CO from AIRS during INTEX-A

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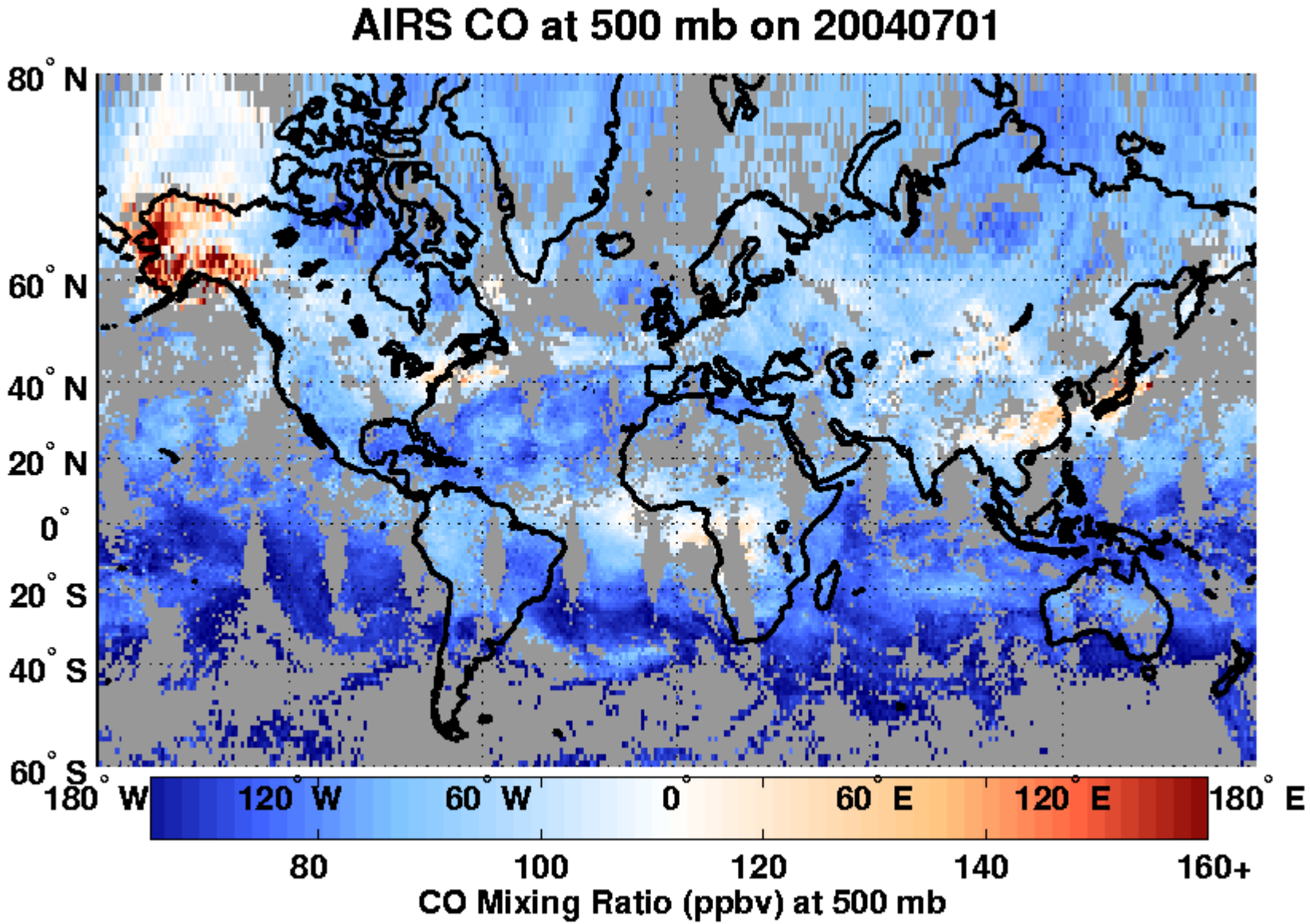
Thanks to the entire AIRS Team!

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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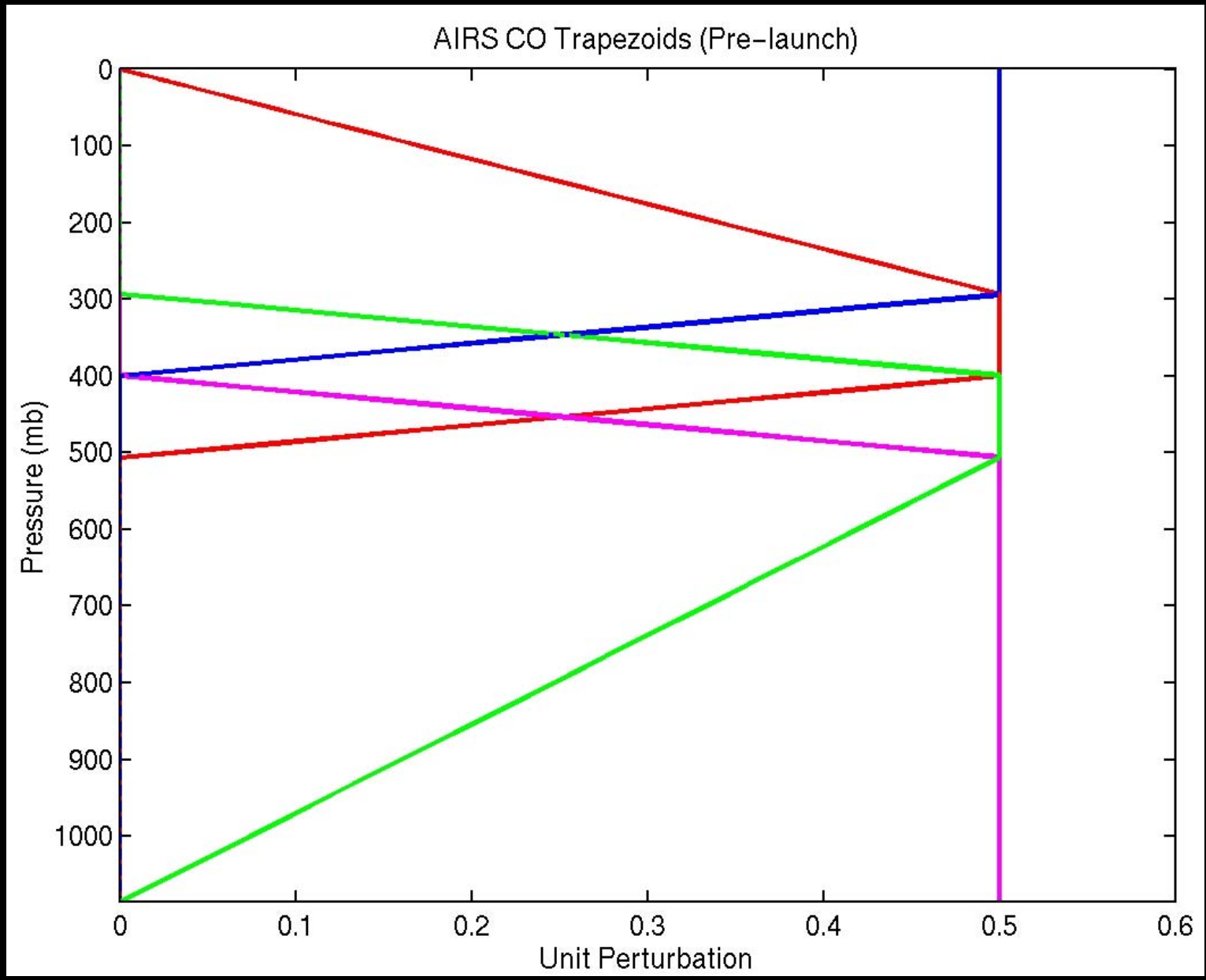
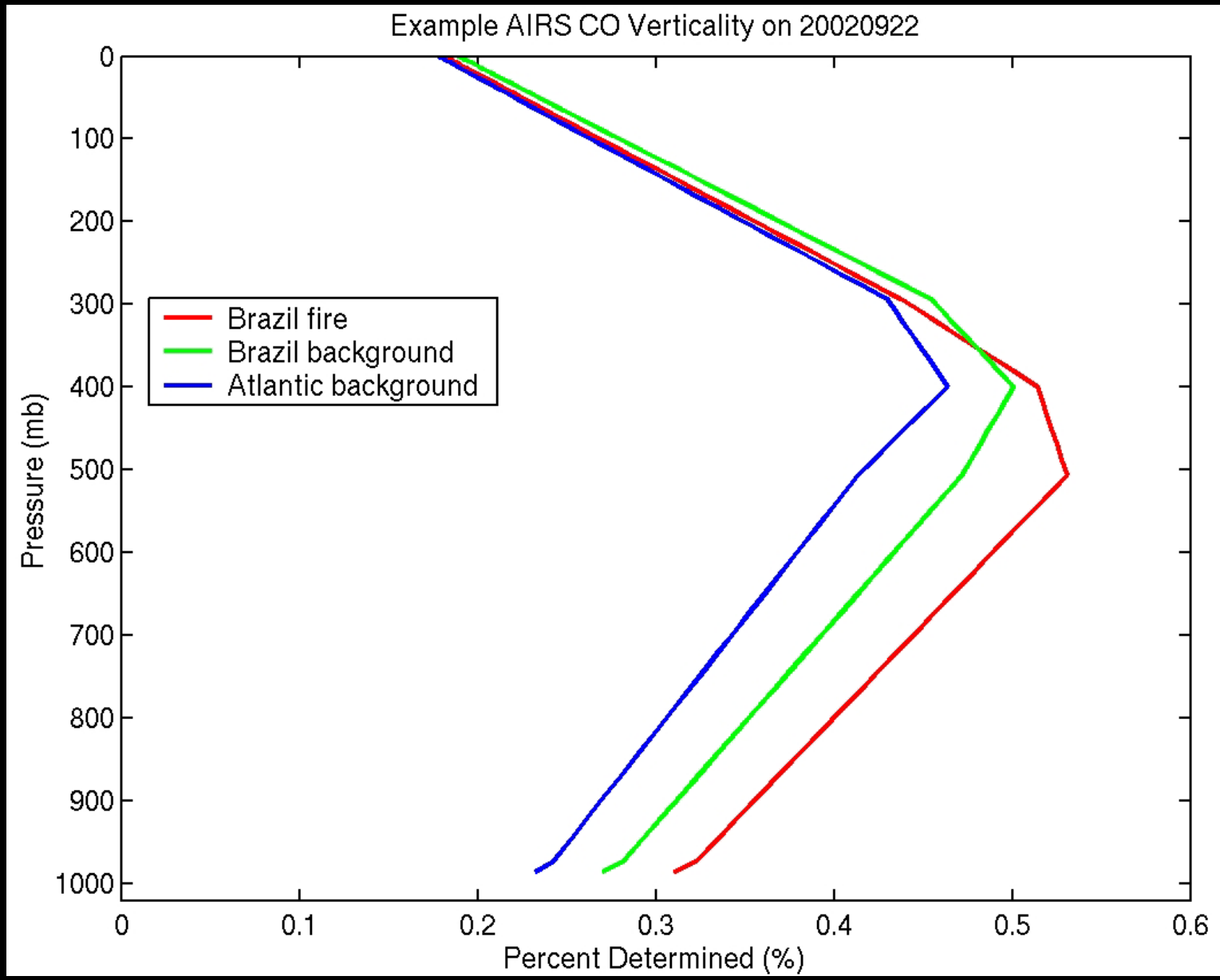
Outline

- 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



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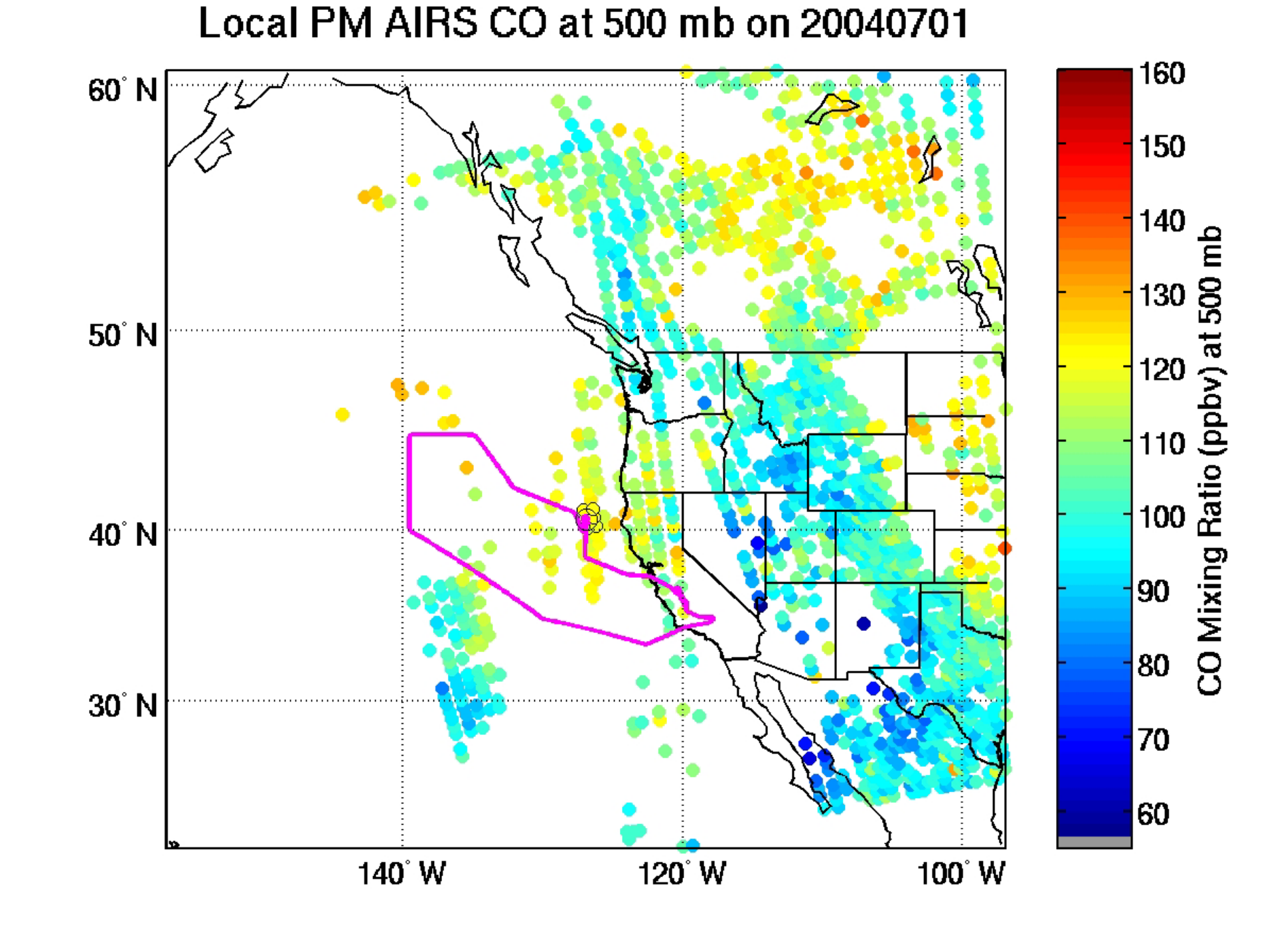
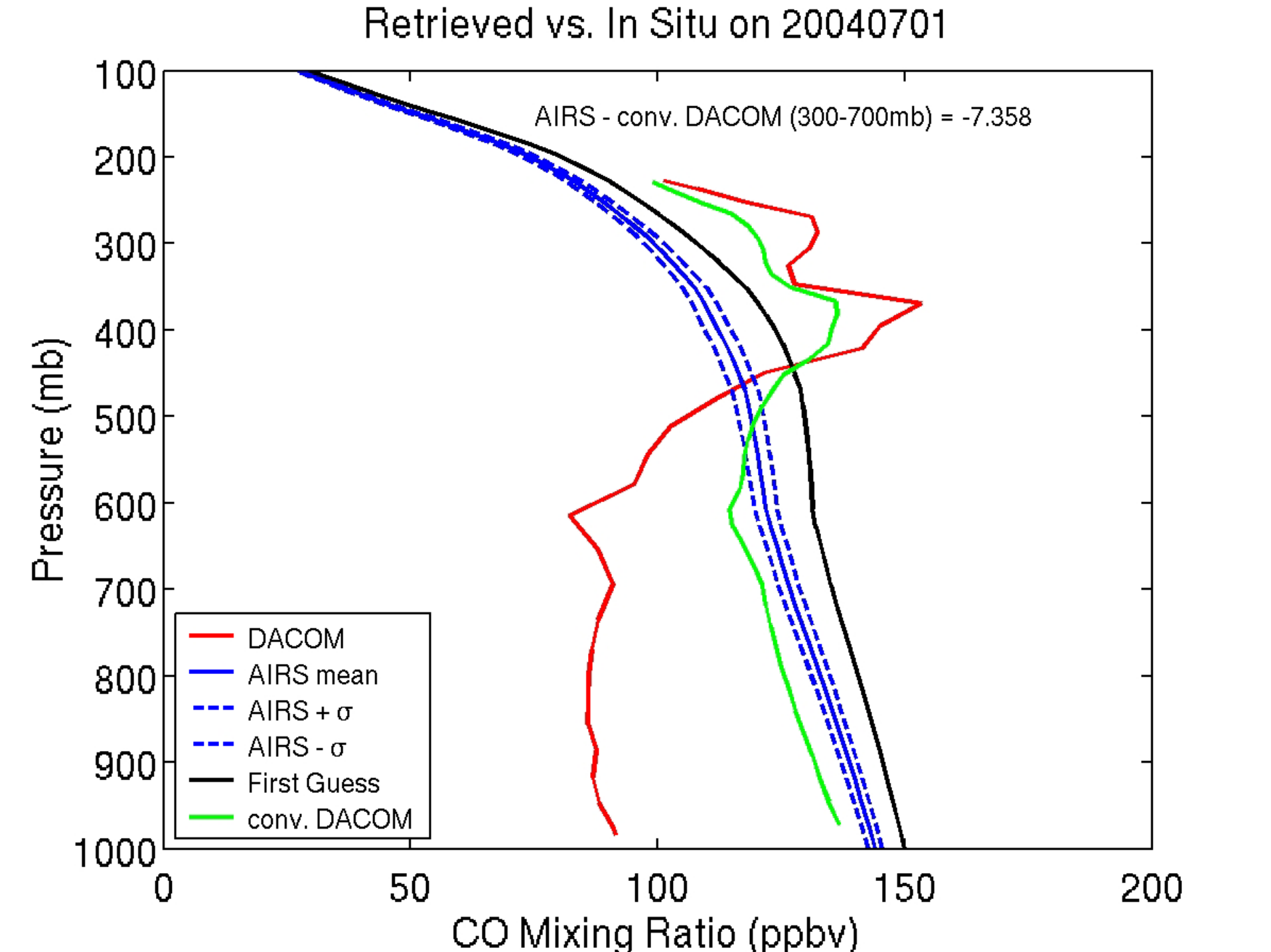
INTEX-A Profile Summary

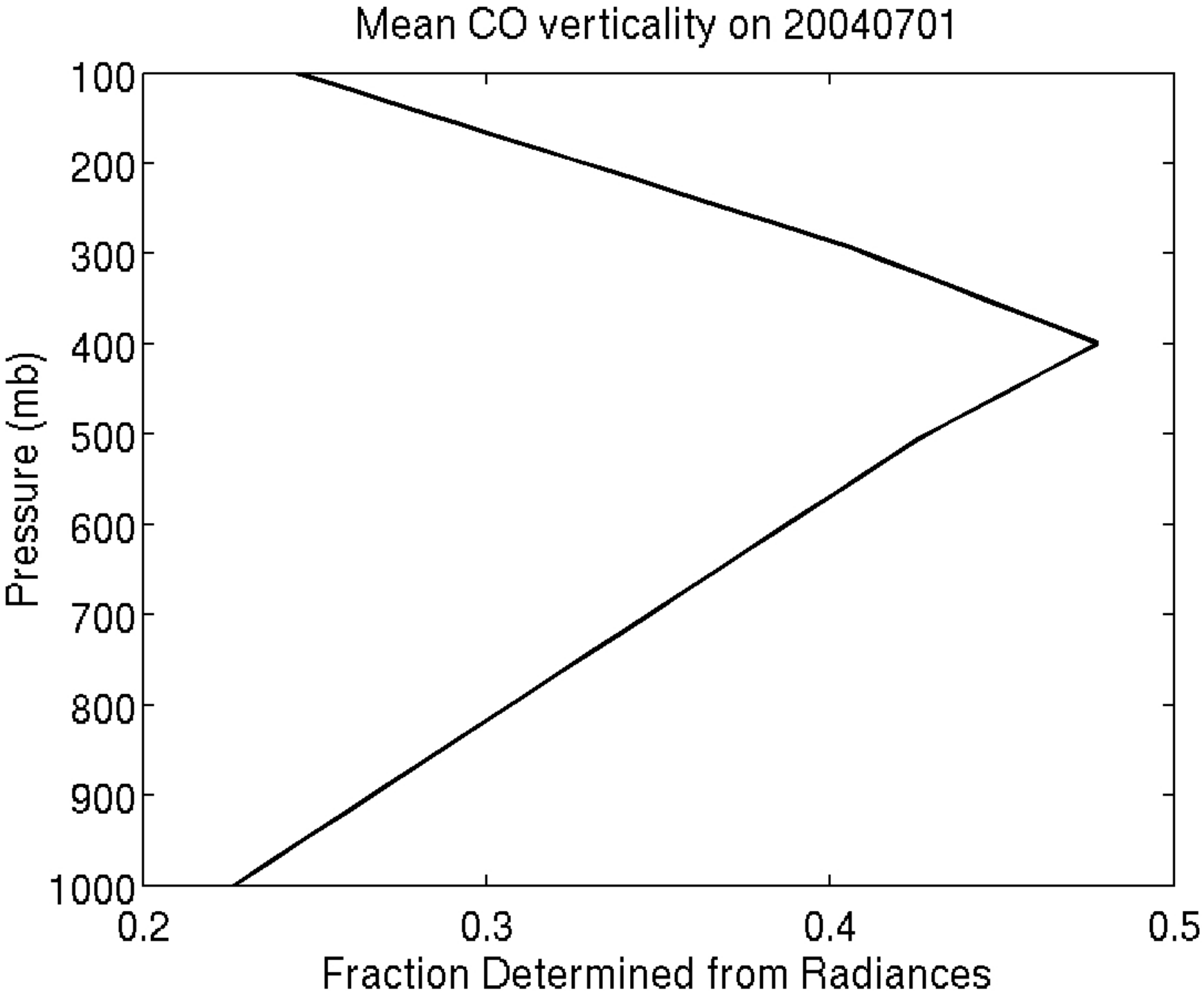
JCET

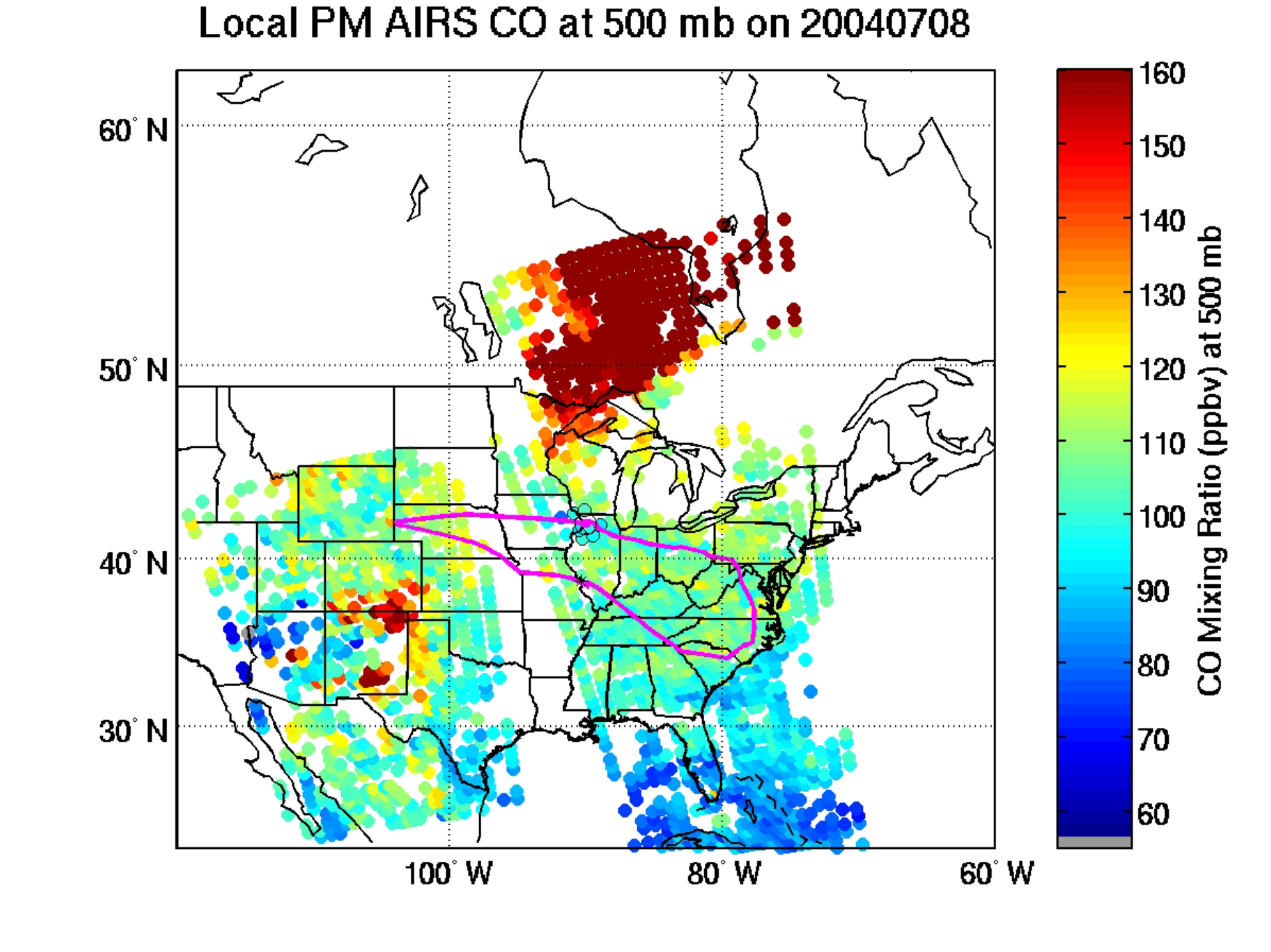
DATE	LOCATION	TIMING	TIME (AIRS)	DATA STATUS	AIRS-DACOM (%)
7/1	Pacific	Coincident	21.81 UTC	Good	-6.4
7/6			18.85 UTC	No AIRS < 100 km	
7/8	Illinois	1 hour	18.63 UTC	Good	-15.4
7/10	South Carolina	Coincident	18.39 UTC	Good	-12.5
7/12	Oklahoma	Coincident	19.83 UTC	Good	-13.3
7/15	Wisconsin	1 hour	18.75 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	

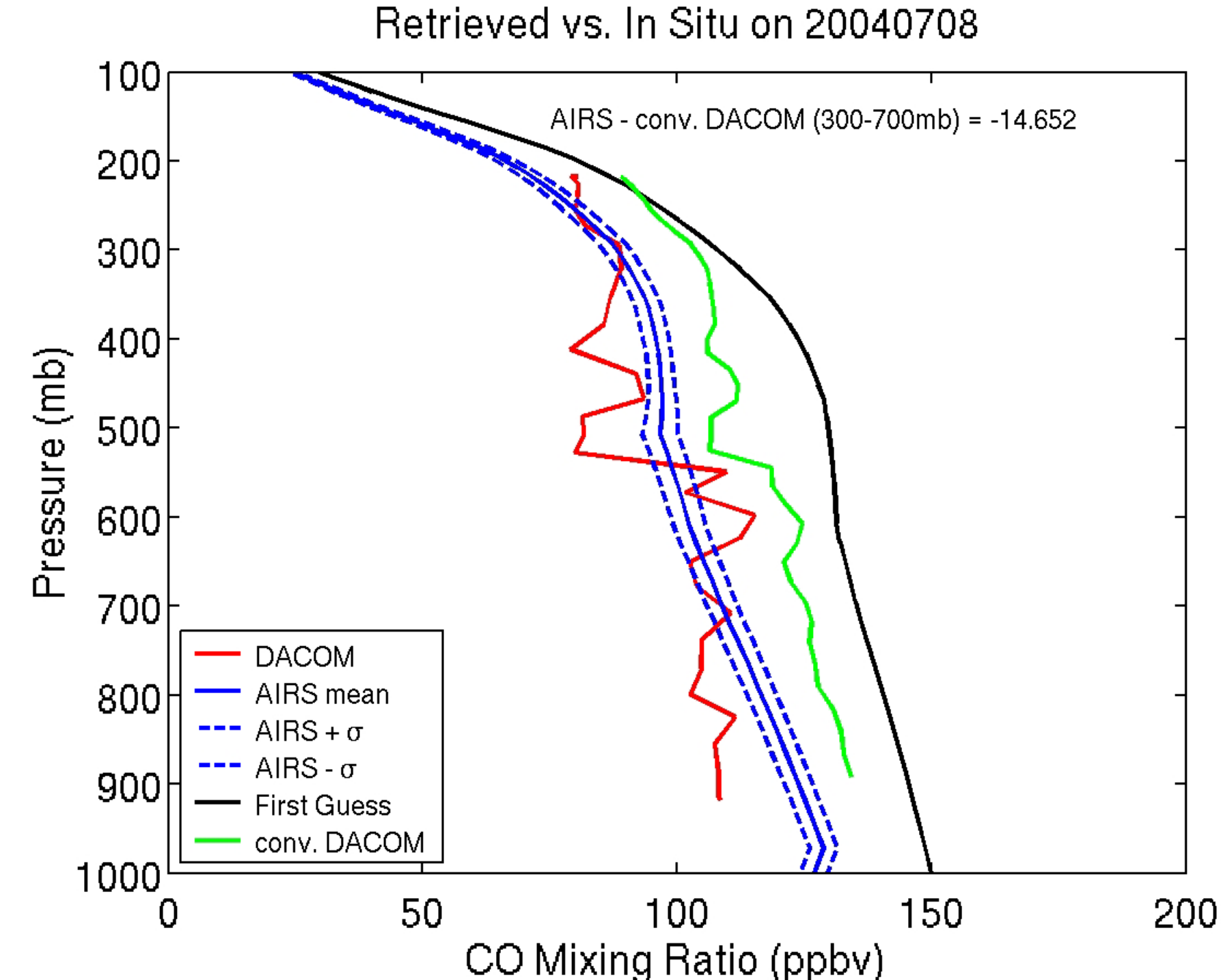
-8.88

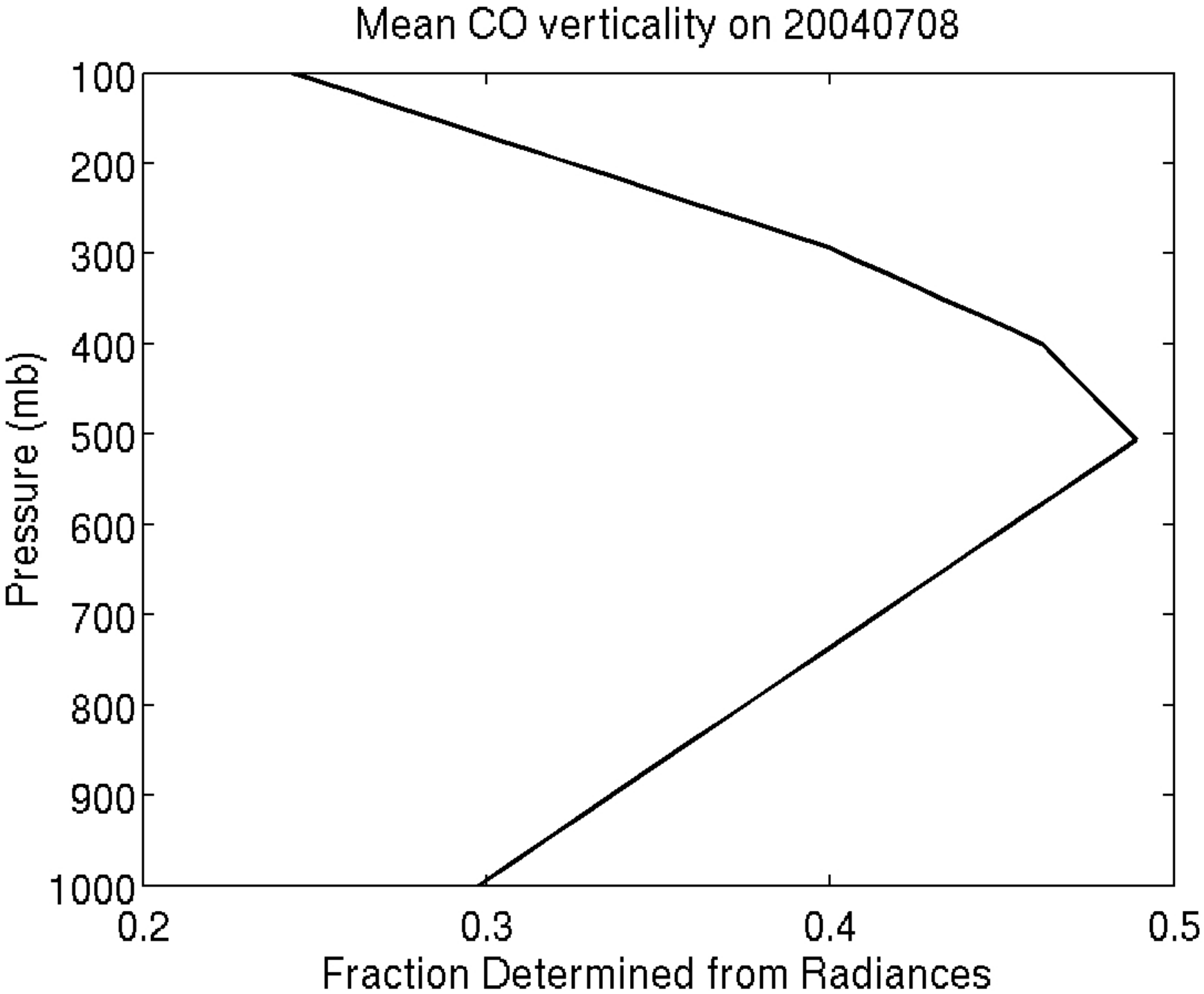

Local PM AIRS CO at 500 mb on 20040701
60° N
50° N
40° N
30° N
140° W
120° W
100° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

