N
20° N
100° W
80° W
60° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

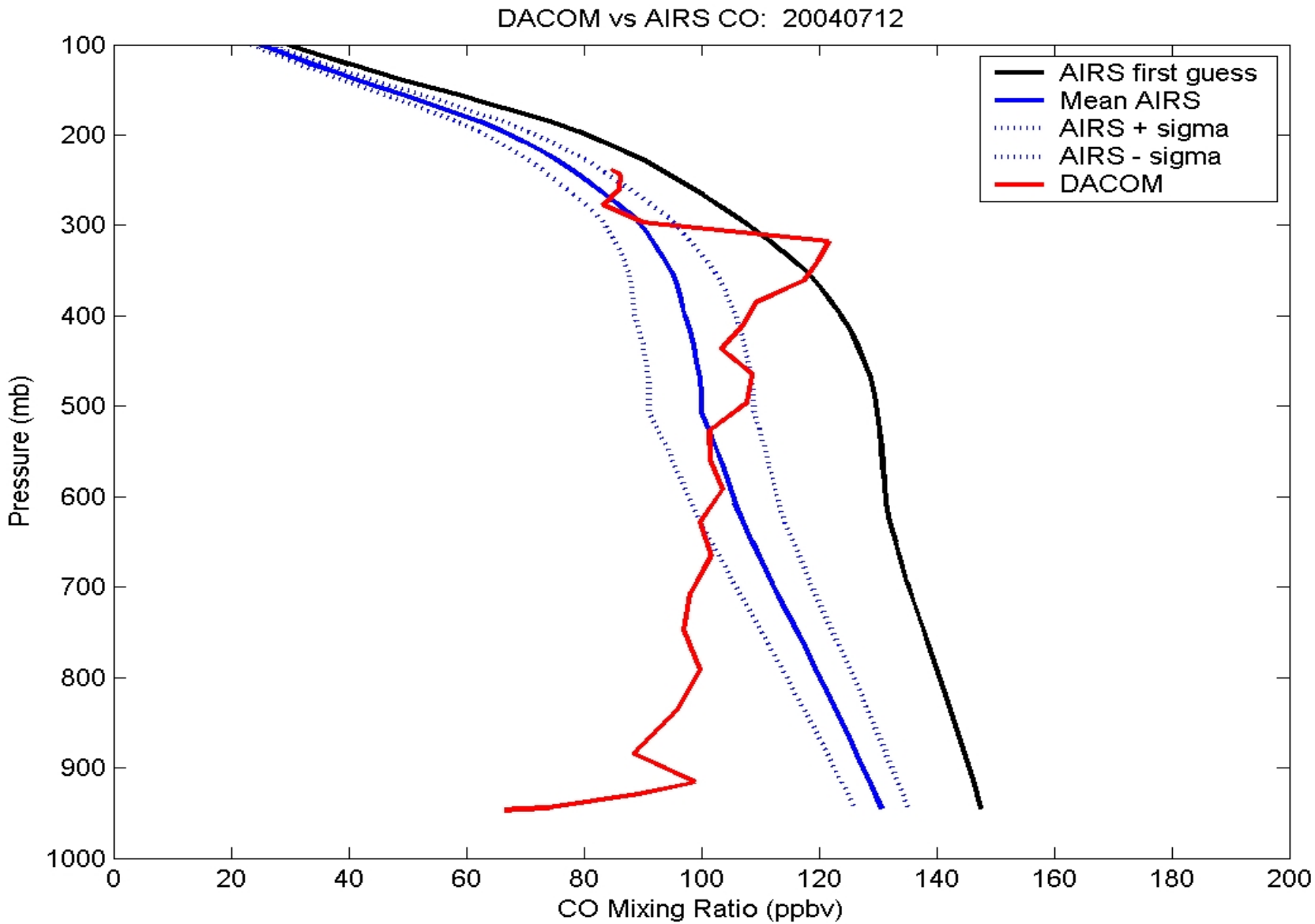

Retrieved vs. In Situ on 20040710
AIRS - conv. DACOM (300-700mb) = -12.5534
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

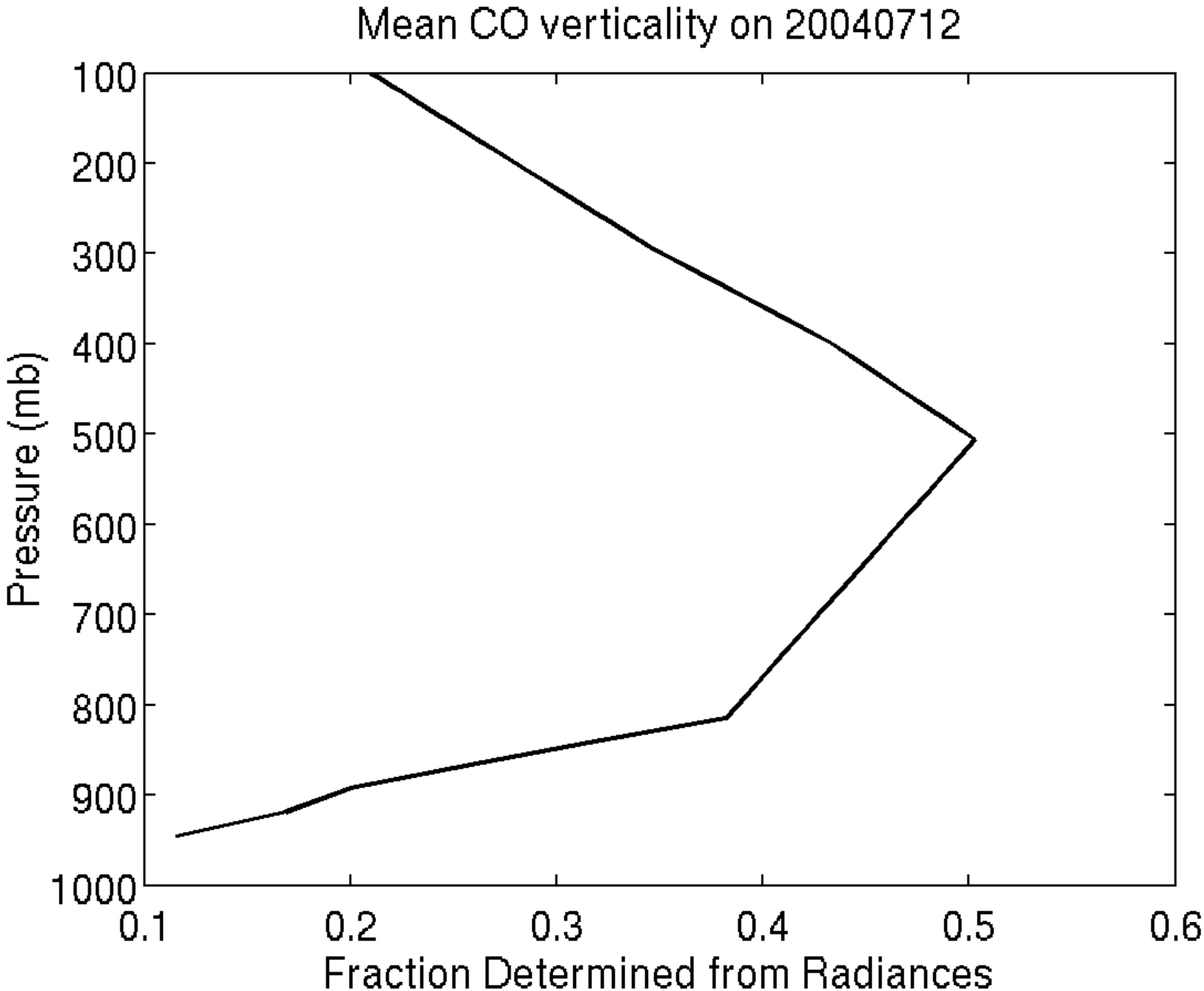

Mean CO verticality on 20040710
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0
0.1
0.2
0.3
0.4
0.5
Fraction Determined from Radiances


Local PM AIRS CO at 500 mb on 20040712
50° N
40° N
30° N
20° N
120° W
100° W
80° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

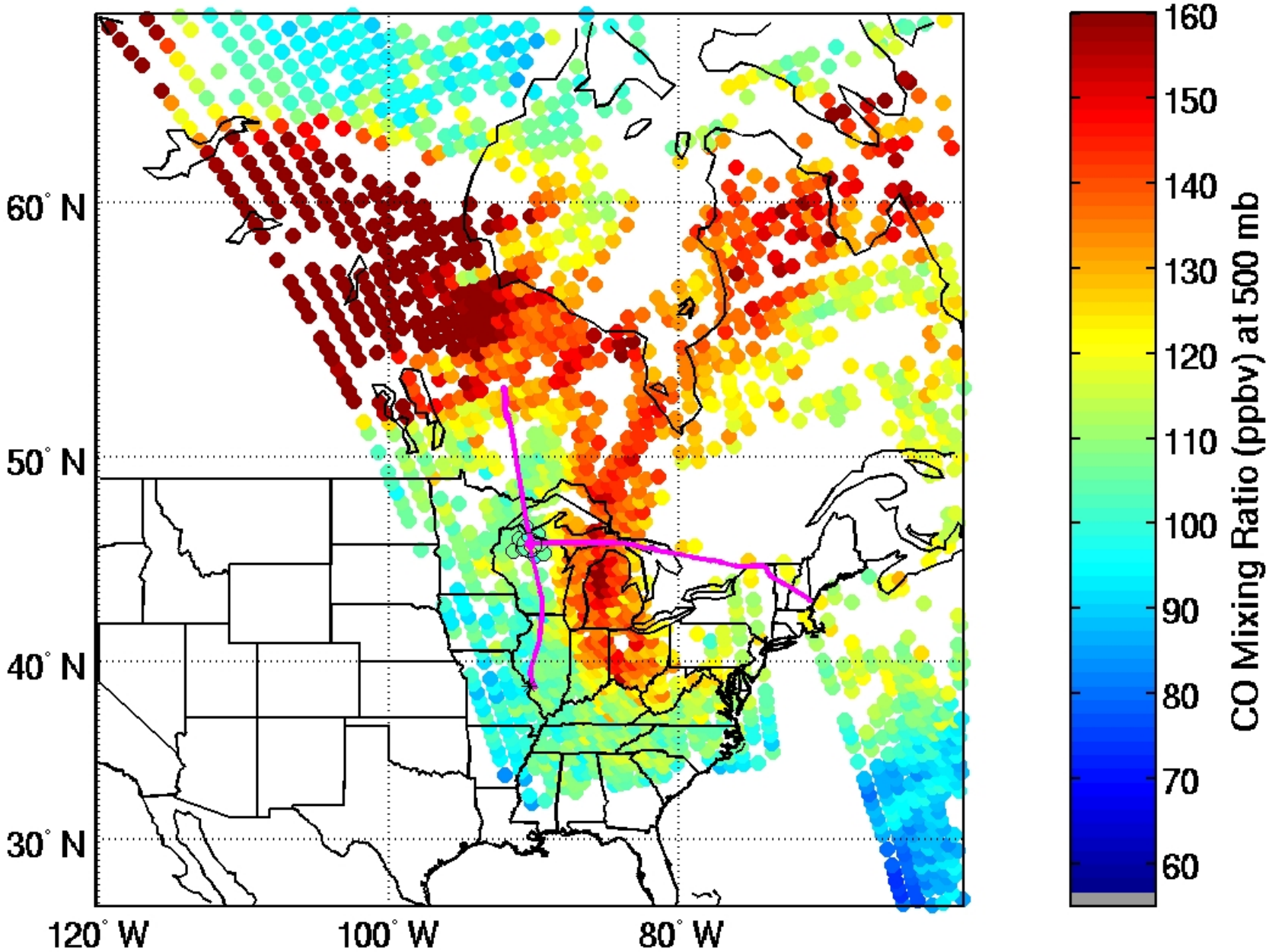

Retrieved vs. In Situ on 20040712
AIRS - conv. DACOM (300-700mb) = -13.2526
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

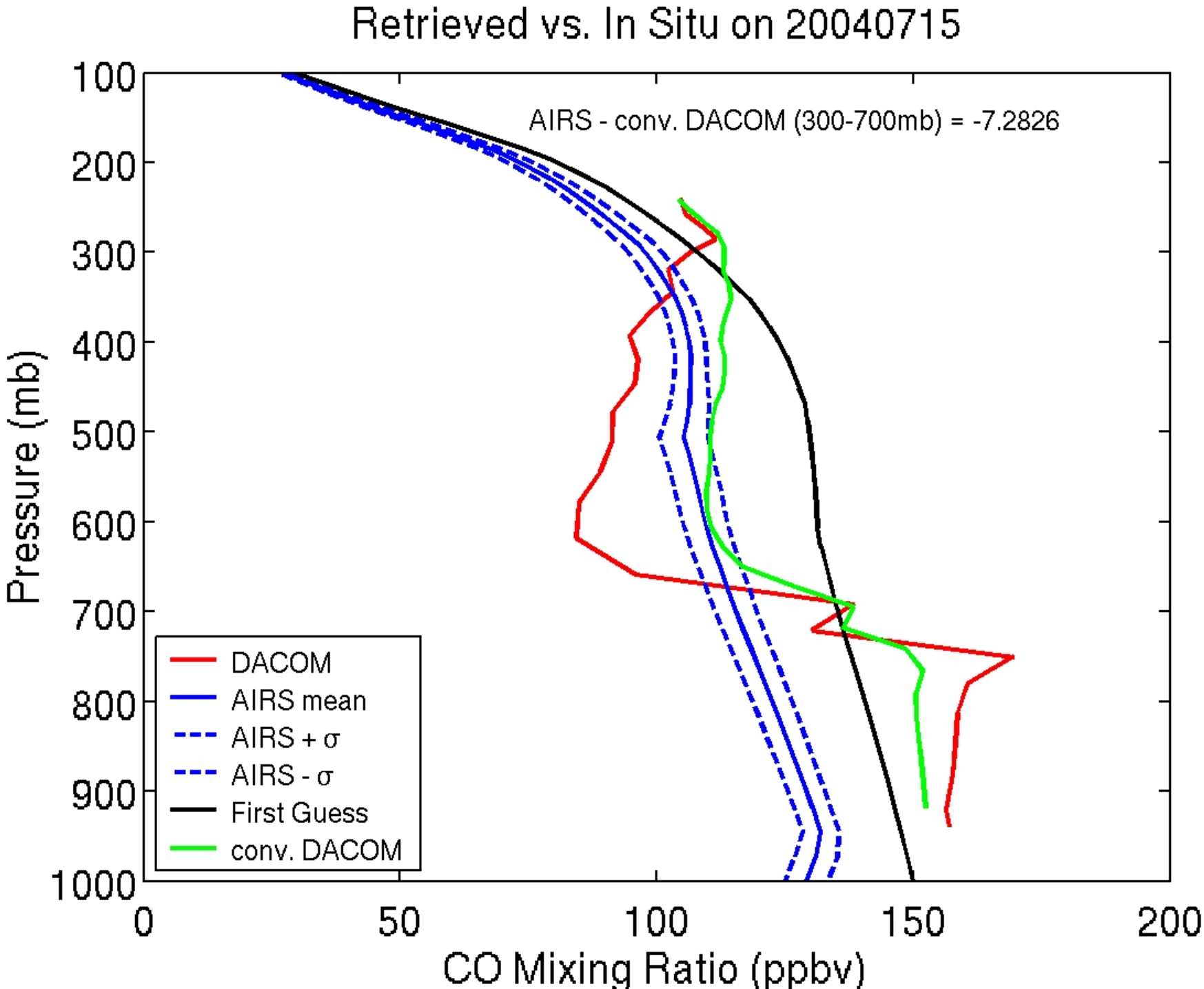
First INTEX AIRS Validation

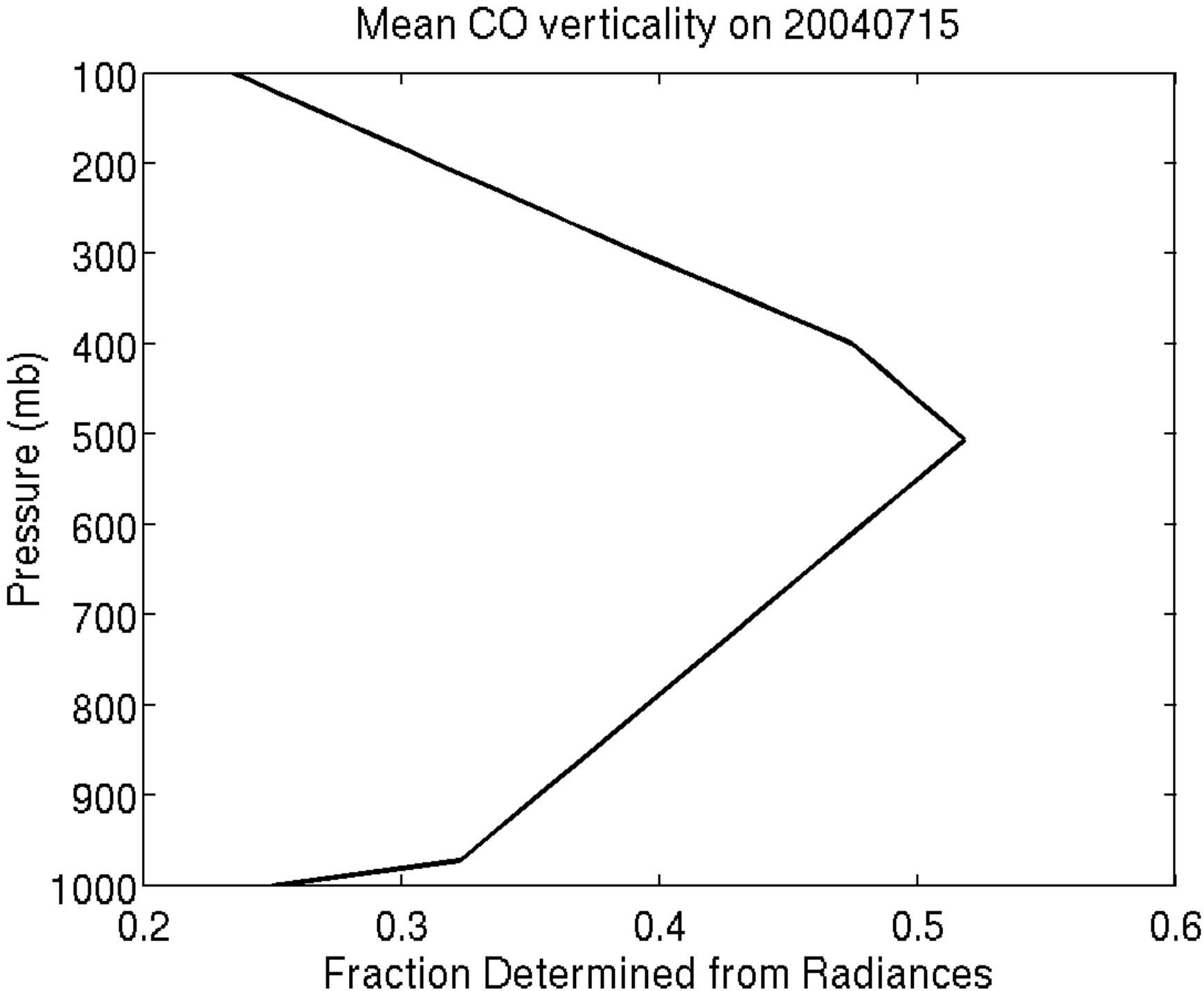



Mean CO verticality on 20040712
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.1
0.2
0.3
0.4
0.5
0.6
Fraction Determined from Radiances

