Pyro

Mike Fromm
Brian Stocks
11 July 2008

Pyrocumulus (pyroCu)

- condensation but no lightning, no ice

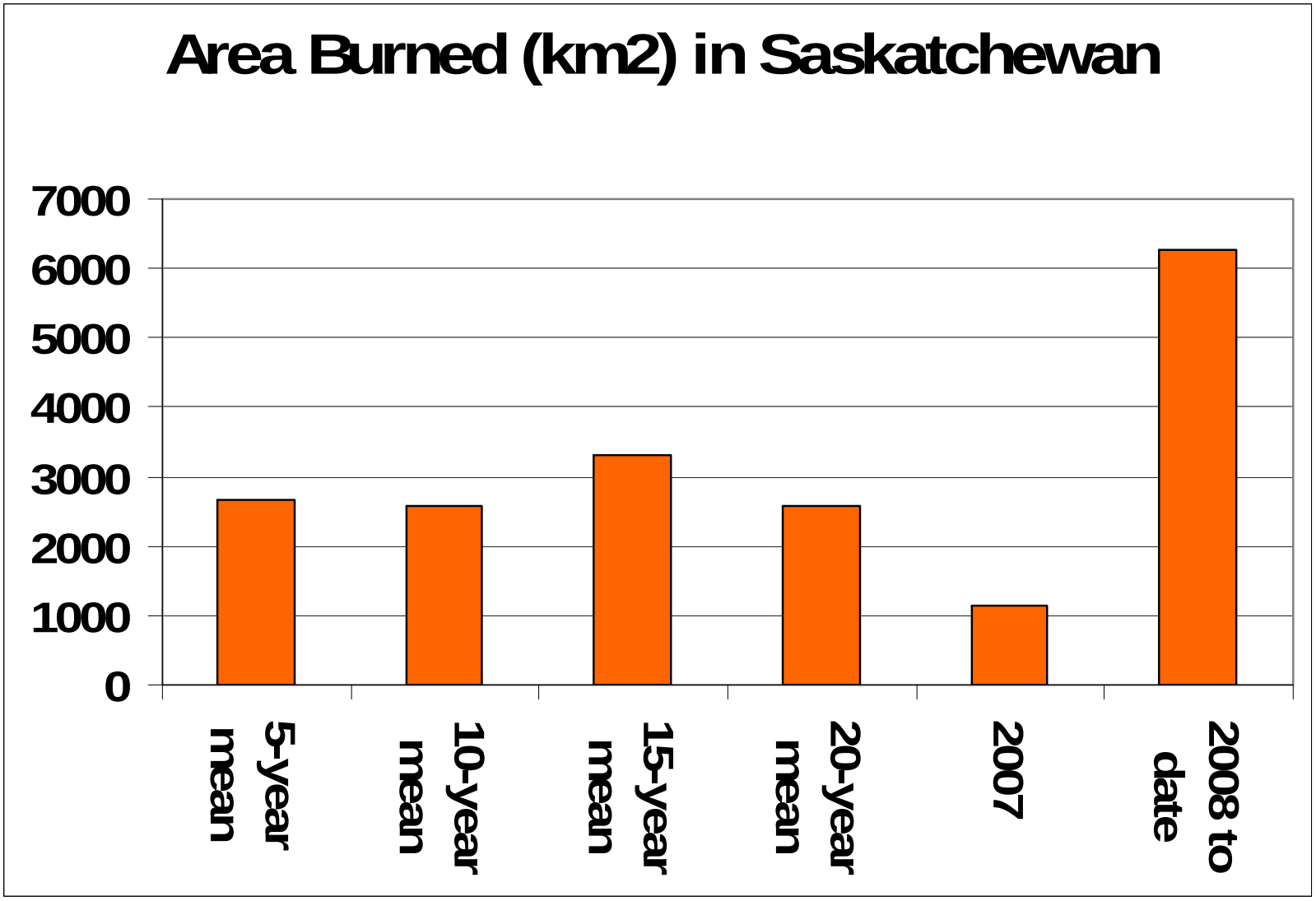
Pyrocumulonimbus (pyroCb)