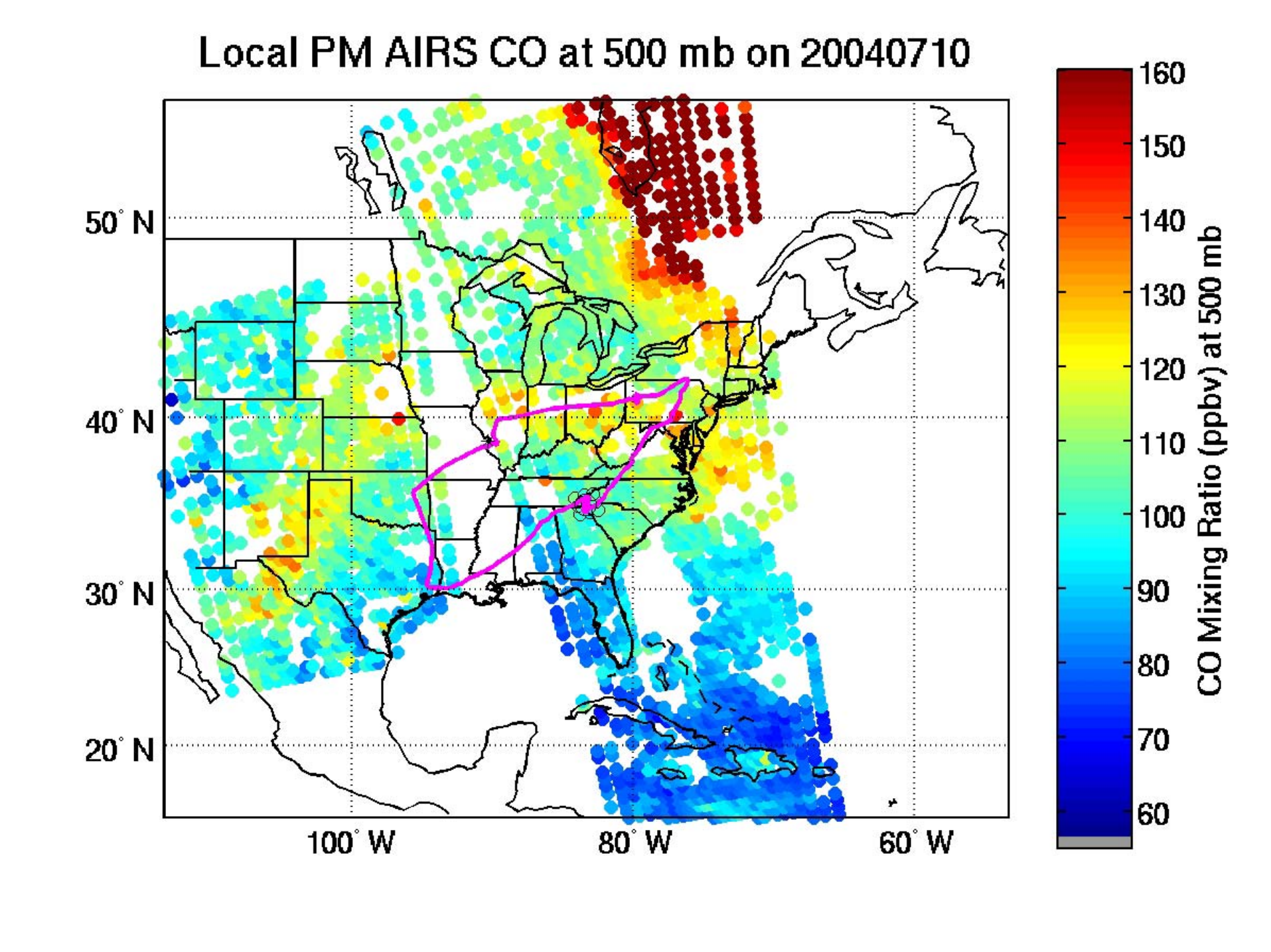

Retrieved vs. In Situ on 20040701
AIRS - conv. DACOM (300-700mb) = -7.358
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

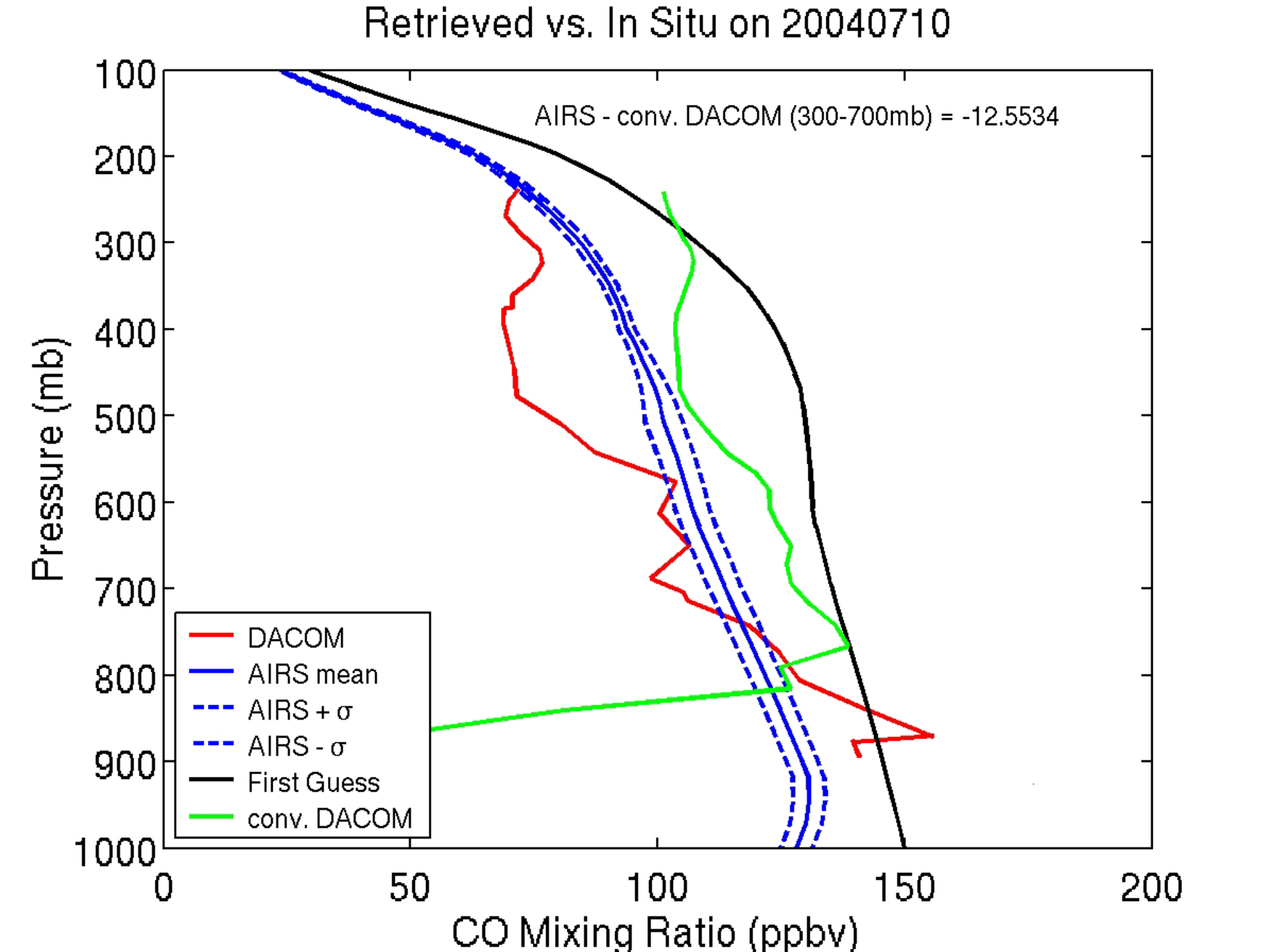

Mean CO verticality on 20040701
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

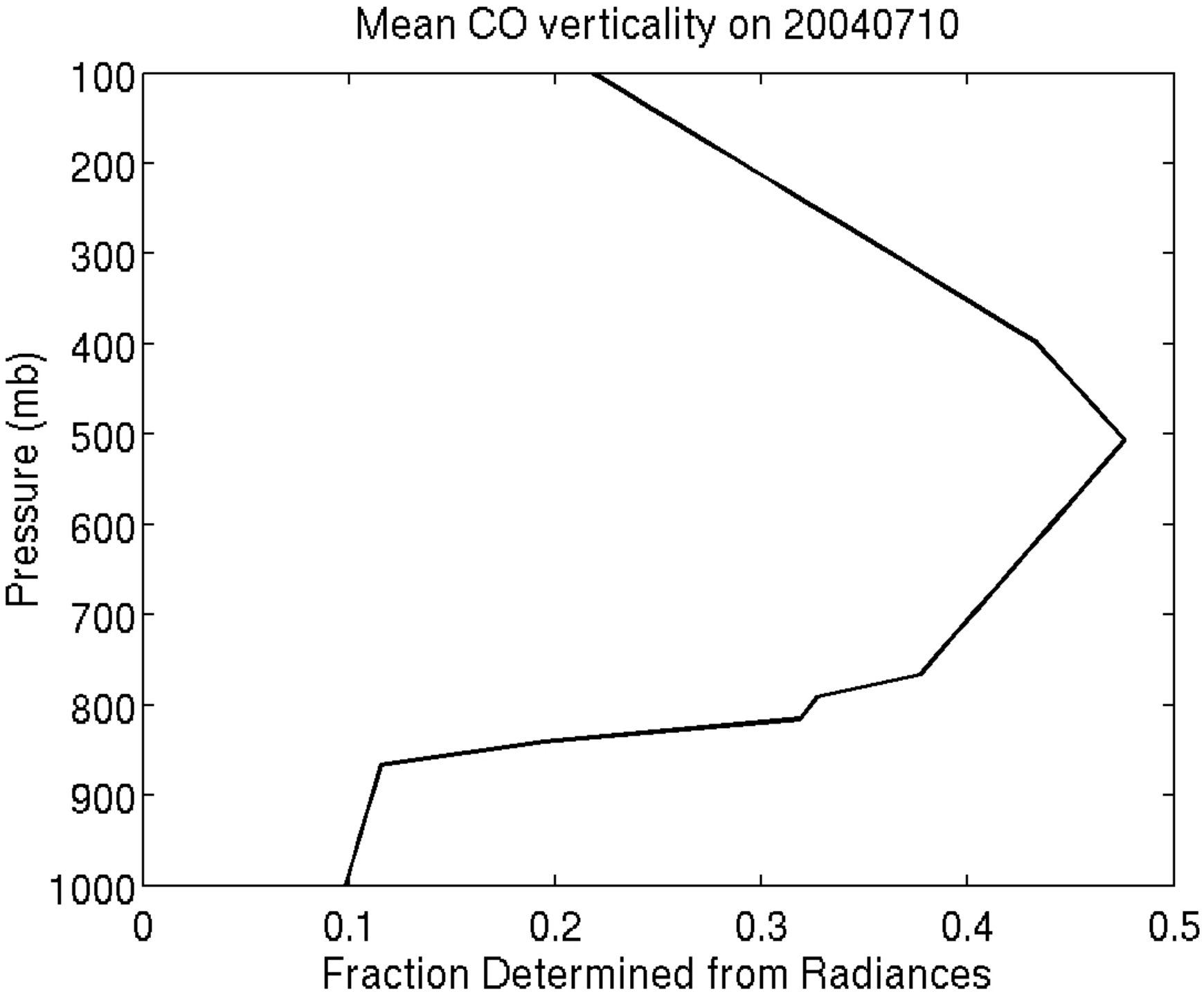

Local PM AIRS CO at 500 mb on 20040708
60˚ N
50˚ N
40˚ N
30˚ N
100˚ W
80˚ W
60˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

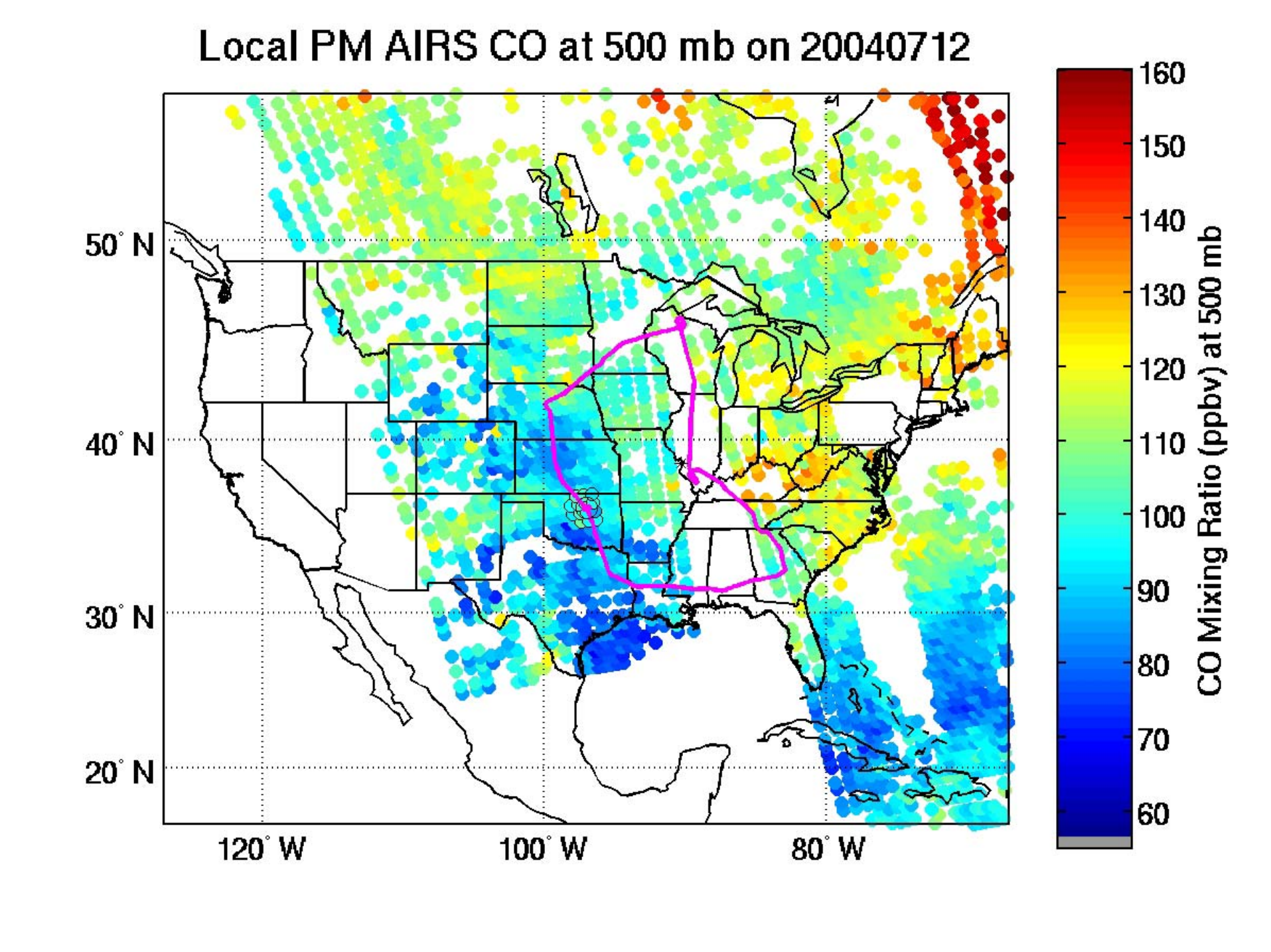

Retrieved vs. In Situ on 20040708
AIRS - conv. DACOM (300-700mb) = -14.652
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

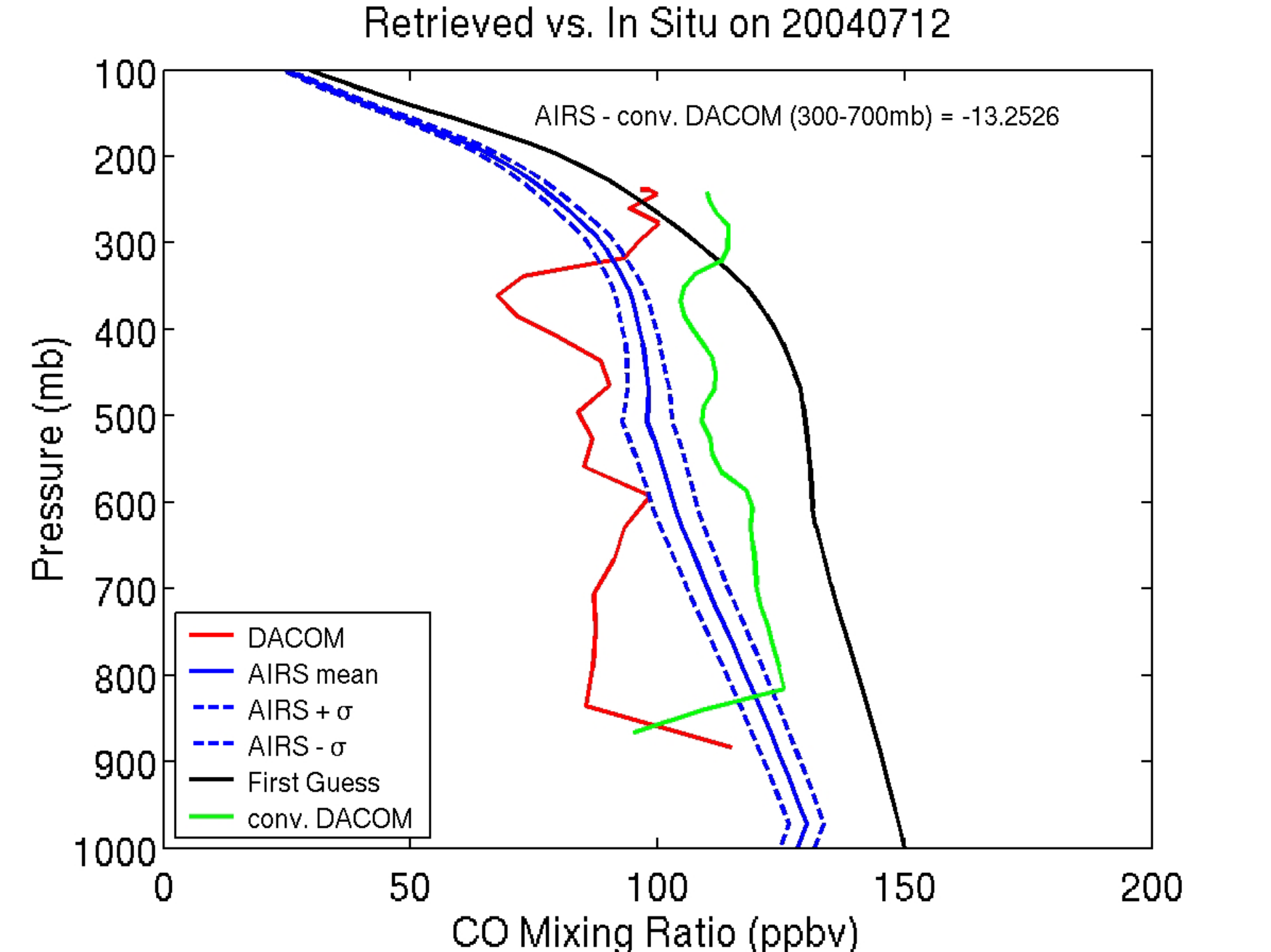

Mean CO verticality on 20040708
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances


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

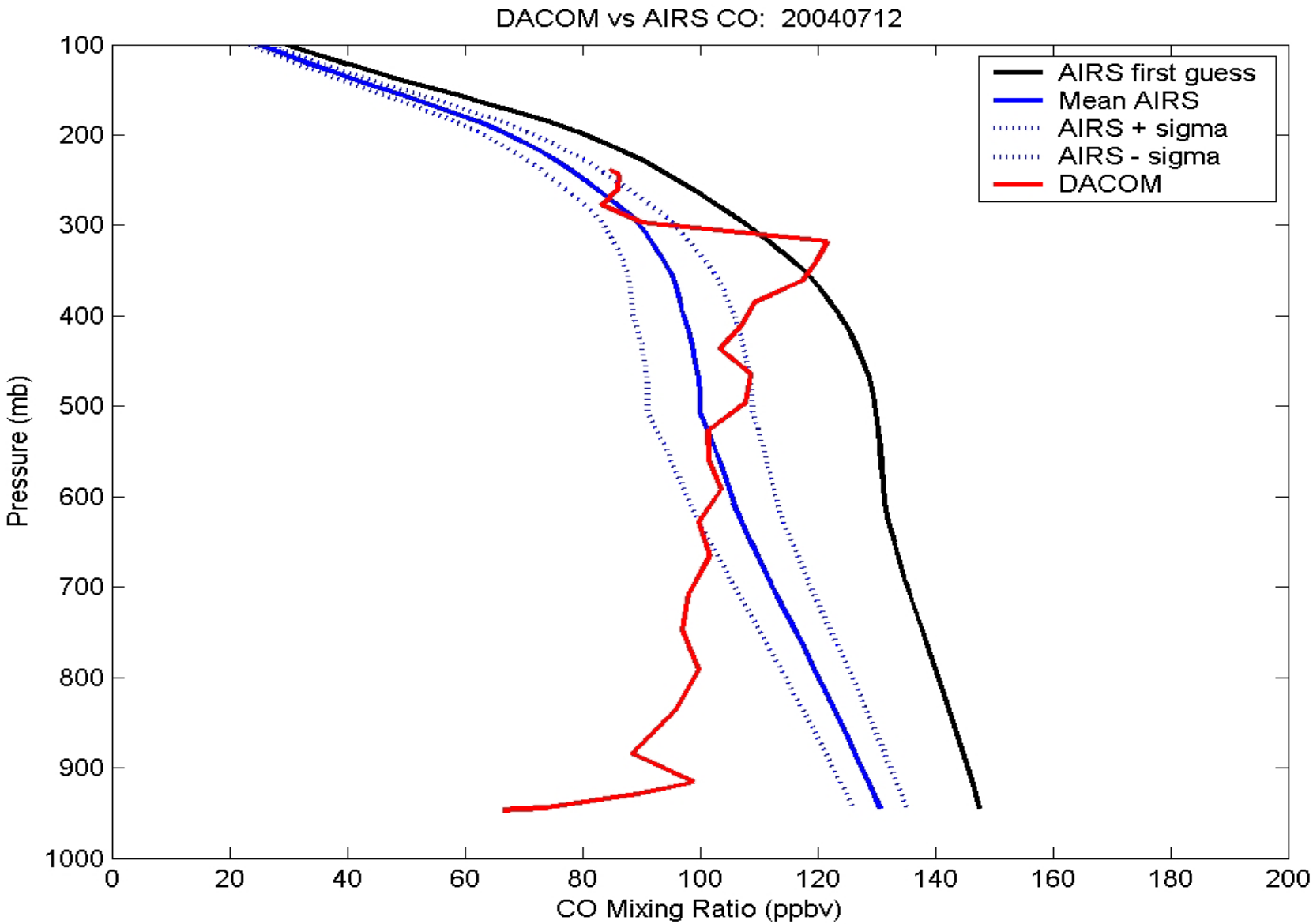

Retrieved vs. In Situ on 20040710
AIRS - conv. DACOM (300-700mb) = -12.5534
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

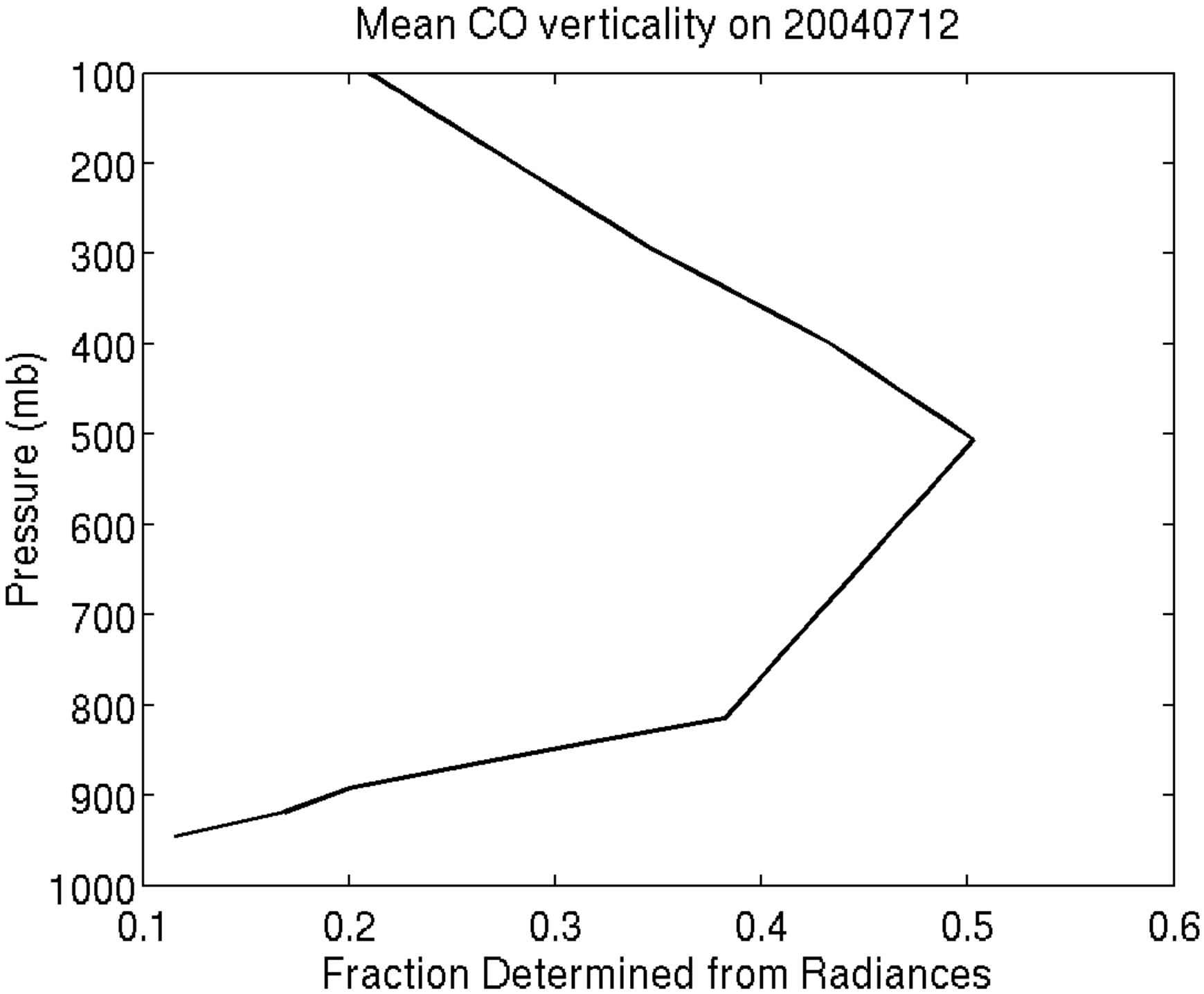

Mean CO verticality on 20040710
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0
0.1
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