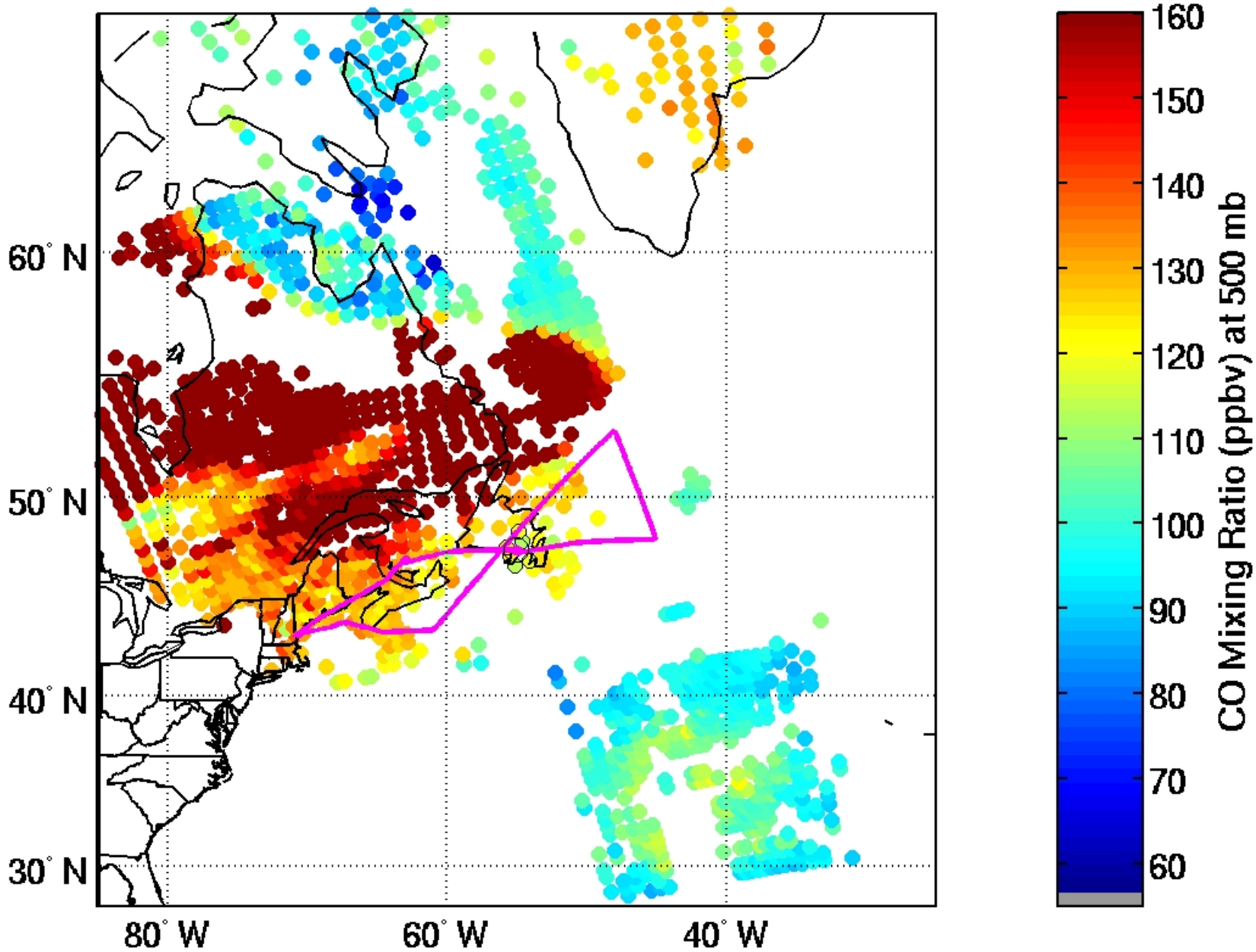
Local PM AIRS CO at 500 mb on 20040715

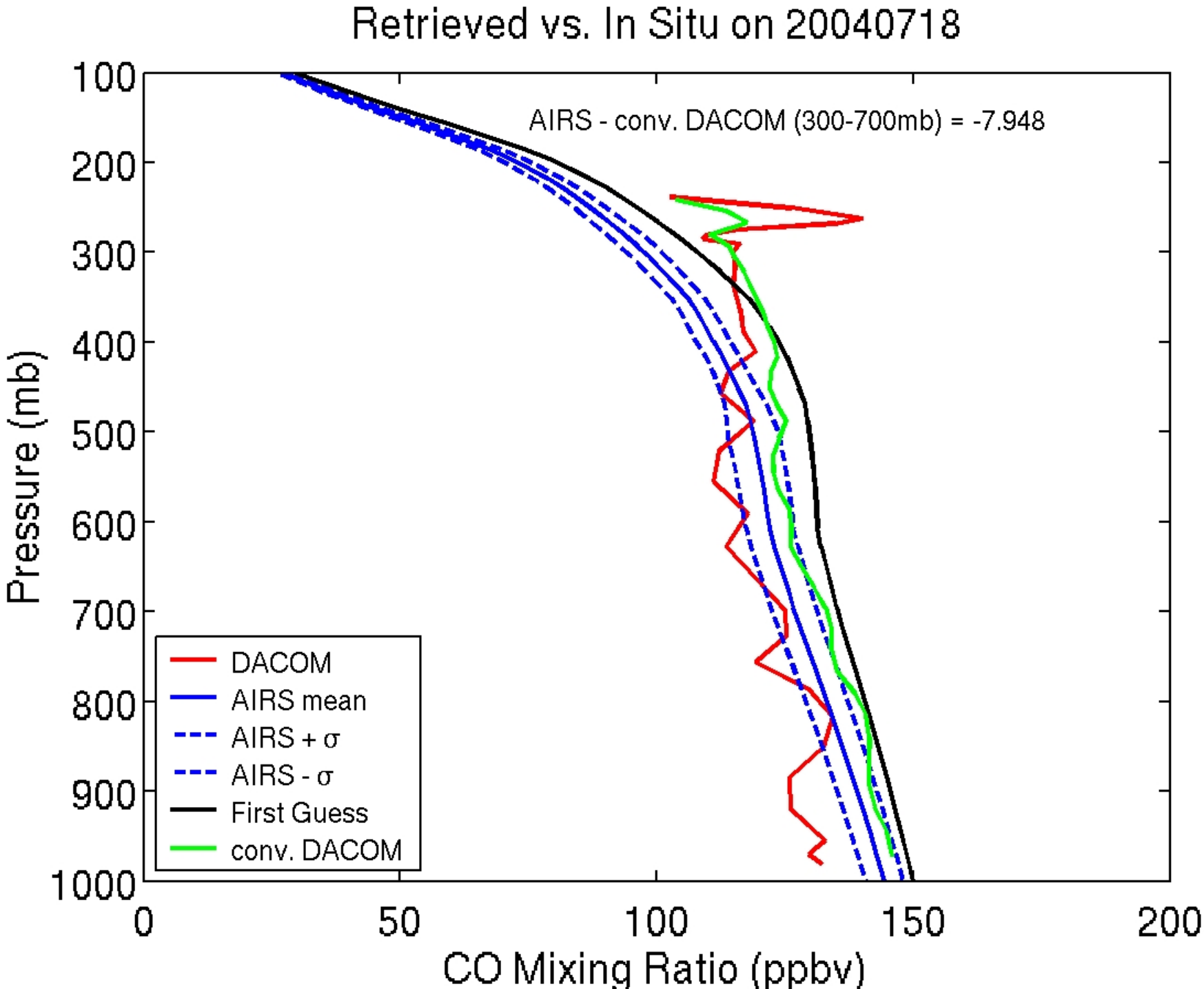


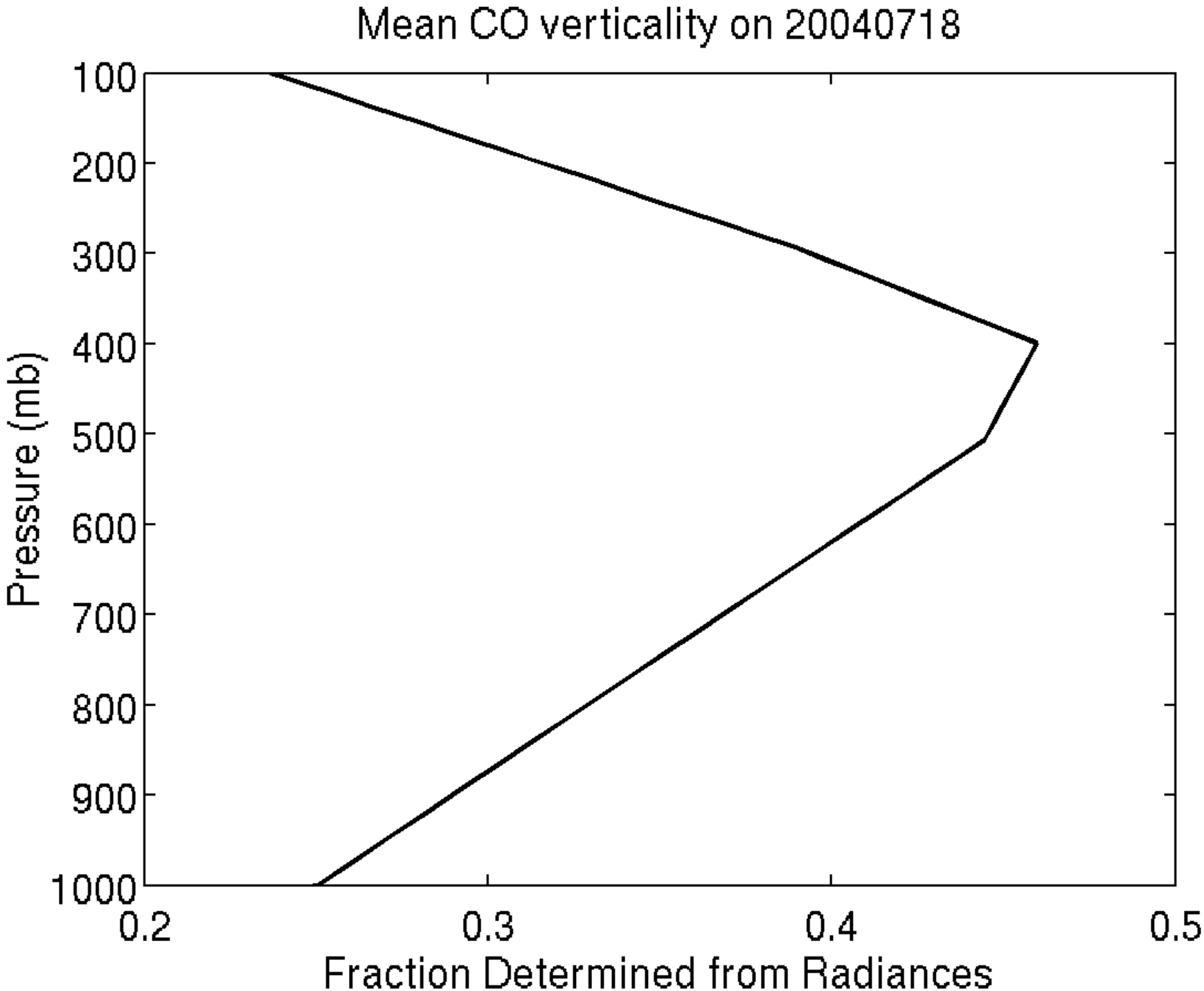

Retrieved vs. In Situ on 20040715
AIRS - conv. DACOM (300-700mb) = -7.2826
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


Mean CO verticality on 20040715
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
0.6
Fraction Determined from Radiances

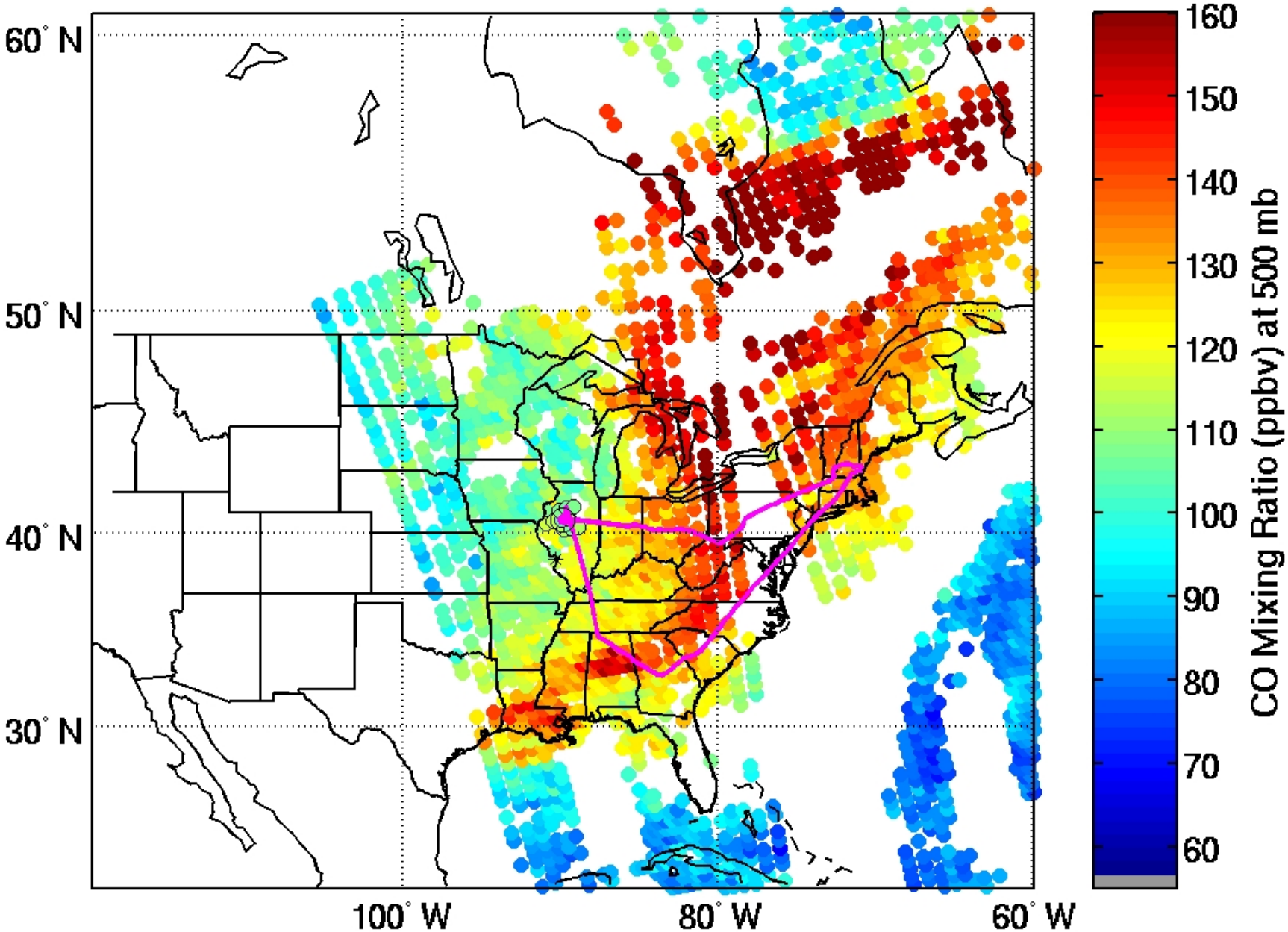
Local PM AIRS CO at 500 mb on 20040718

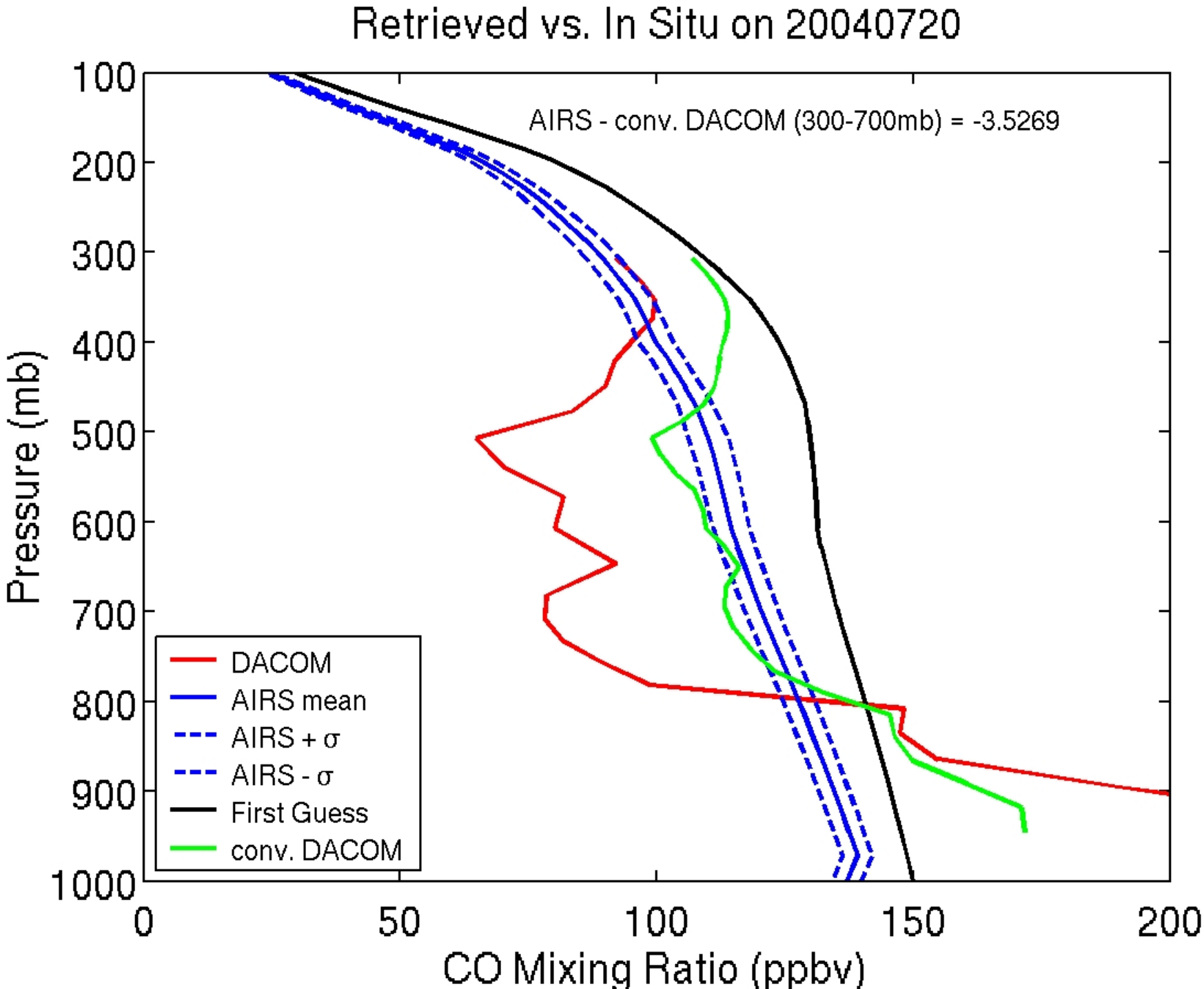


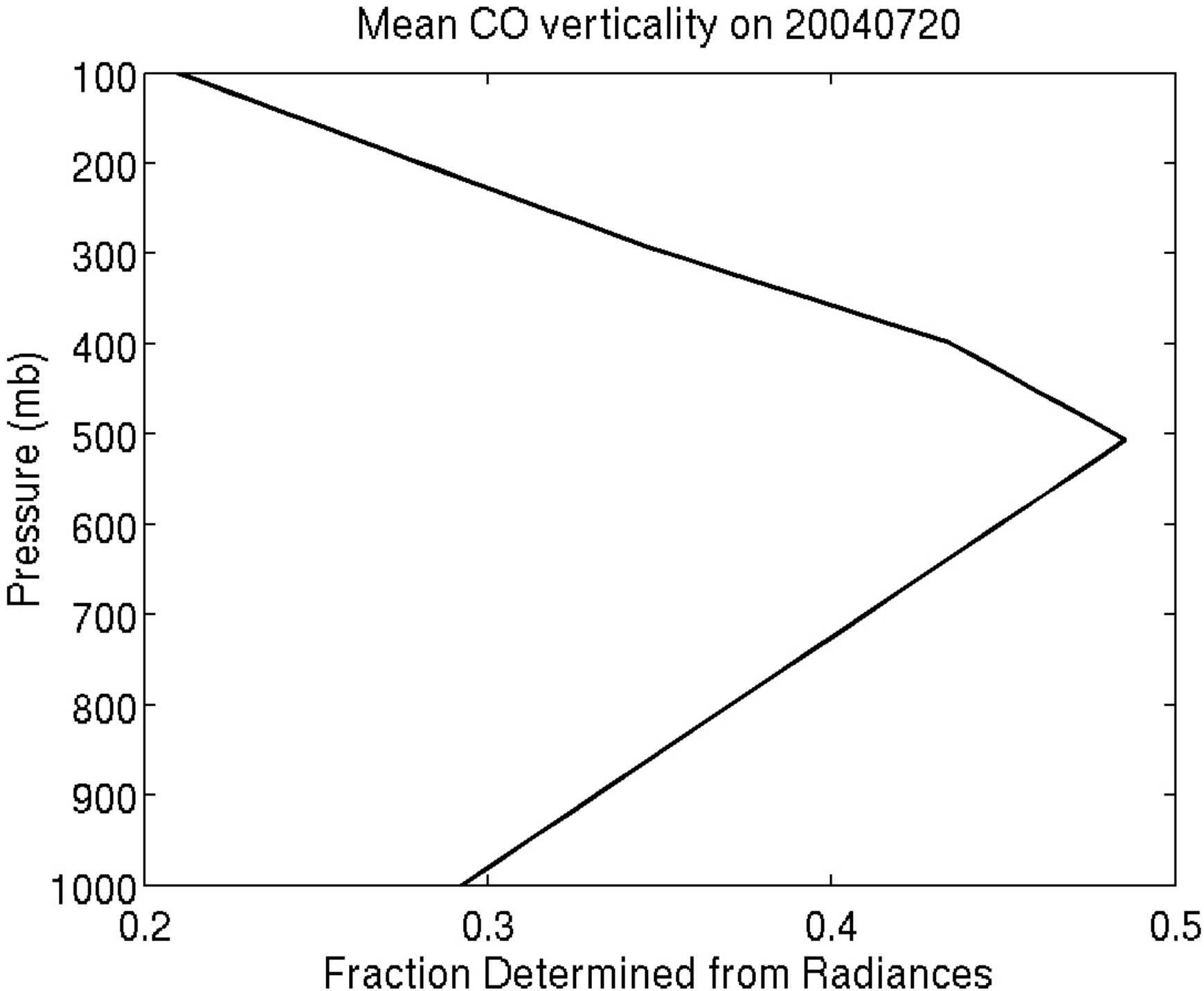

Retrieved vs. In Situ on 20040718
AIRS - conv. DACOM (300-700mb) = -7.948
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


Mean CO verticality on 20040718
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

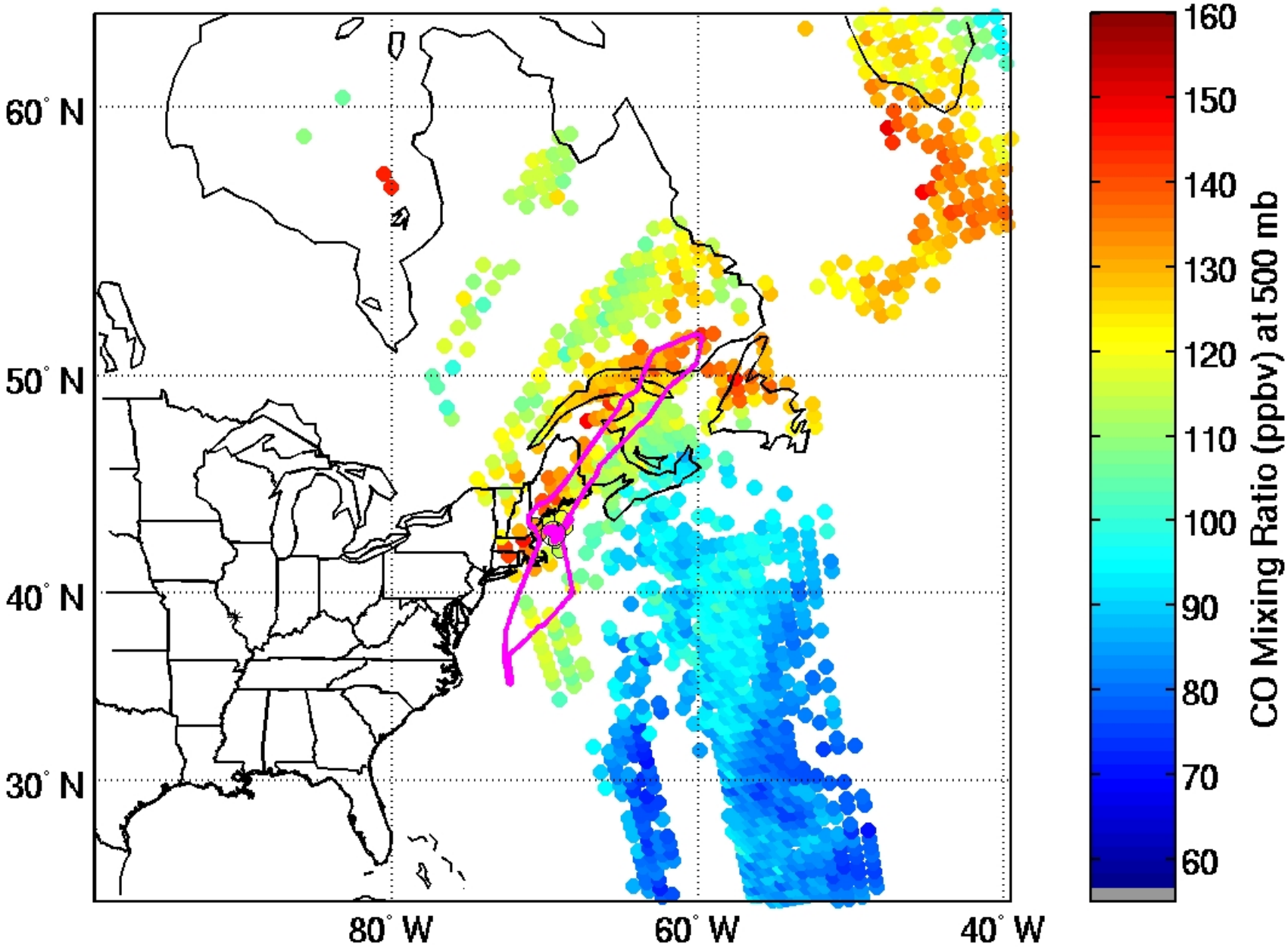
Local PM AIRS CO at 500 mb on 20040720

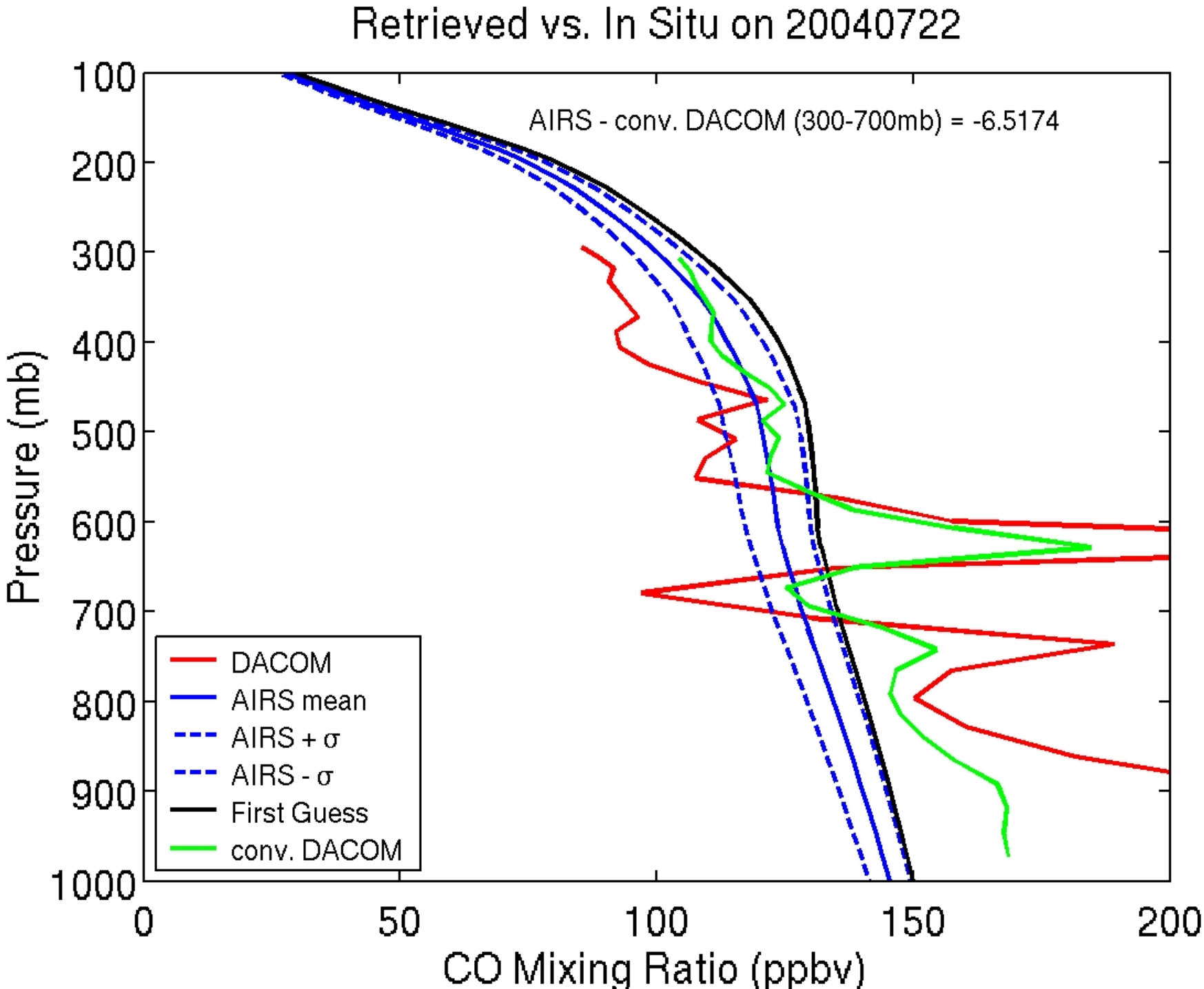


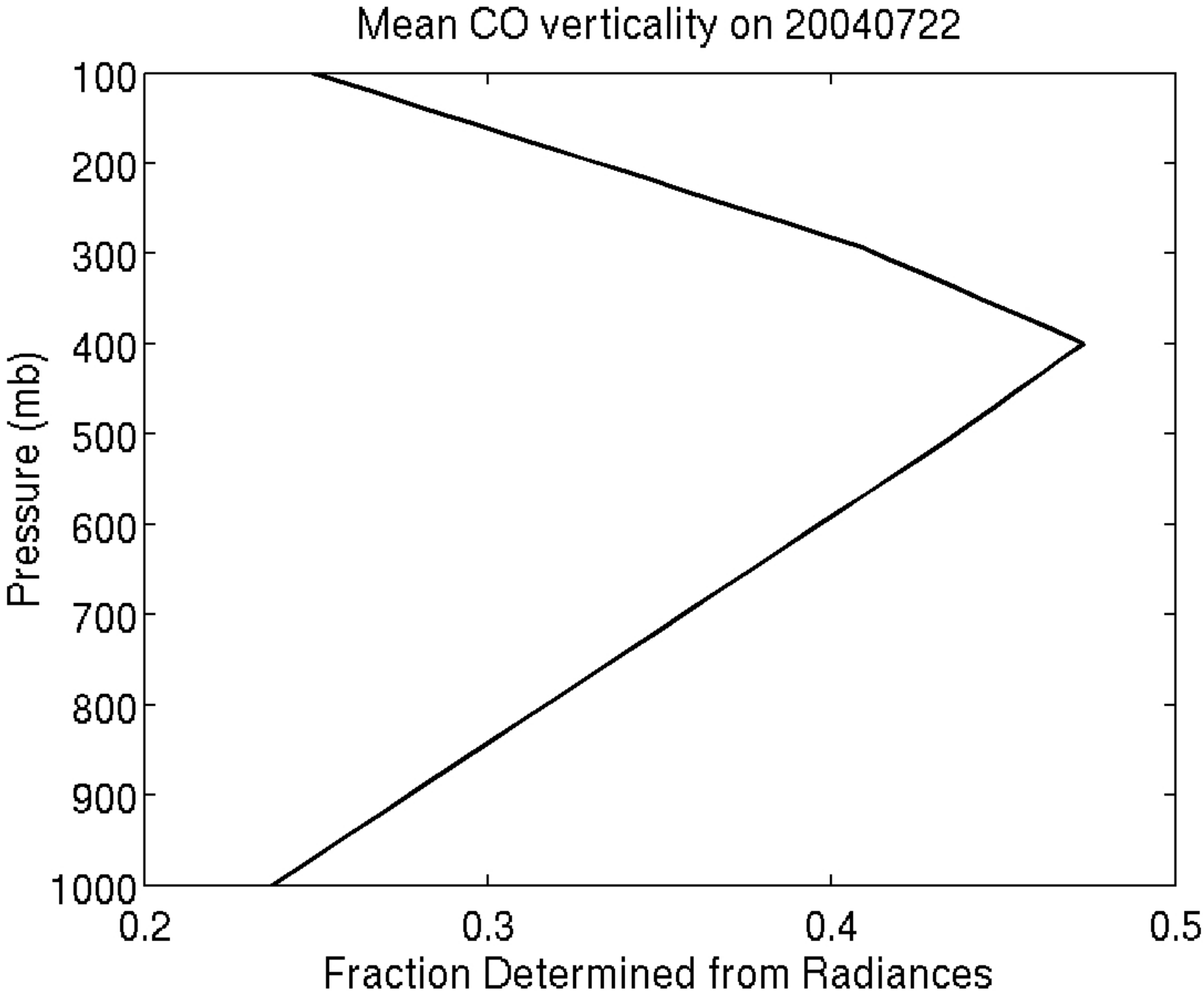

Retrieved vs. In Situ on 20040720
AIRS - conv. DACOM (300-700mb) = -3.5269
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