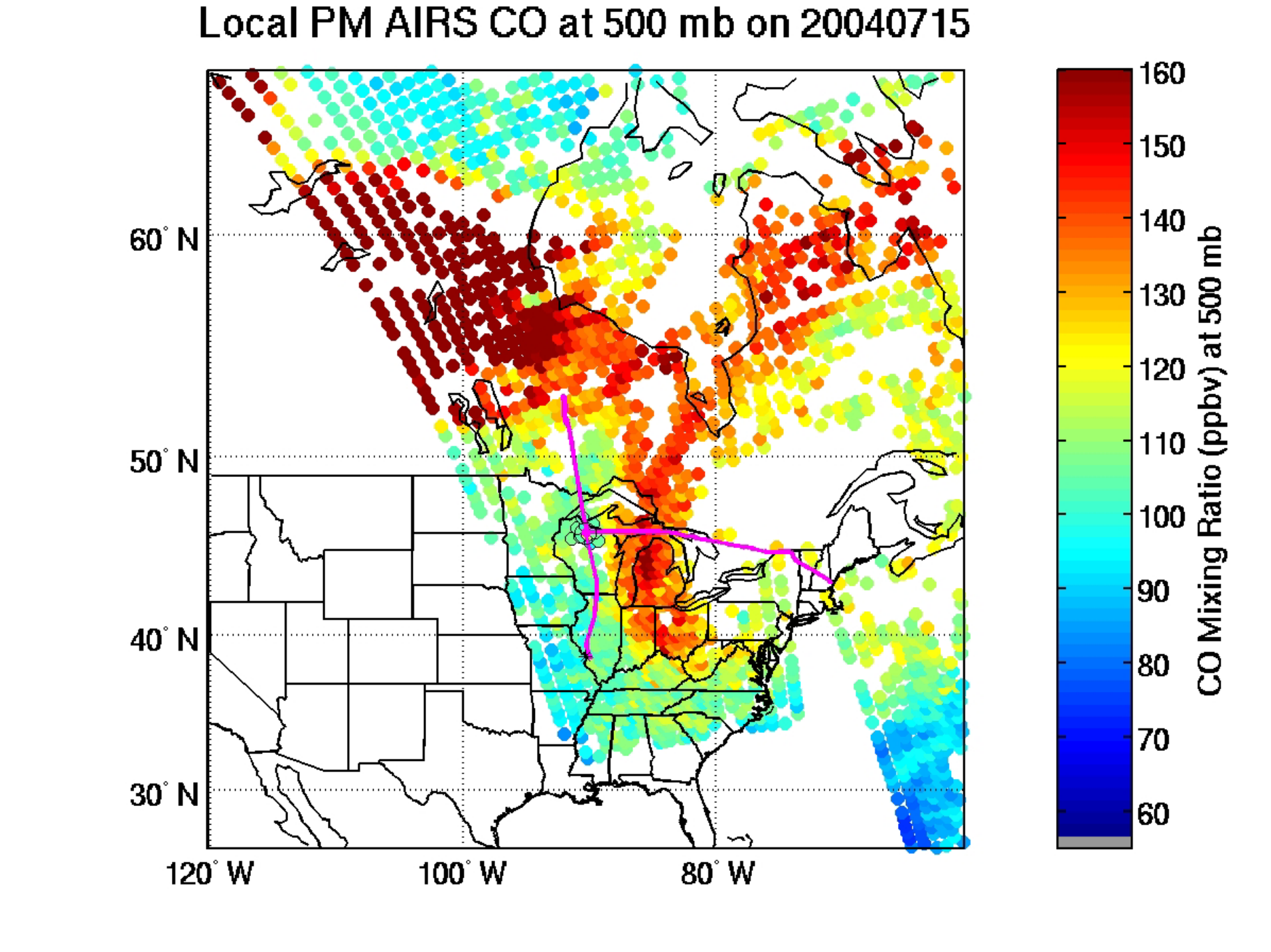

Local PM AIRS CO at 500 mb on 20040712
50˚ N
40˚ N
30˚ N
20˚ N
120˚ W
100˚ W
80˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

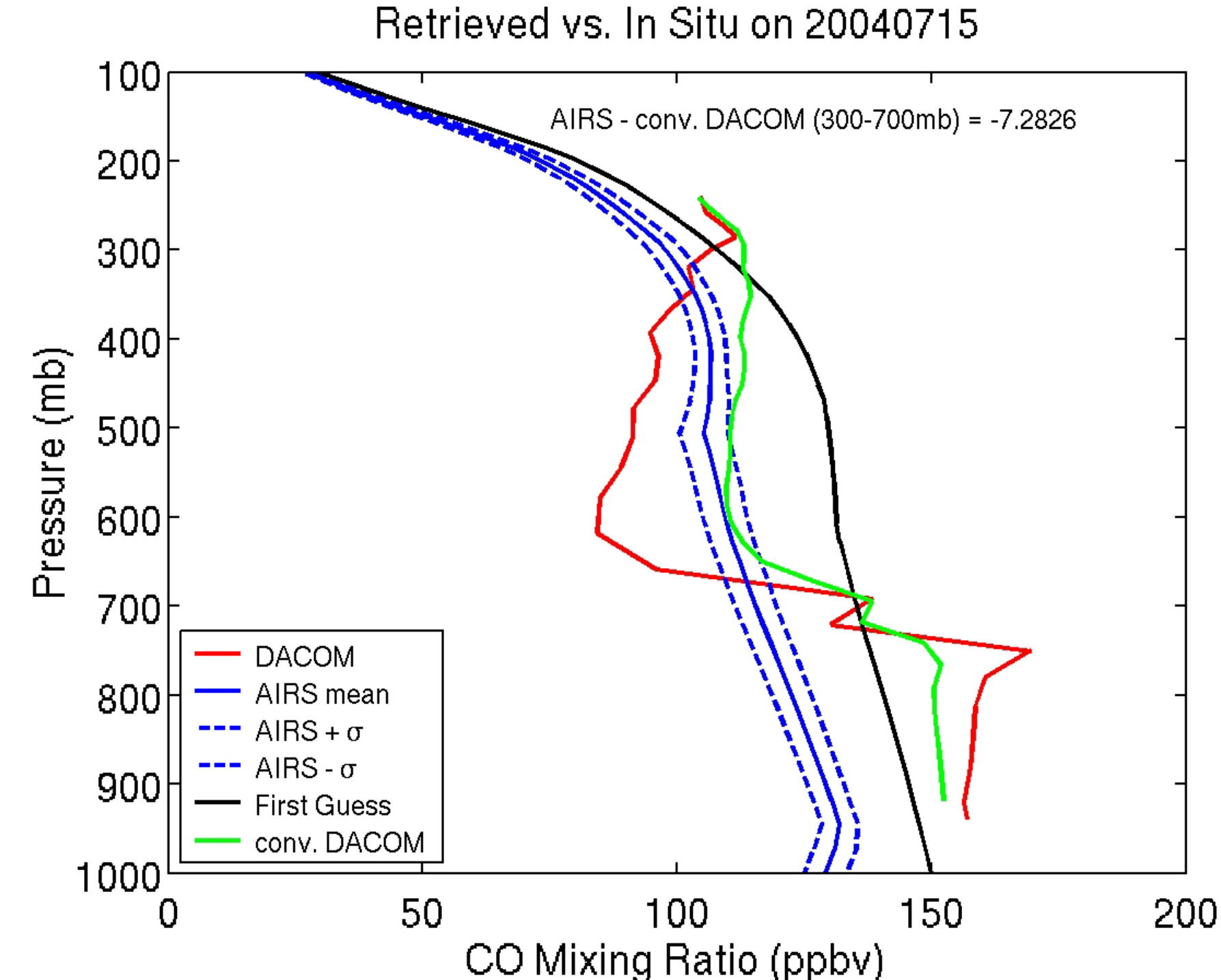

Retrieved vs. In Situ on 20040712
AIRS - conv. DACOM (300-700mb) = -13.2526
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

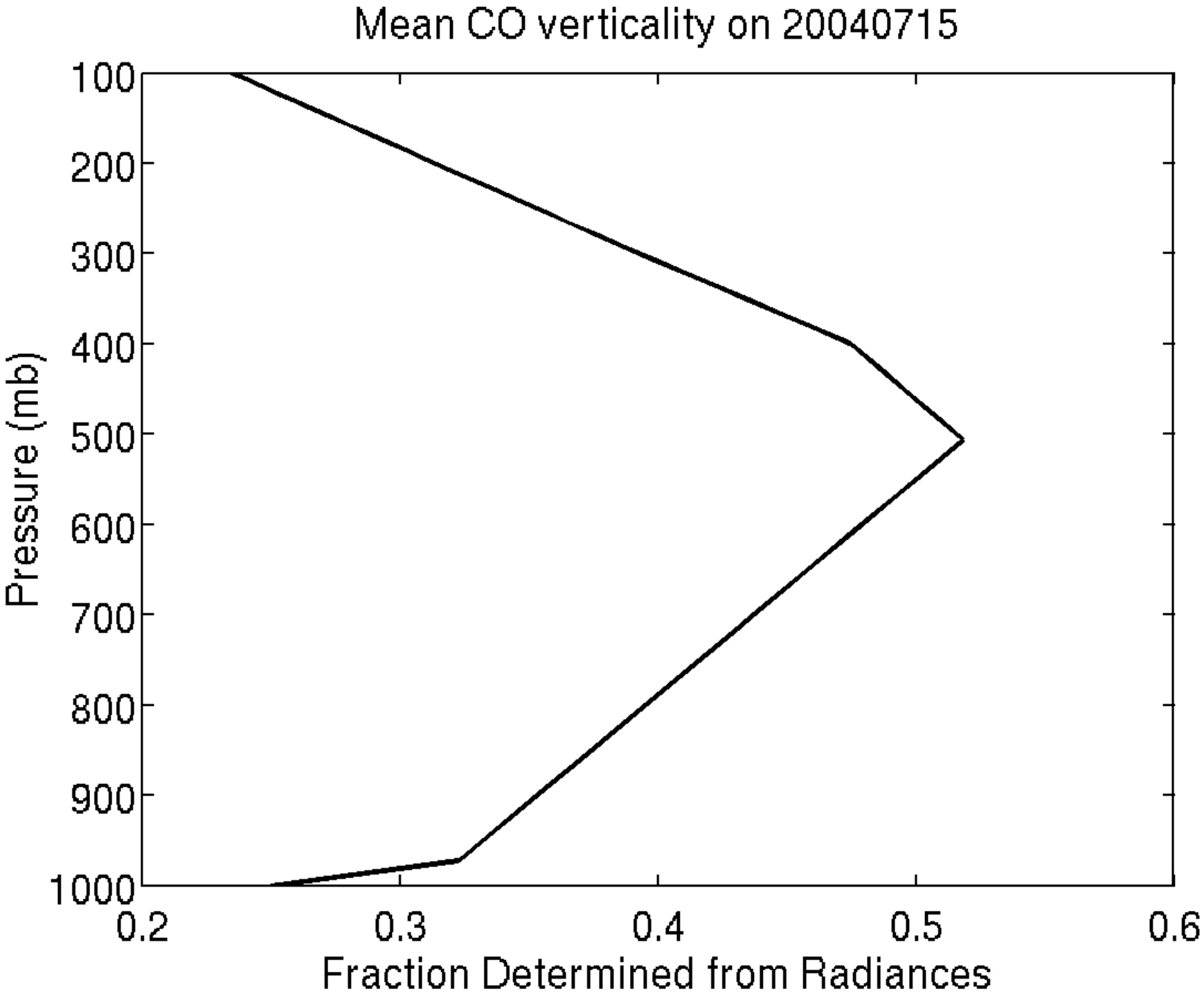
First INTEX AIRS Validation

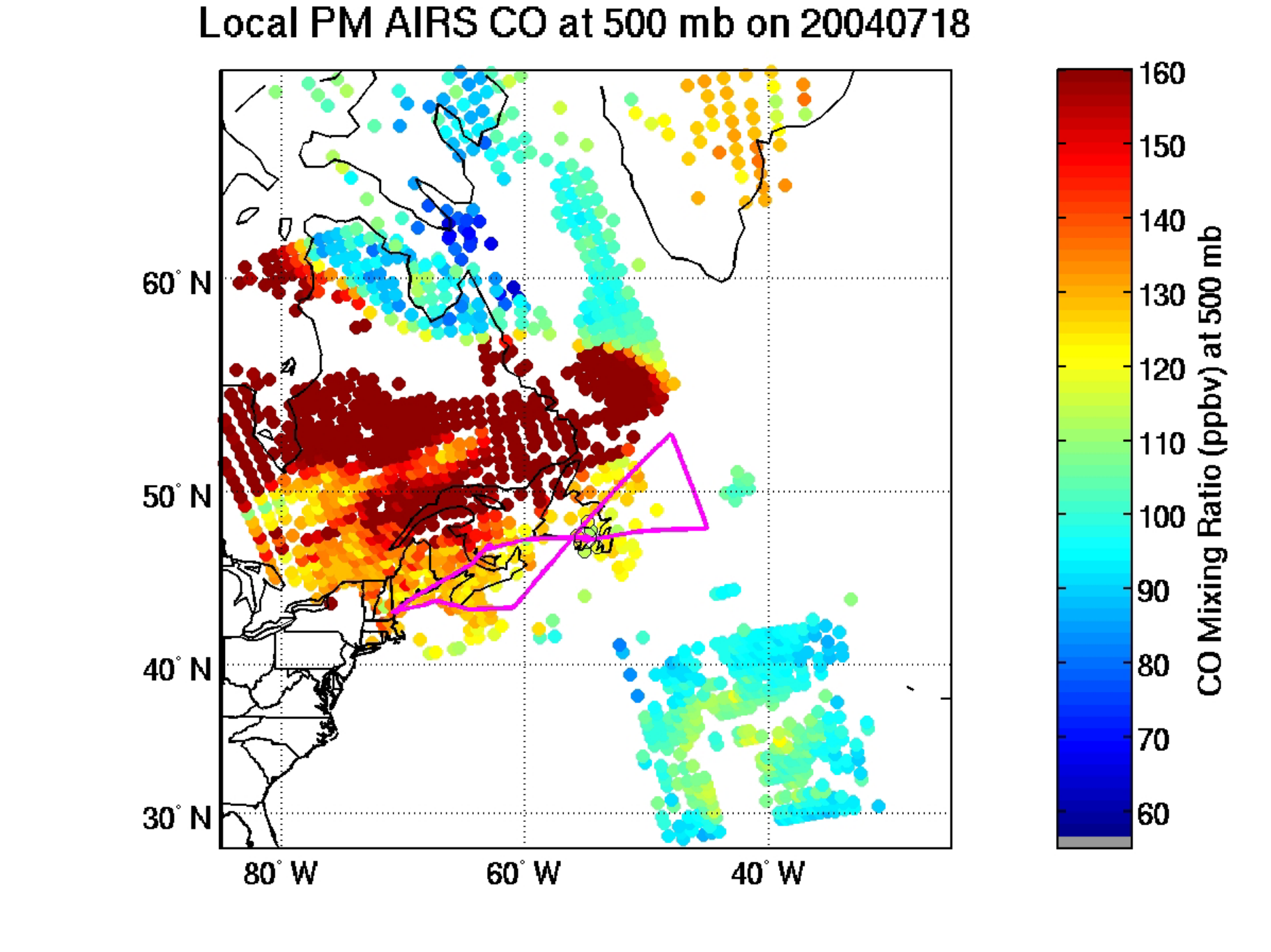


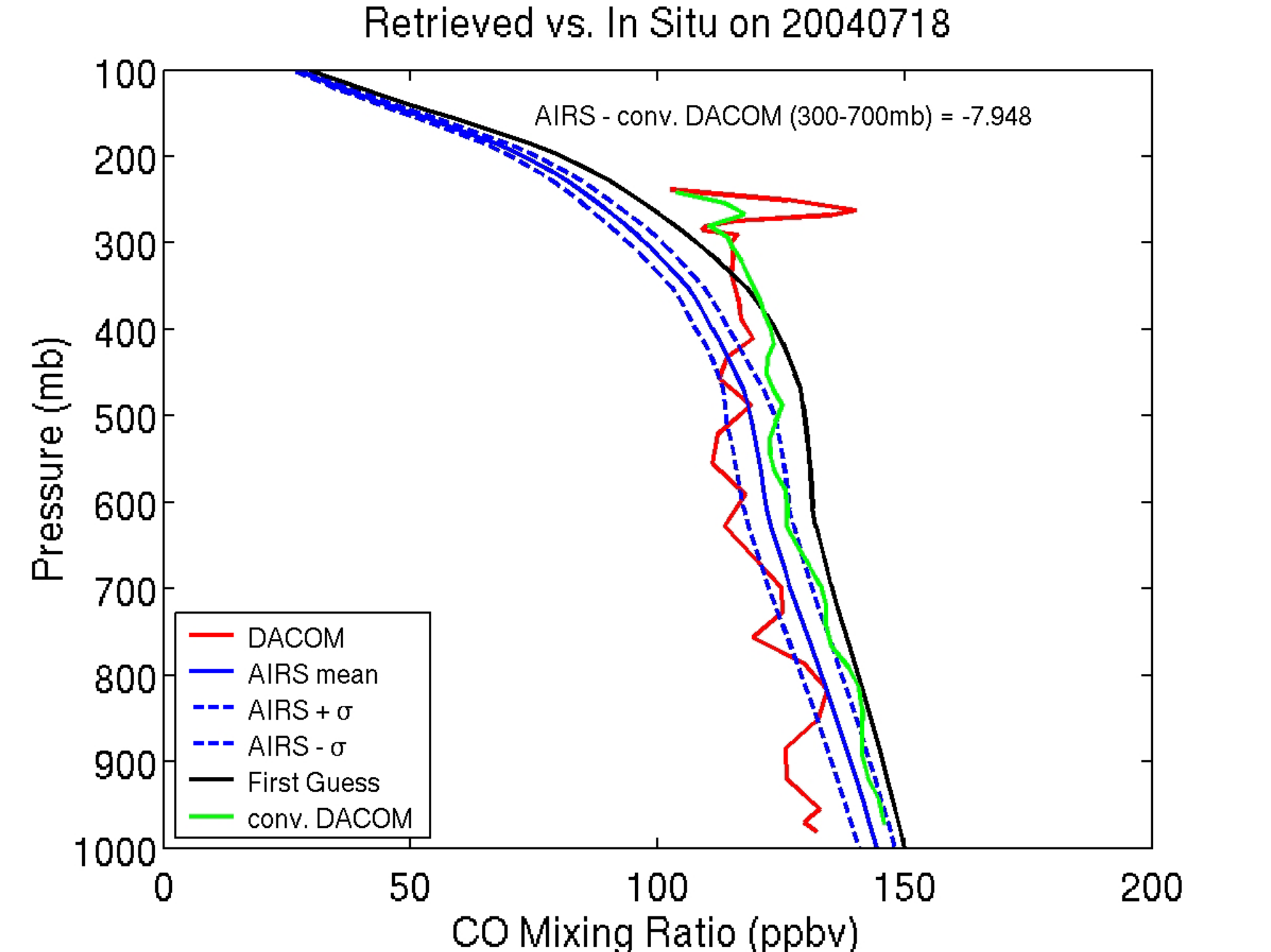

Mean CO verticality on 20040712
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.1
0.2
0.3
0.4
0.5
0.6
Fraction Determined from Radiances

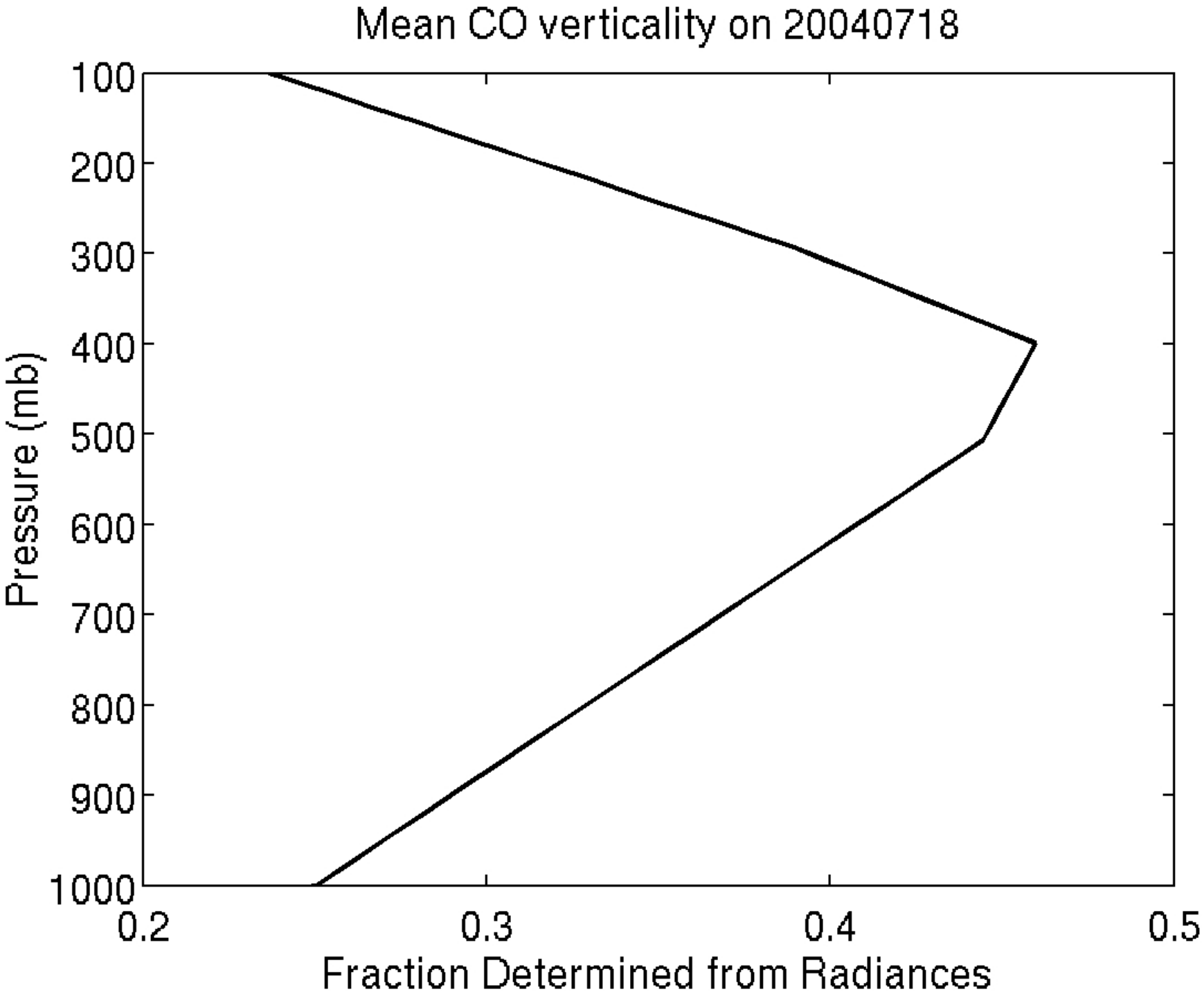

Local PM AIRS CO at 500 mb on 20040715
60˚ N
50˚ N
40˚ N
30˚ N
120˚ W
100˚ W
80˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

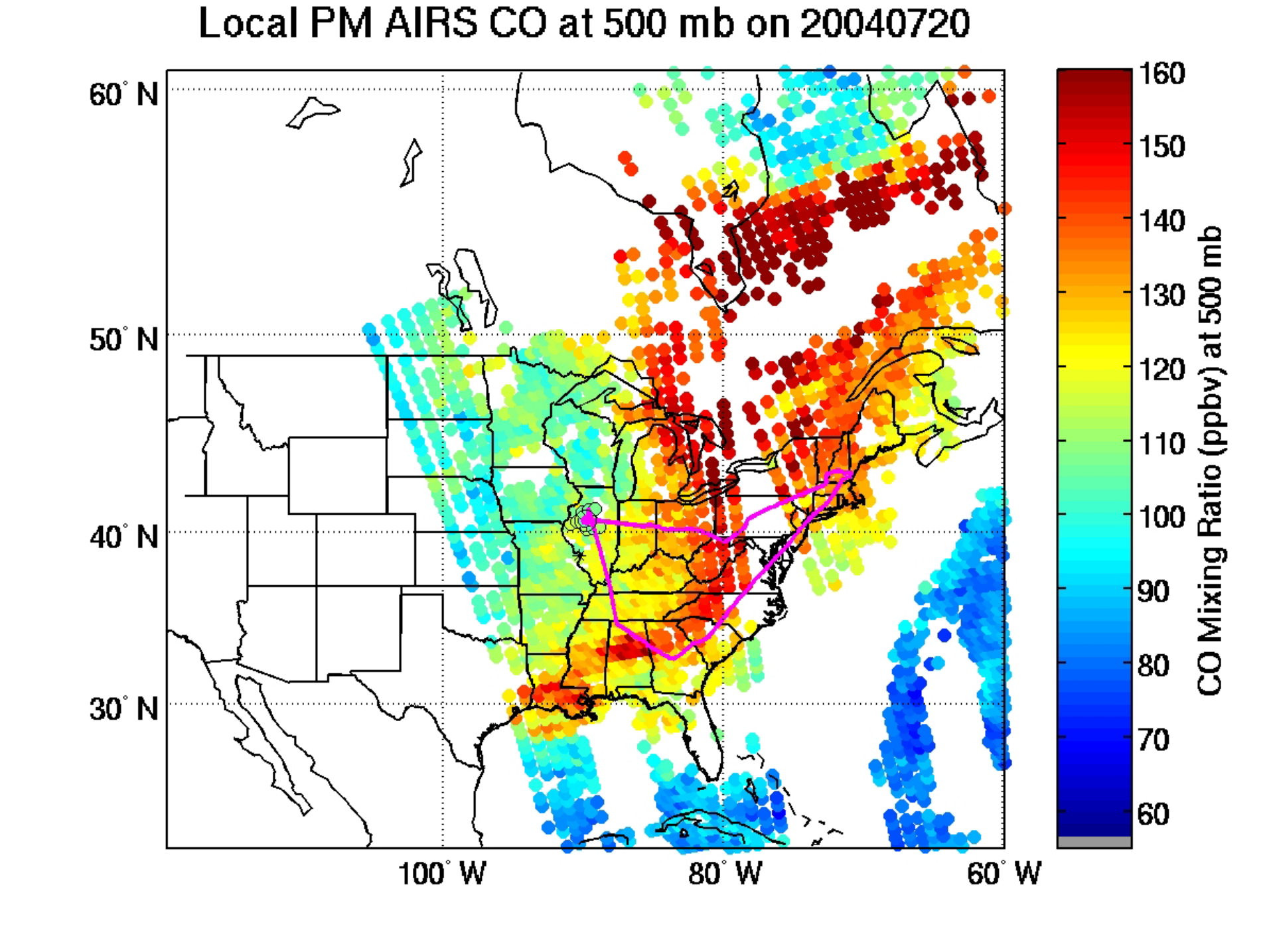

Retrieved vs. In Situ on 20040715
AIRS - conv. DACOM (300-700mb) = -7.2826
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

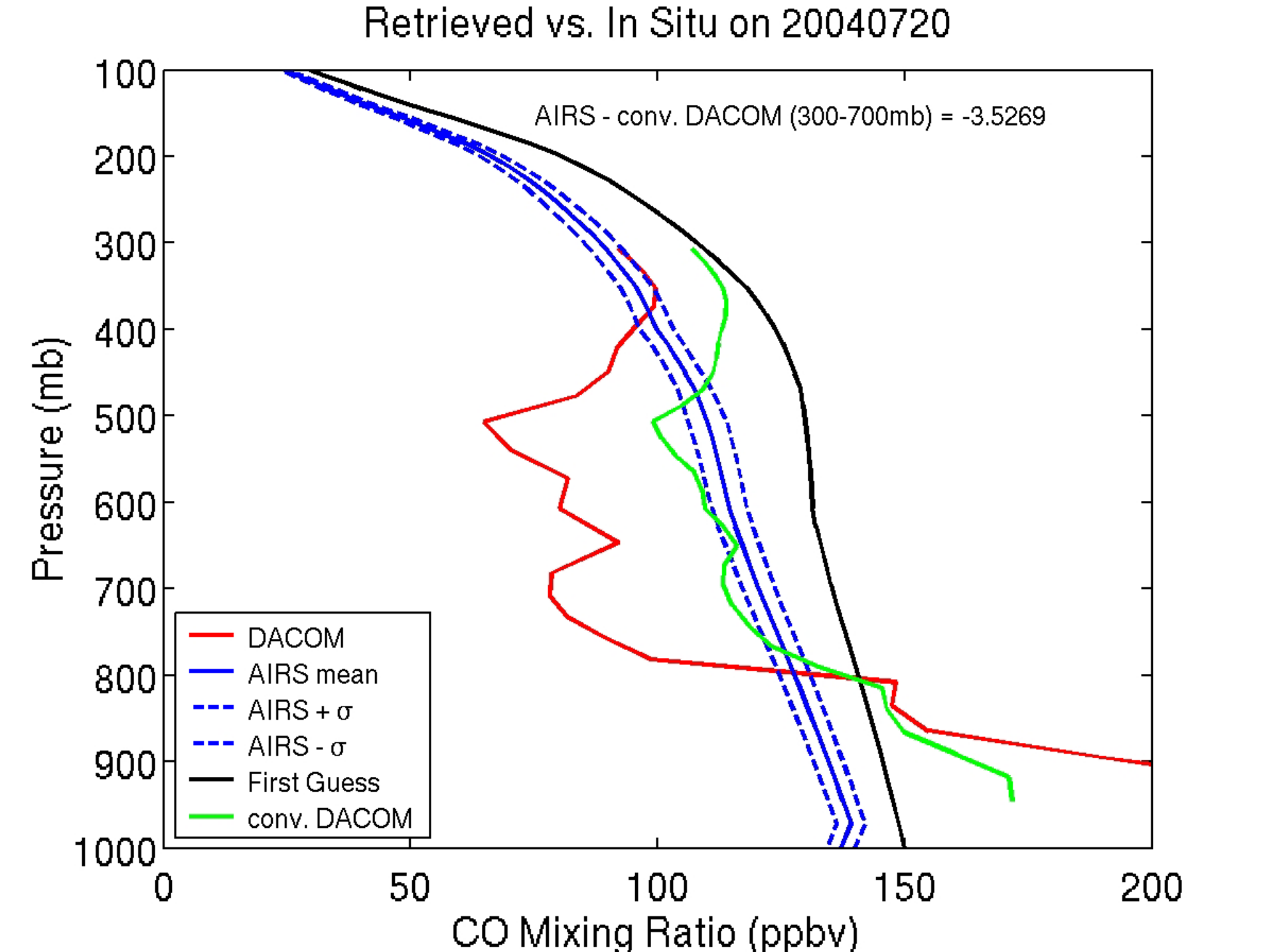

Mean CO verticality on 20040715
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
0.6
Fraction Determined from Radiances