Mean CO verticality on 20040720
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

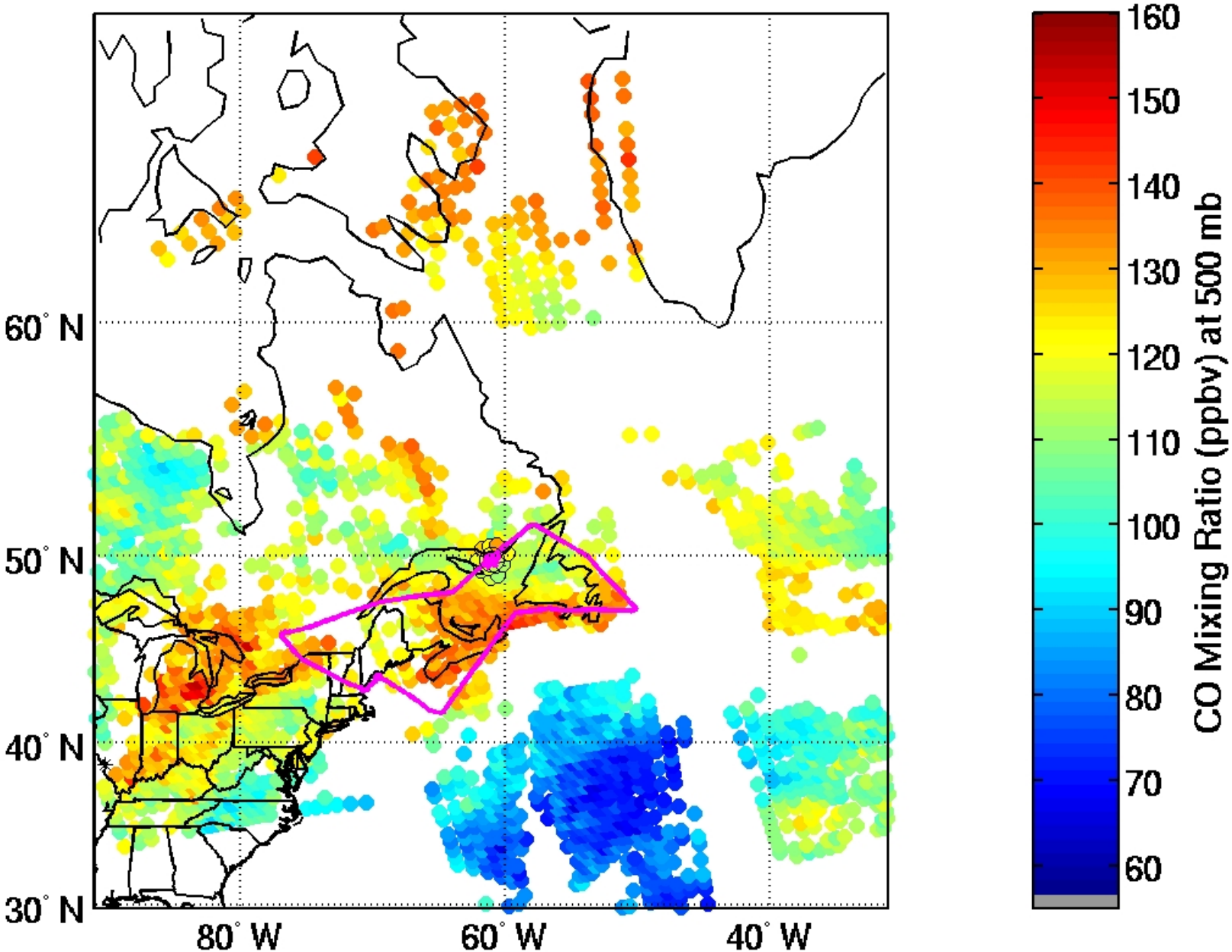
Local PM AIRS CO at 500 mb on 20040722

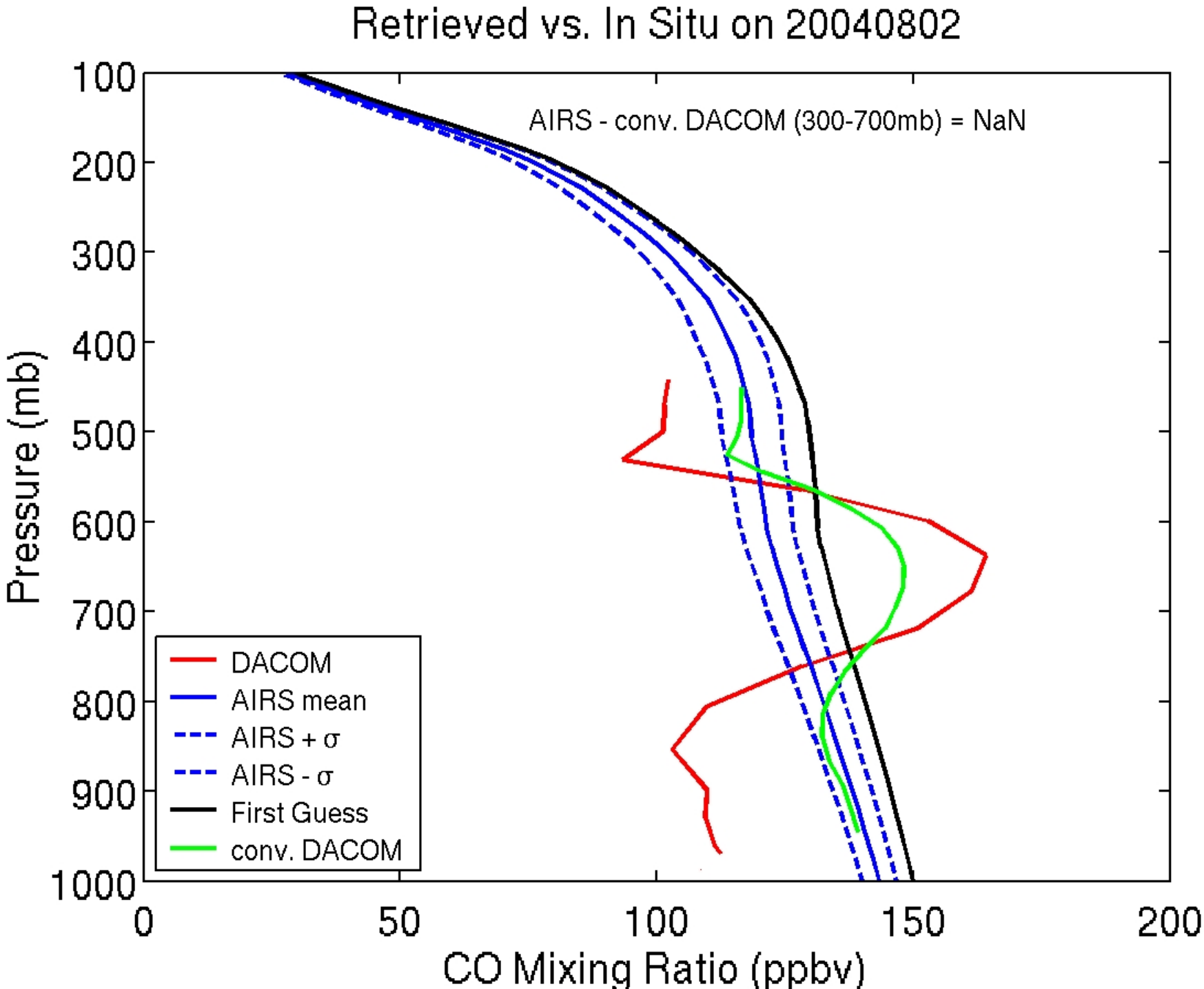


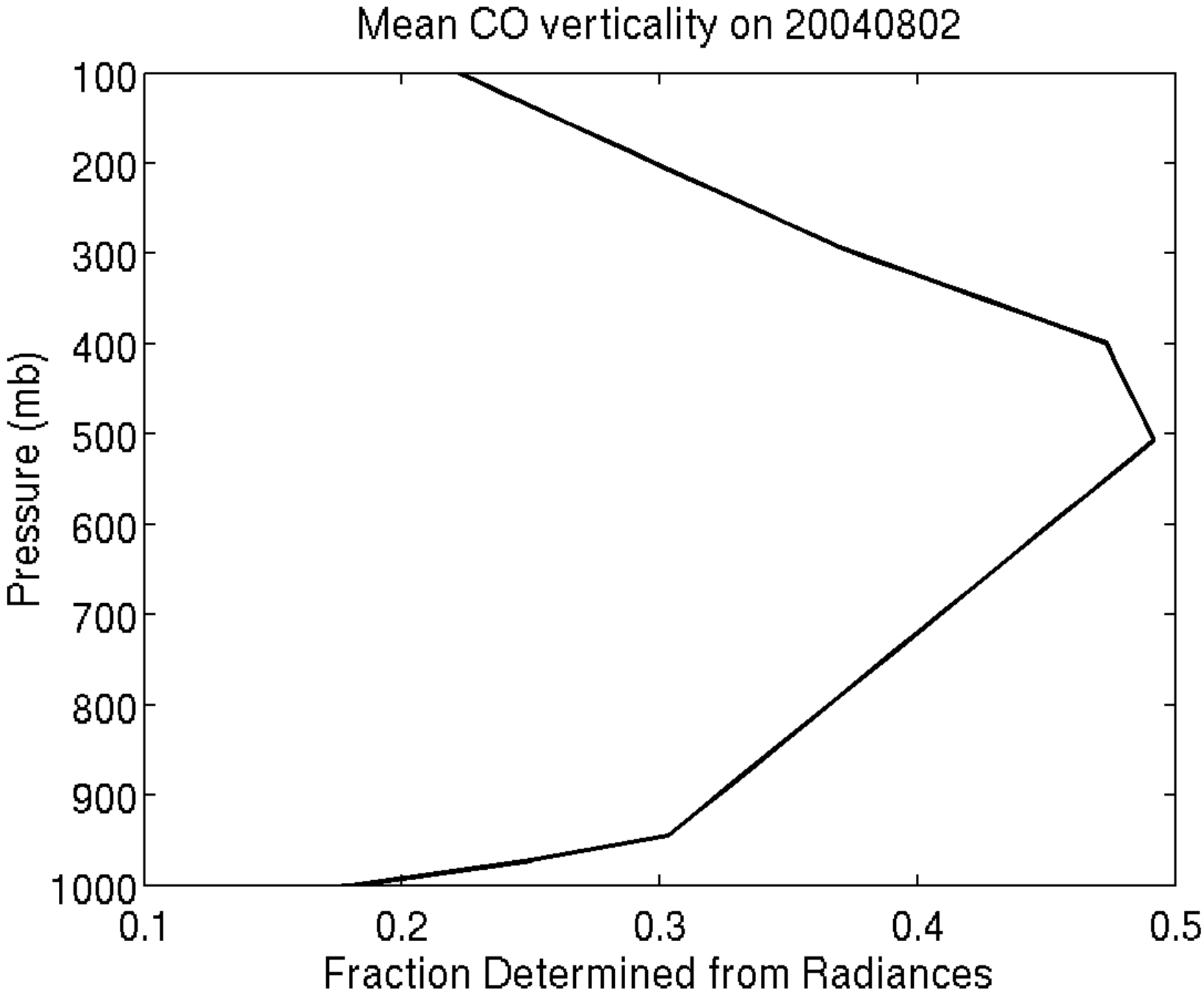

Retrieved vs. In Situ on 20040722
AIRS - conv. DACOM (300-700mb) = -6.5174
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

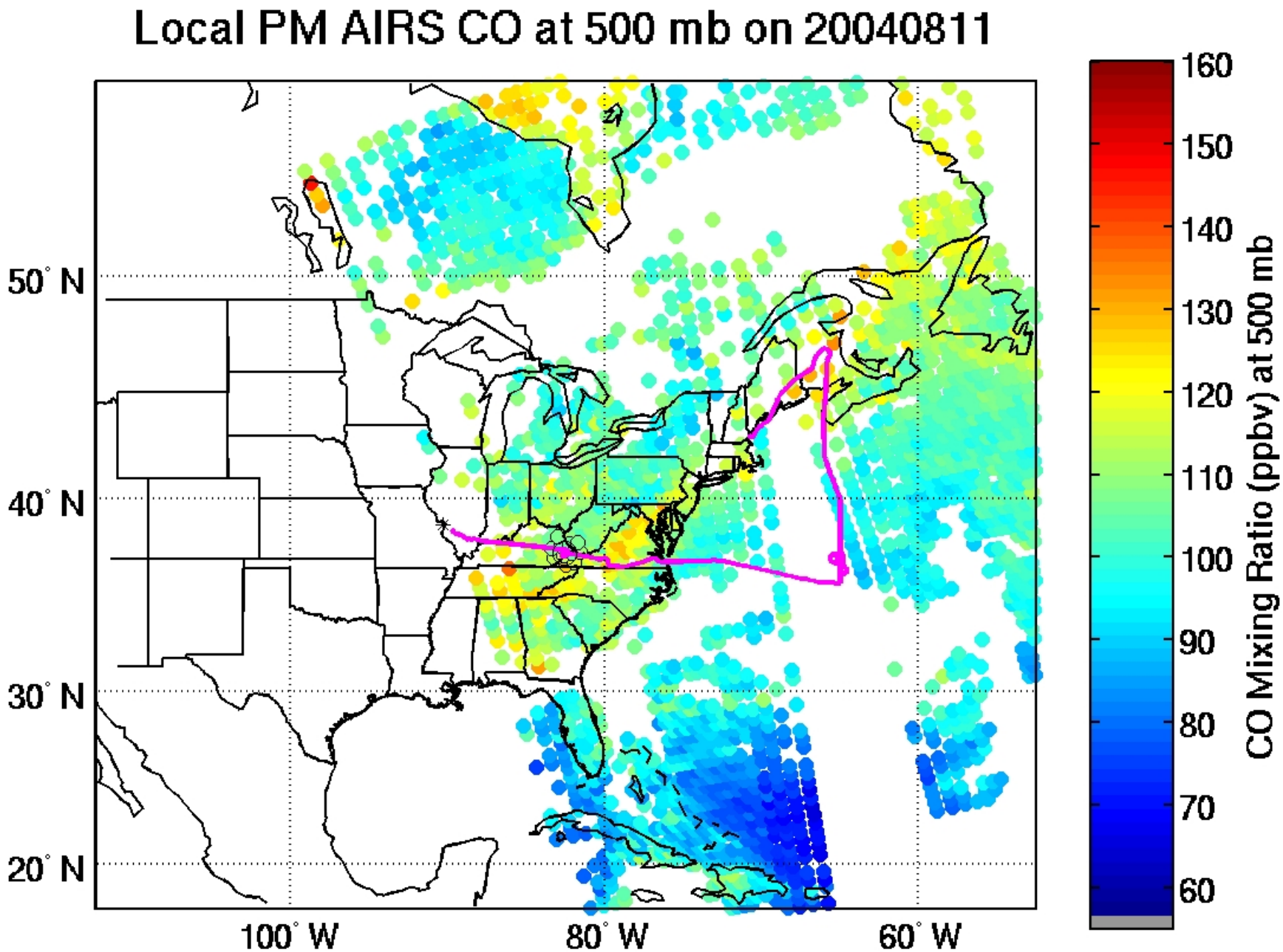

Mean CO verticality on 20040722
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

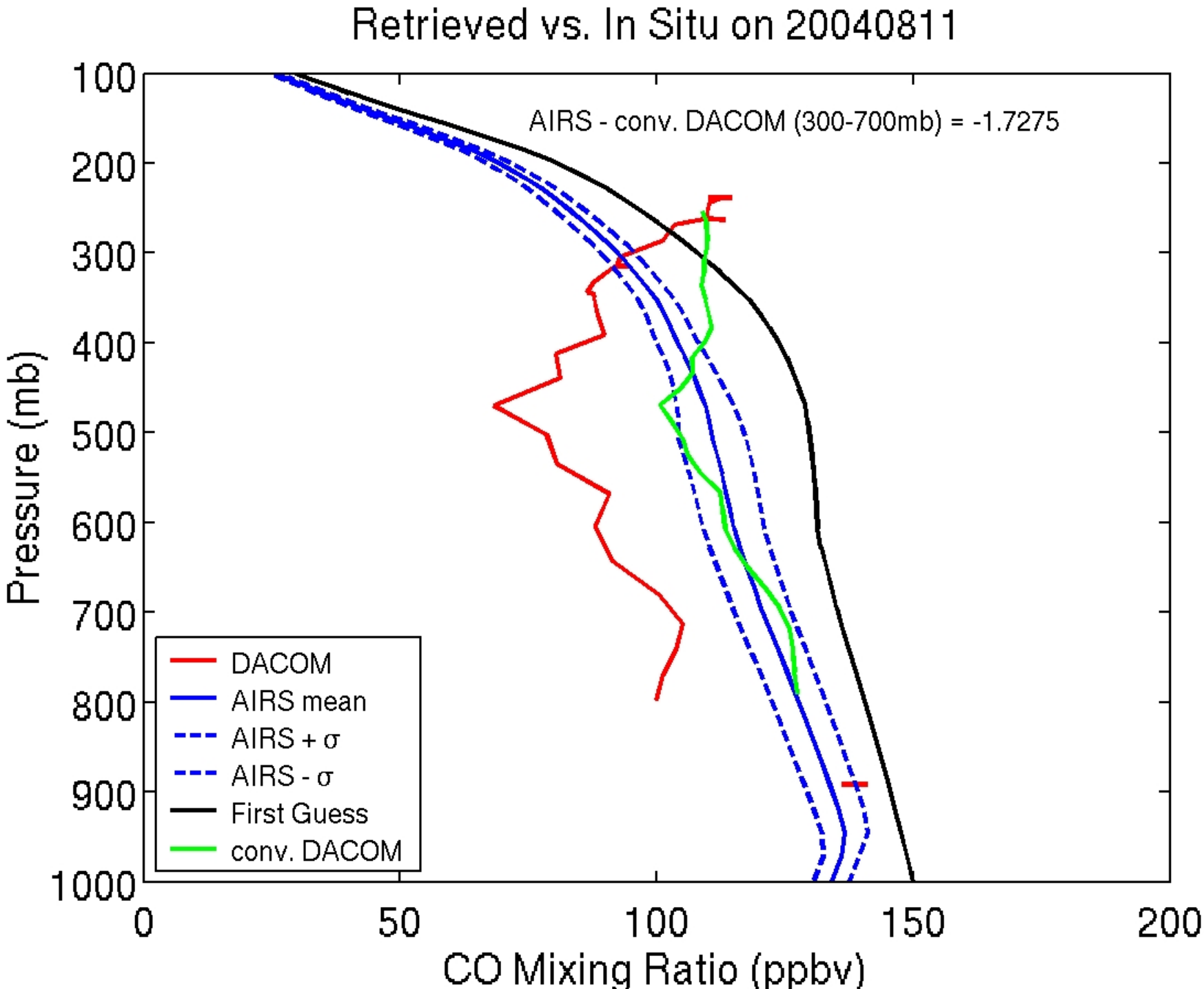
Local PM AIRS CO at 500 mb on 20040802

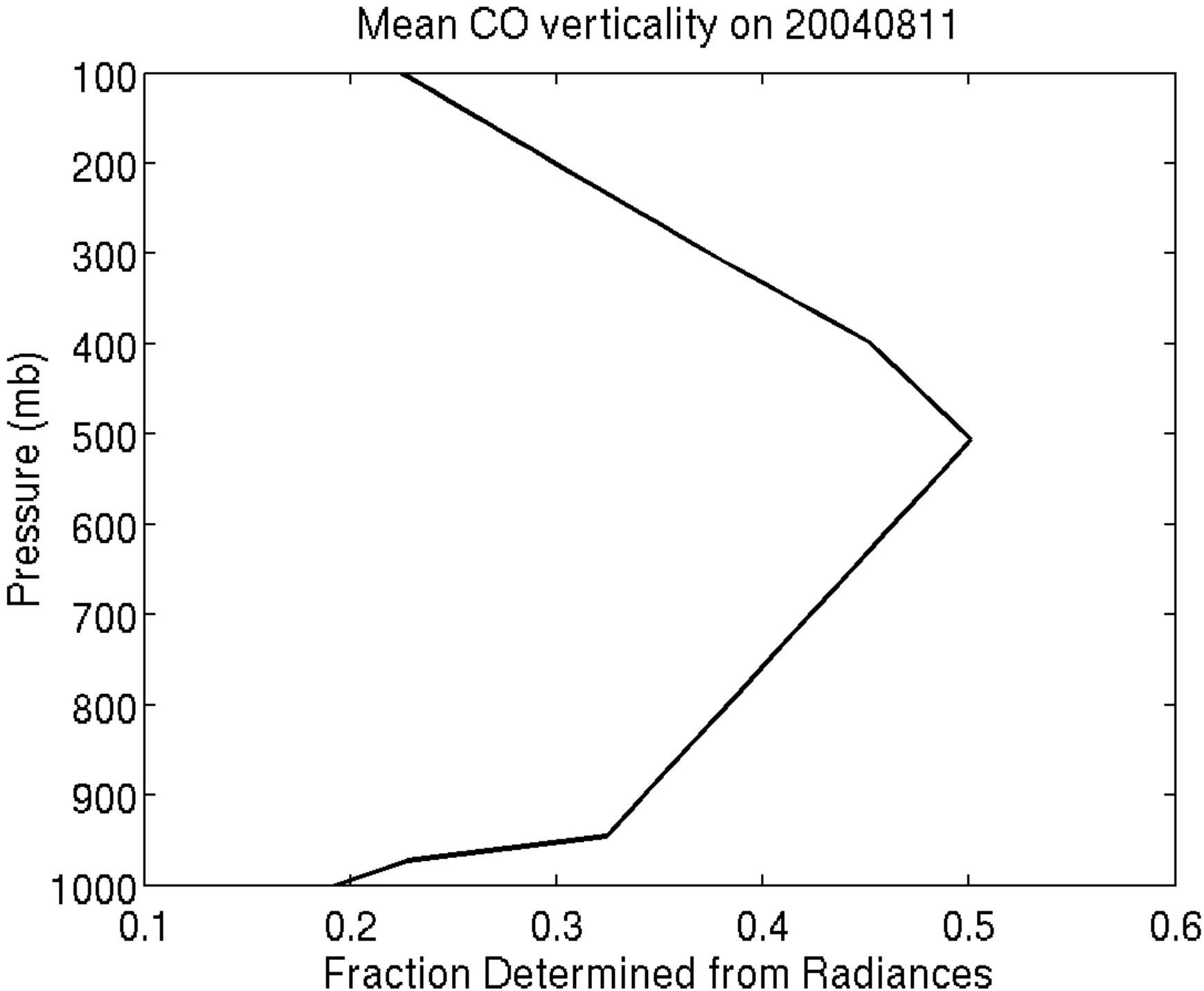



Retrieved vs. In Situ on 20040802
AIRS - conv. DACOM (300-700mb) = NaN
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


Mean CO verticality on 20040802
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.1
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

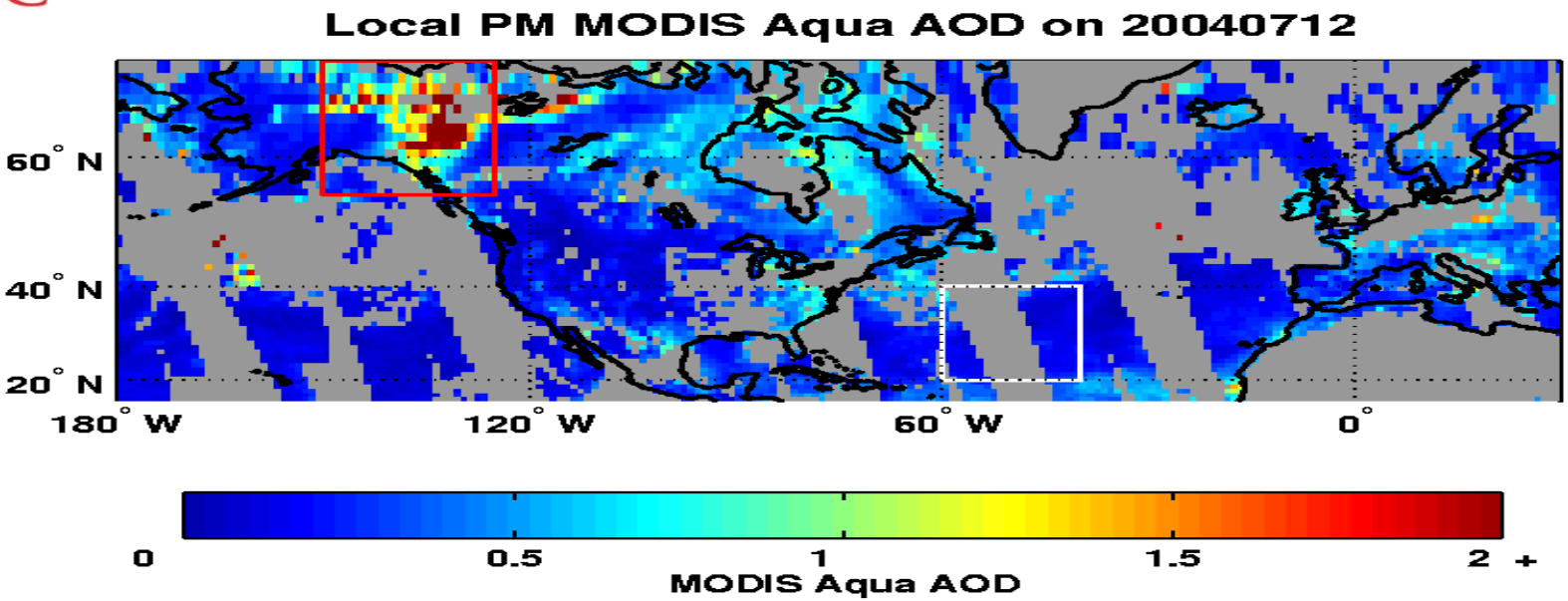

Local PM AIRS CO at 500 mb on 20040811
50° N
40° N
30° N
20° N
100° W
80° W
60° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

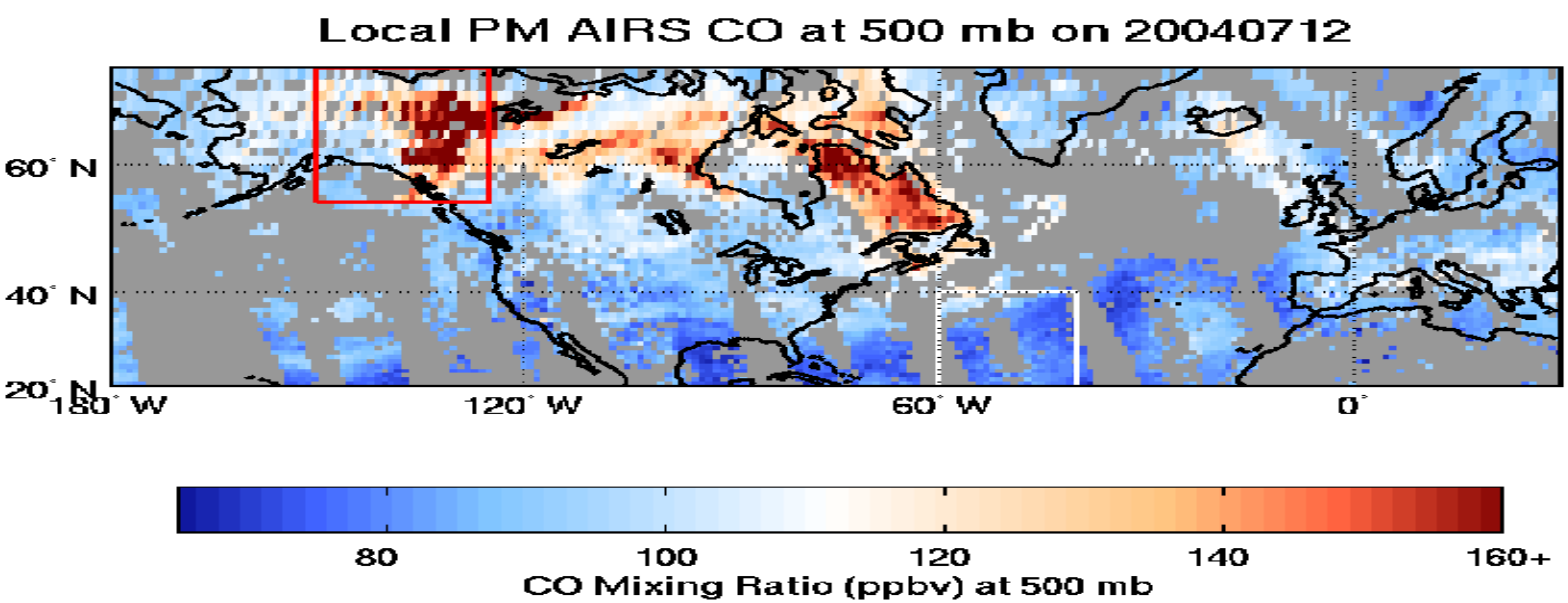

Retrieved vs. In Situ on 20040811
AIRS - conv. DACOM (300-700mb) = -1.7275
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


Mean CO verticality on 20040811
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.1
0.2
0.3
0.4
0.5
0.6
Fraction Determined from Radiances

UMBC

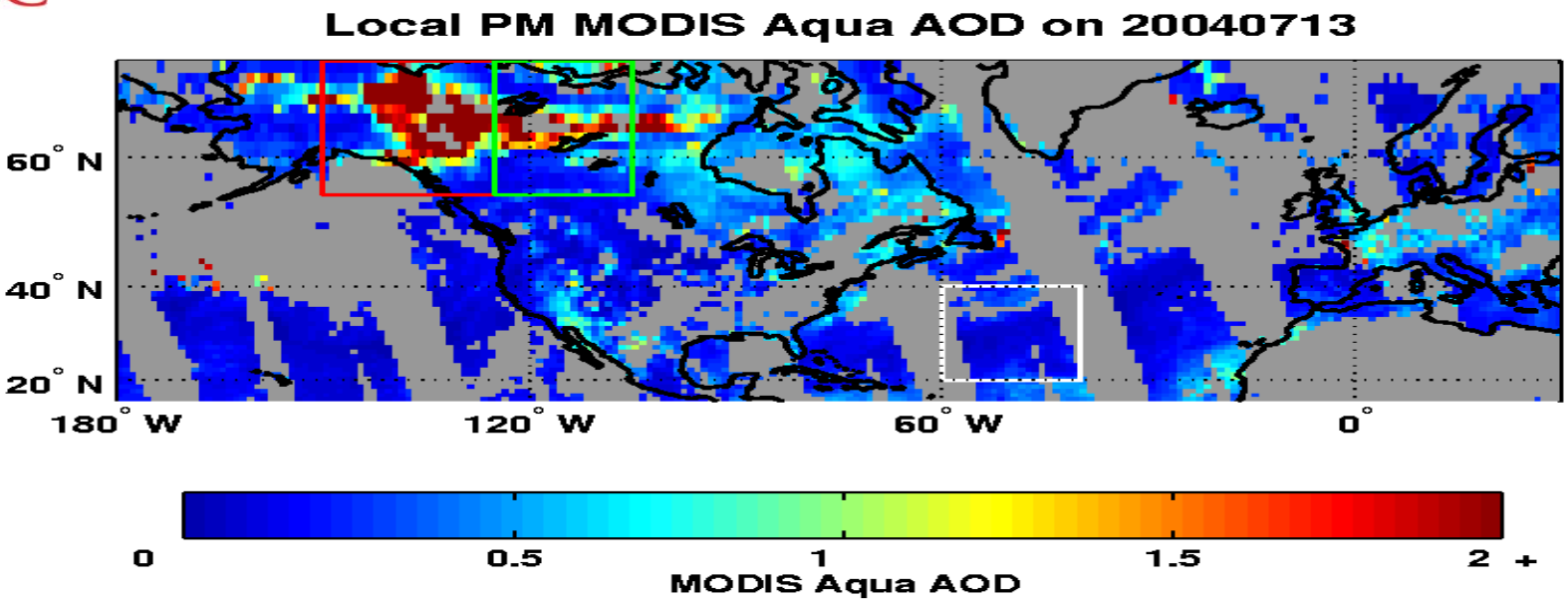
JCET

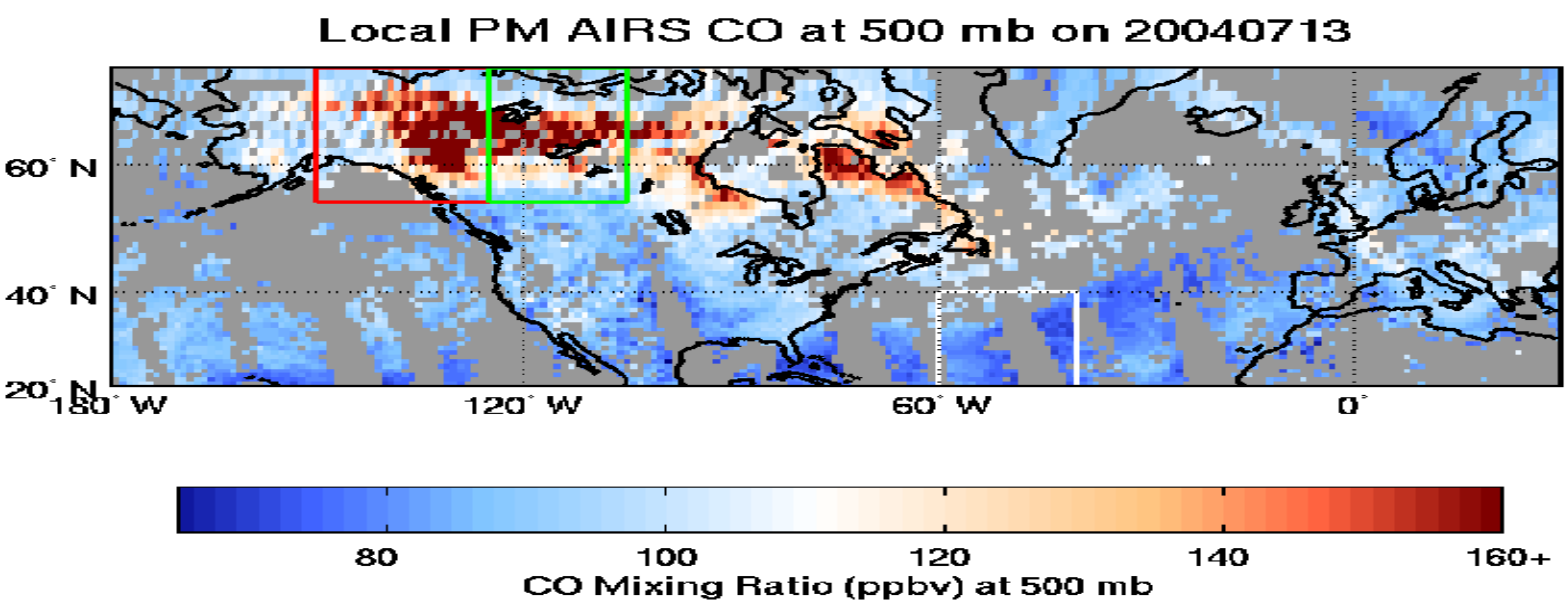

Local PM MODIS Aqua AOD on 20040712
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040712
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

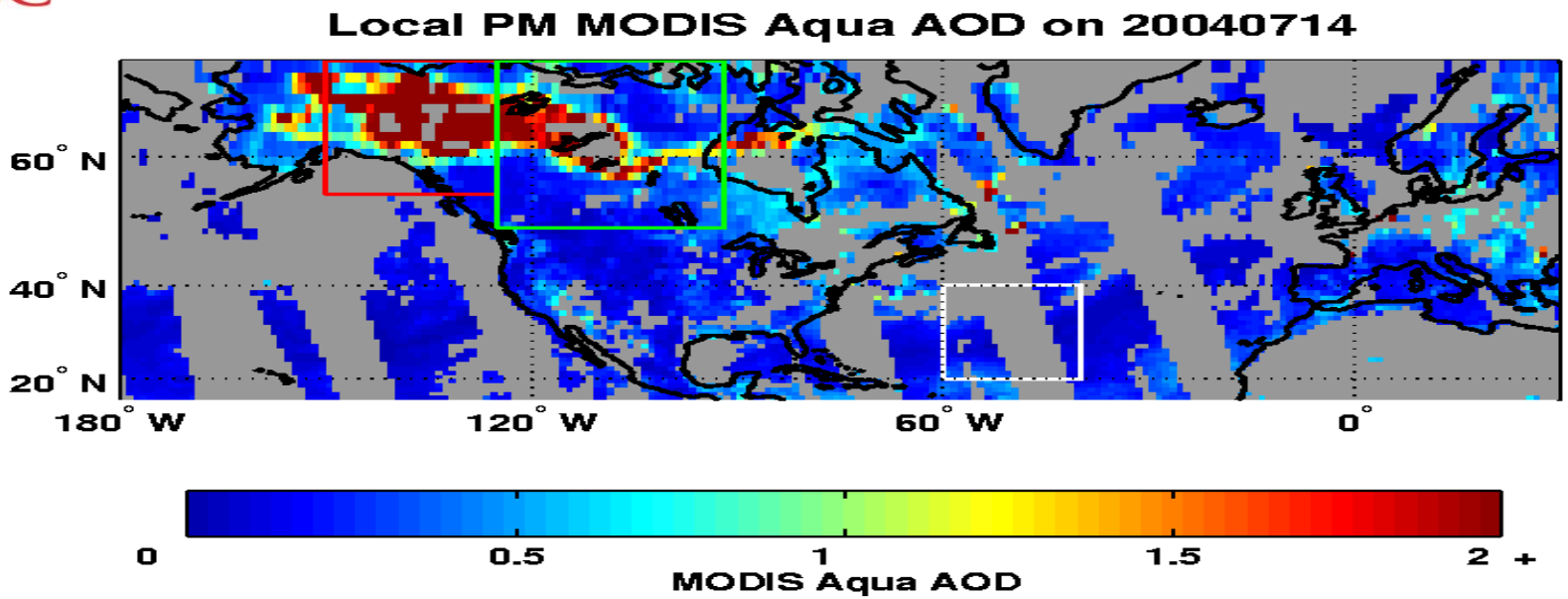
JCET

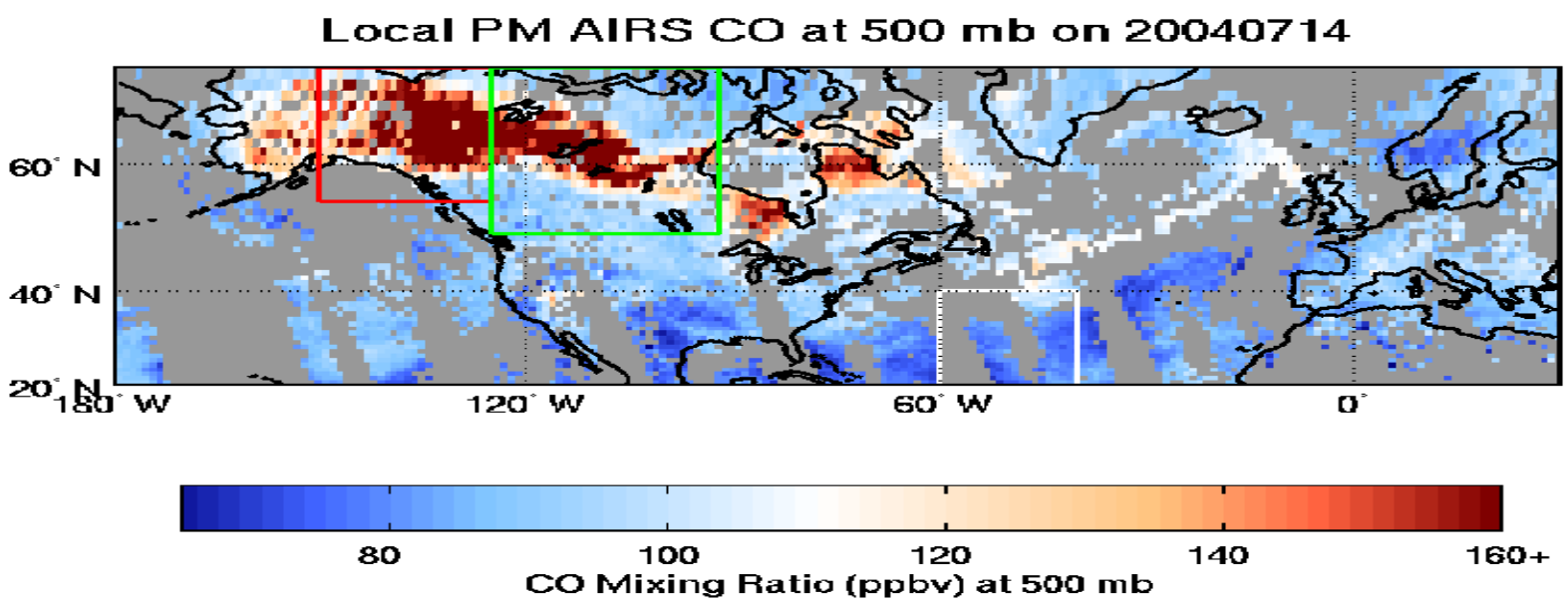

Local PM MODIS Aqua AOD on 20040713
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040713
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

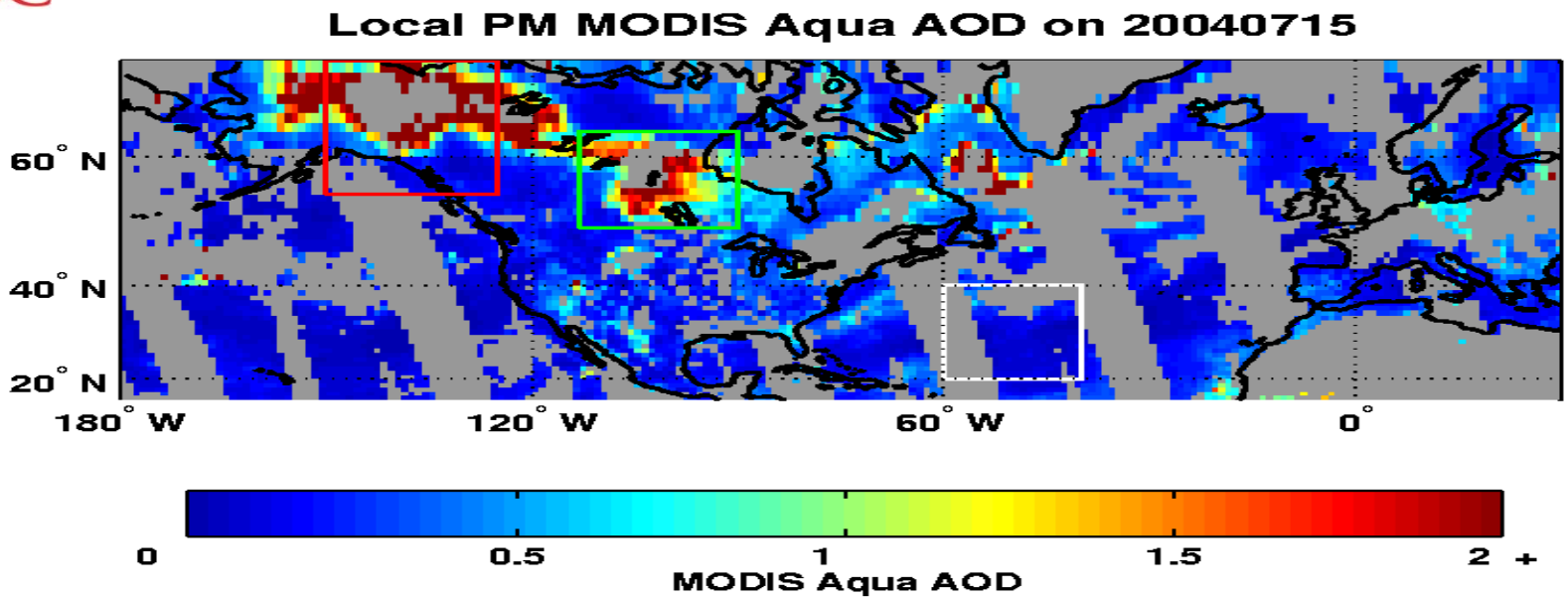
JCET

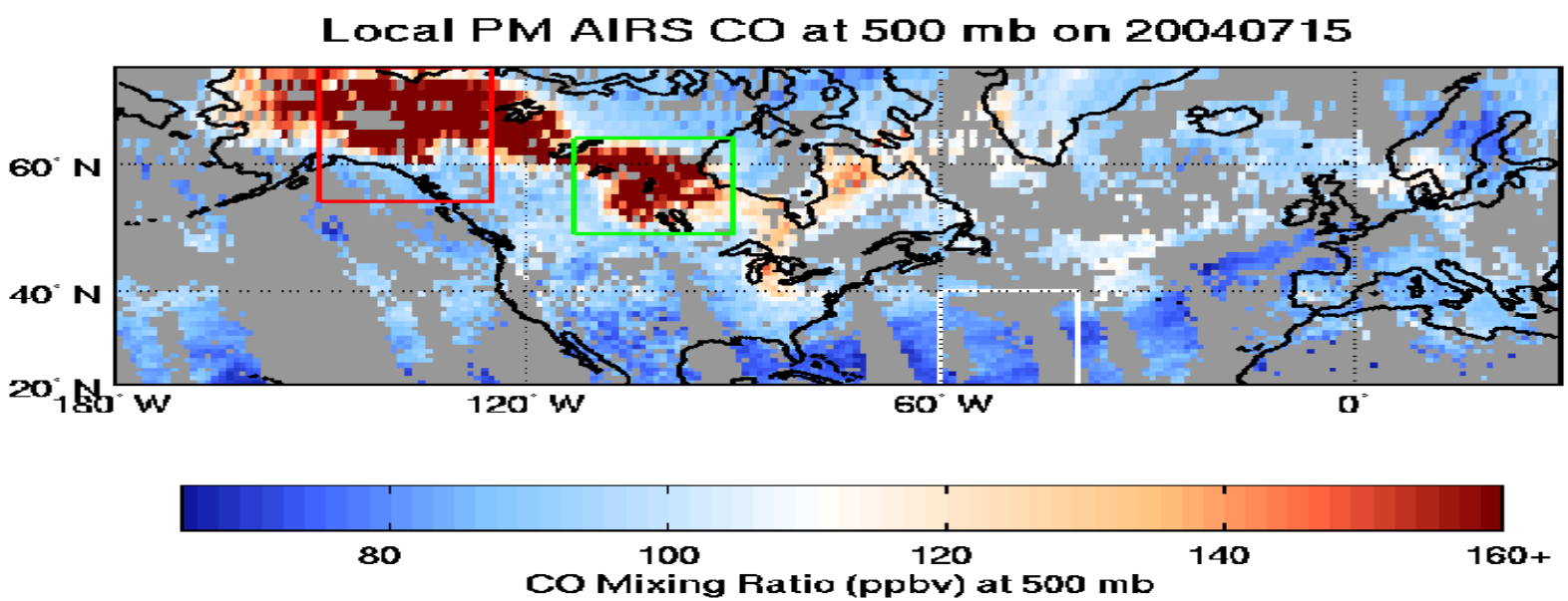

Local PM MODIS Aqua AOD on 20040714
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040714
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