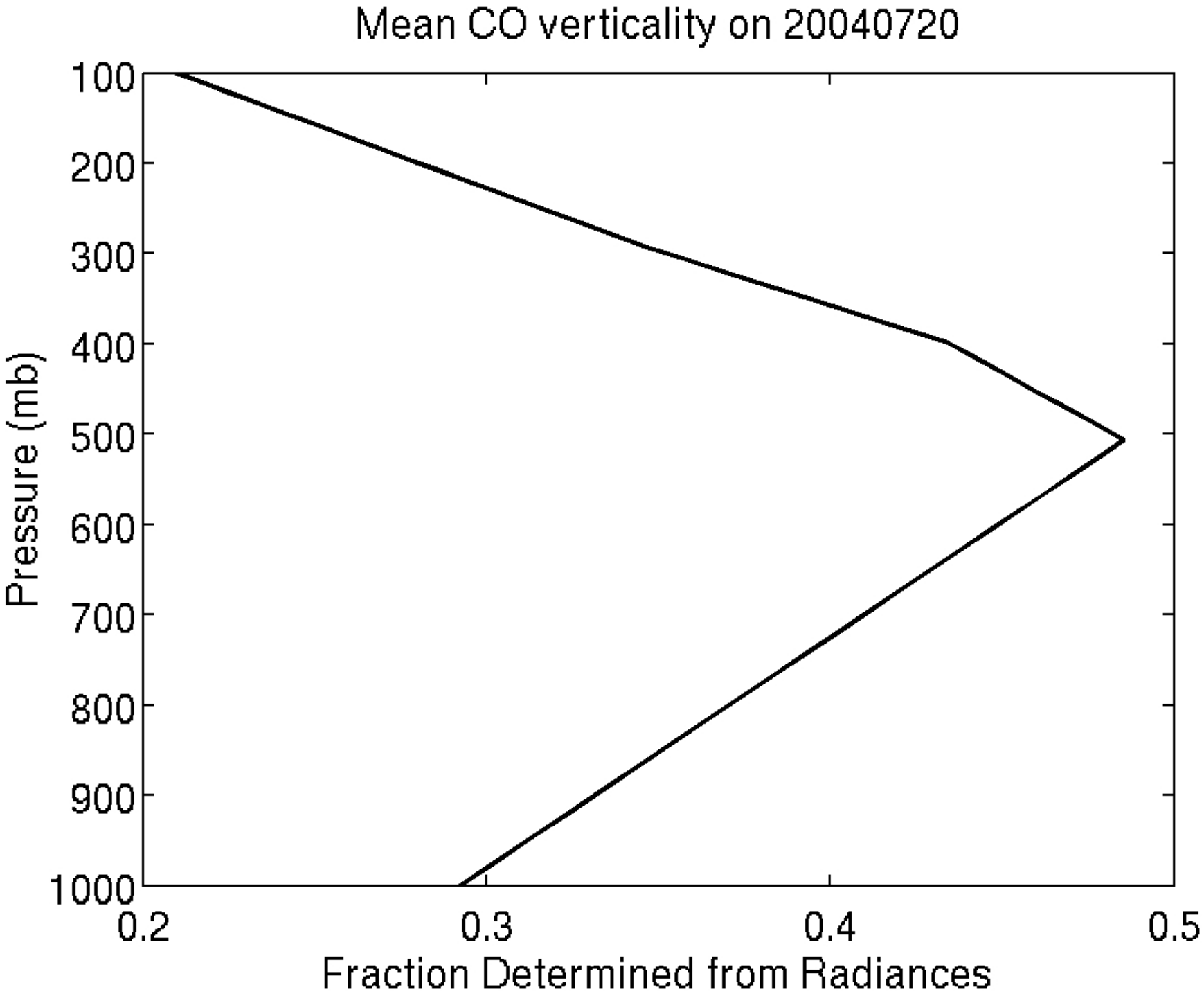

Local PM AIRS CO at 500 mb on 20040718
60˚ N
50˚ N
40˚ N
30˚ N
80˚ W
60˚ W
40˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

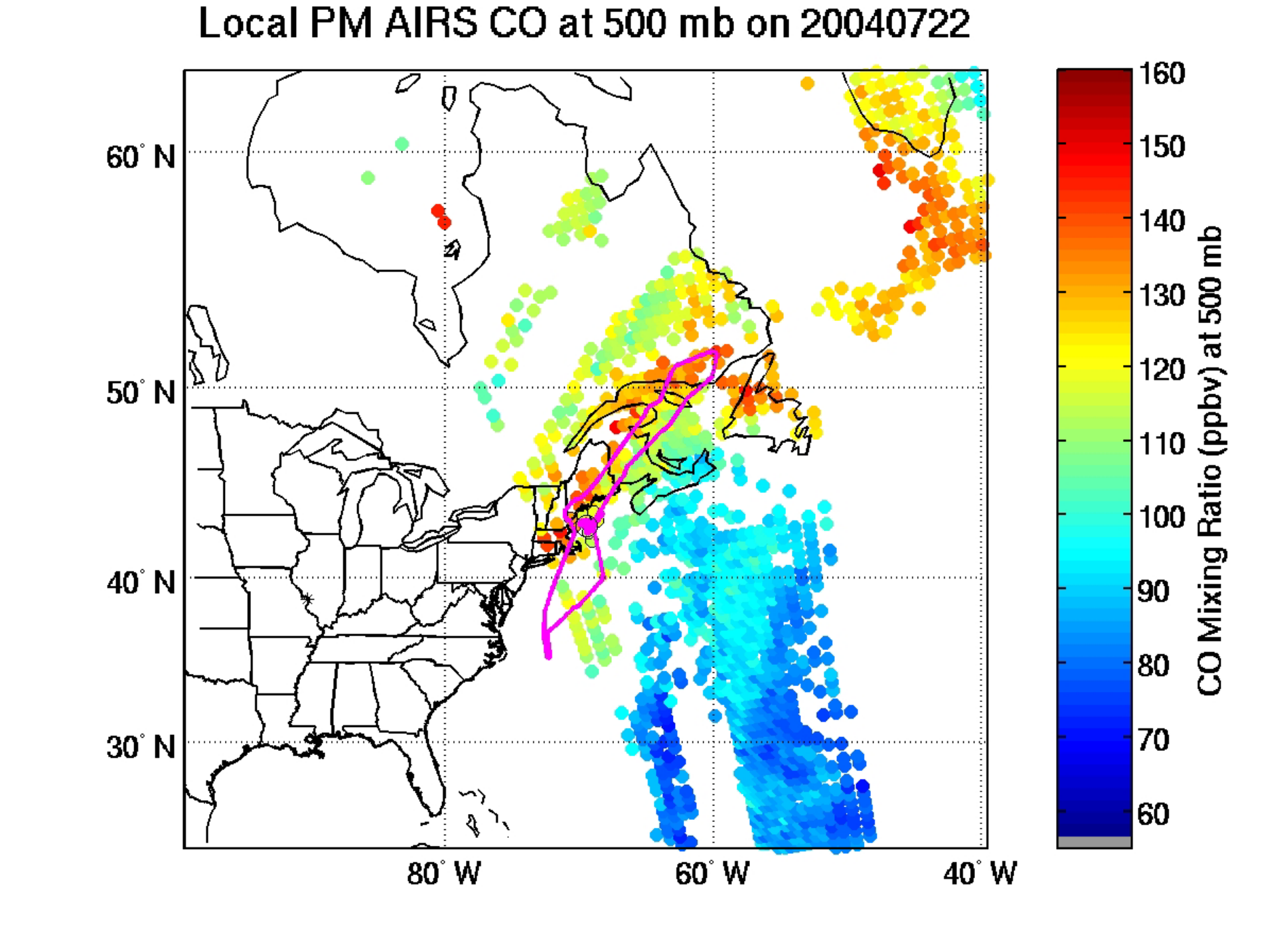

Retrieved vs. In Situ on 20040718
AIRS - conv. DACOM (300-700mb) = -7.948
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

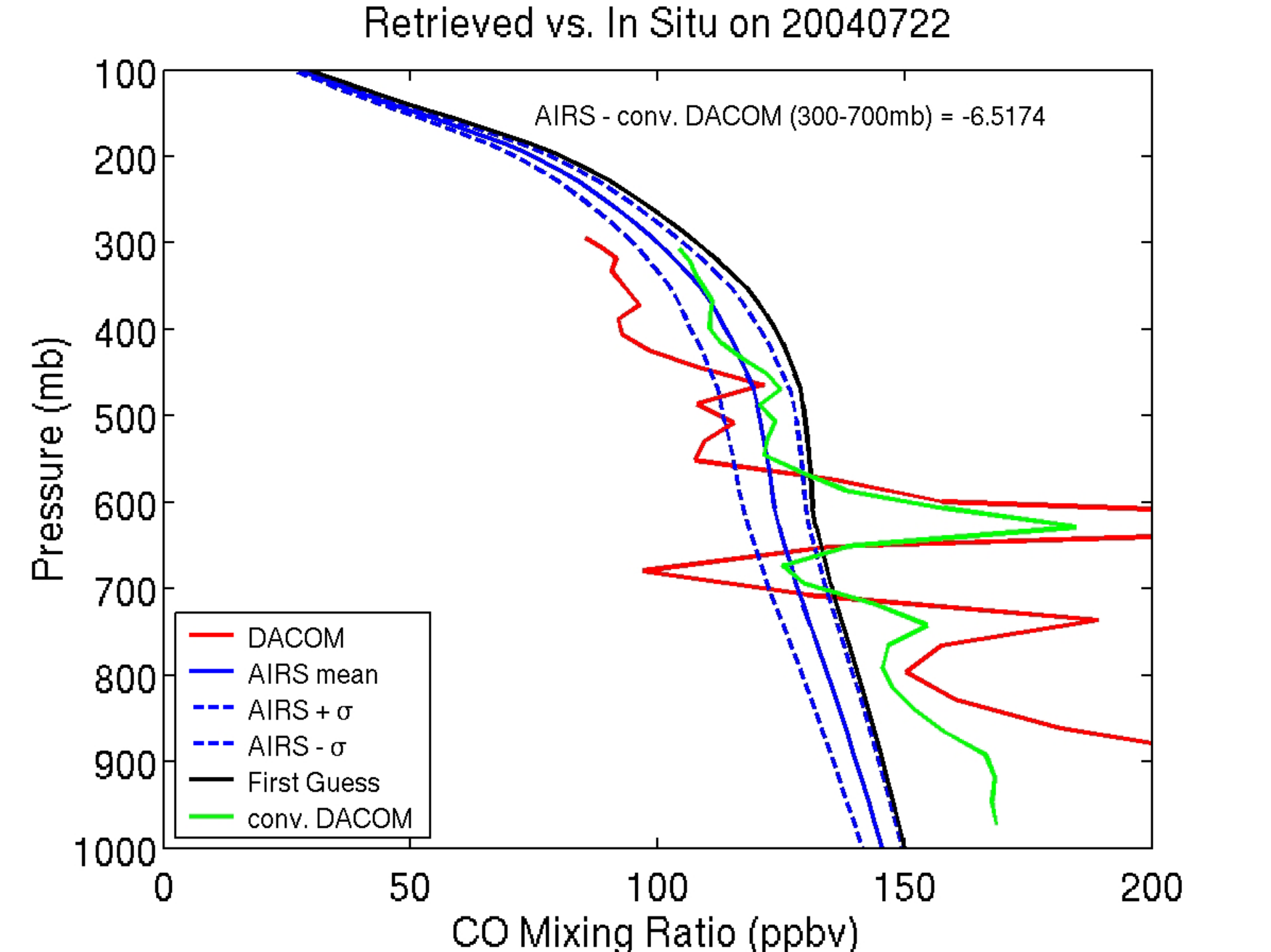

Mean CO verticality on 20040718
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

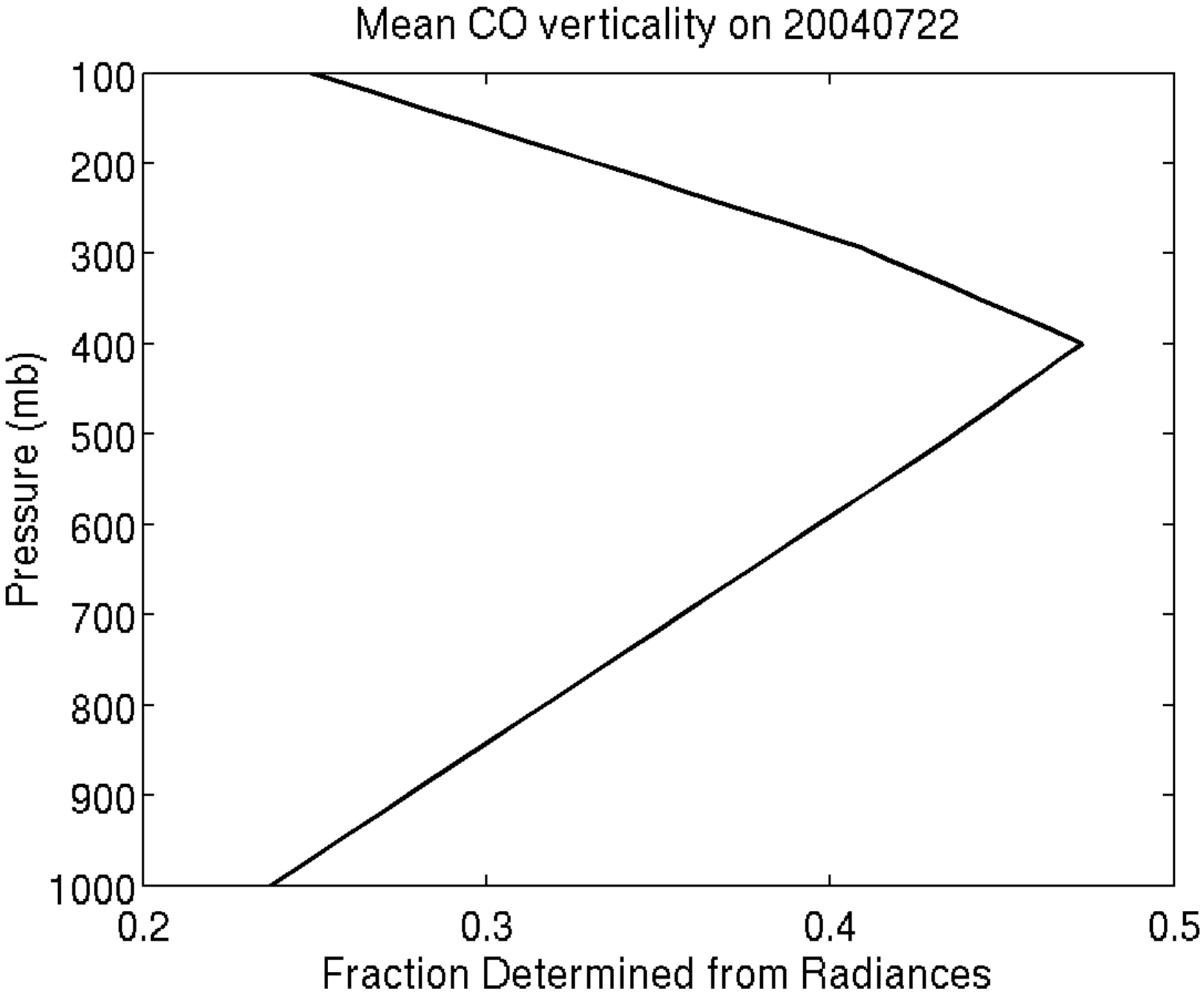

Local PM AIRS CO at 500 mb on 20040720
60˚ N
50˚ N
40˚ N
30˚ N
100˚ W
80˚ W
60˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

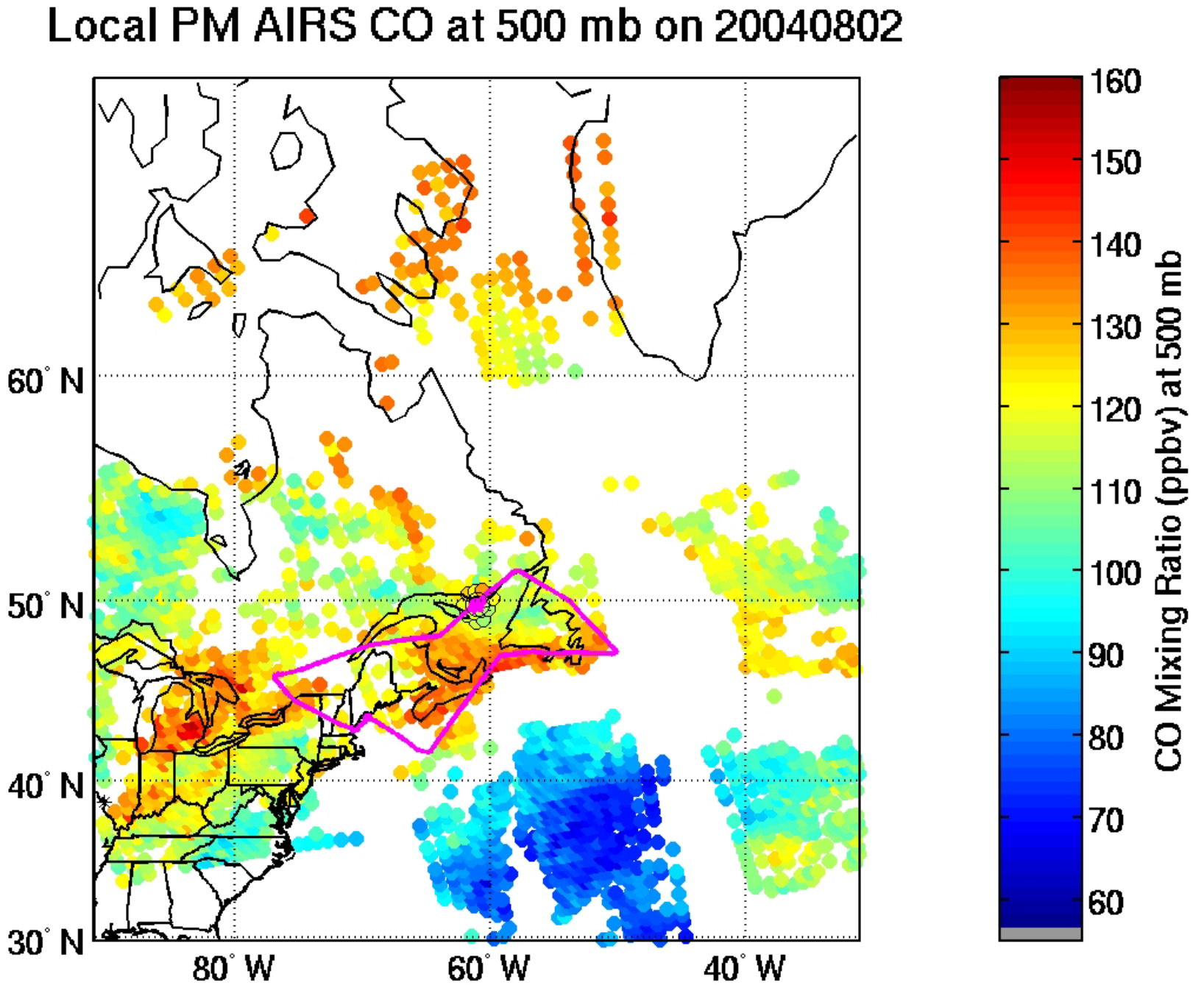

Retrieved vs. In Situ on 20040720
AIRS - conv. DACOM (300-700mb) = -3.5269
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

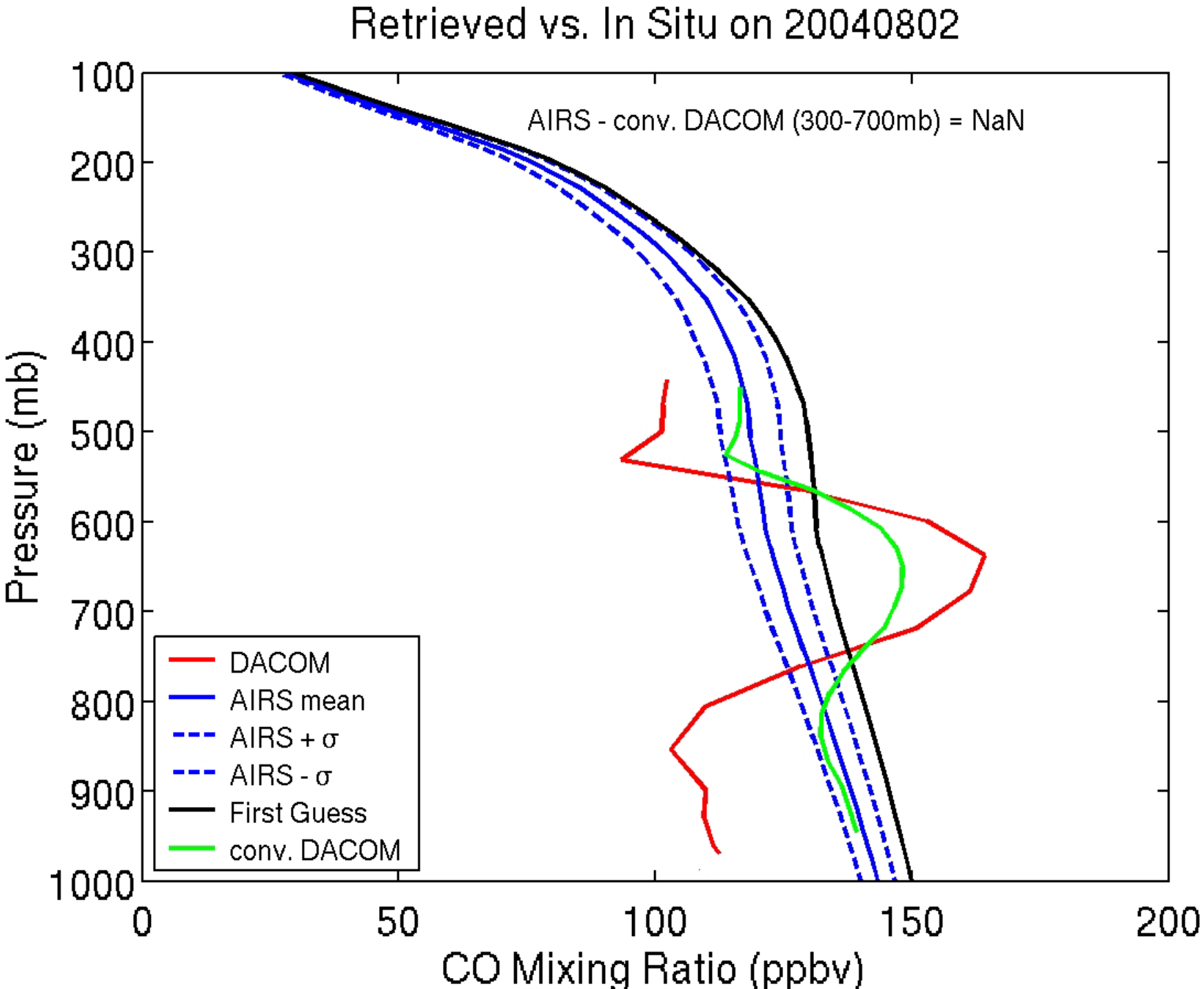

Mean CO verticality on 20040720
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

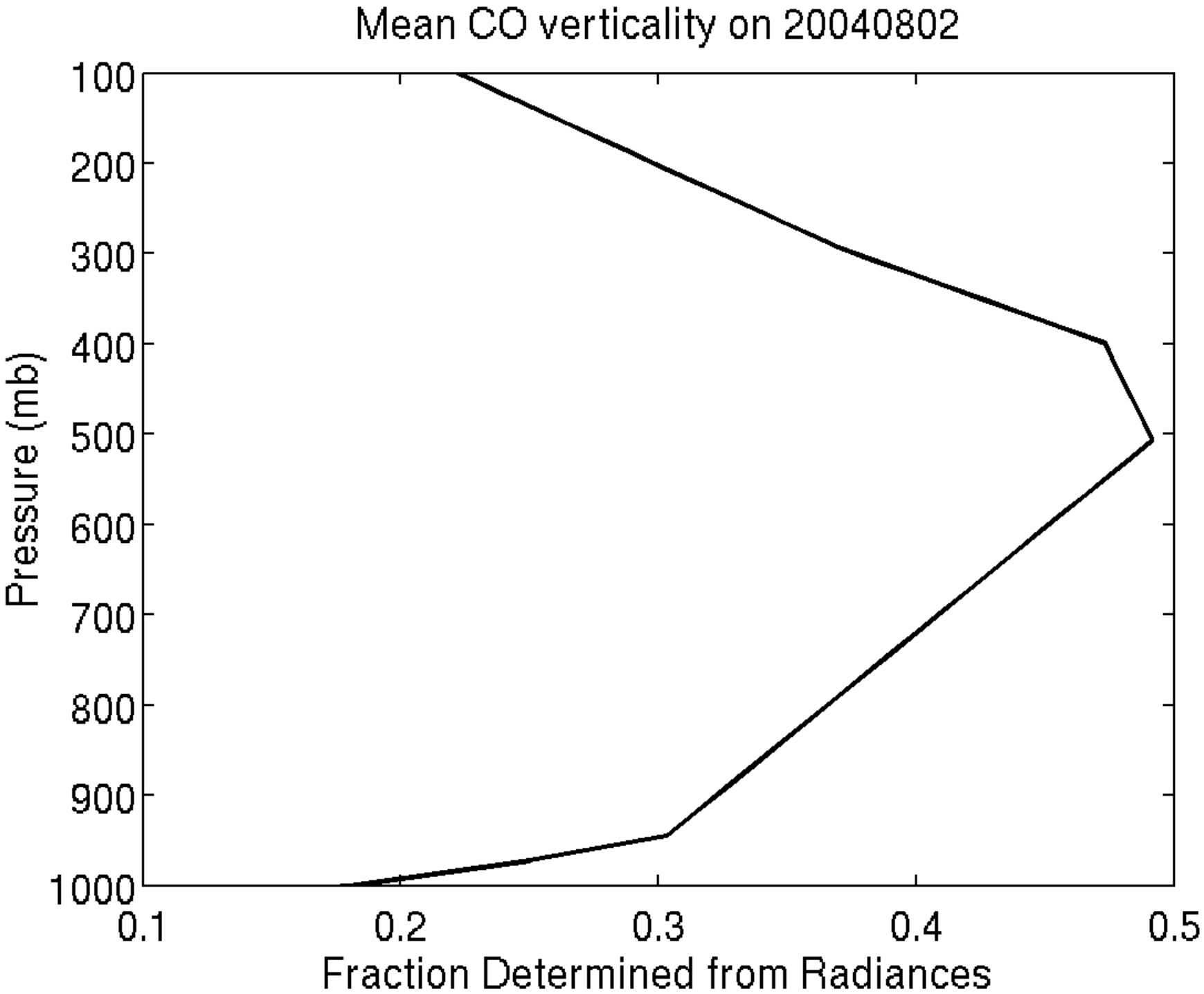

Local PM AIRS CO at 500 mb on 20040722
60° N
50° N
40° N
30° N
80° W
60° W
40° W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb

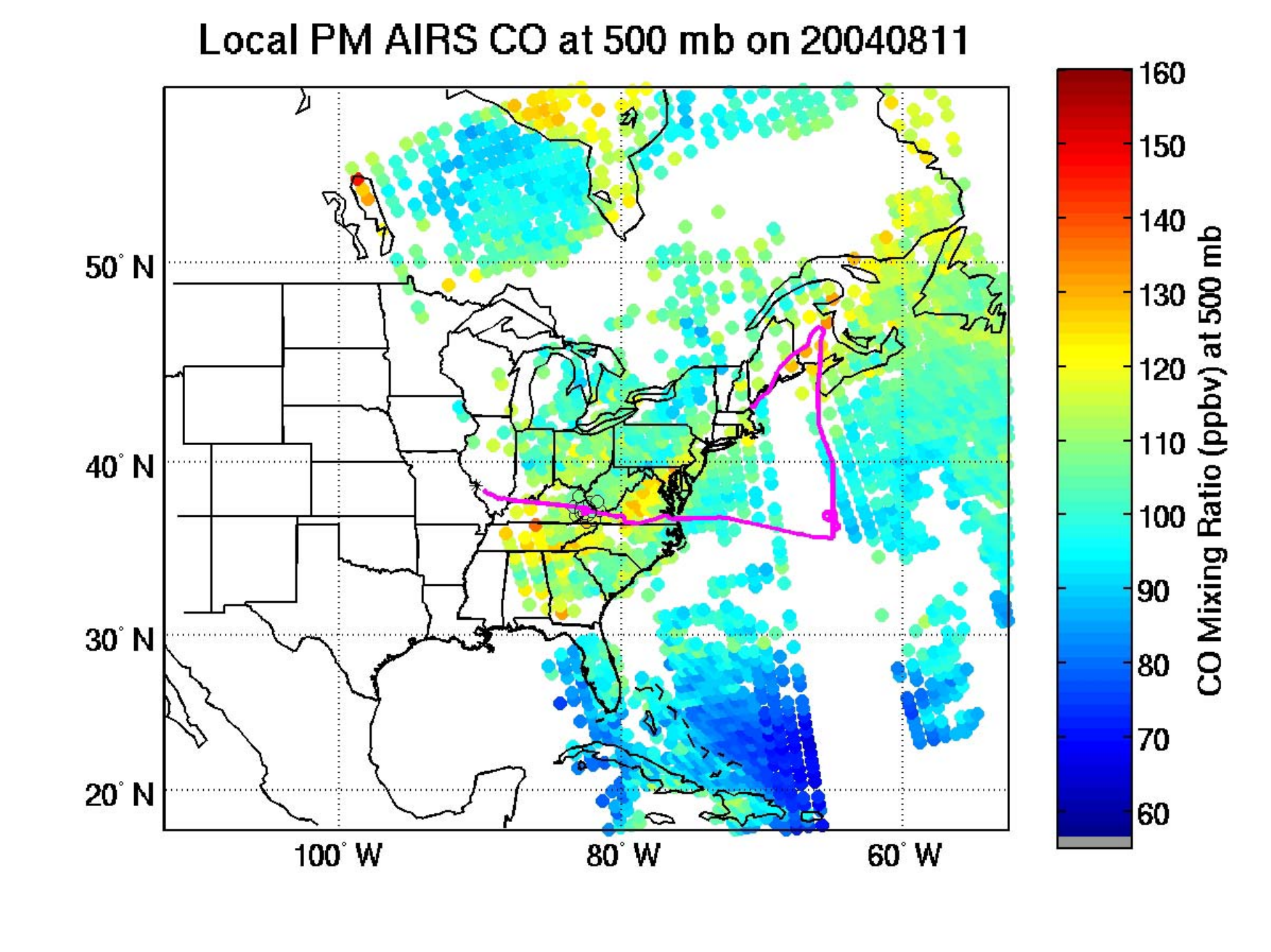

Retrieved vs. In Situ on 20040722
AIRS - conv. DACOM (300-700mb) = -6.5174
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM

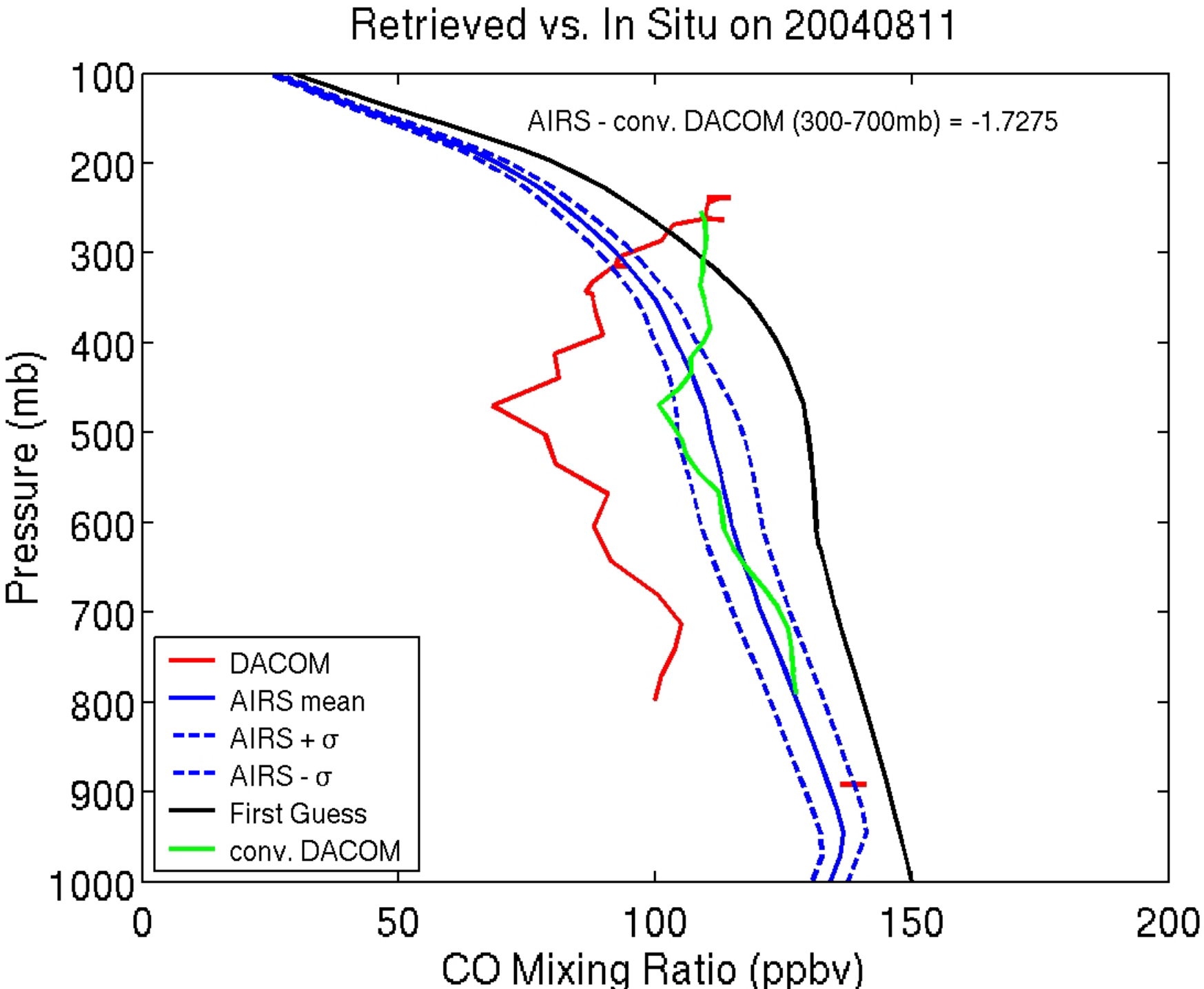

Mean CO verticality on 20040722
Pressure (mb)
100
200
300
400
500
600
700
800
900
1000
0.2
0.3
0.4
0.5
Fraction Determined from Radiances

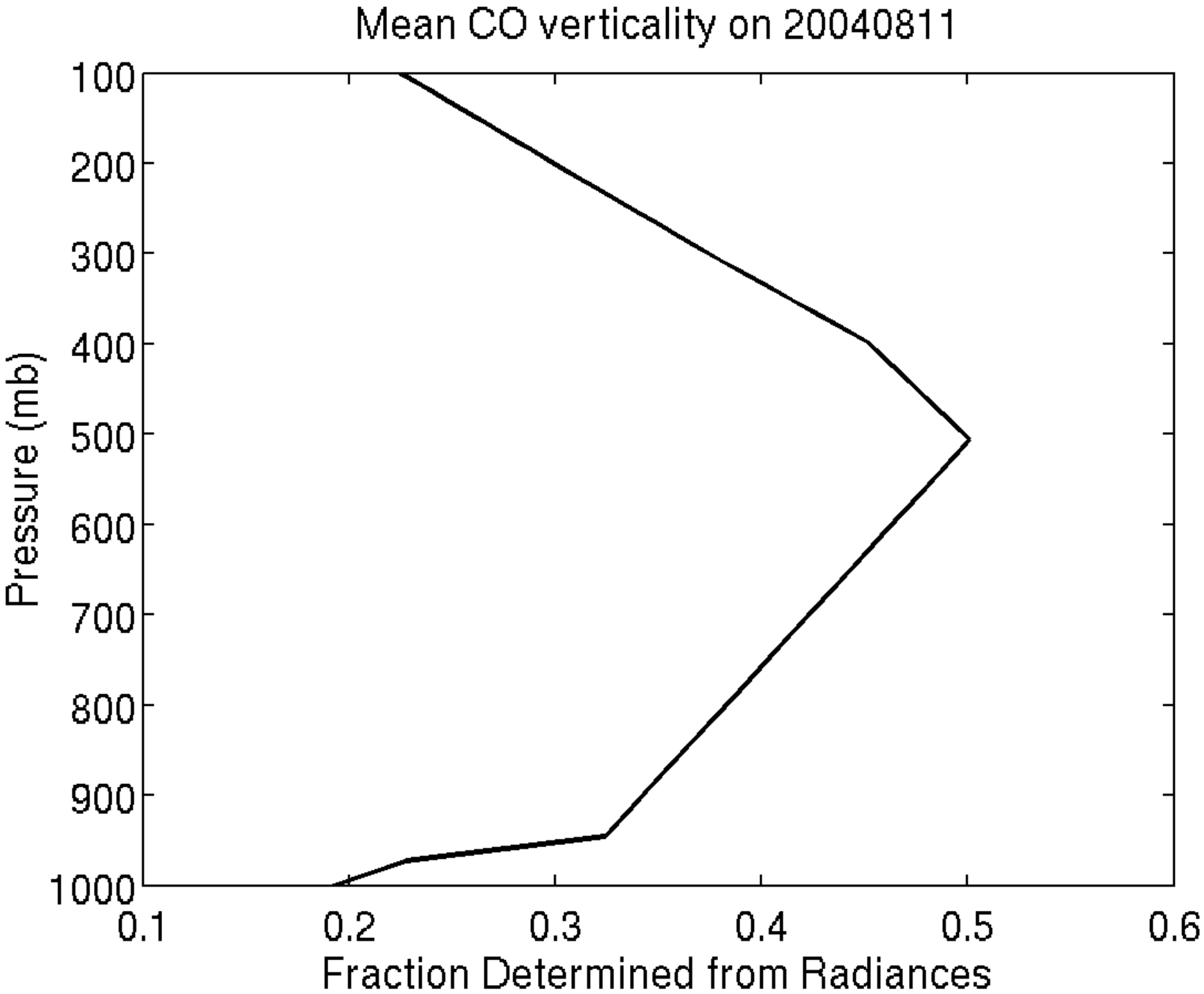

Local PM AIRS CO at 500 mb on 20040802
60˚ N
50˚ N
40˚ N
30˚ N
80˚ W
60˚ W
40˚ W
160
150
140
130
120
110
100
90
80
70
60
CO Mixing Ratio (ppbv) at 500 mb


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

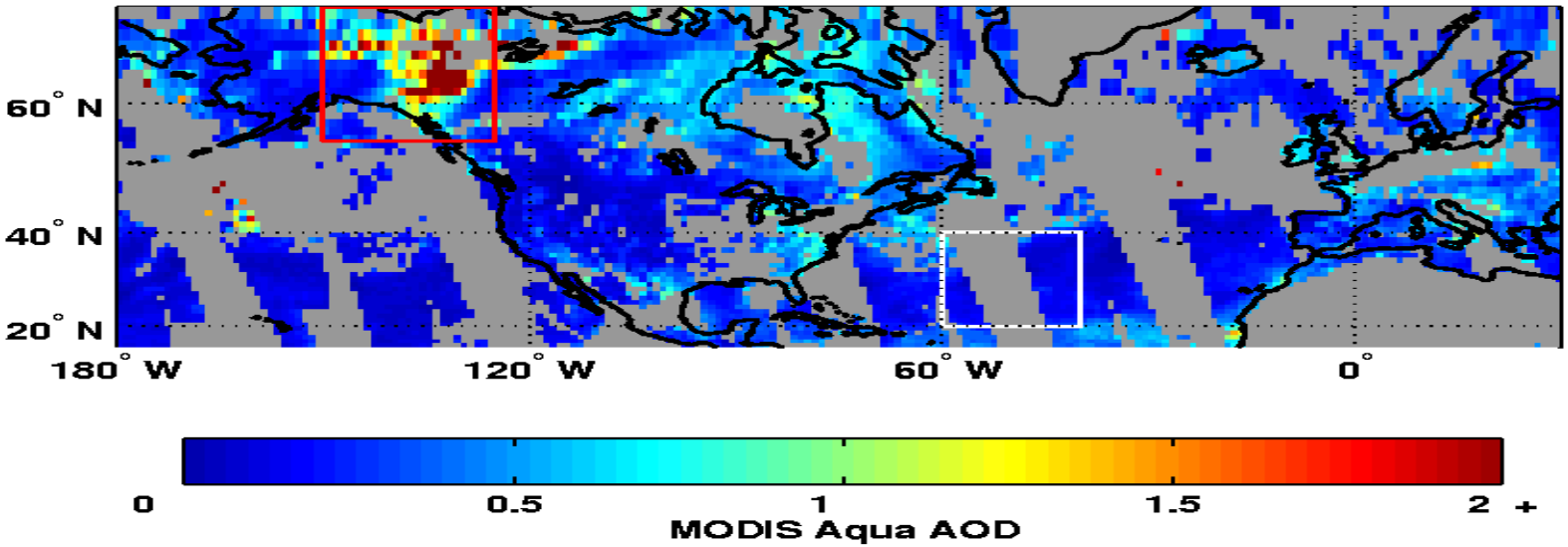

Retrieved vs. In Situ on 20040811
AIRS - conv. DACOM (300-700mb) = -1.7275
Pressure (mb)
CO Mixing Ratio (ppbv)
100
200
300
400
500
600
700
800
900
1000
0
50
100
150
200
DACOM
AIRS mean
AIRS + σ
AIRS - σ
First Guess
conv. DACOM