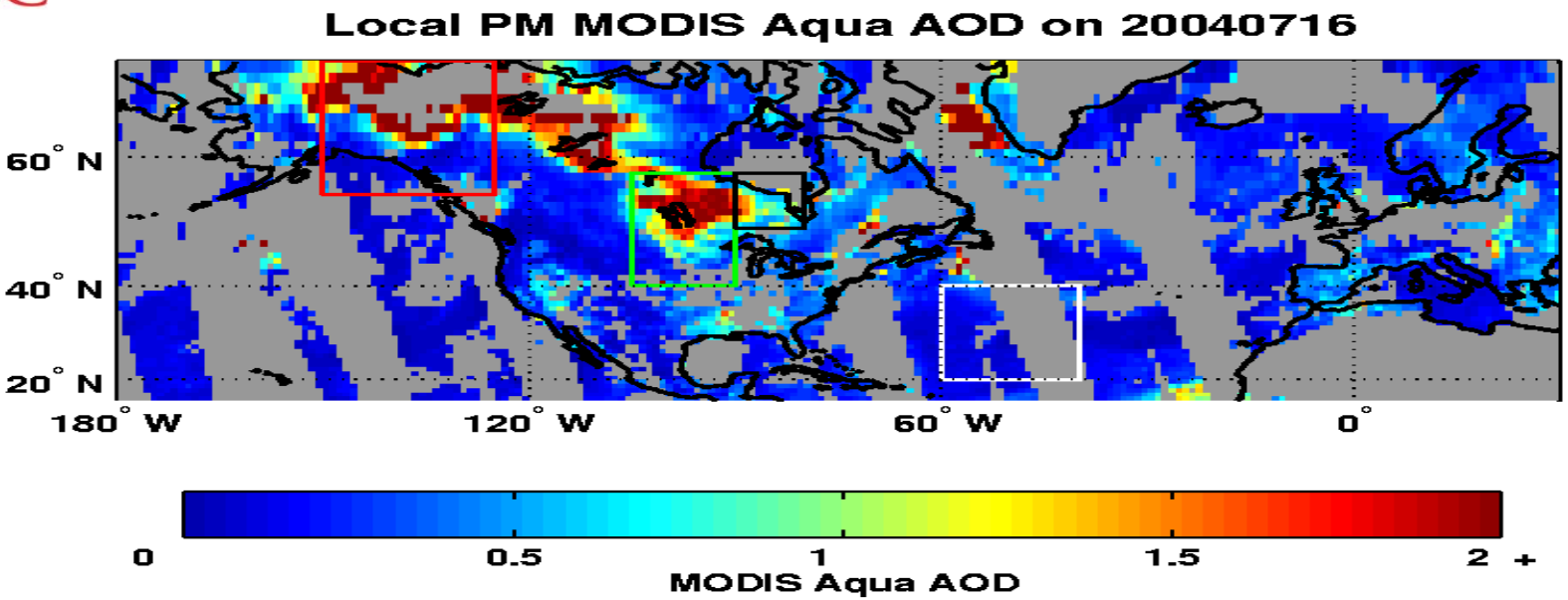
JCET

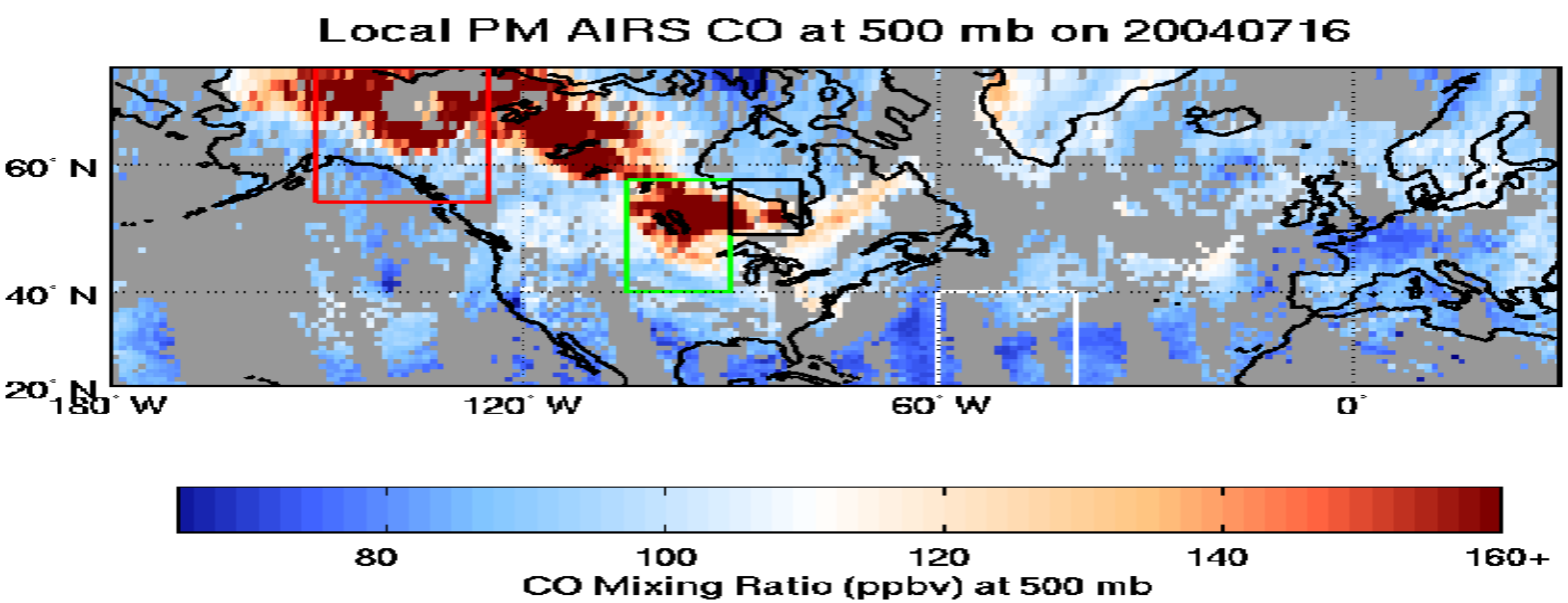

Local PM MODIS Aqua AOD on 20040715
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040715
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

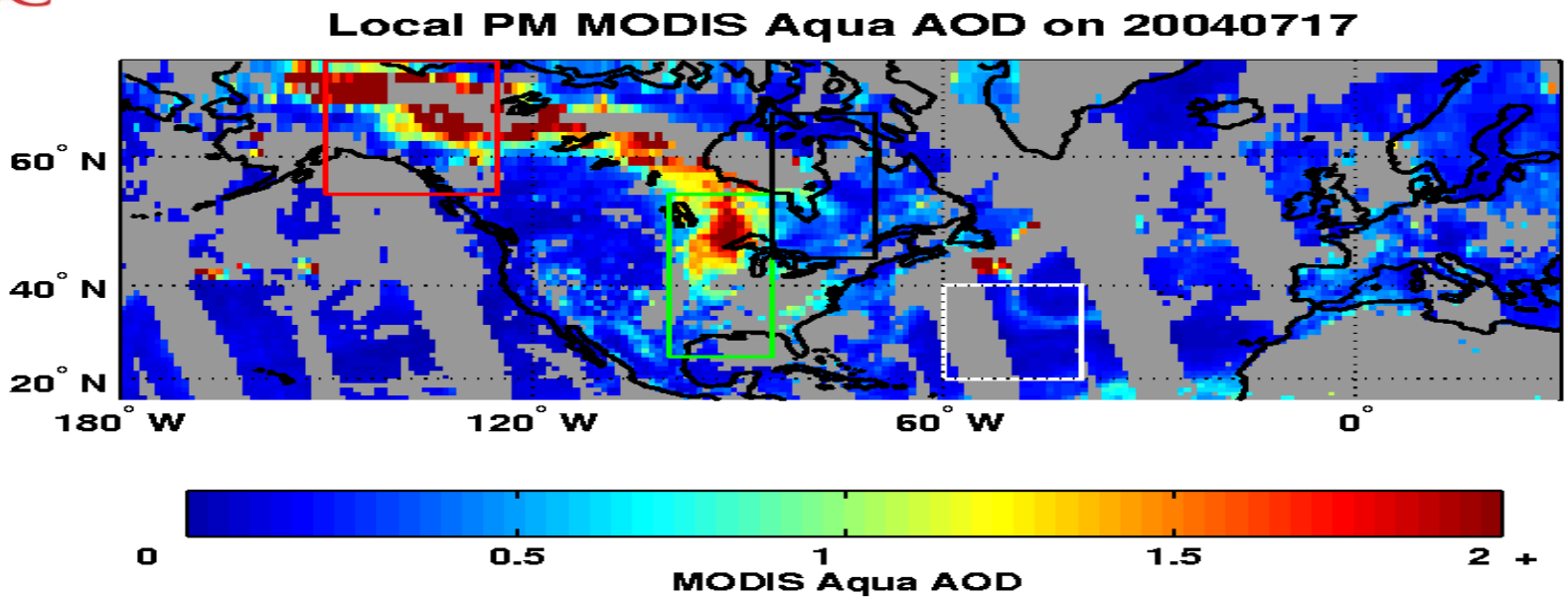
JCET

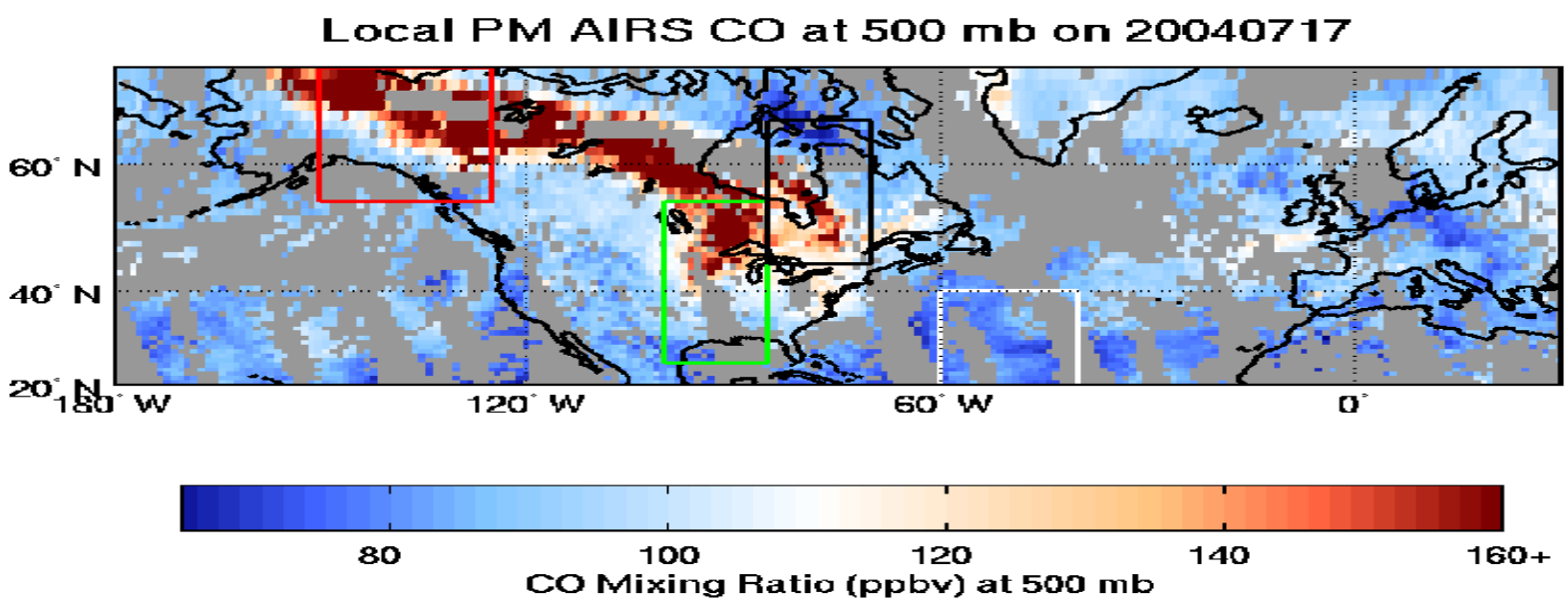

Local PM MODIS Aqua AOD on 20040716
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040716
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

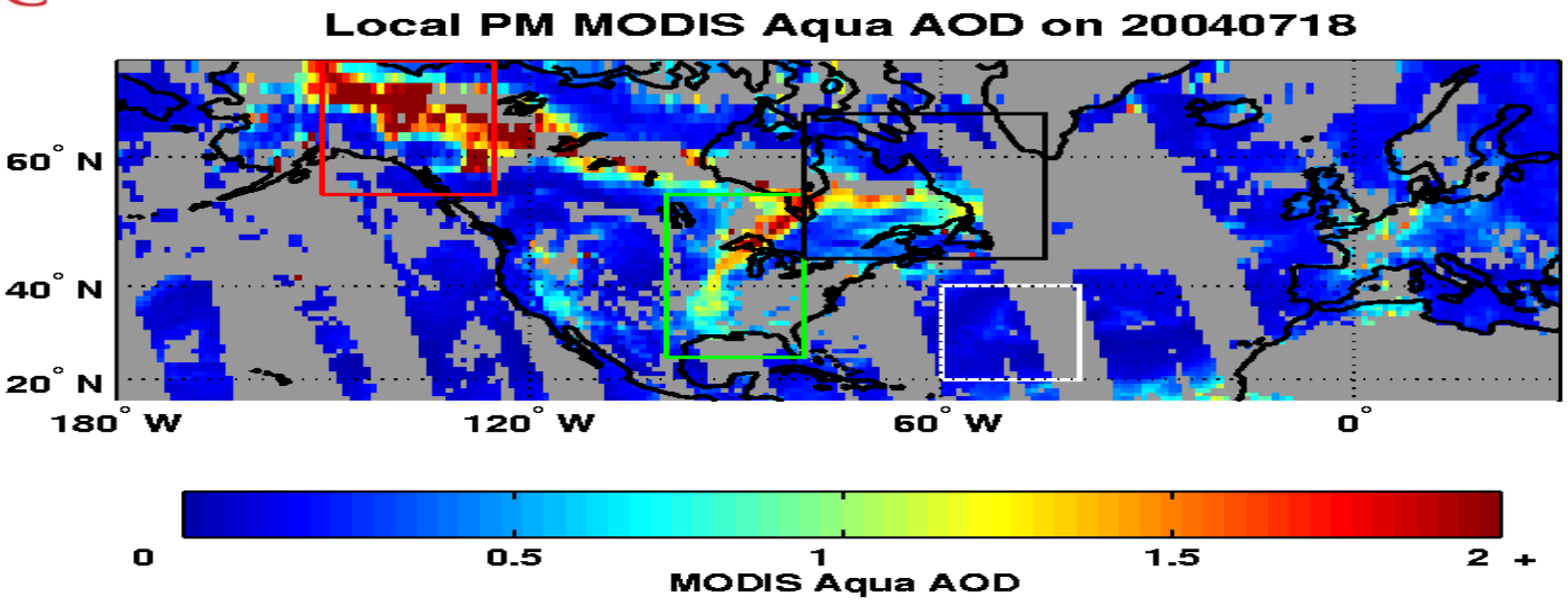
JCET

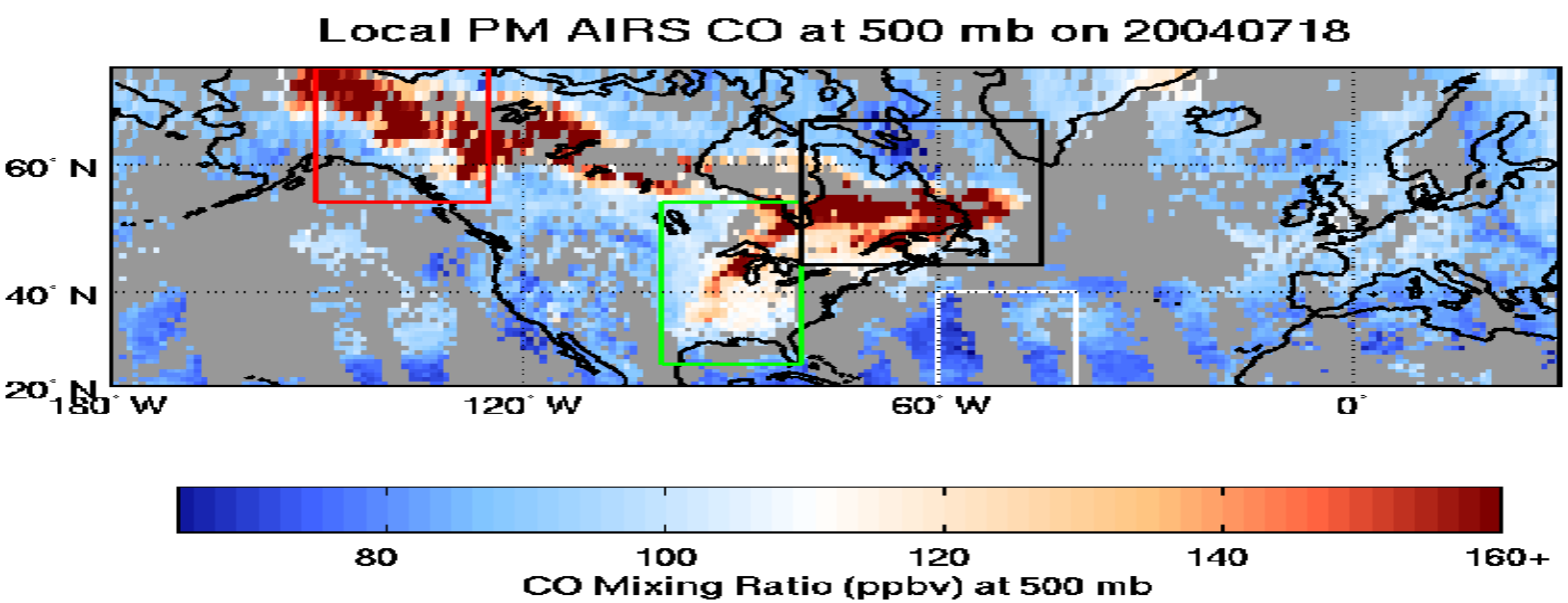

Local PM MODIS Aqua AOD on 20040717
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040717
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

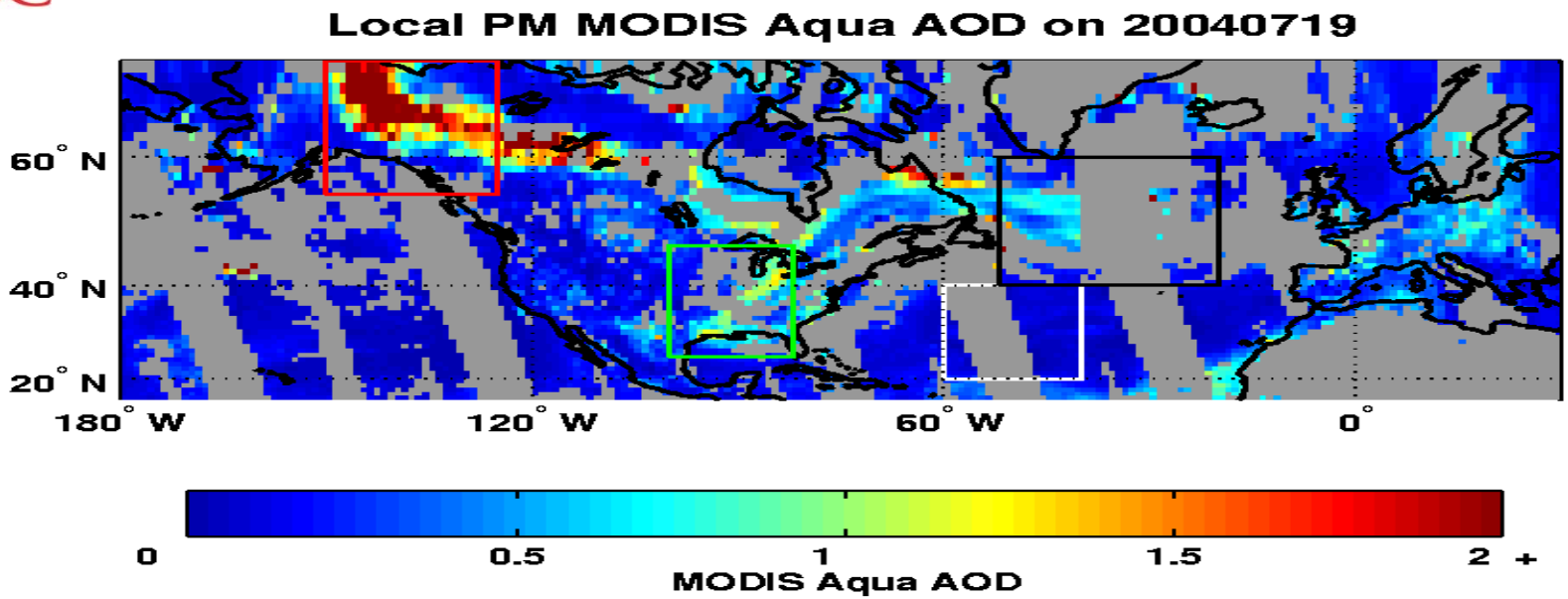
JCET

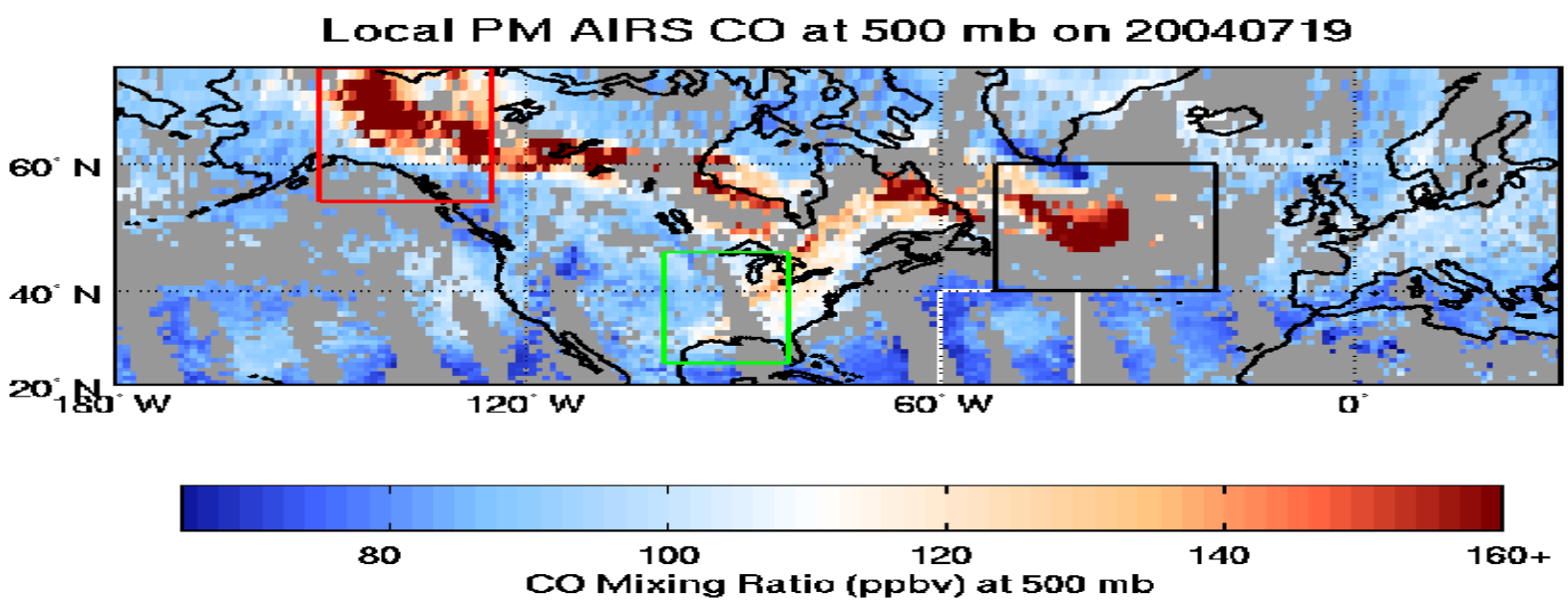

Local PM MODIS Aqua AOD on 20040718
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


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

UMBC

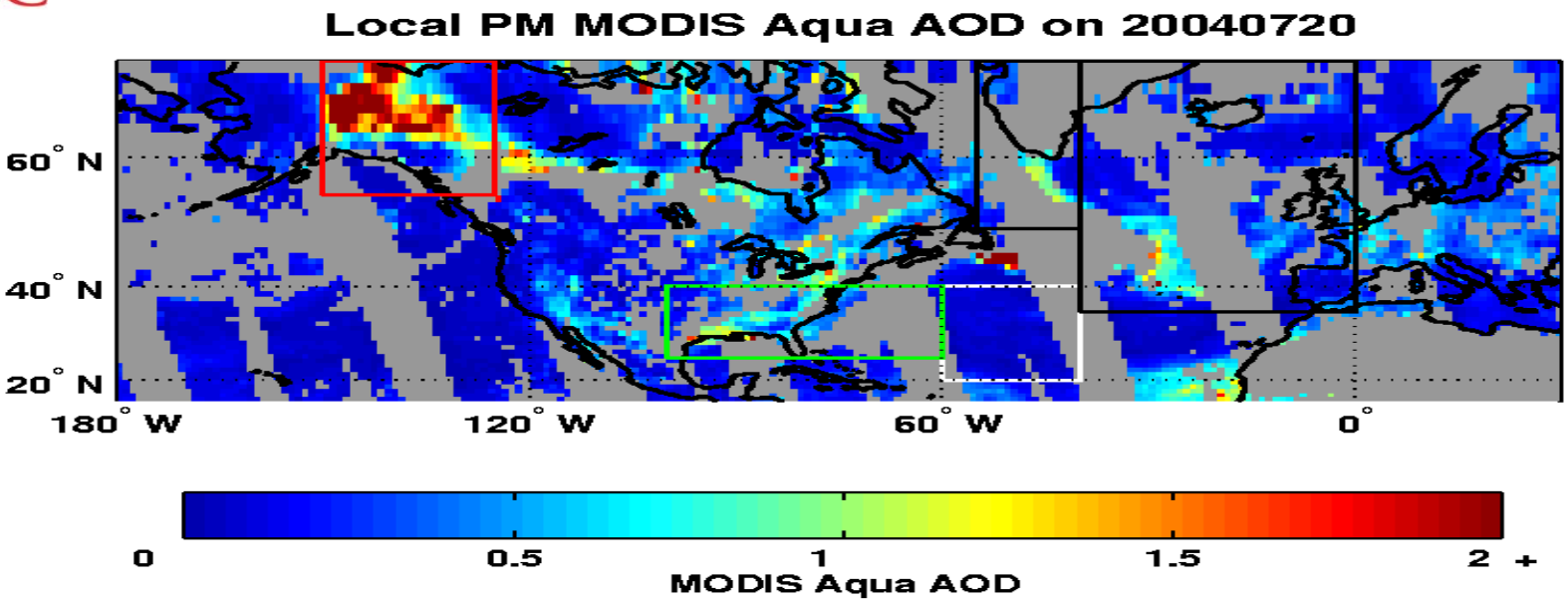
JCET

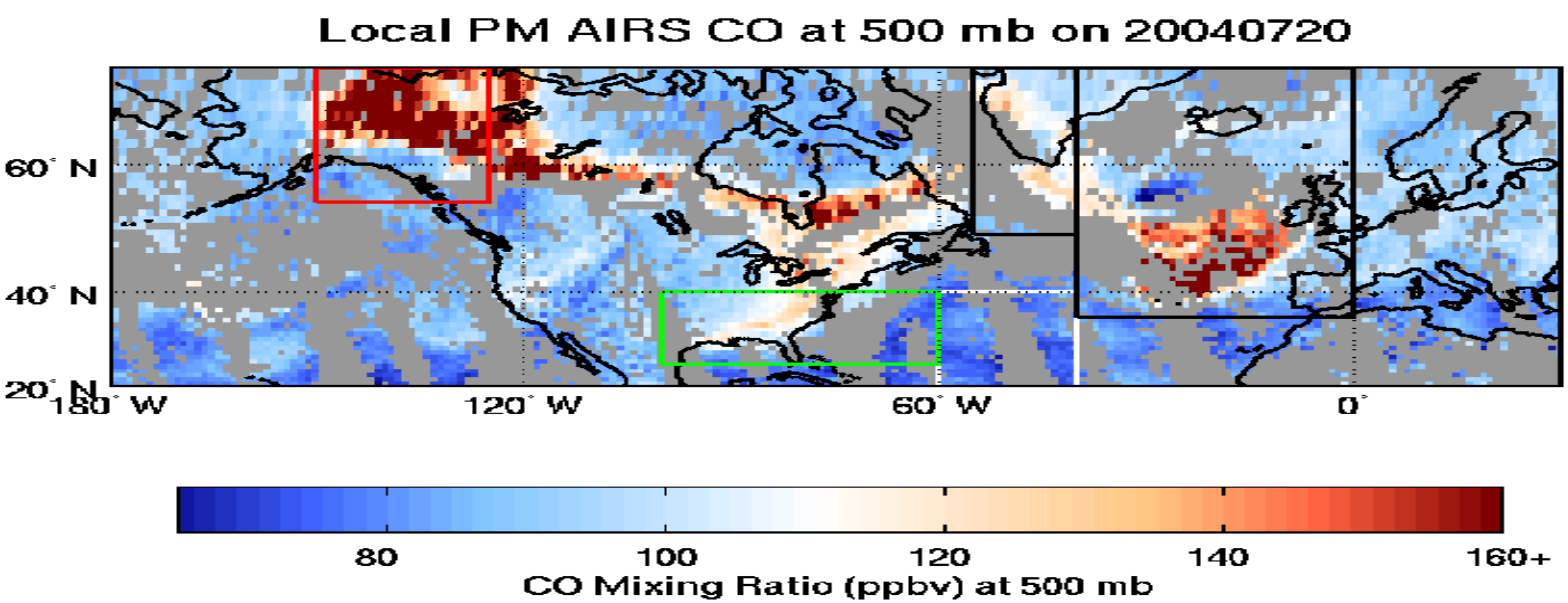

Local PM MODIS Aqua AOD on 20040719
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040719
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

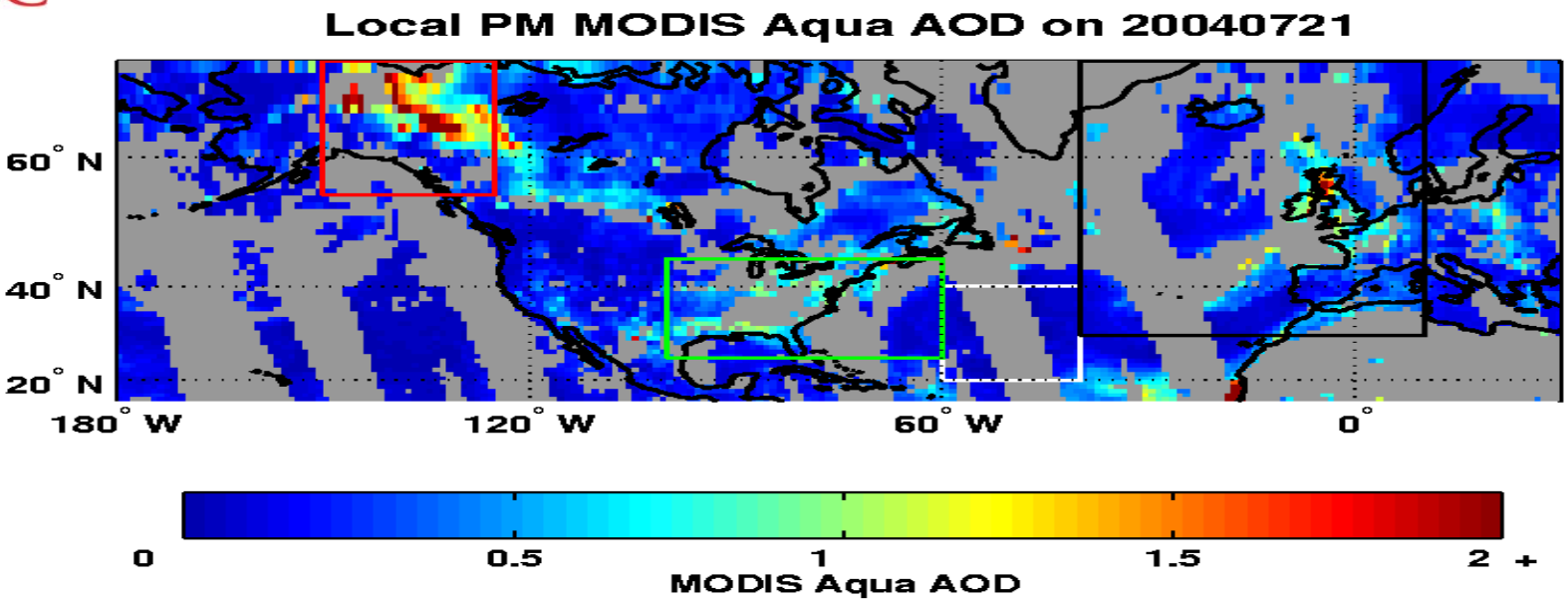
JCET

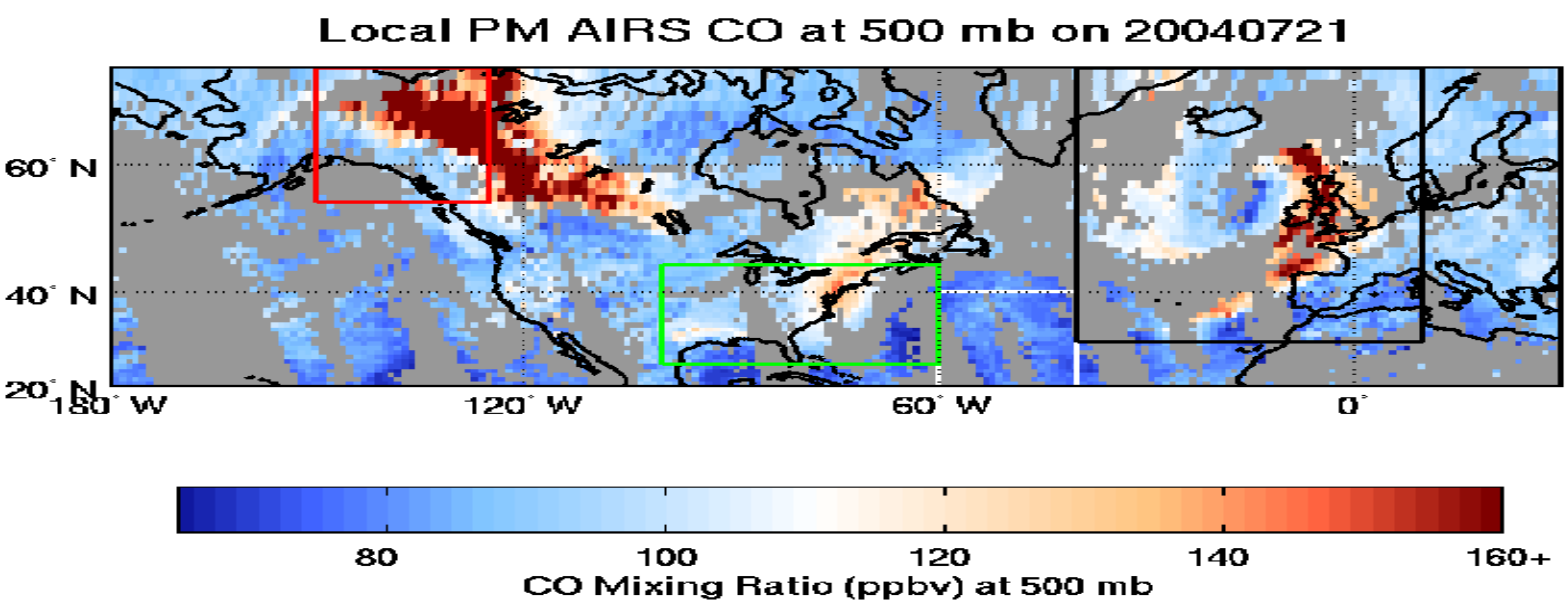

Local PM MODIS Aqua AOD on 20040720
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


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

UMBC

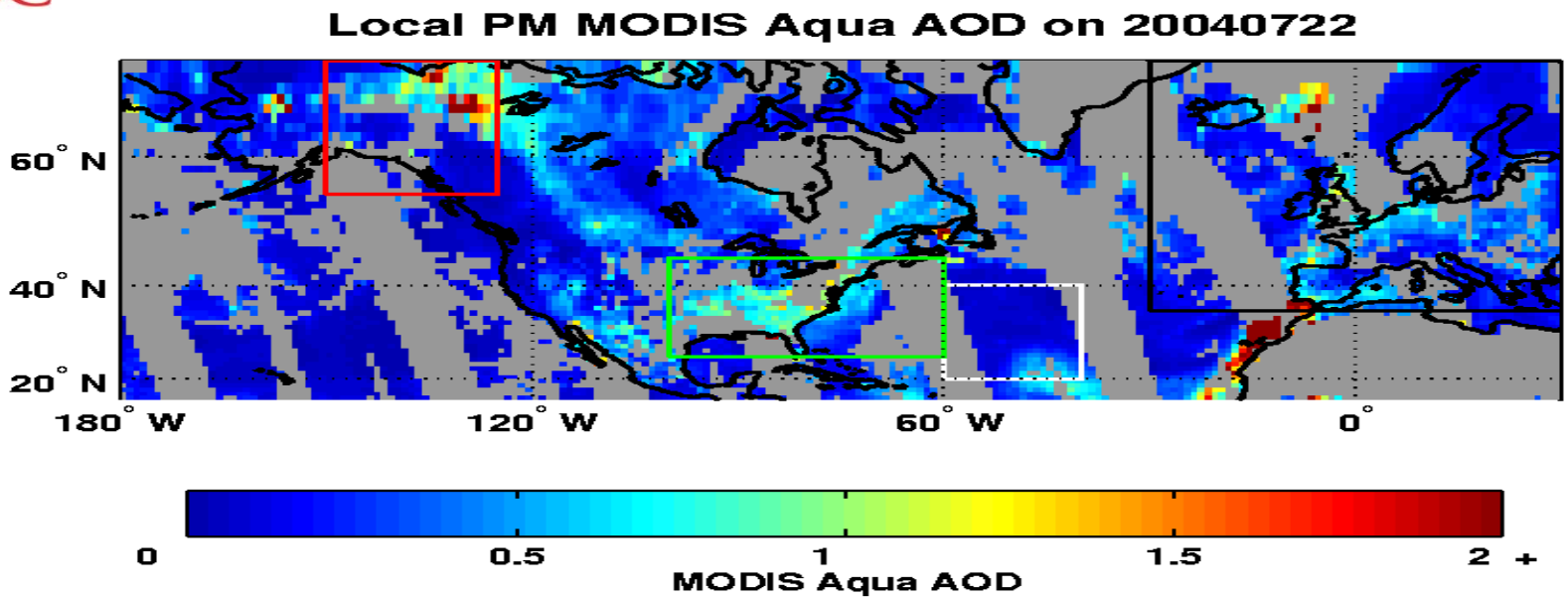
JCET

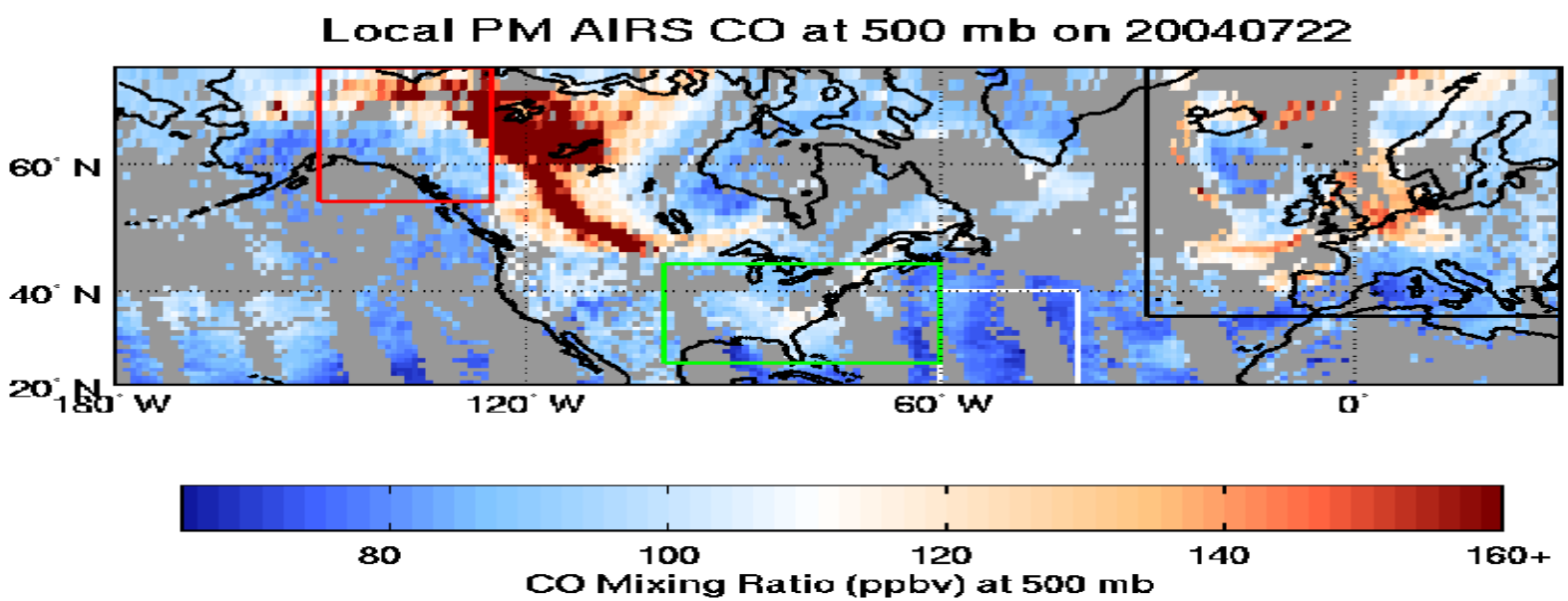

Local PM MODIS Aqua AOD on 20040721
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


Local PM AIRS CO at 500 mb on 20040721
60° N
40° N
20° N
180° W
120° W
60° W
0°
80
100
120
140
160+
CO Mixing Ratio (ppbv) at 500 mb

UMBC

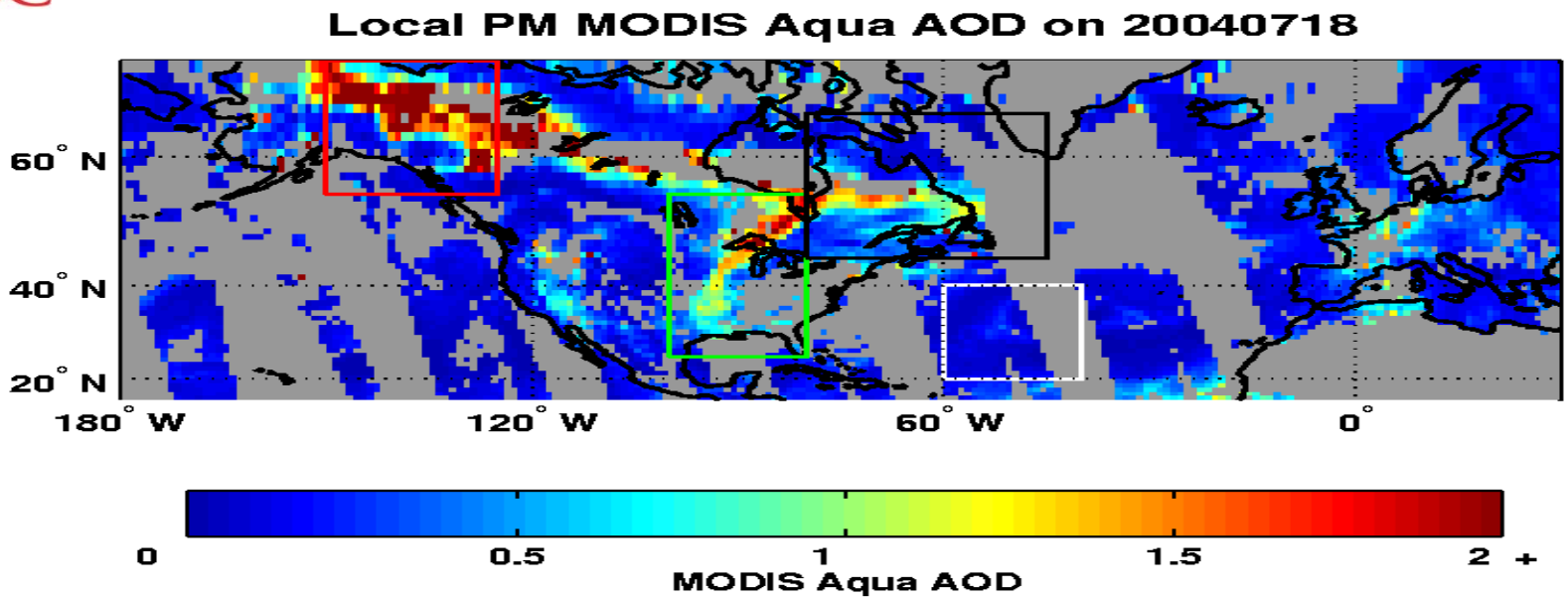
JCET

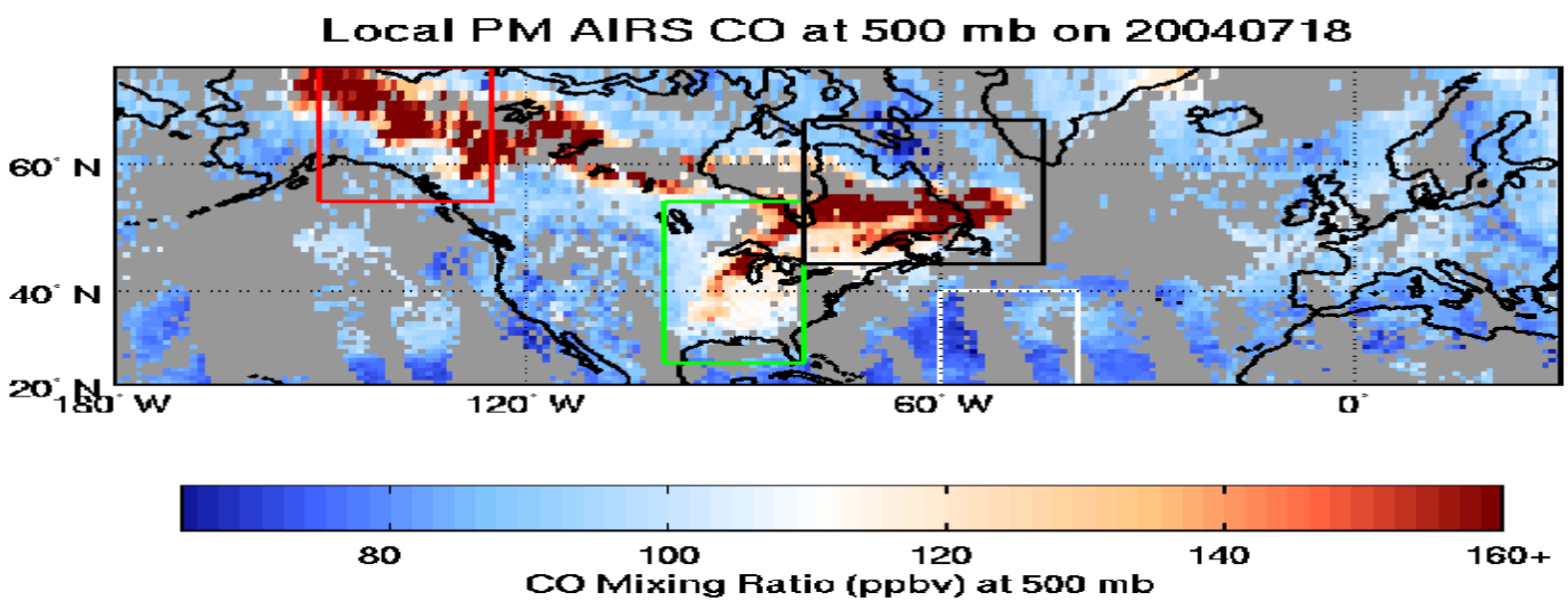

Local PM MODIS Aqua AOD on 20040722
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