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

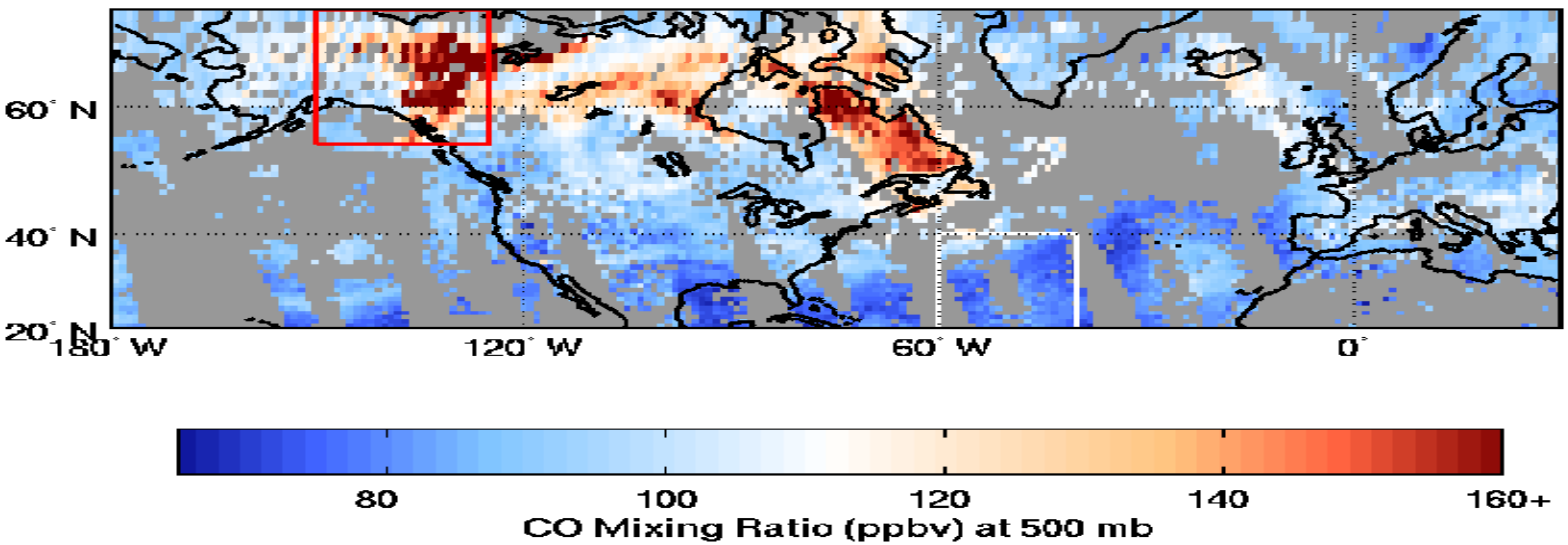
UMBC

JCET

Local PM MODIS Aqua AOD on 20040712



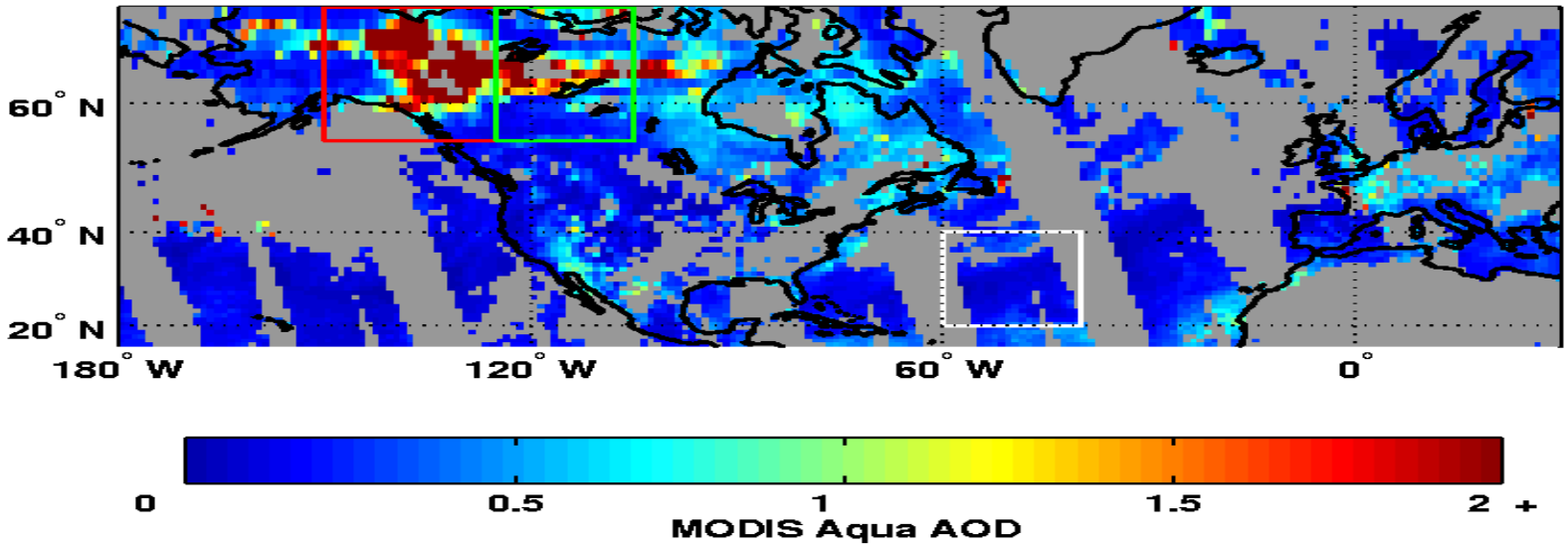
Local PM AIRS CO at 500 mb on 20040712



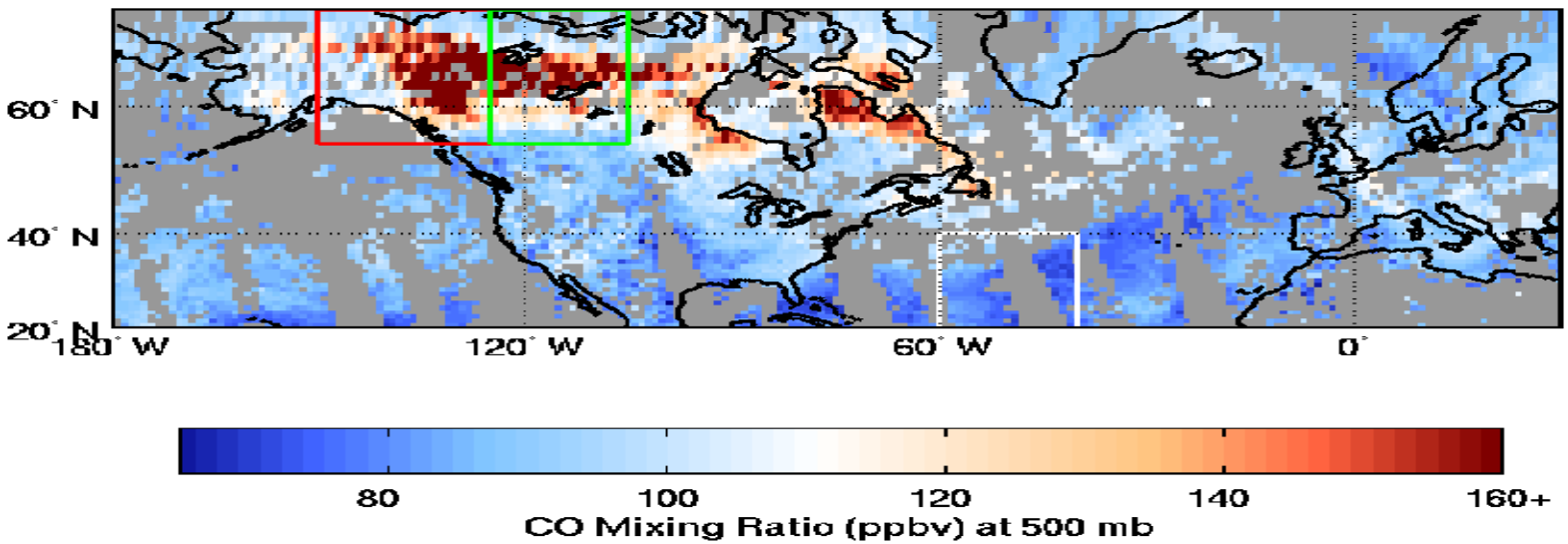
UMBC

JCET

Local PM MODIS Aqua AOD on 20040713



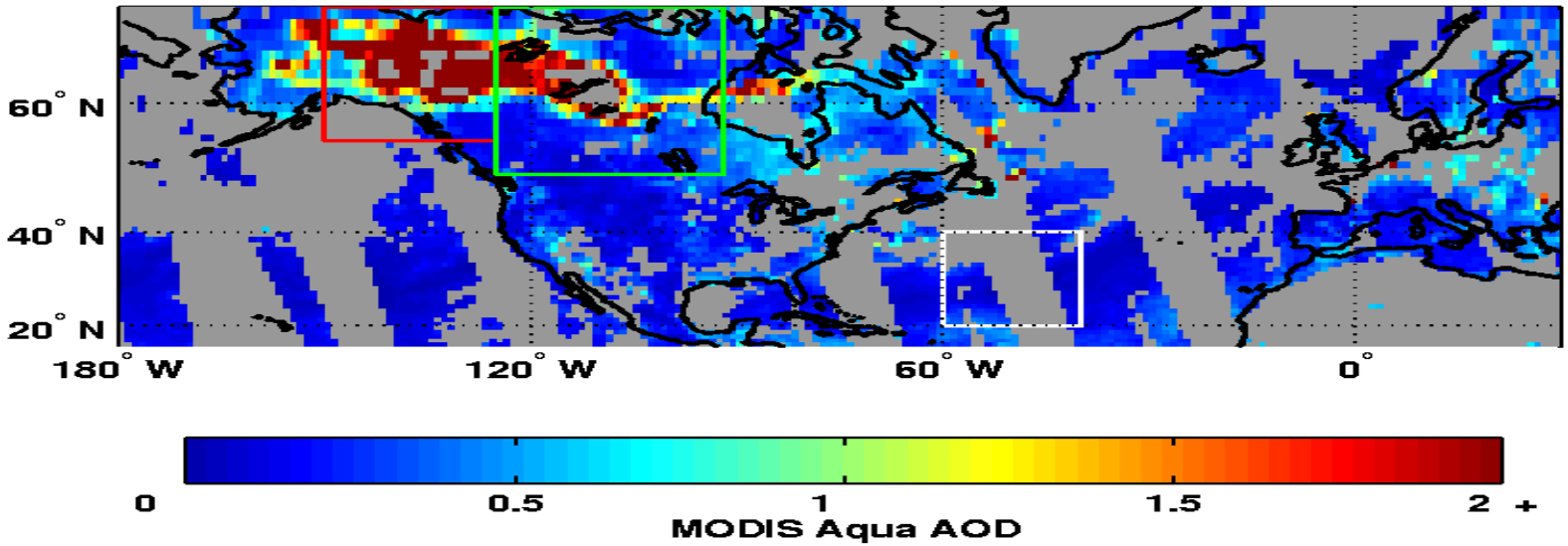
Local PM AIRS CO at 500 mb on 20040713



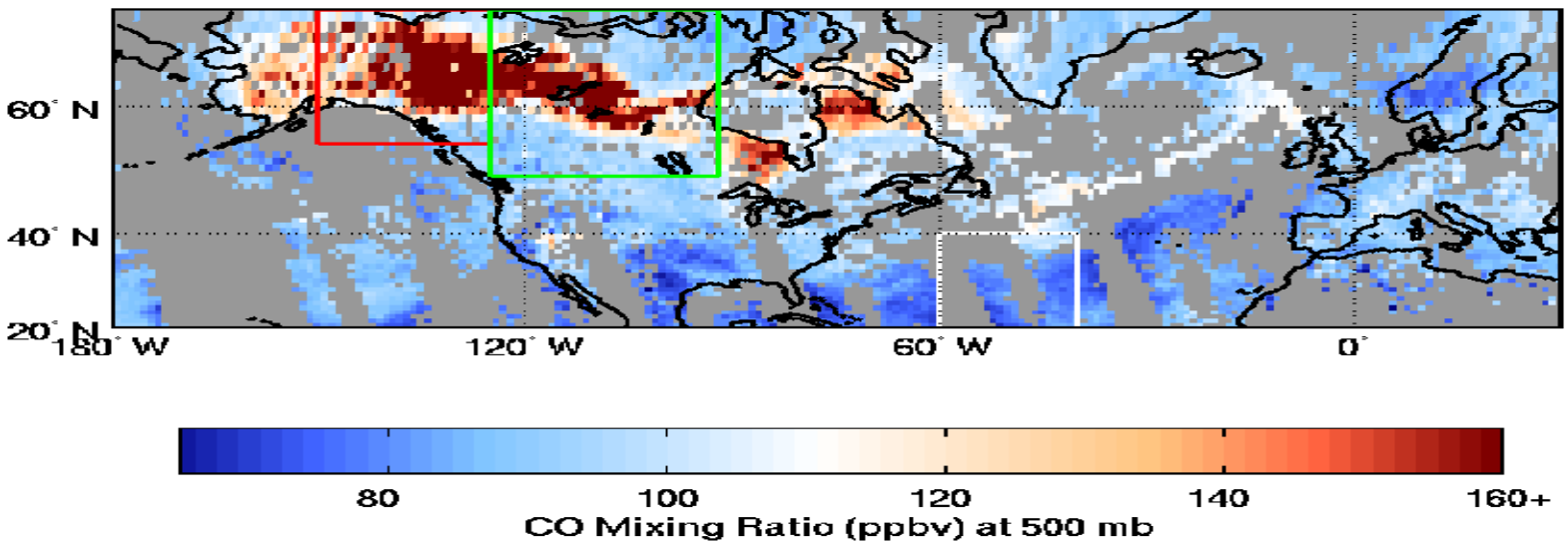
UMBC

JCET

Local PM MODIS Aqua AOD on 20040714



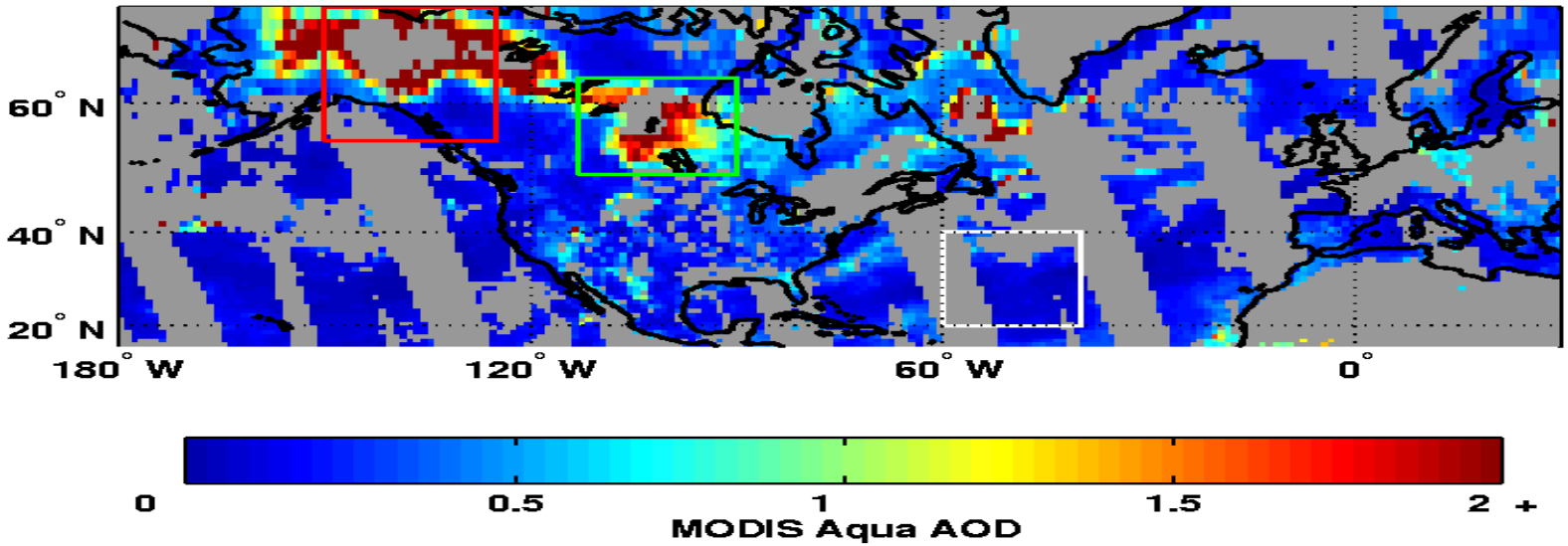
Local PM AIRS CO at 500 mb on 20040714



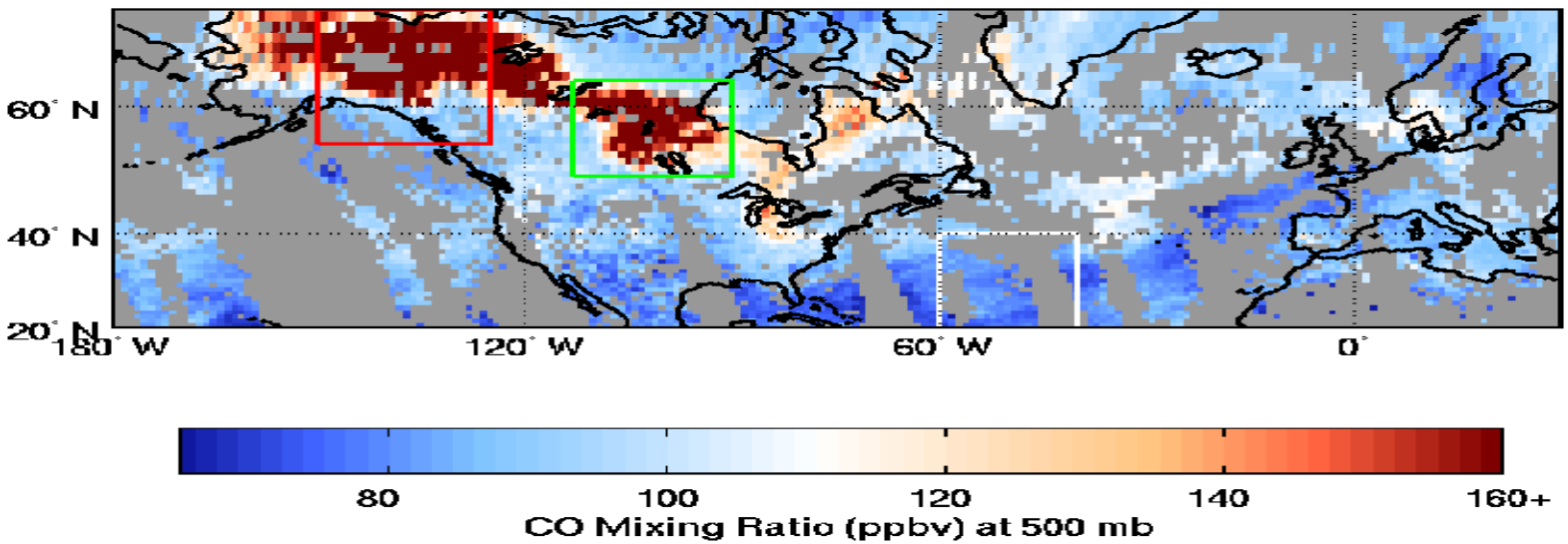
UMBC

JCET

Local PM MODIS Aqua AOD on 20040715



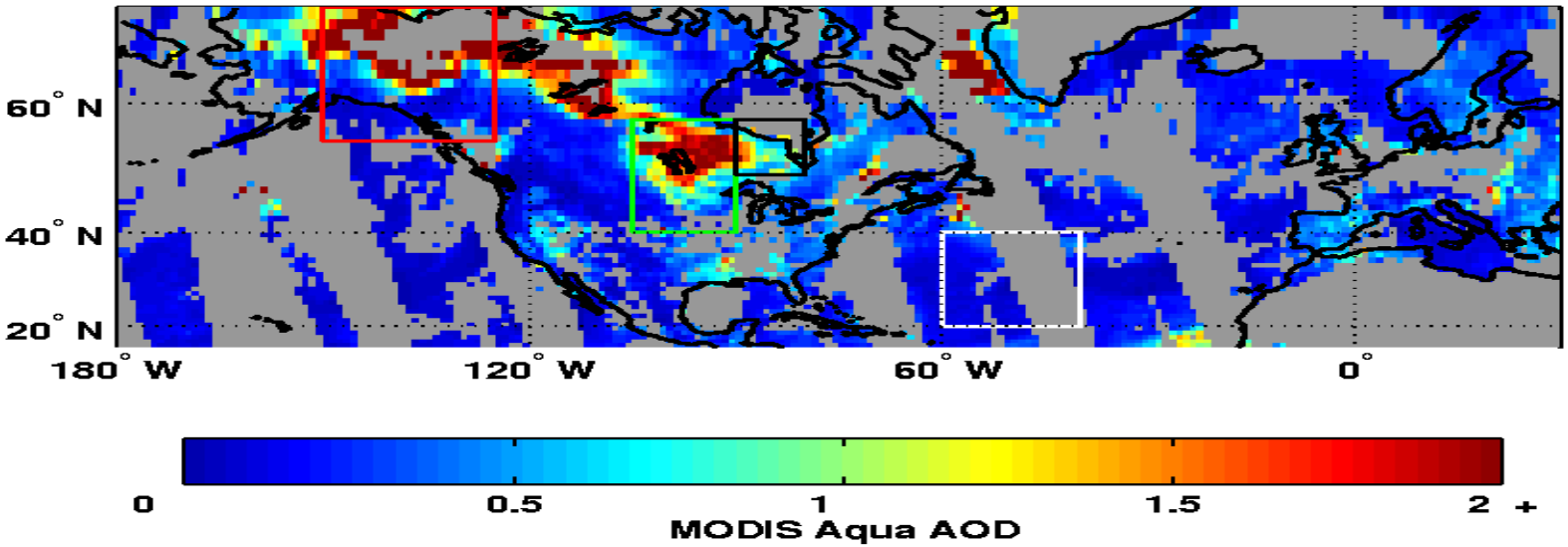
Local PM AIRS CO at 500 mb on 20040715



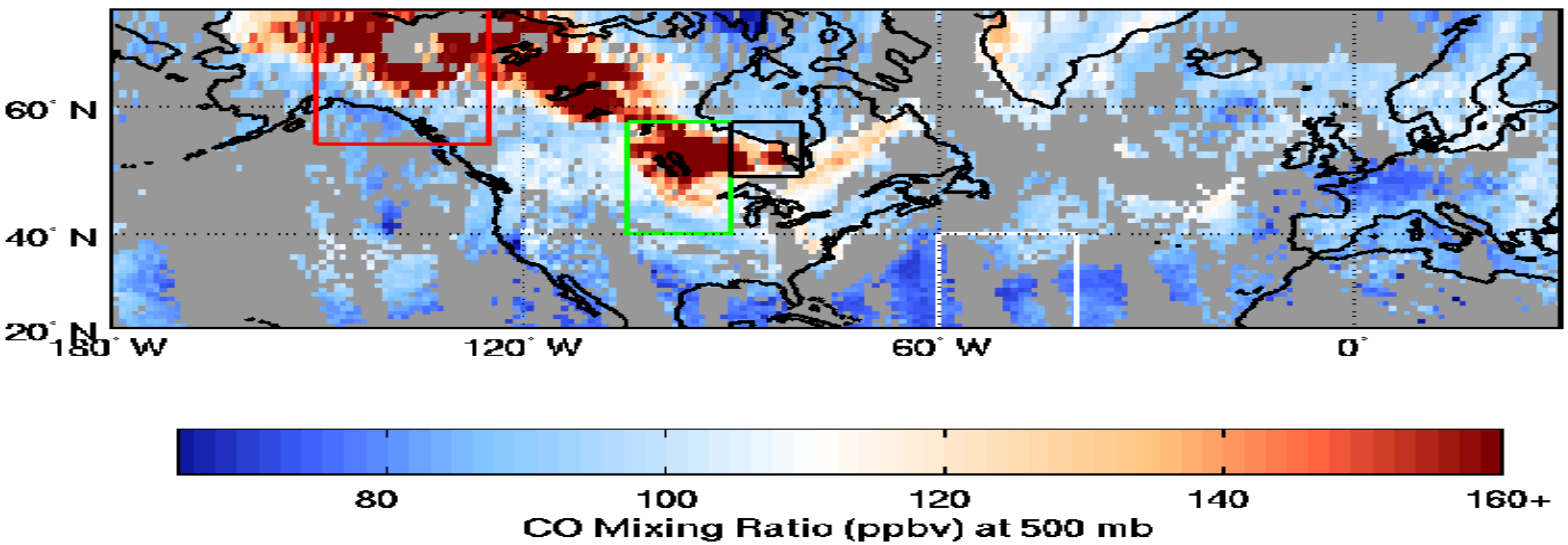
UMBC

JCET

Local PM MODIS Aqua AOD on 20040716



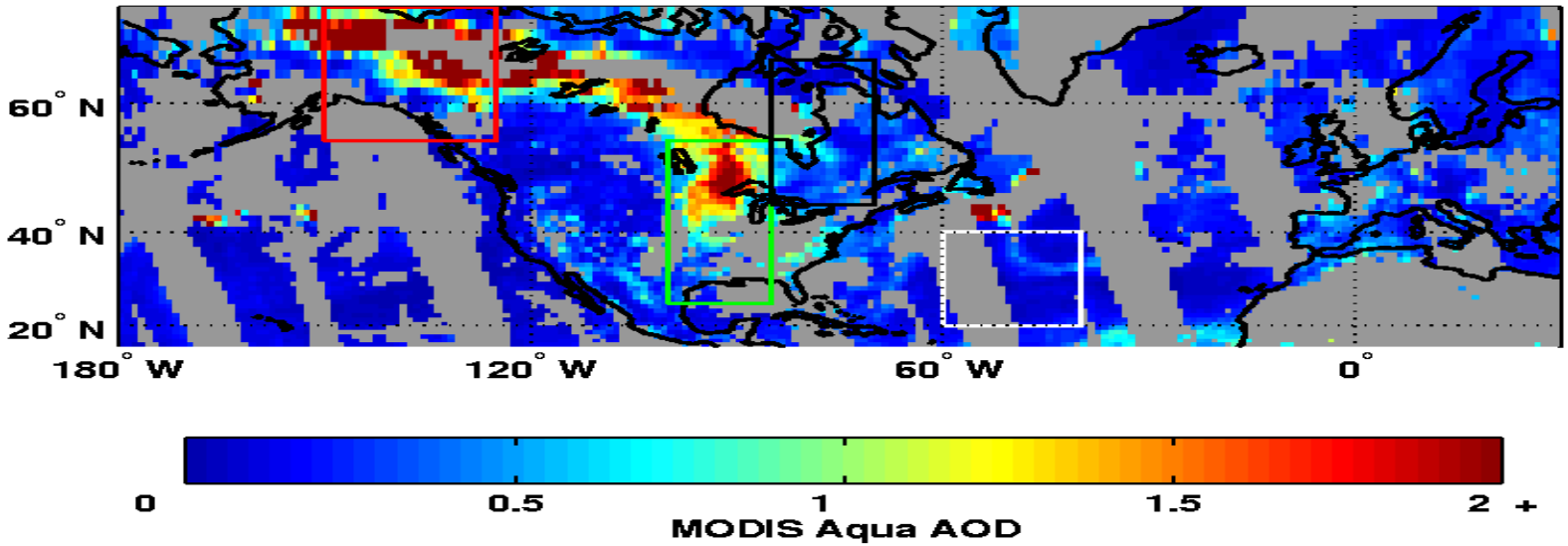
Local PM AIRS CO at 500 mb on 20040716



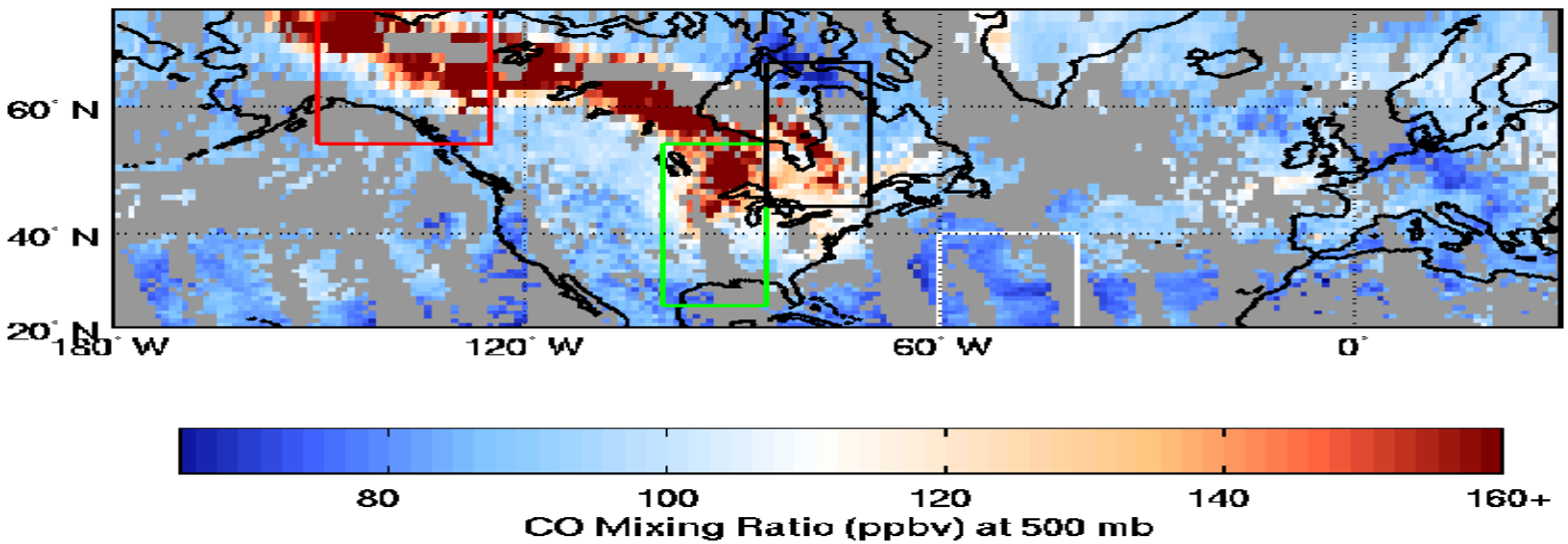
UMBC

JCET

Local PM MODIS Aqua AOD on 20040717



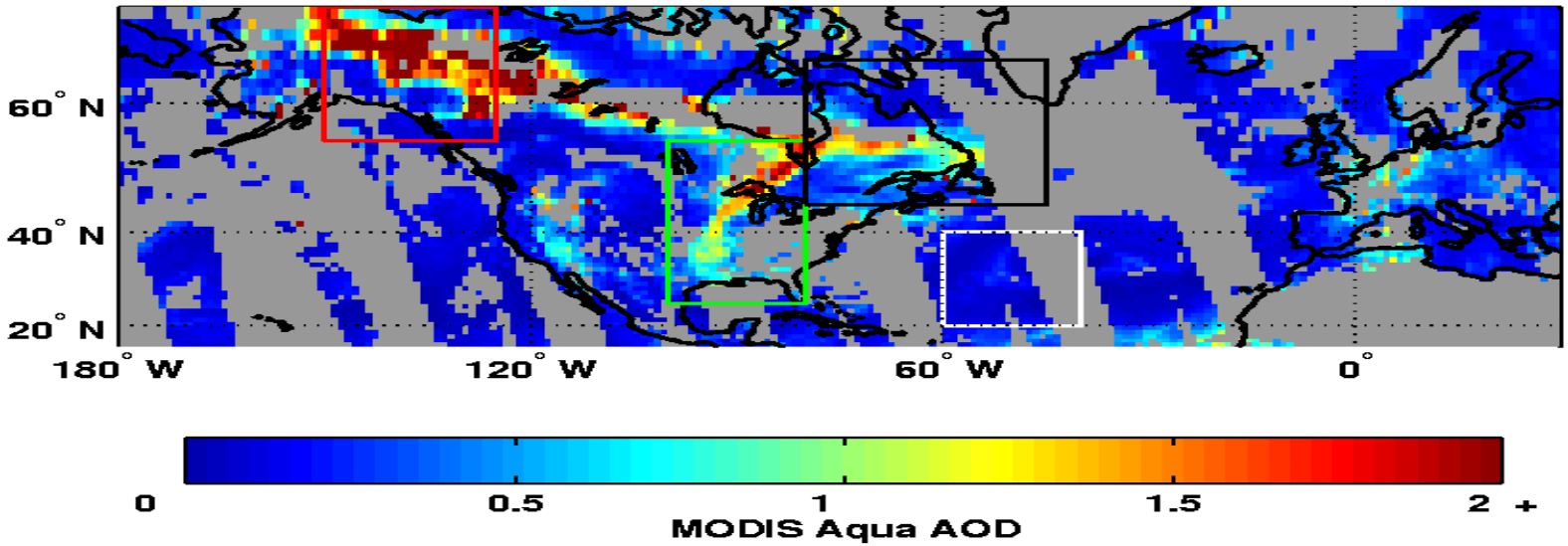
Local PM AIRS CO at 500 mb on 20040717



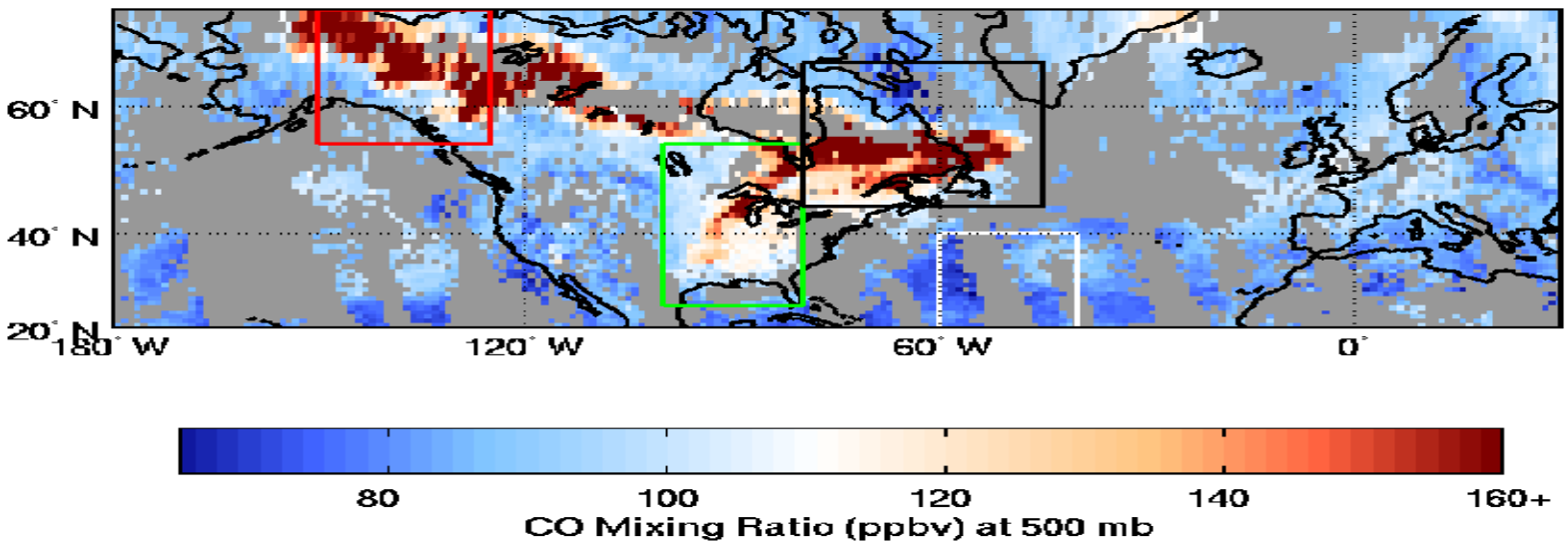
UMBC

JCET

Local PM MODIS Aqua AOD on 20040718



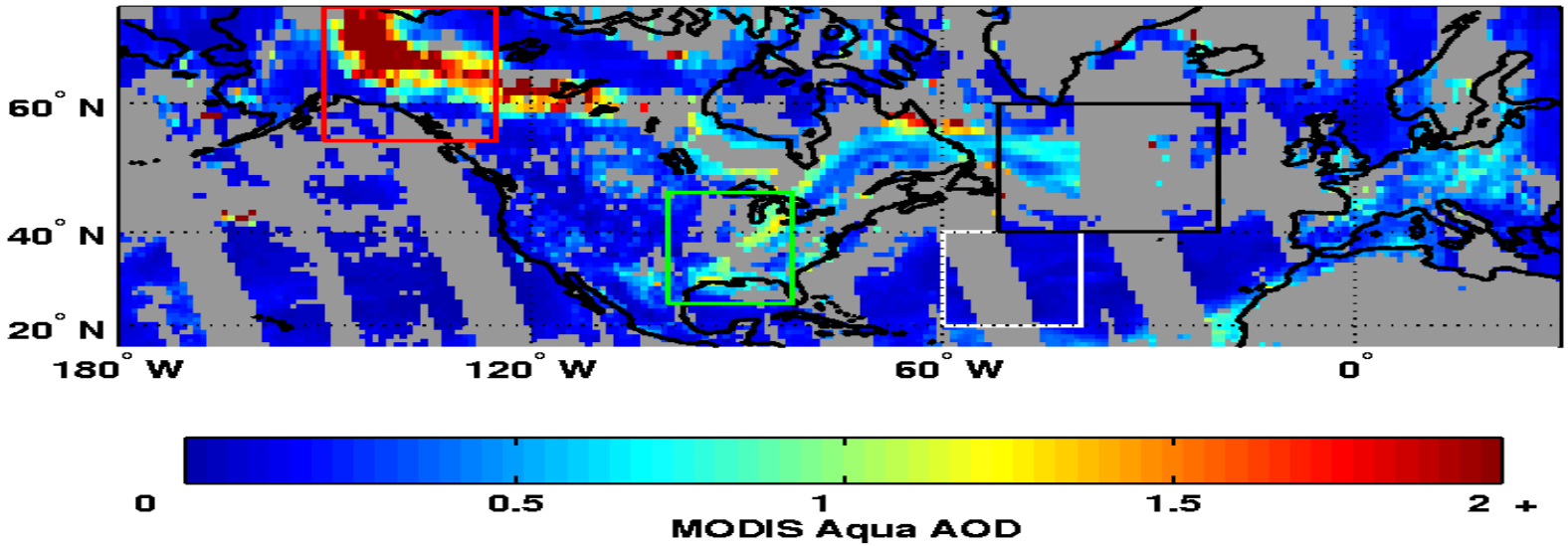
Local PM AIRS CO at 500 mb on 20040718