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

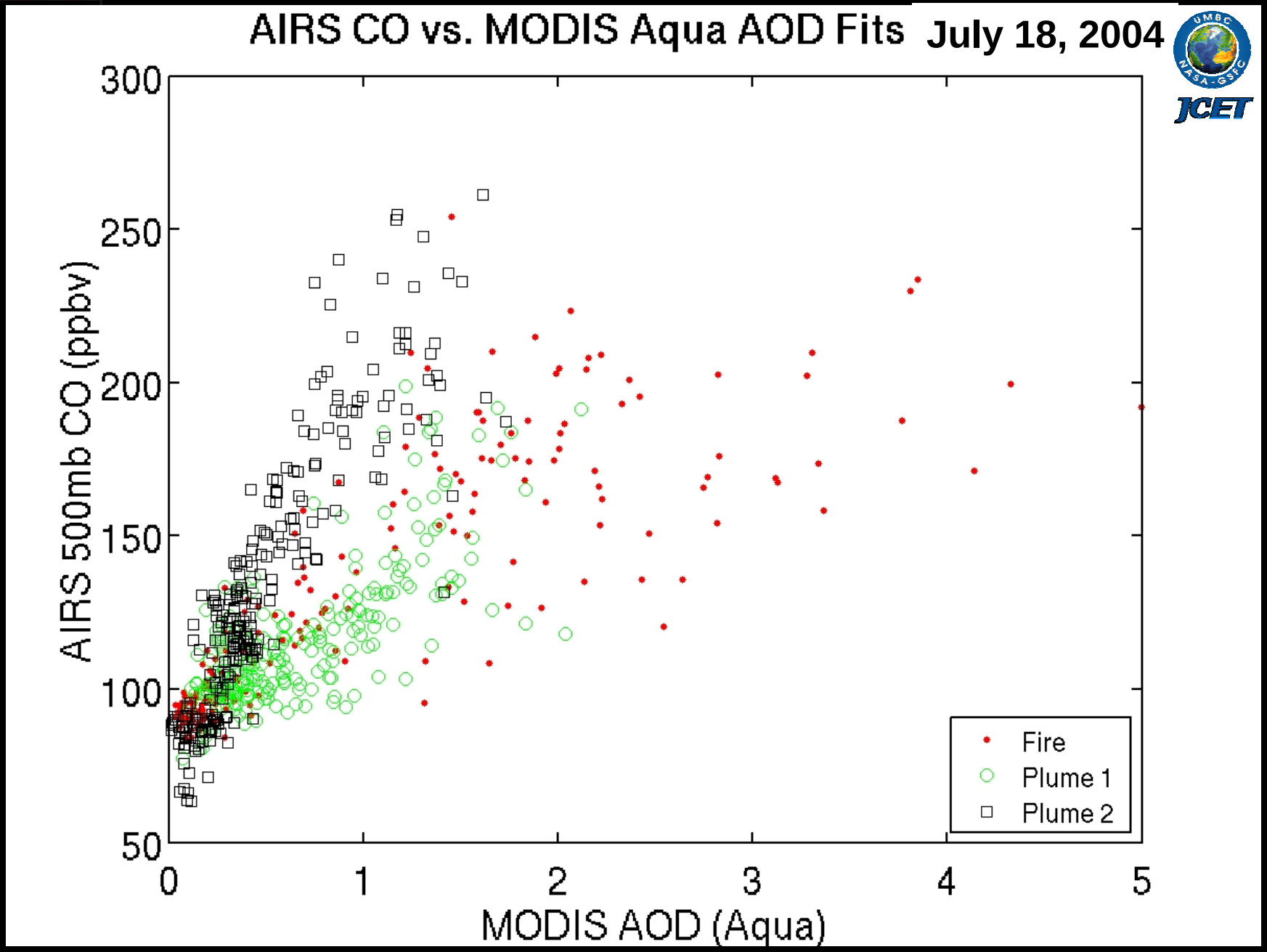
UMBC

JCET

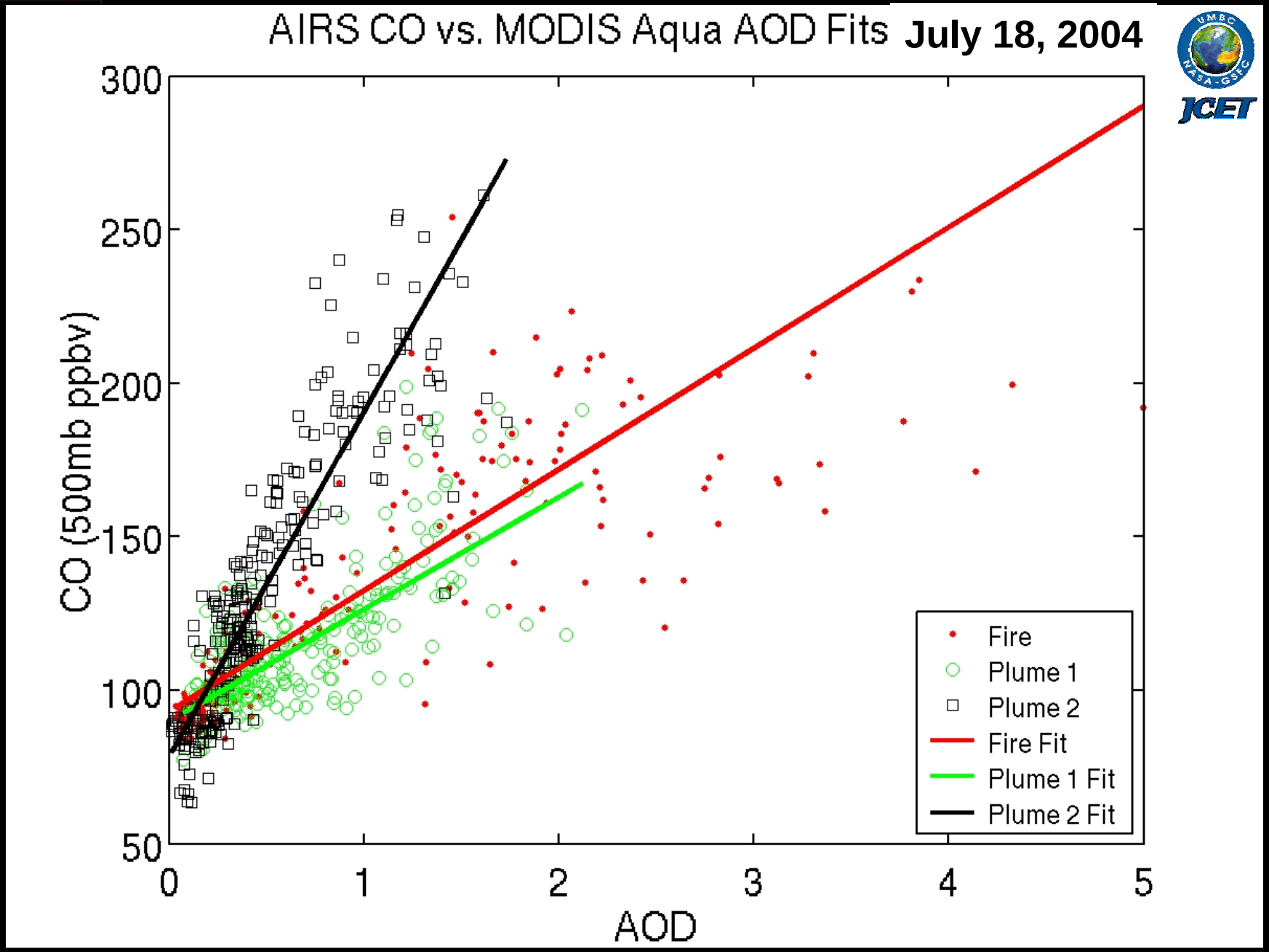

Local PM MODIS Aqua AOD on 20040718
60° N
40° N
20° N
180° W
120° W
60° W
0°
0
0.5
1
1.5
2 +
MODIS Aqua AOD


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

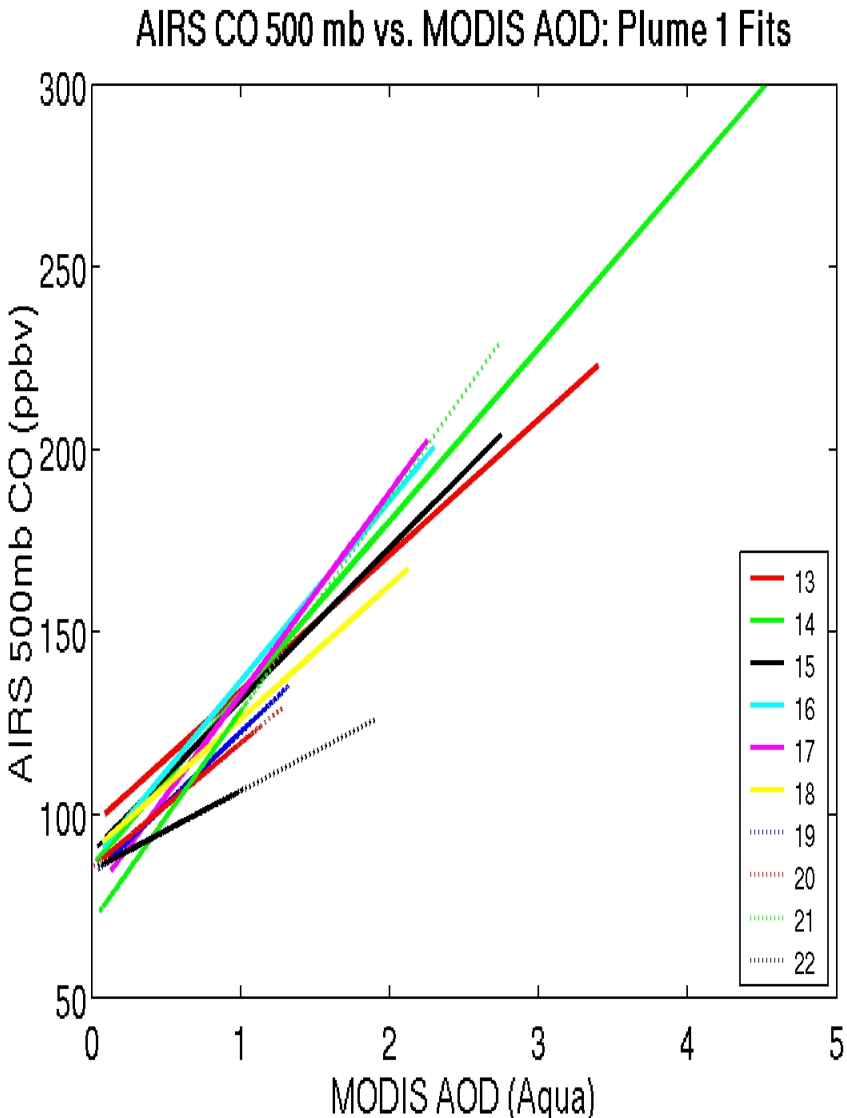
UMBC

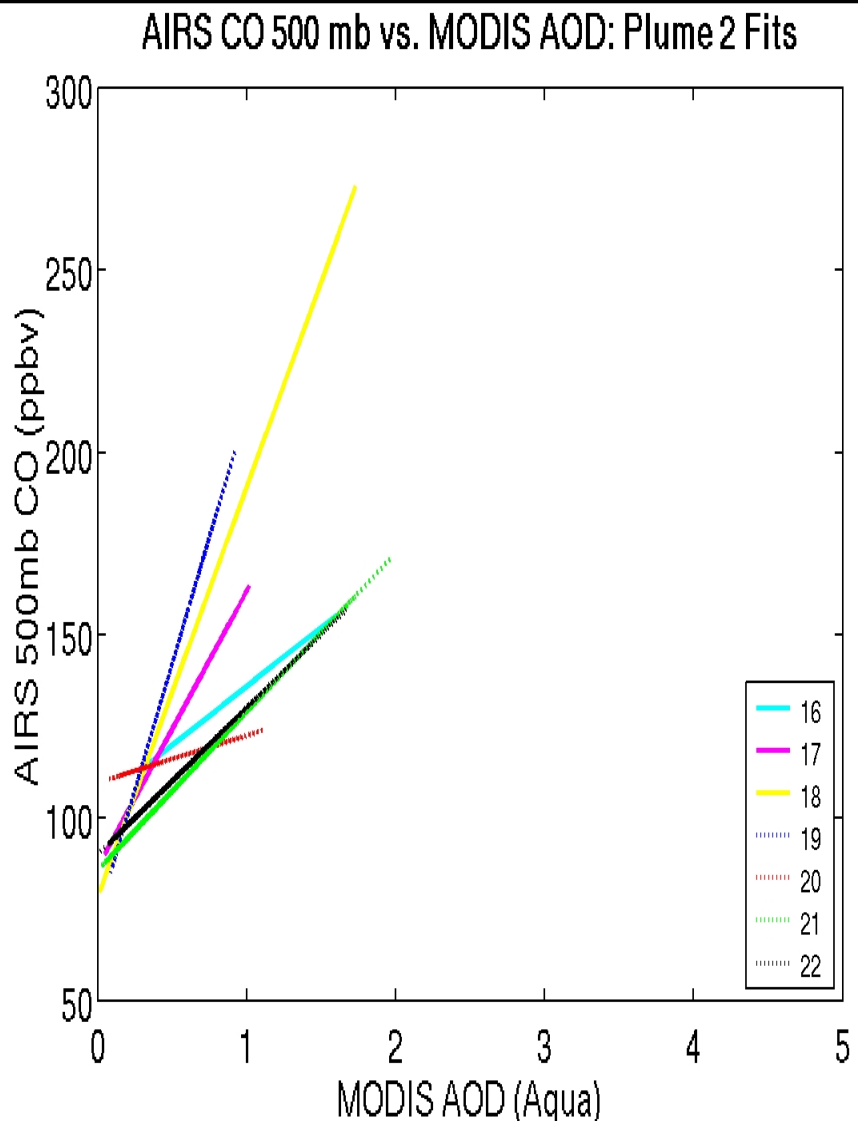

AIRS CO vs. MODIS Aqua AOD Fits
July 18, 2004
AIRS 500mb CO (ppbv)
MODIS AOD (Aqua)
300
250
200
150
100
50
0
1
2
3
4
5
Fire
Plume 1
Plume 2

UMBC

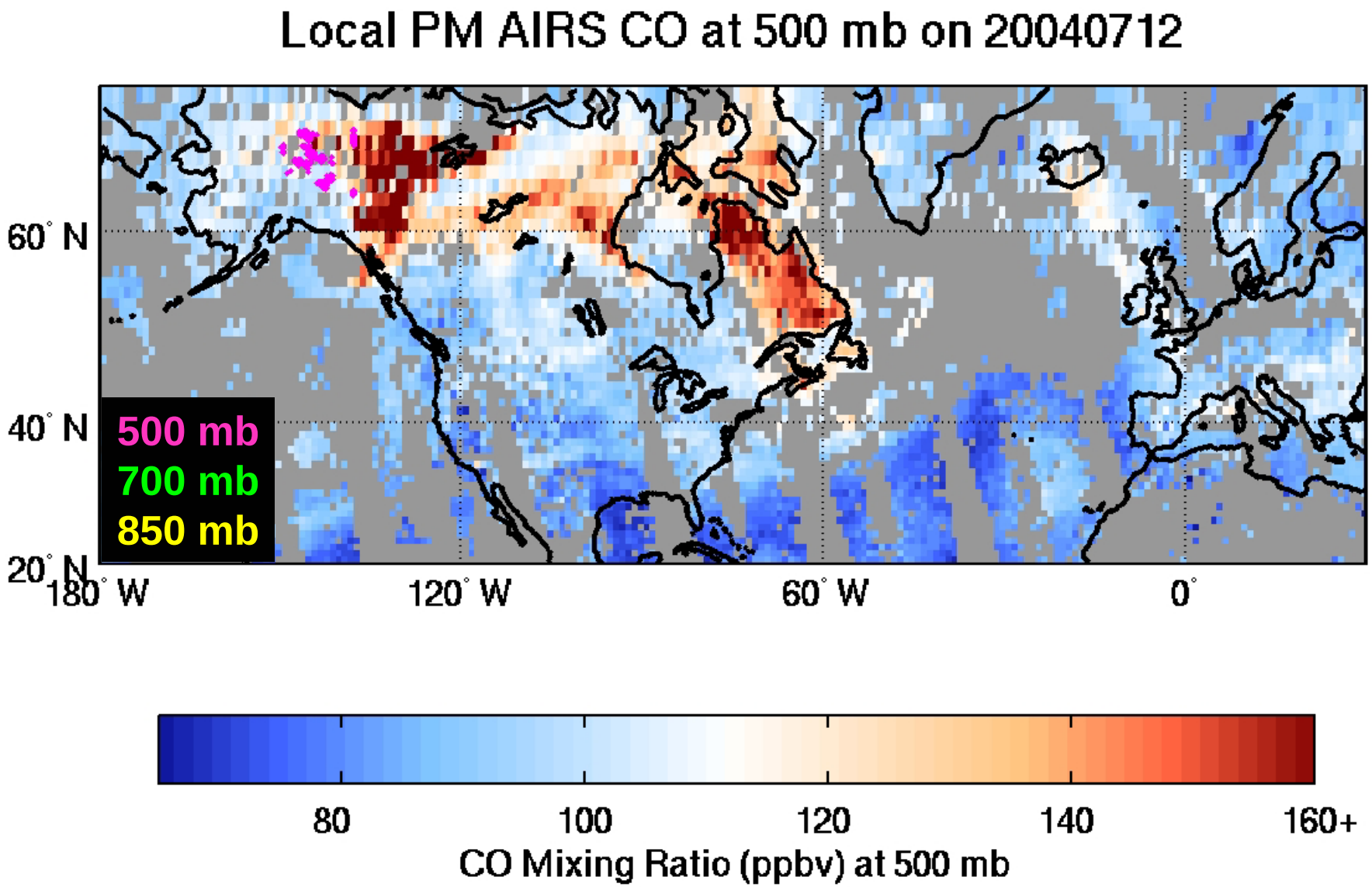

AIRS CO vs. MODIS Aqua AOD Fits
July 18, 2004
CO (500mb ppbv)
AOD
300
250
200
150
100
50
0
1
2
3
4
5
Fire
Plume 1
Plume 2
Fire Fit
Plume 1 Fit
Plume 2 Fit

AIRS CO vs. MODIS AOD: Plume Evolution

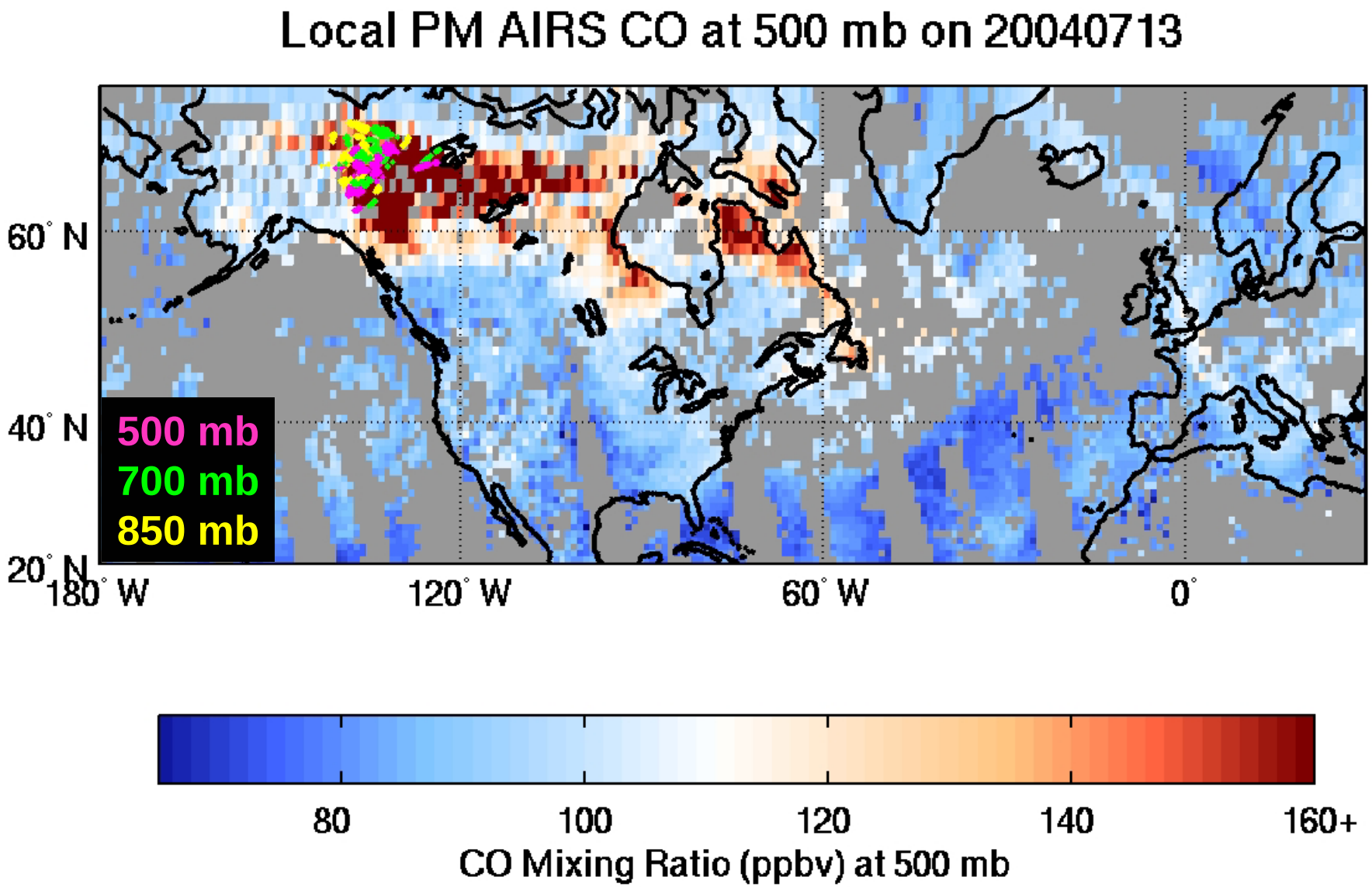




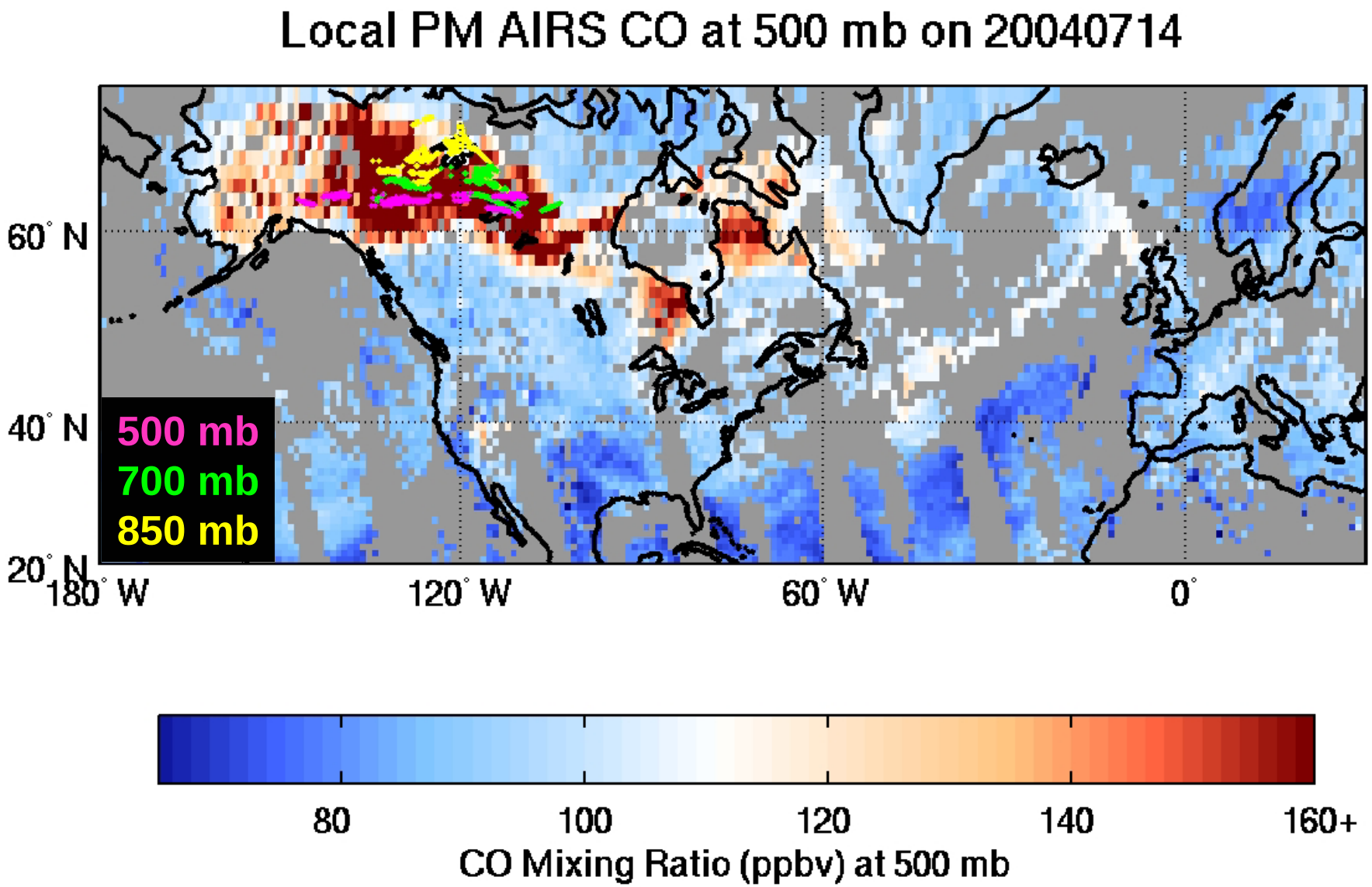
AIRS CO and Trajectories



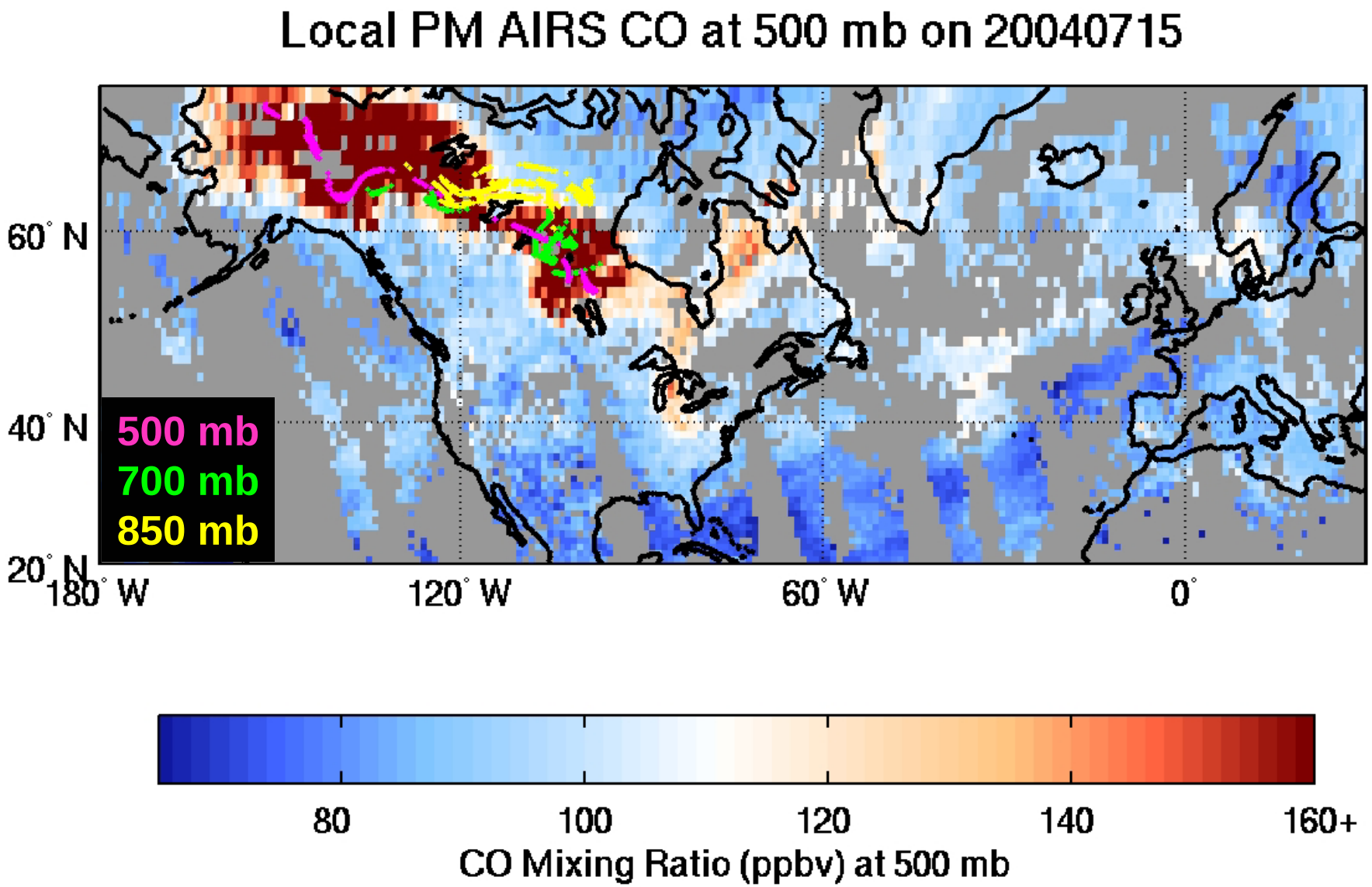
AIRS CO and Trajectories



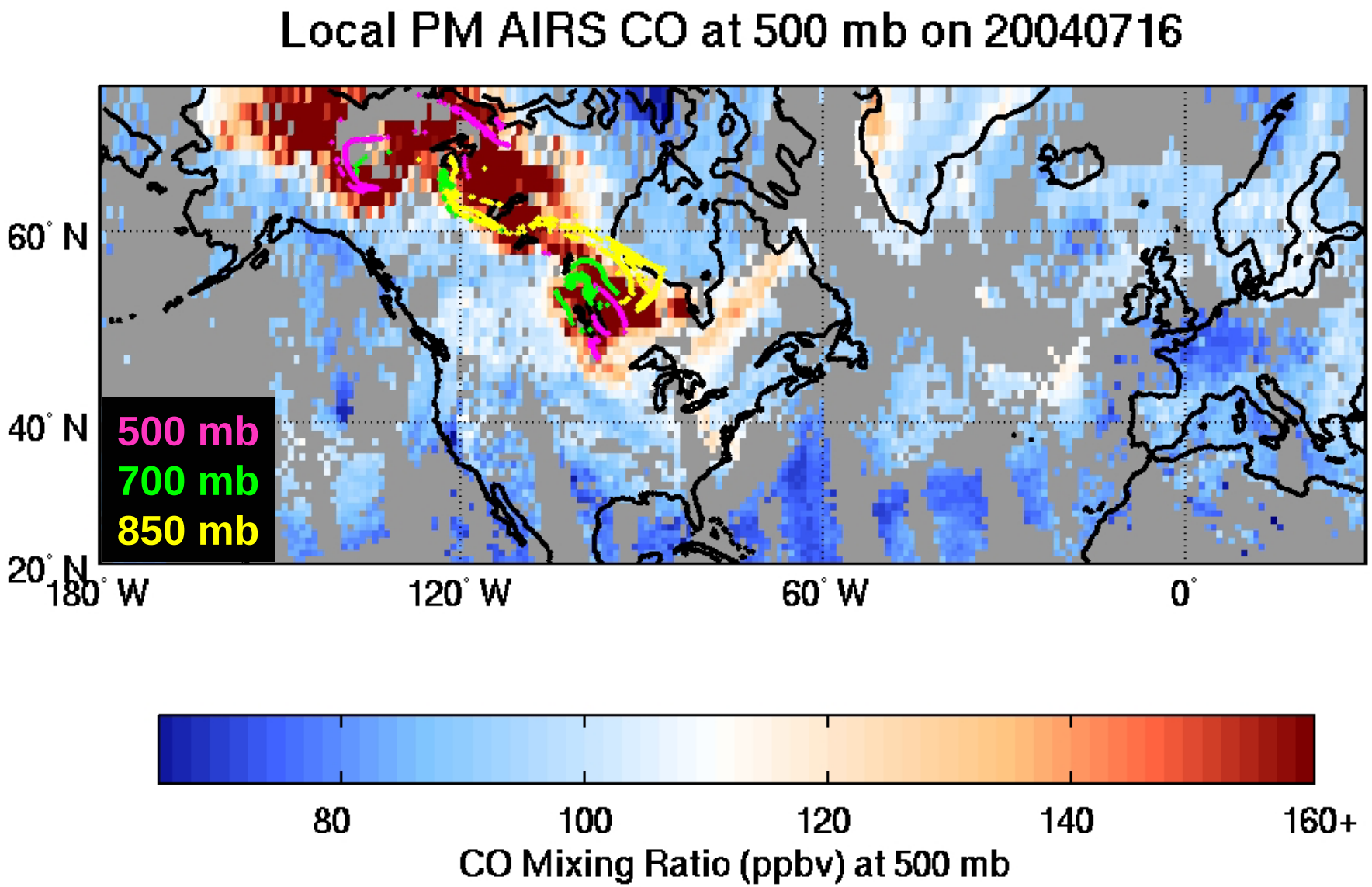
AIRS CO and Trajectories



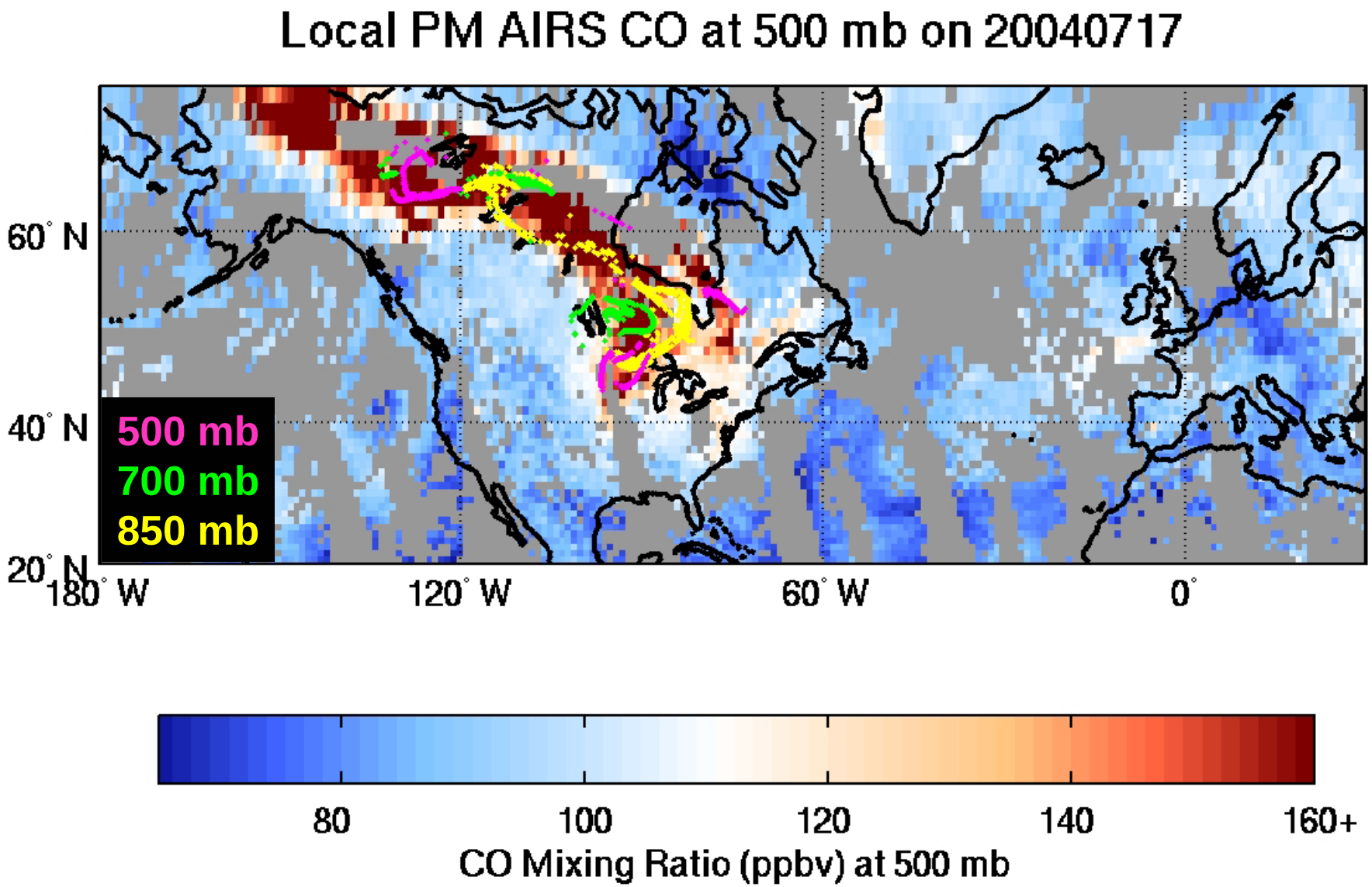
AIRS CO and Trajectories



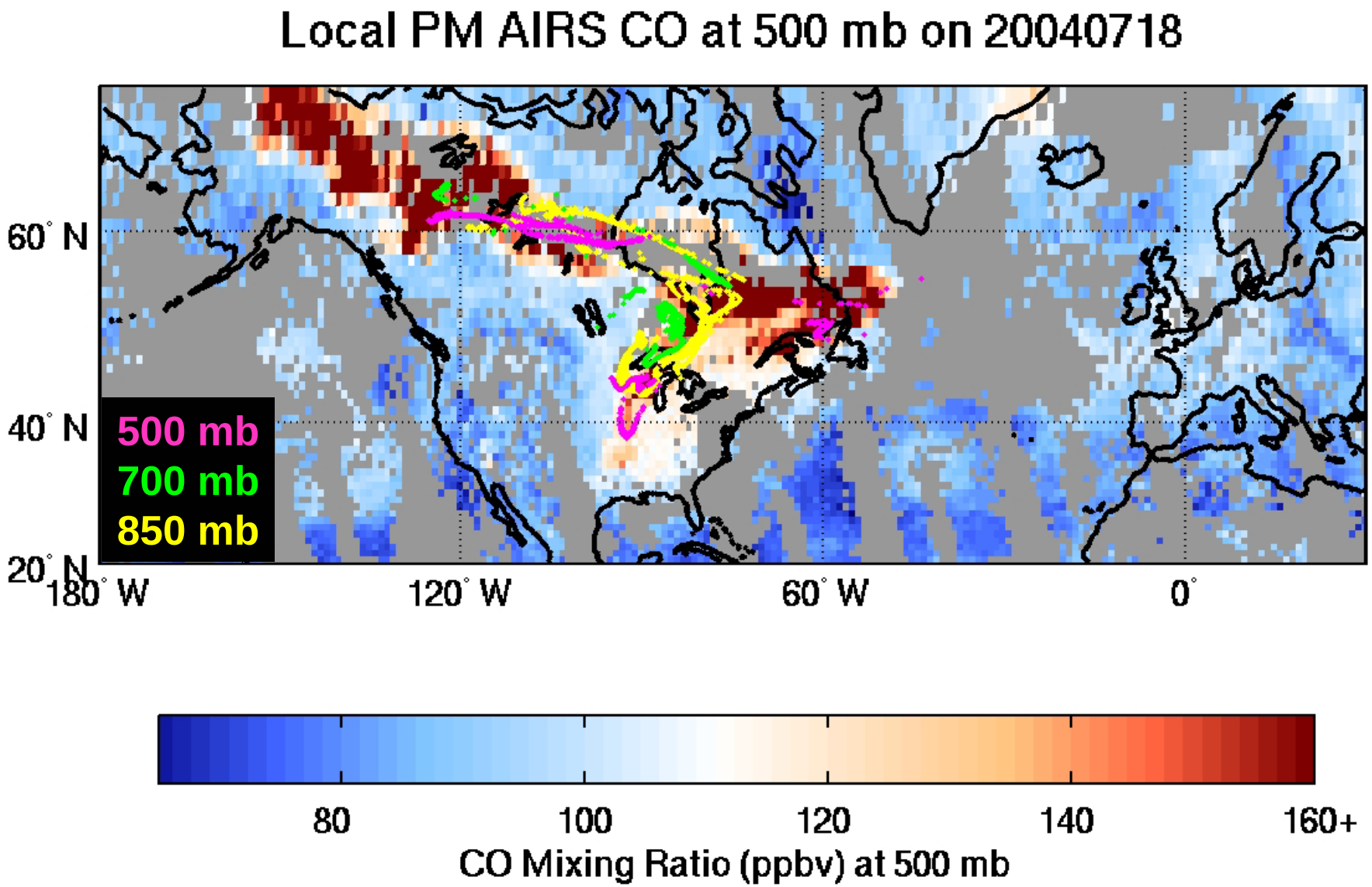
AIRS CO and Trajectories



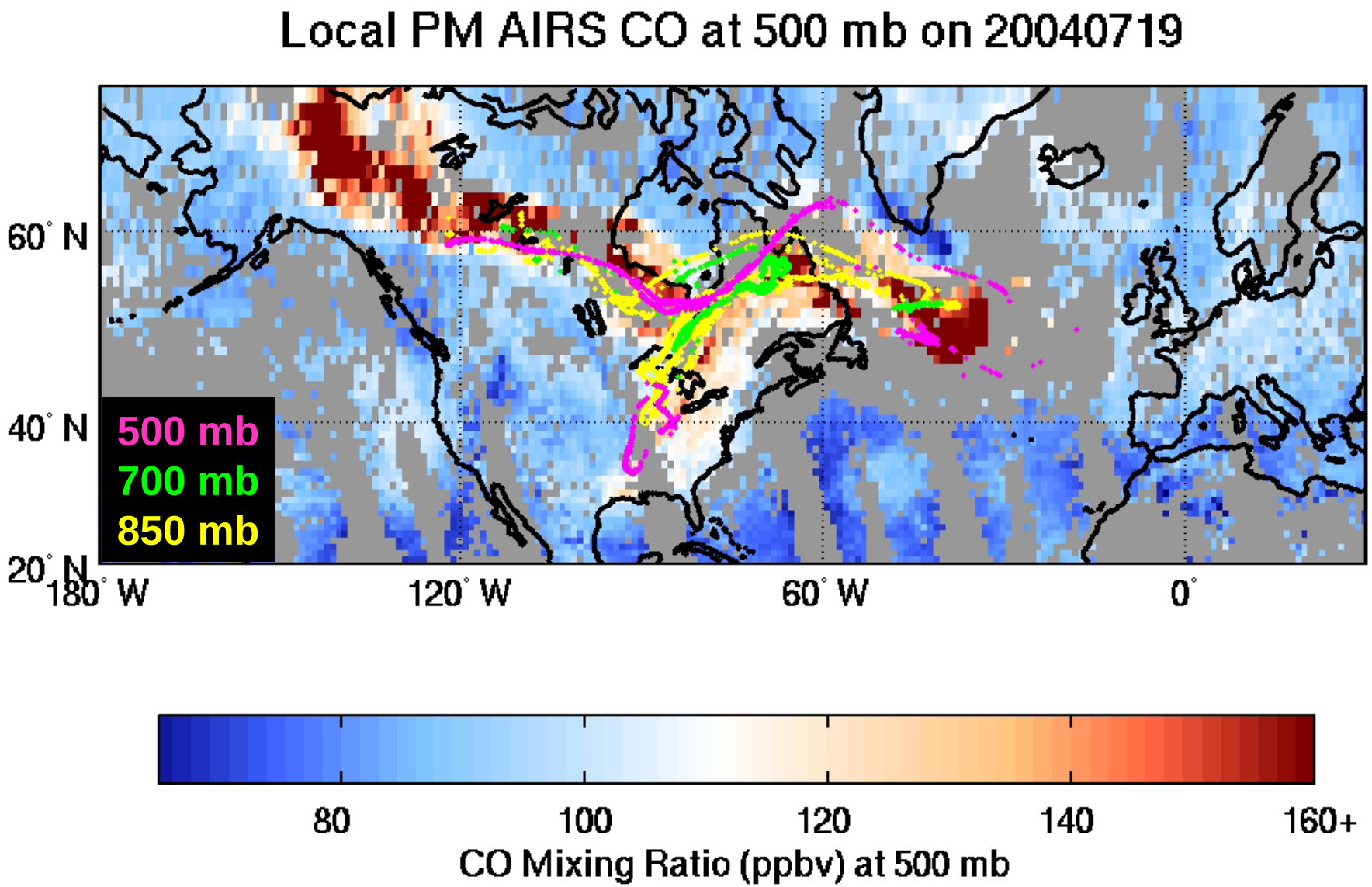
AIRS CO and Trajectories



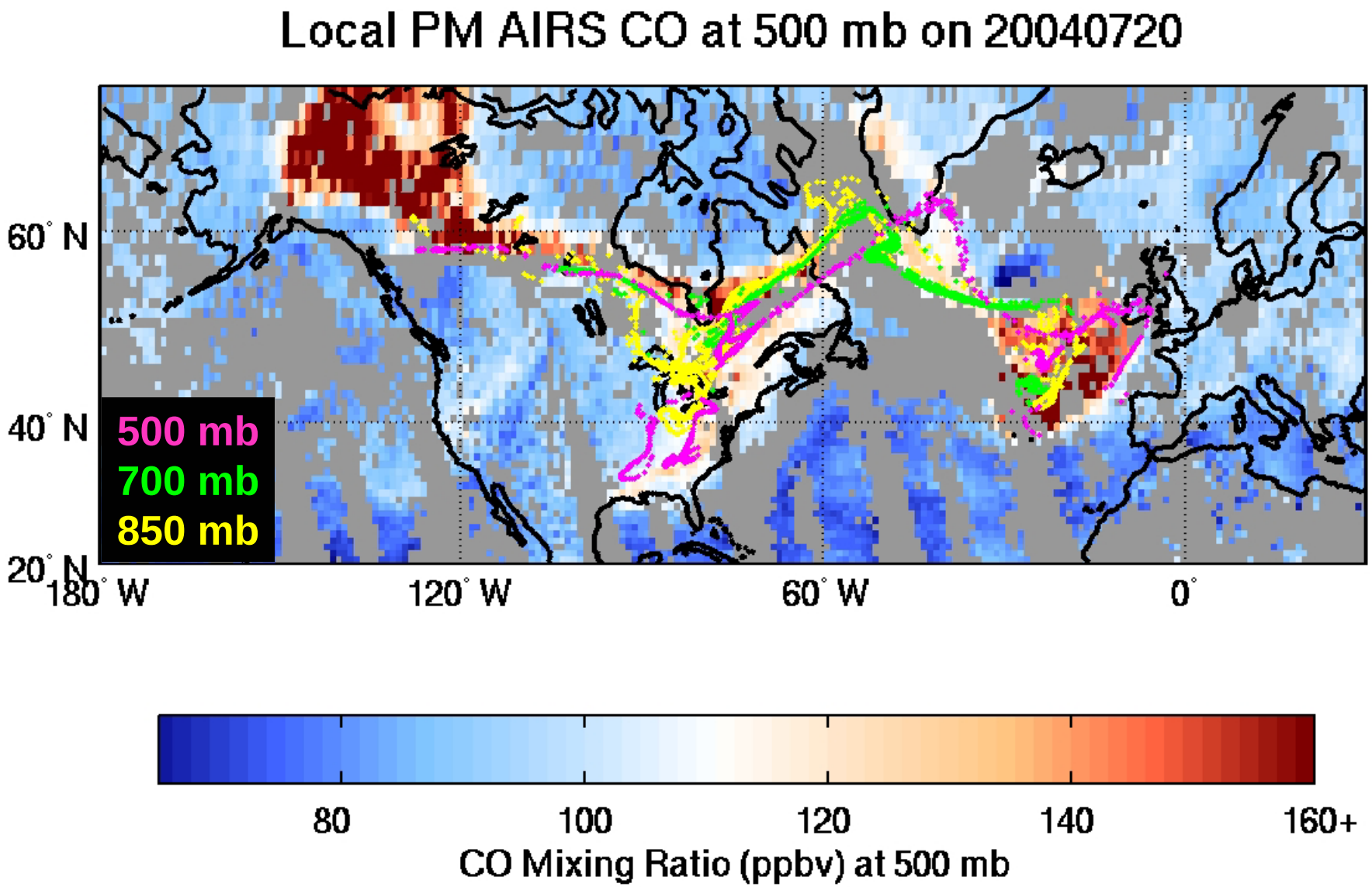
AIRS CO and Trajectories



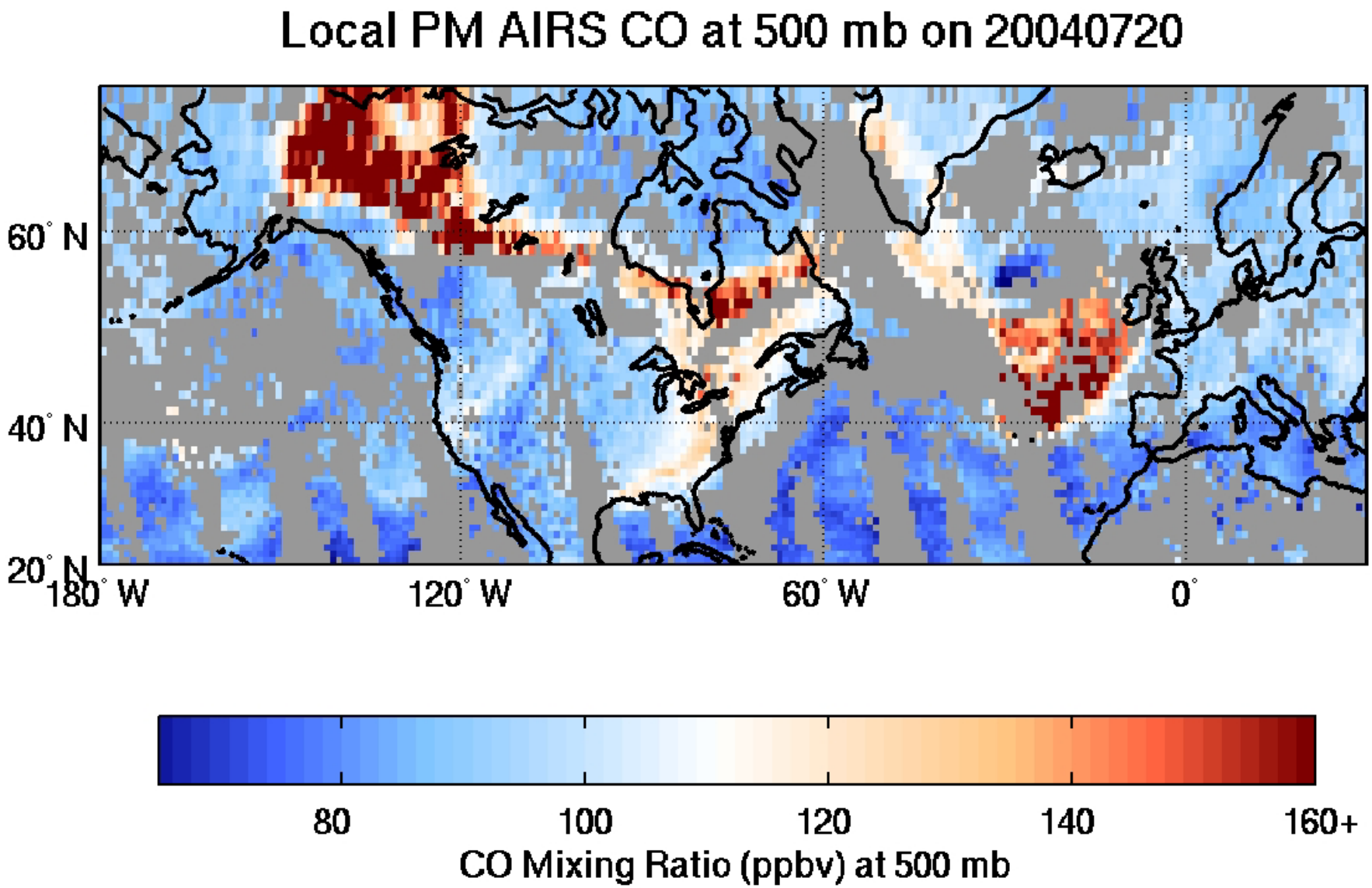
AIRS CO and Trajectories



AIRS CO and Trajectories



AIRS CO


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

OUTLINE

- Reprocessed data with CO verticality available May 1
- Improved CO available by late summer
- AIRS CO – convolved DACOM $\approx$ -9%
- AIRS CO v MODIS AOD:
  - bimodal correlation due to plume height?
- AIRS sometimes sees CO in the lower troposphere
- Papers: AIRS v MODIS, AIRS validation, AIRS v MOPITT, AIRS in models, more??