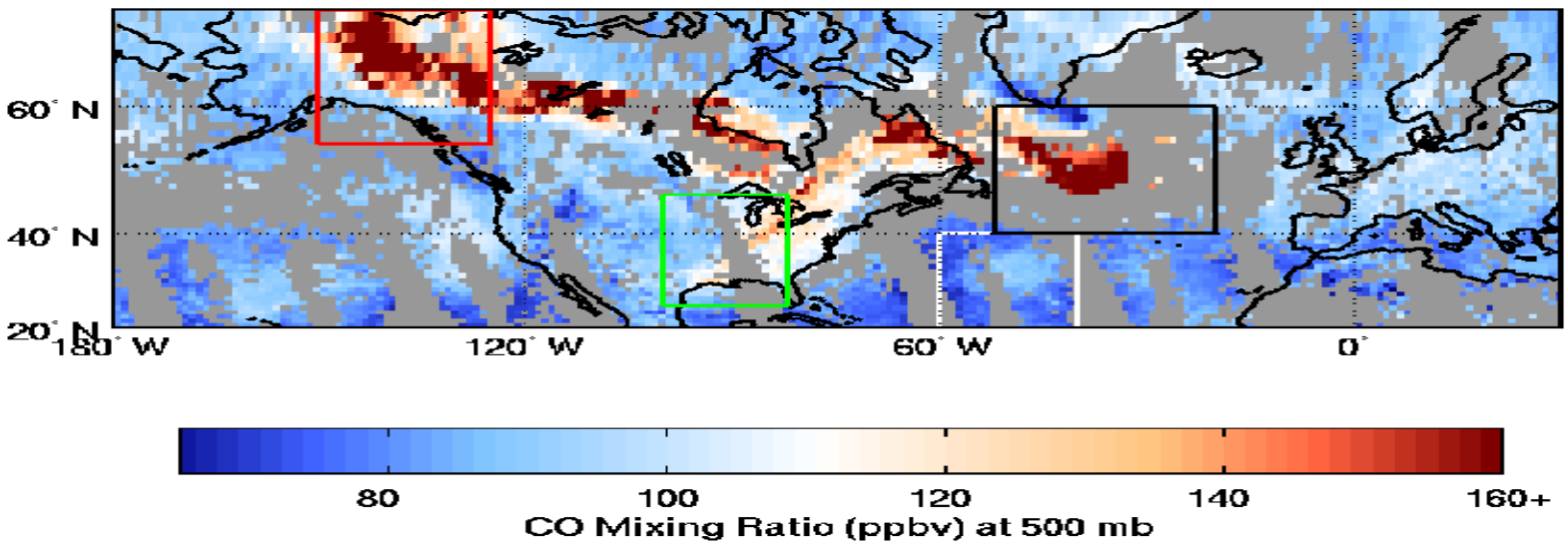
UMBC

JCET

Local PM MODIS Aqua AOD on 20040719



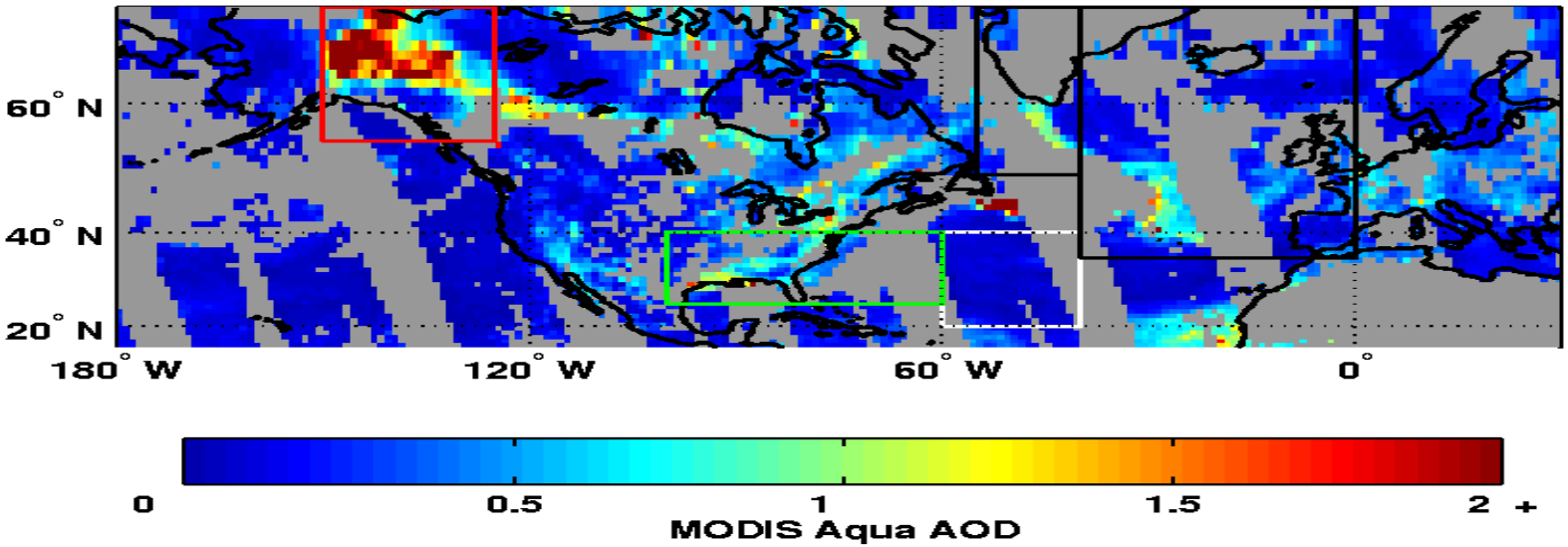
Local PM AIRS CO at 500 mb on 20040719



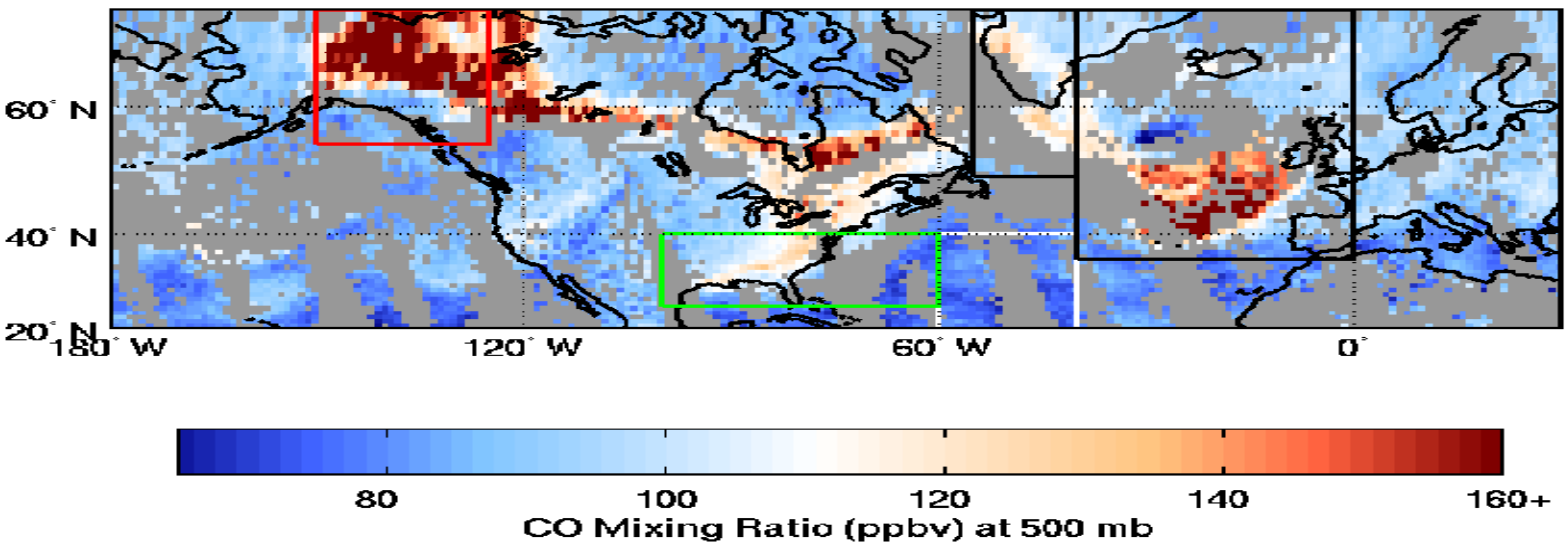
UMBC

JCET

Local PM MODIS Aqua AOD on 20040720



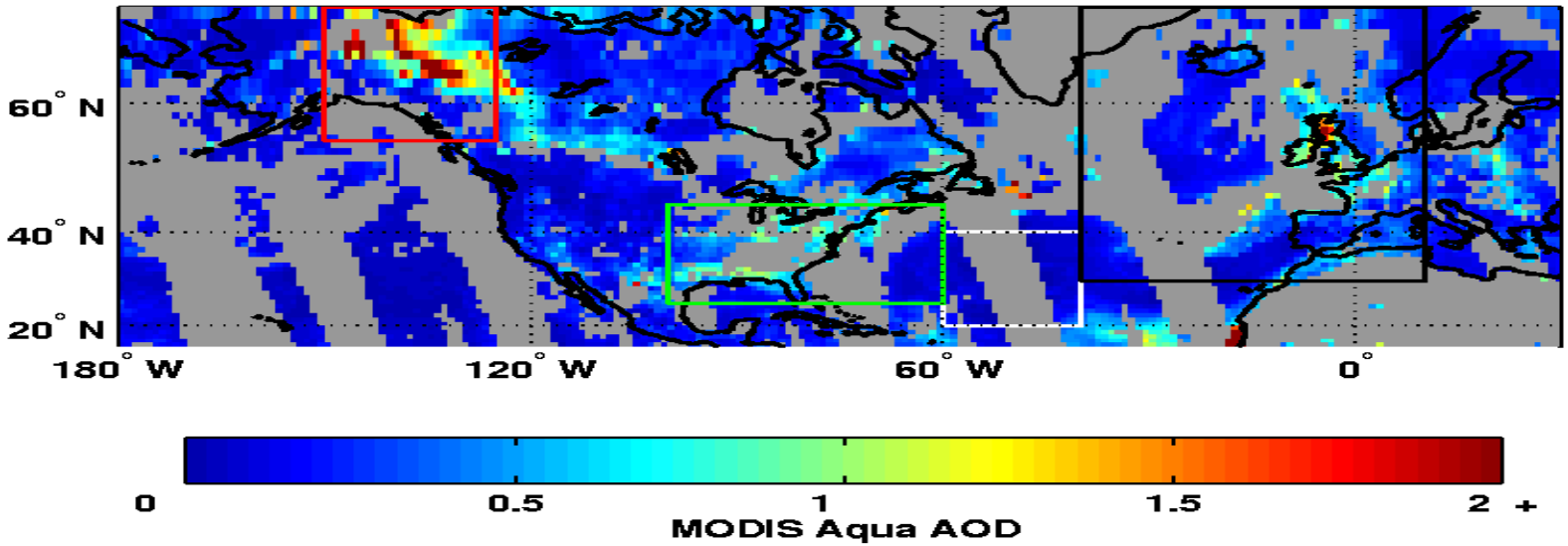
Local PM AIRS CO at 500 mb on 20040720



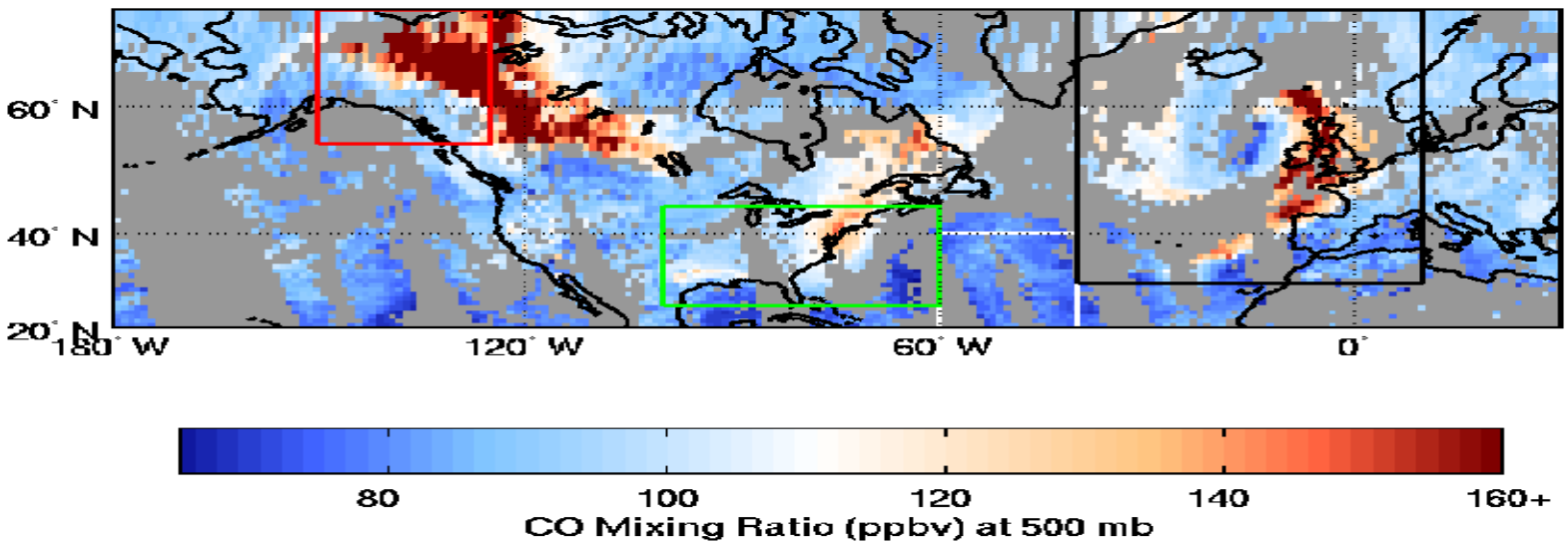
UMBC

JCET

Local PM MODIS Aqua AOD on 20040721



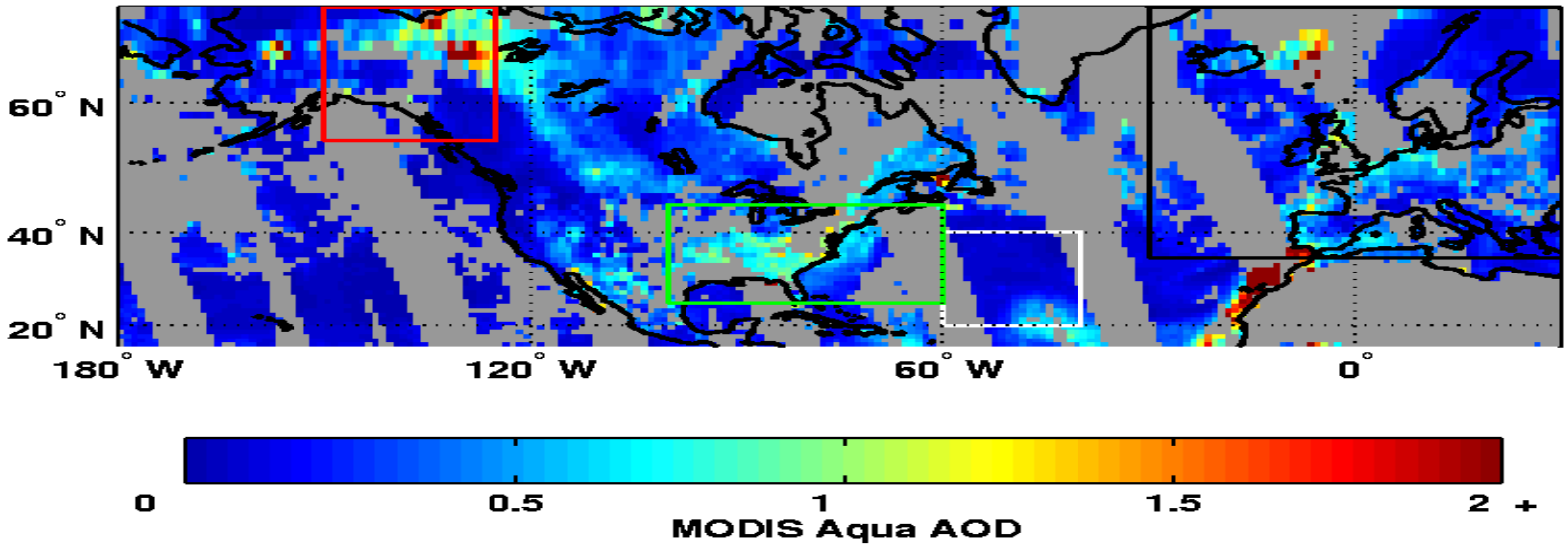
Local PM AIRS CO at 500 mb on 20040721



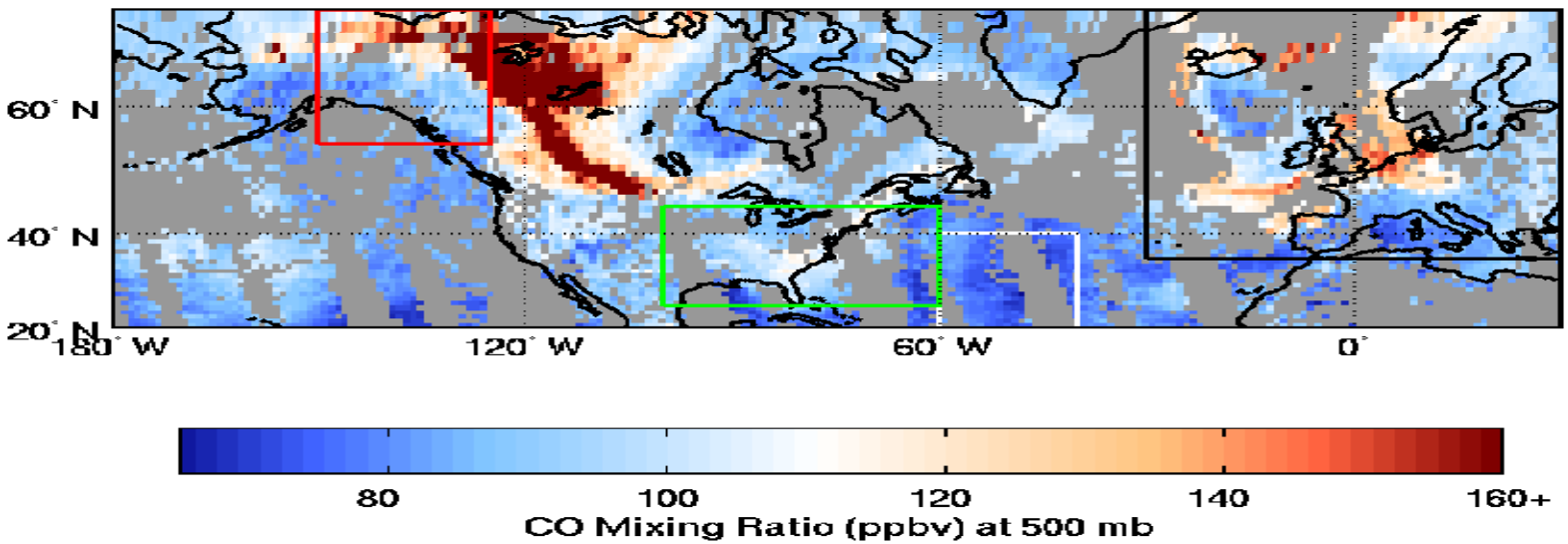
UMBC

JCET

Local PM MODIS Aqua AOD on 20040722



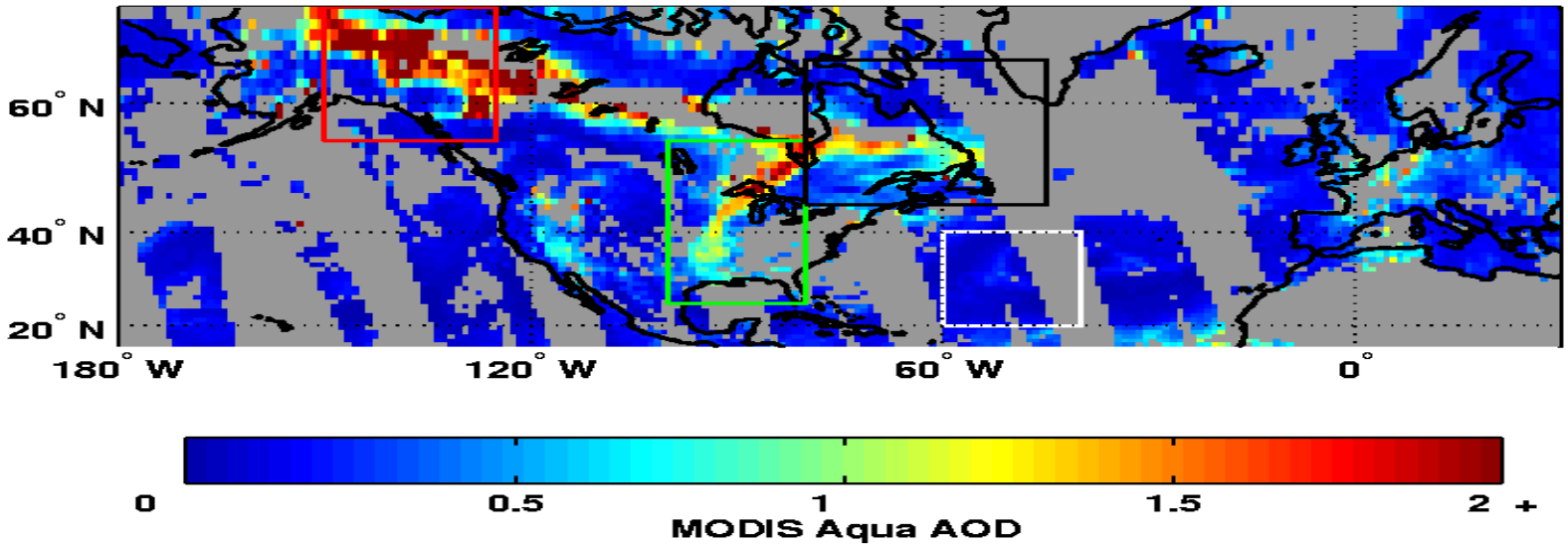
Local PM AIRS CO at 500 mb on 20040722



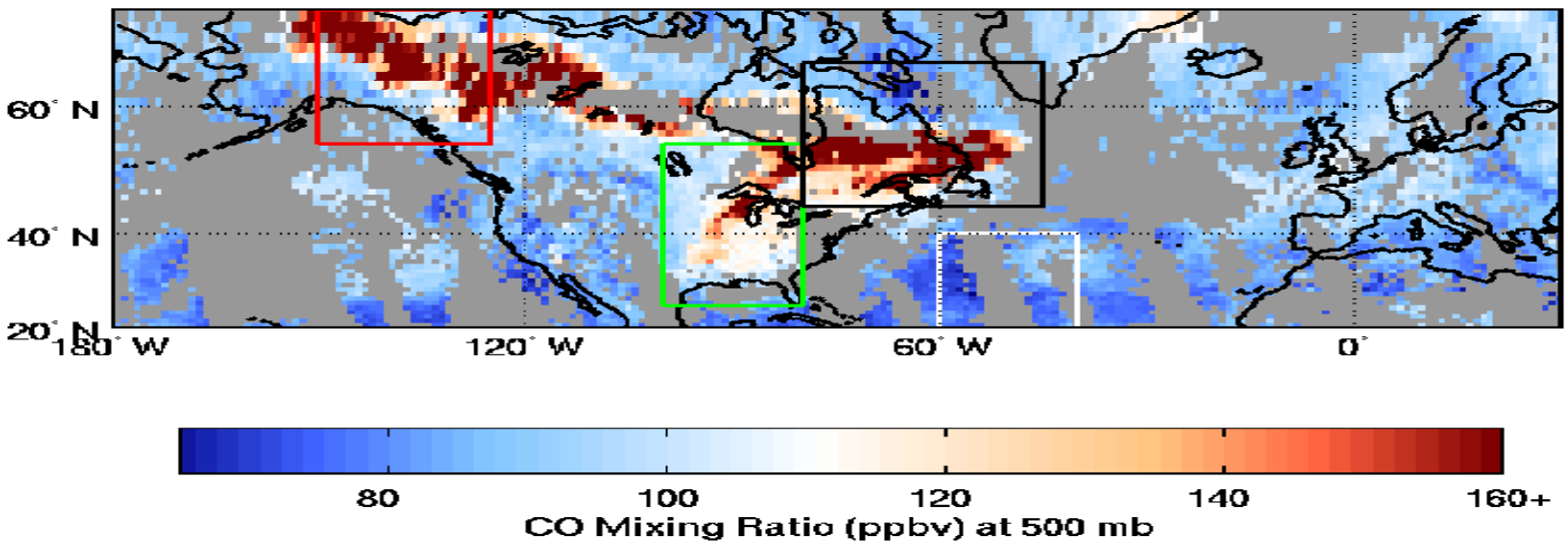
UMBC

JCET

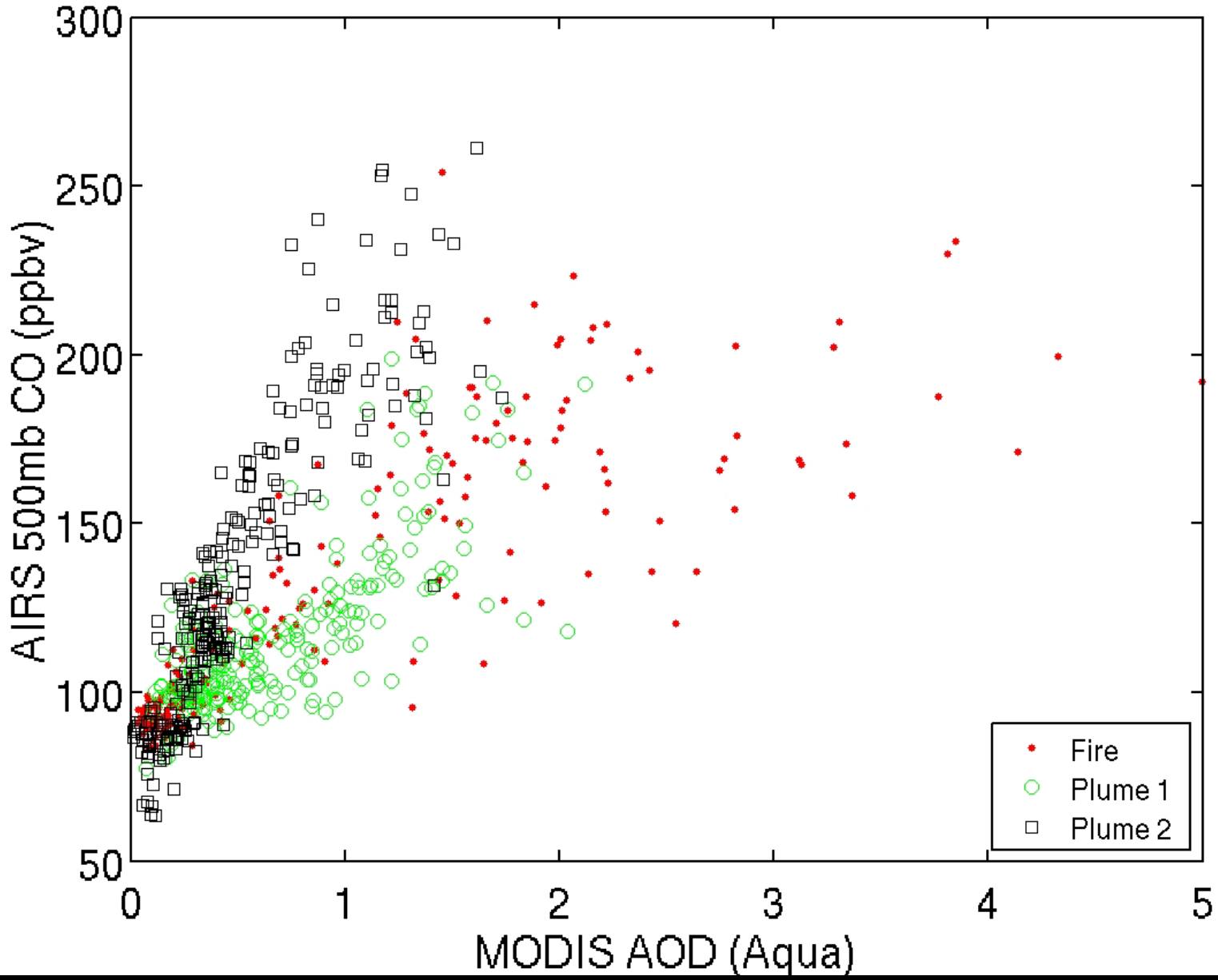
Local PM MODIS Aqua AOD on 20040718



Local PM AIRS CO at 500 mb on 20040718



AIRS CO vs. MODIS Aqua AOD Fits July 18, 2004



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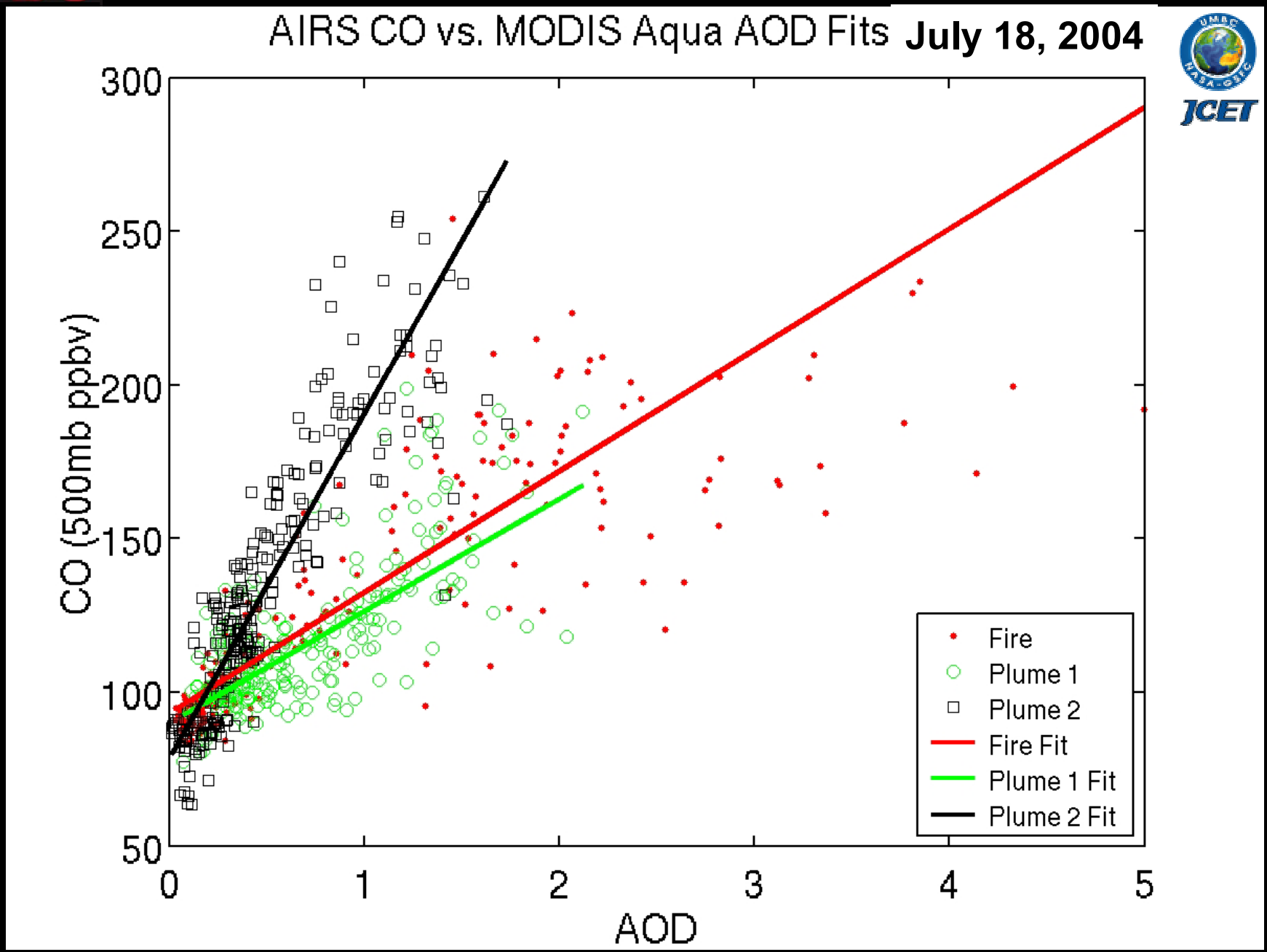
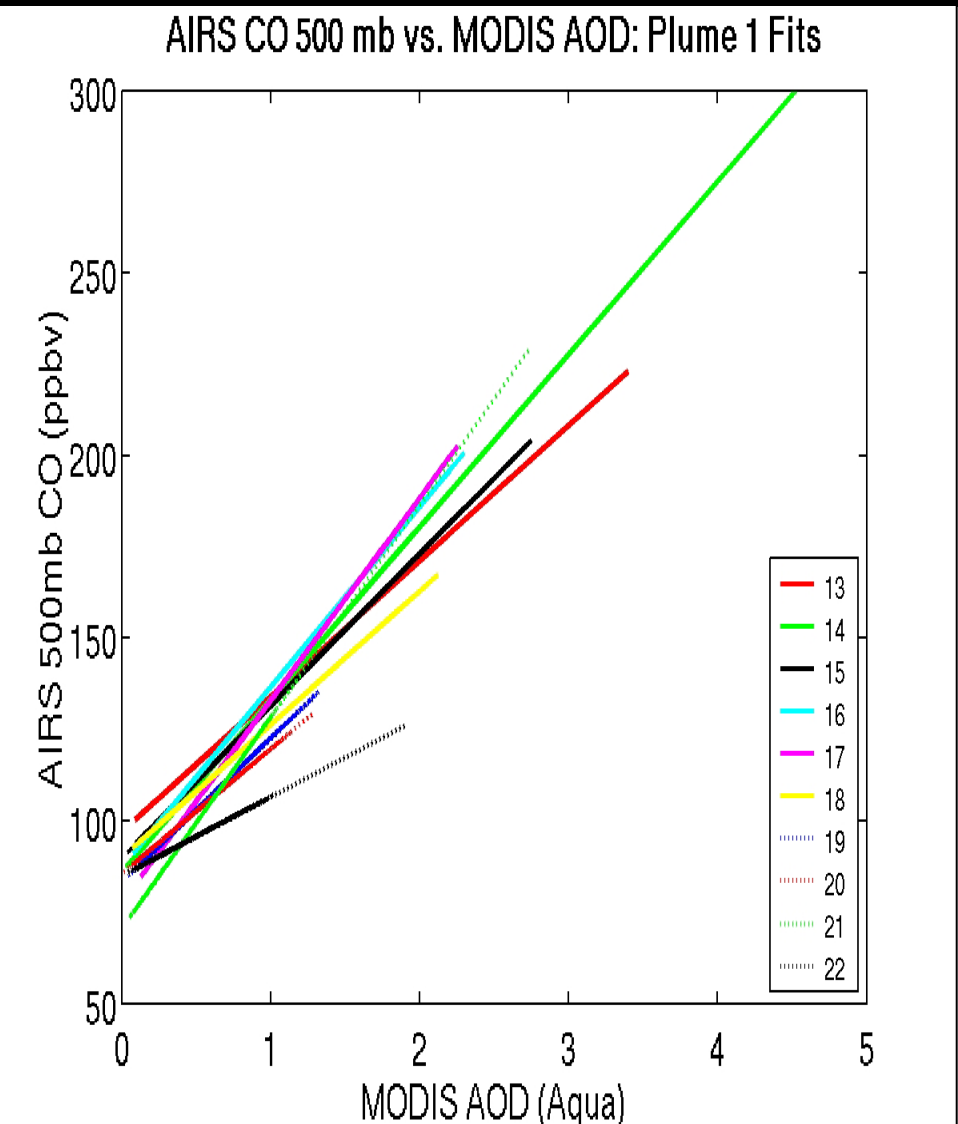
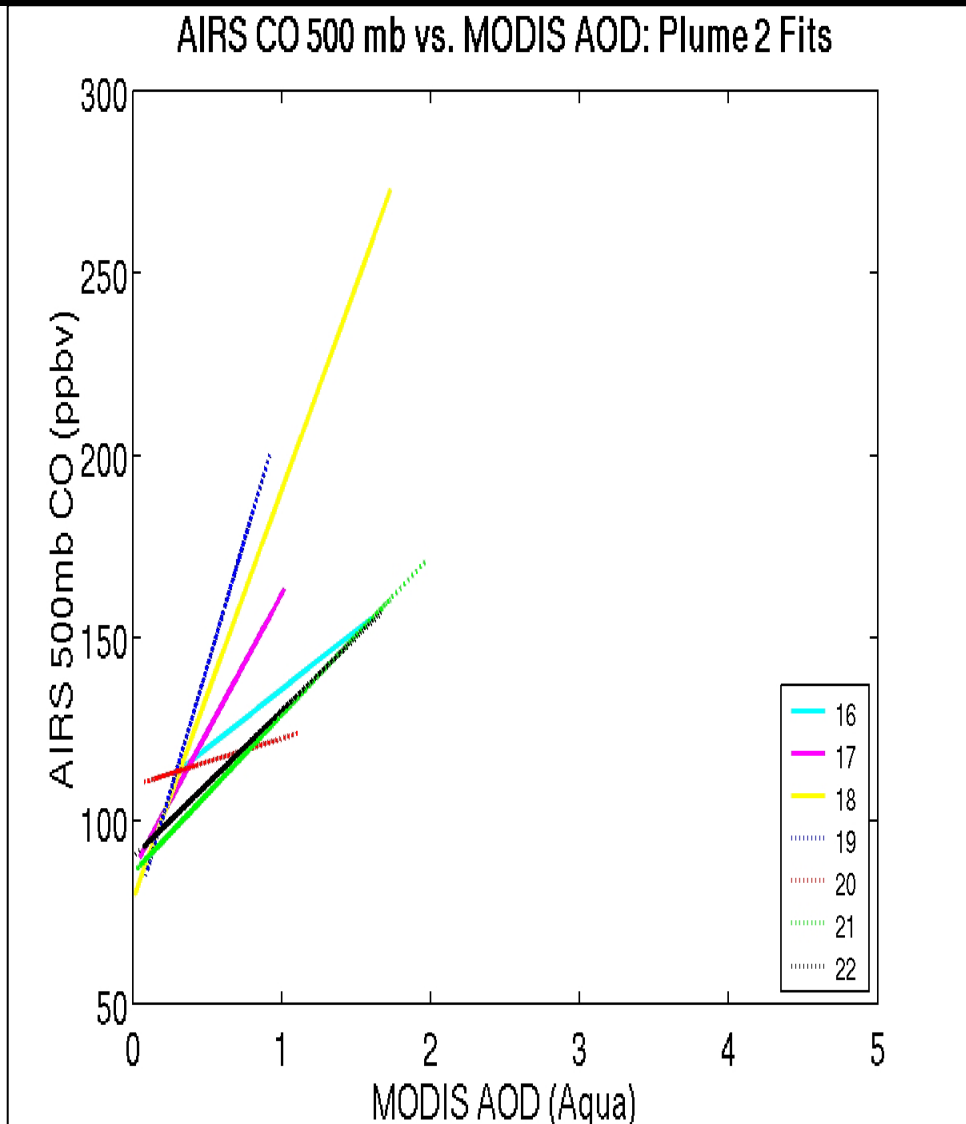

AIRS CO vs. MODIS Aqua AOD Fits
July 18, 2004
CO (500mb ppbv)
AOD
300
250
200
150
100
50
0
1
2
3
4
5
Fire
Plume 1
Plume 2
Fire Fit
Plume 1 Fit
Plume 2 Fit

AIRS CO vs. MODIS AOD: Plume Evolution

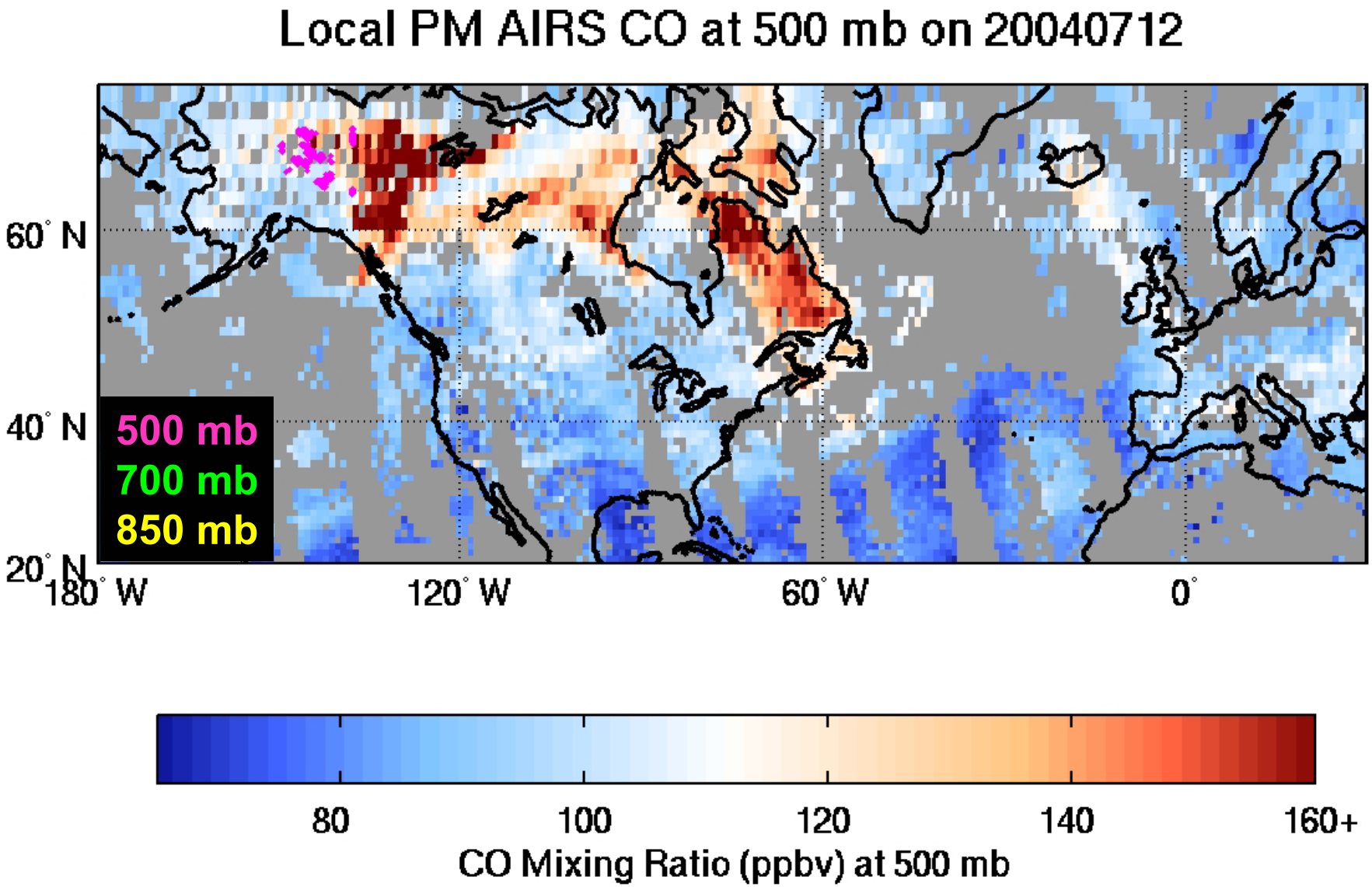




UMBC

AIRS CO and Trajectories

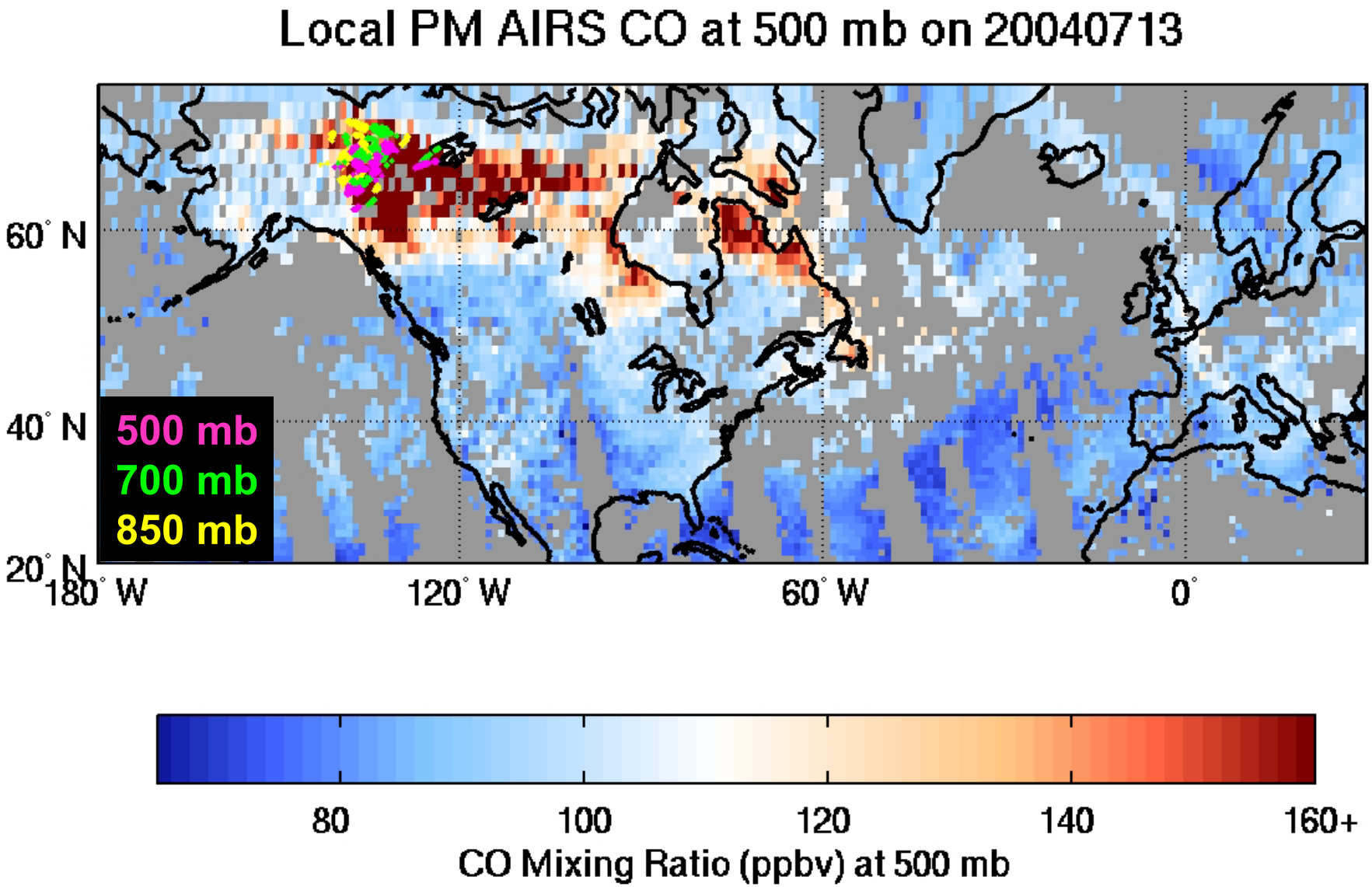
JCET



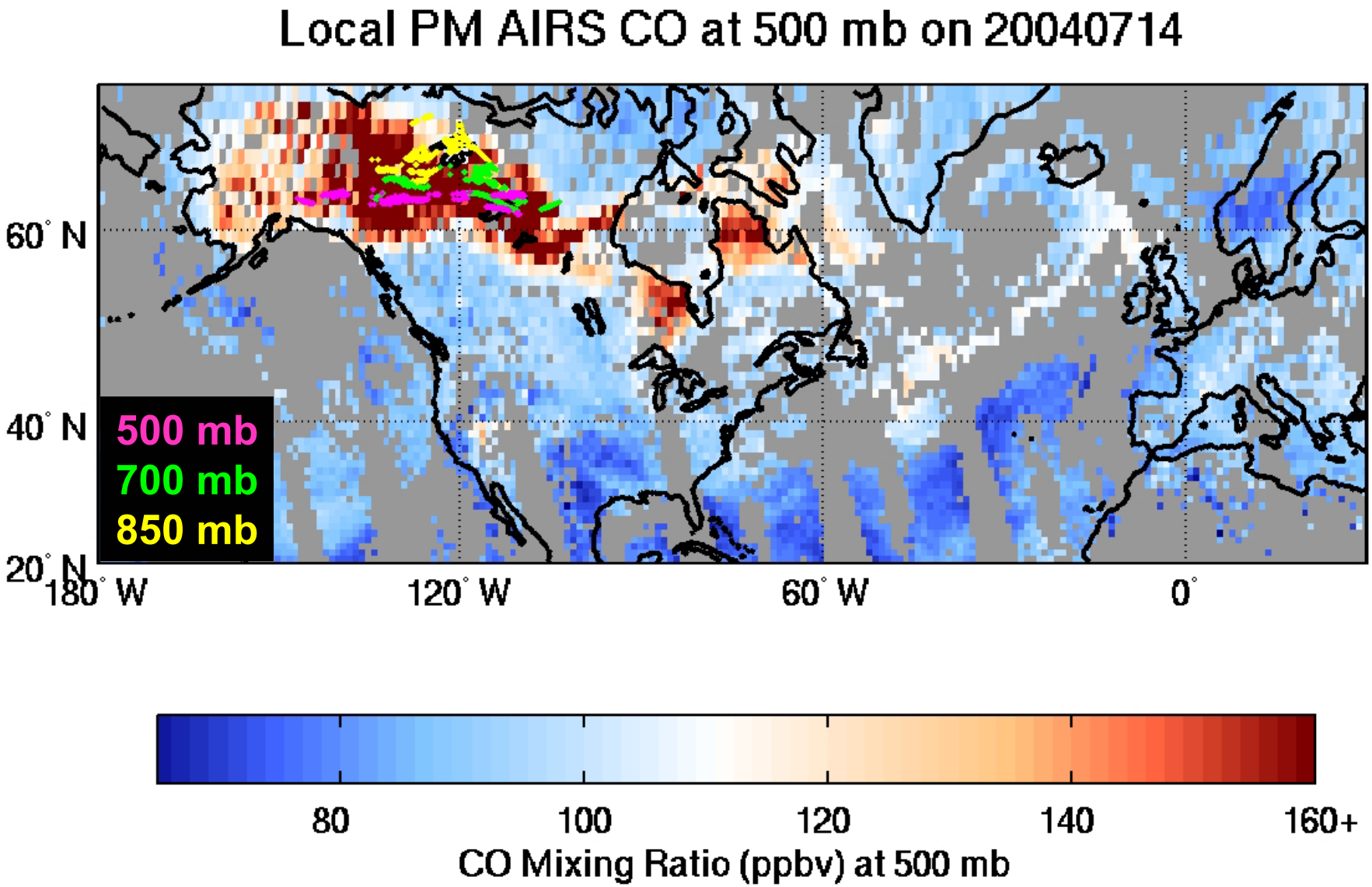
UMBC

AIRS CO and Trajectories

JCET



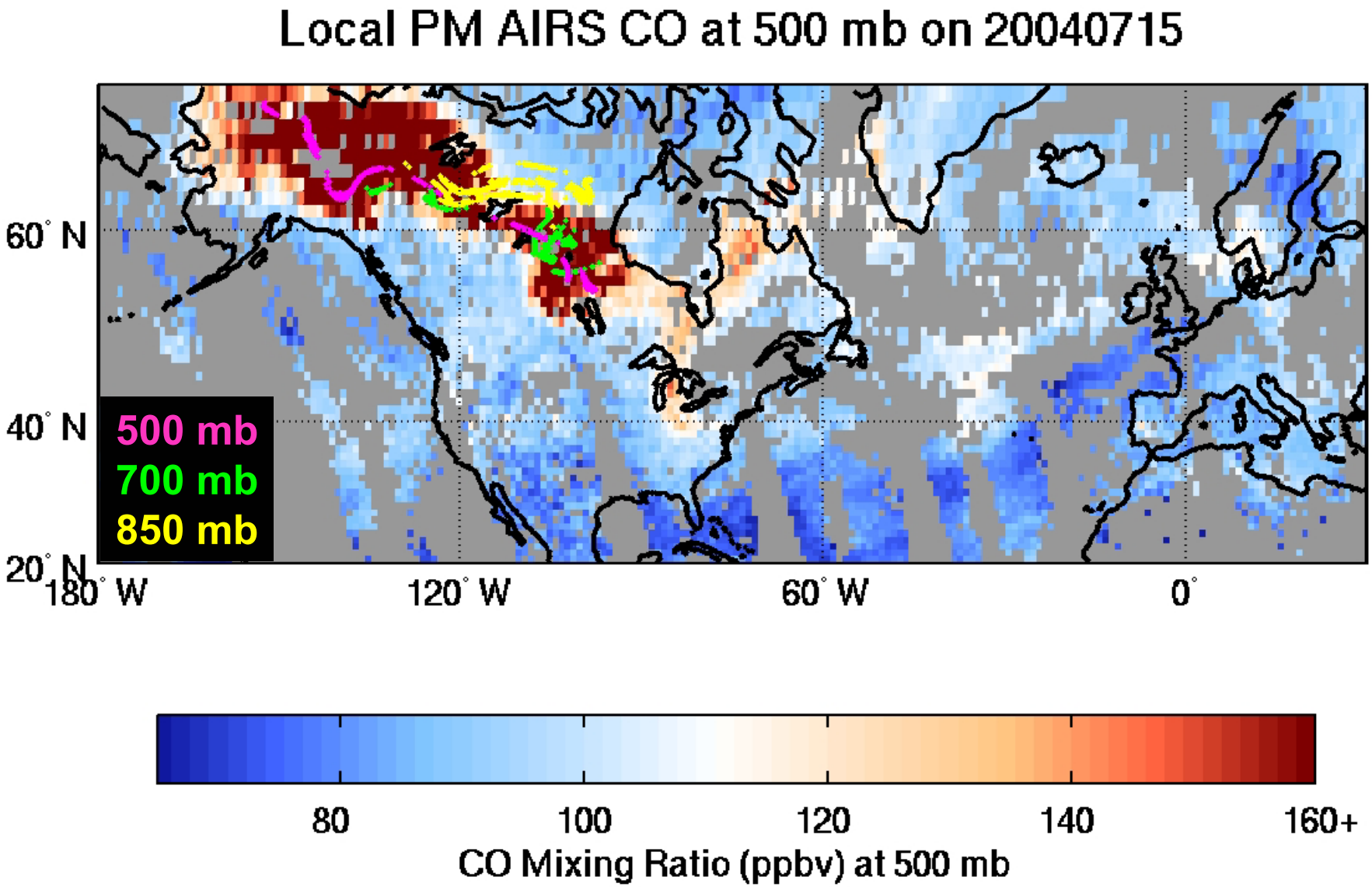
AIRS CO and Trajectories



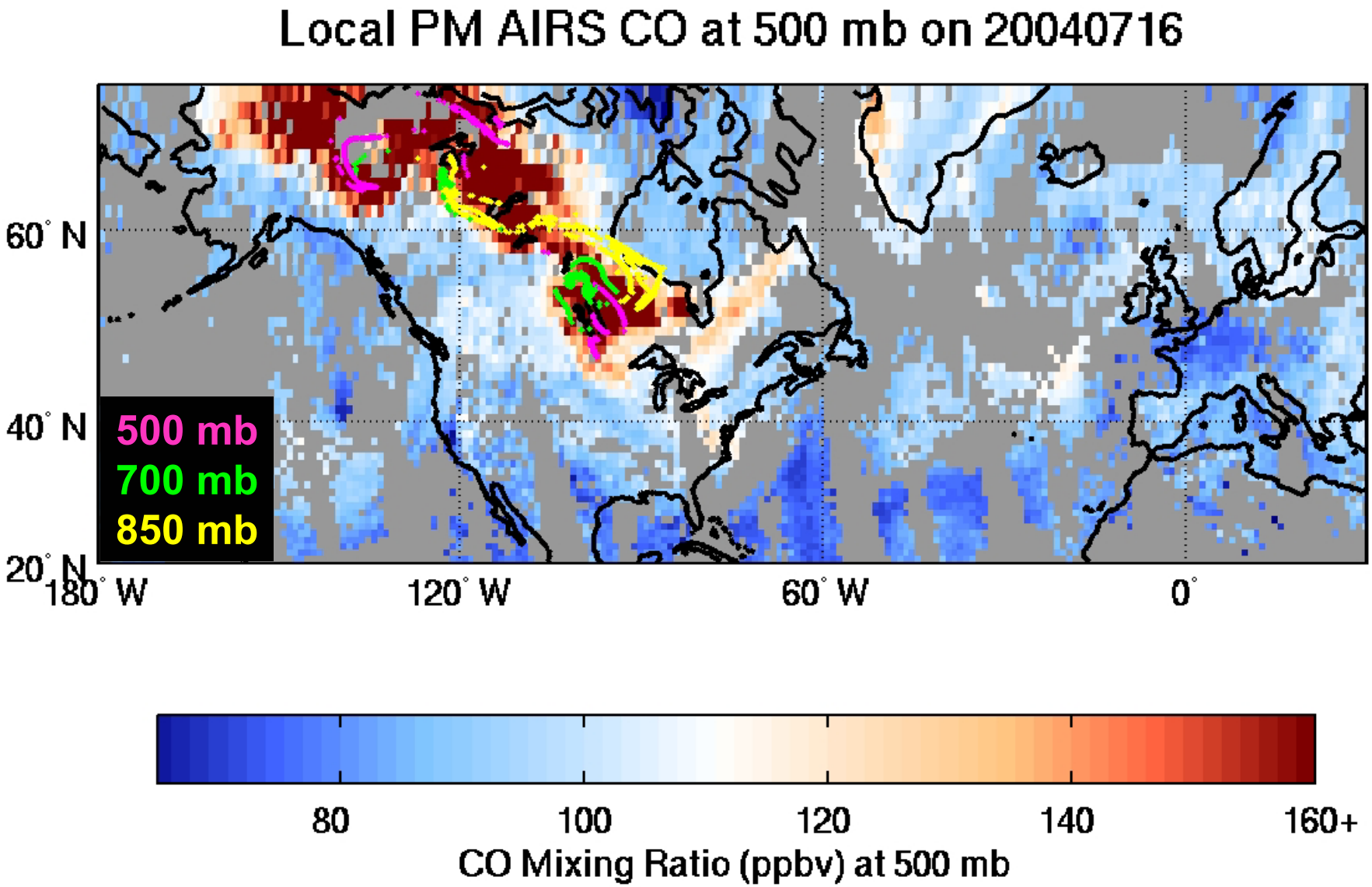
UMBC

AIRS CO and Trajectories

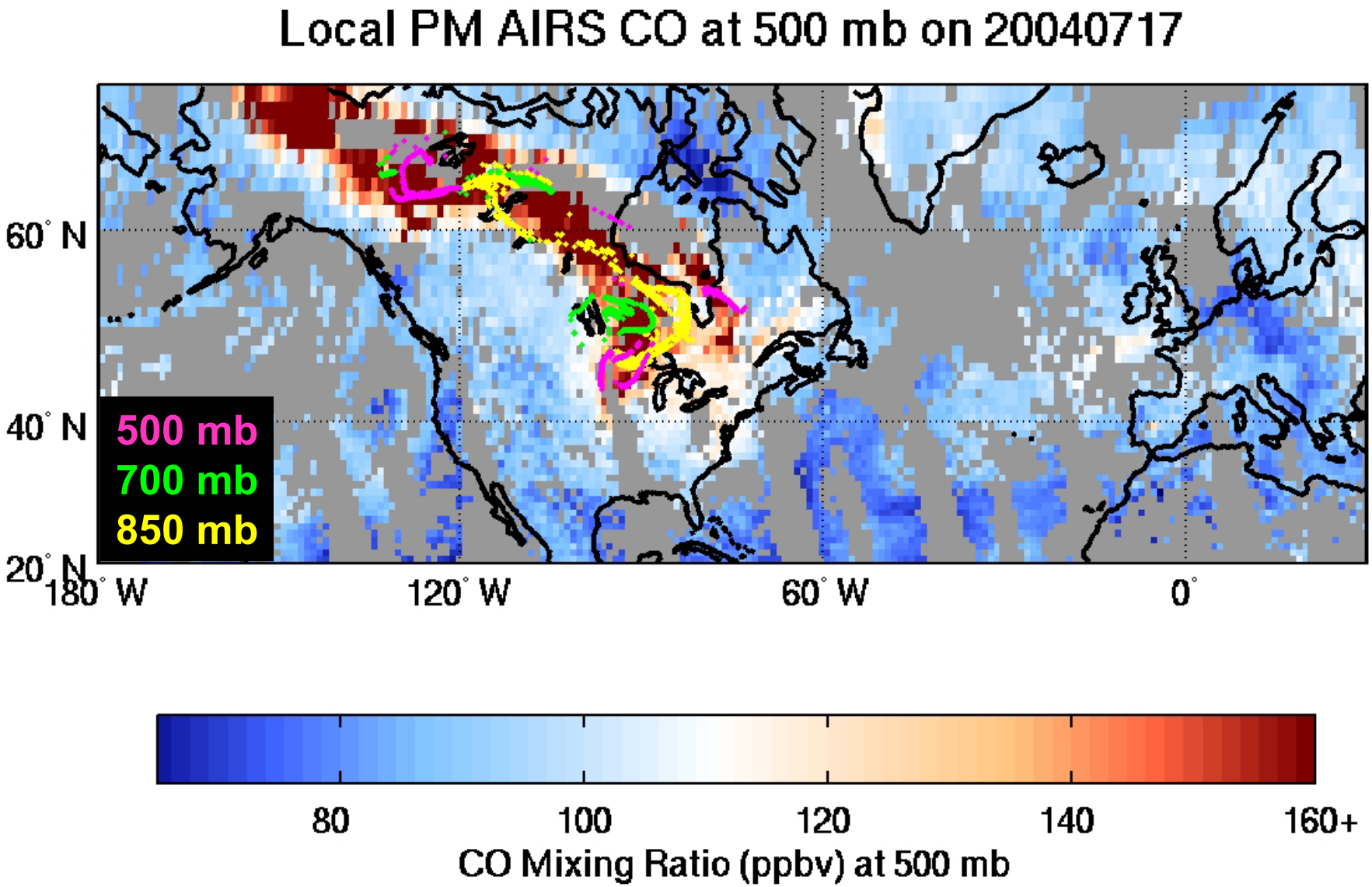
JCET



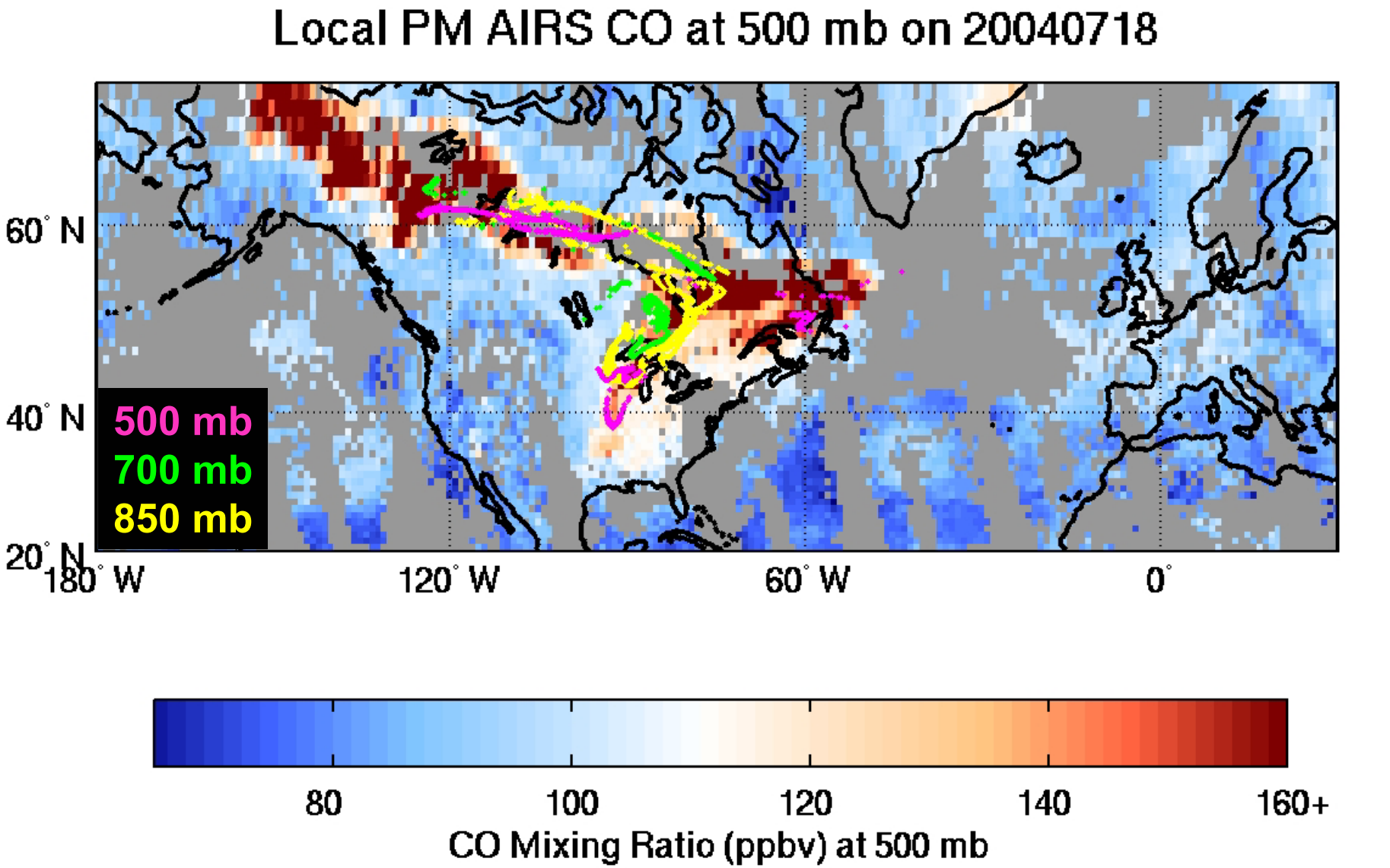
AIRS CO and Trajectories



AIRS CO and Trajectories



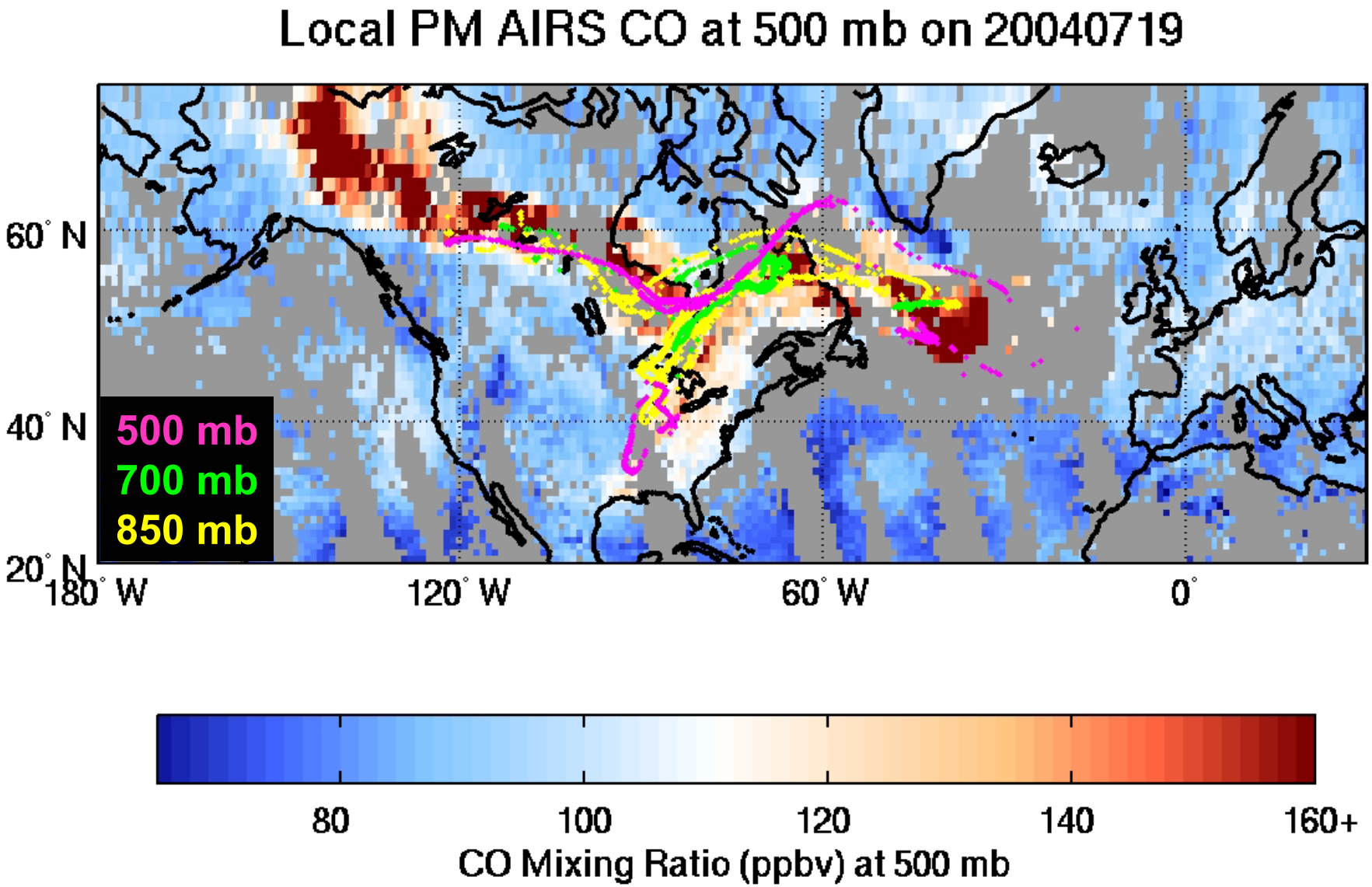
AIRS CO and Trajectories



UMBC

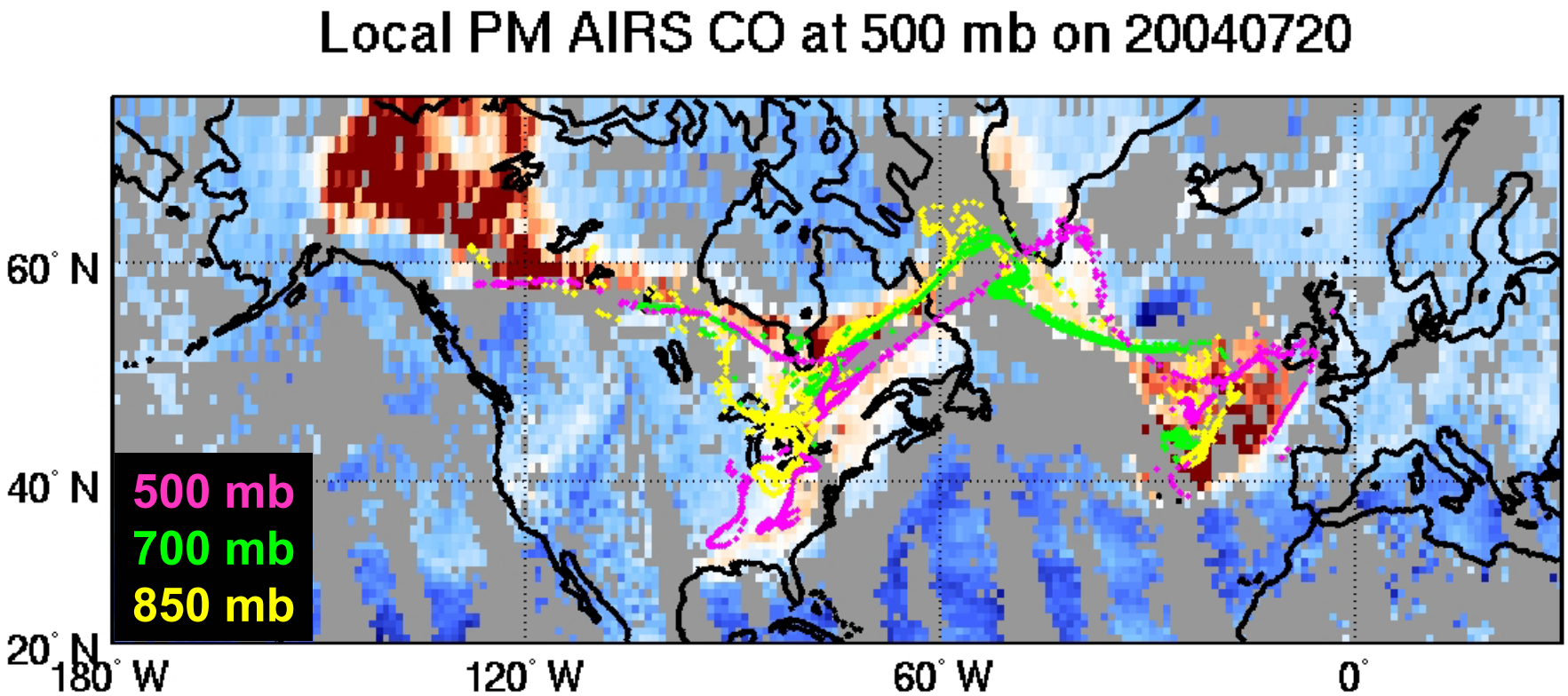
AIRS CO and Trajectories

JCET



UMBC

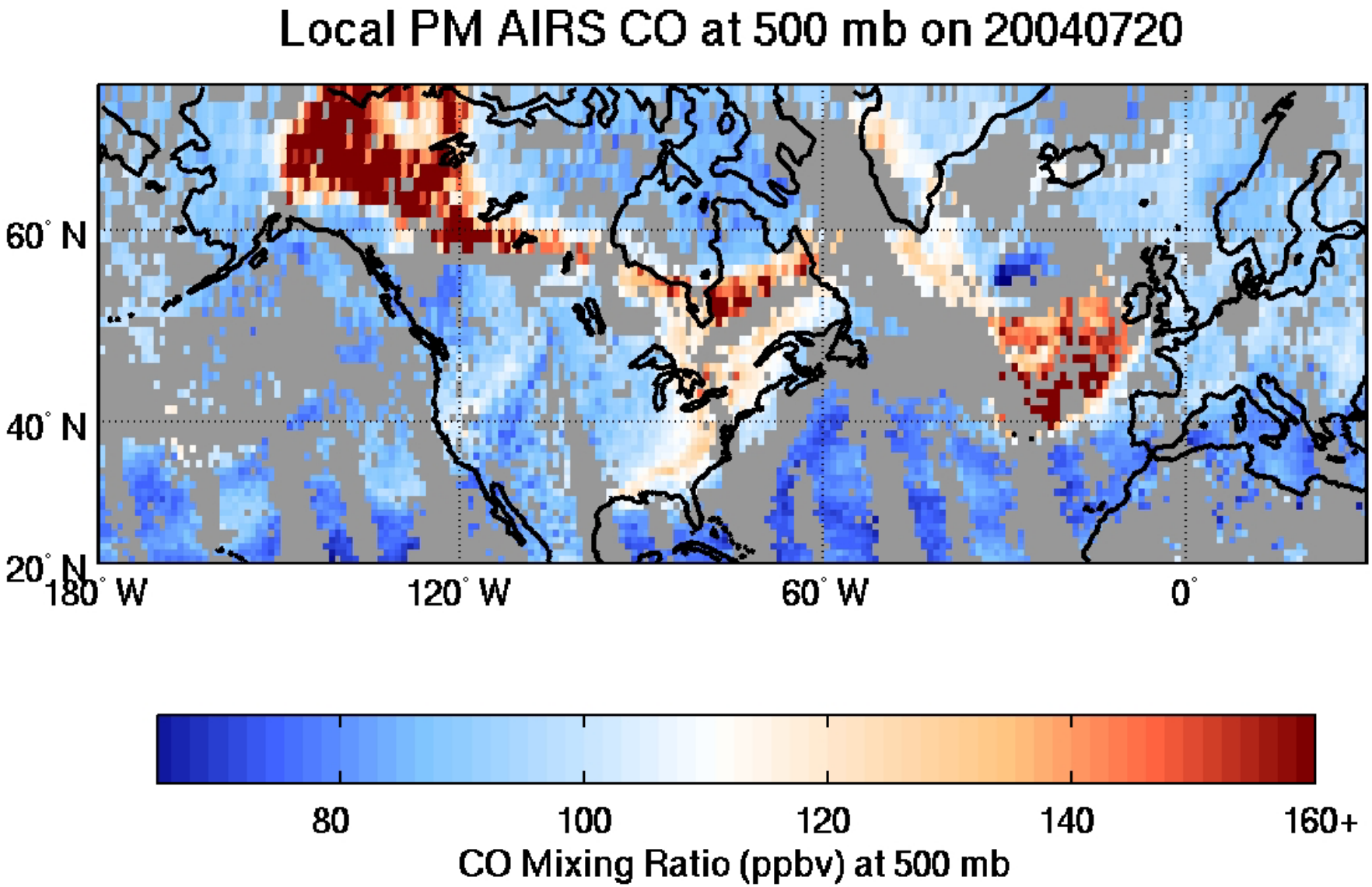
AIRS CO and Trajectories



UMBC

AIRS CO

JCET



OUTLINE

- Reprocessed data with CO verticality available May 1
- Improved CO available by late summer
- AIRS CO – convolved DACOM ≈ -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??