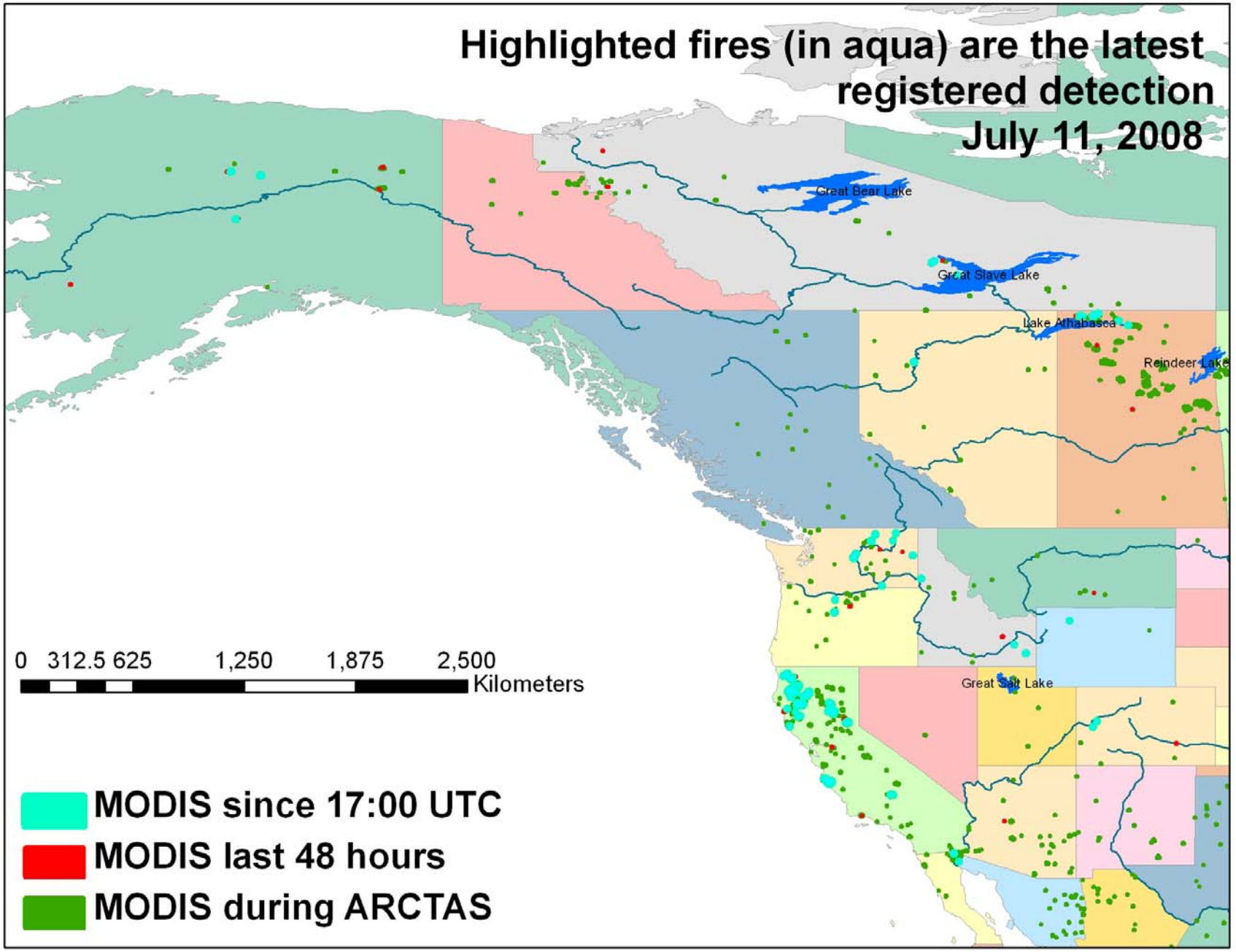
- subset of pyroCu
- lightning, ice, rain, ice, tornado
- can penetrate the tropopause

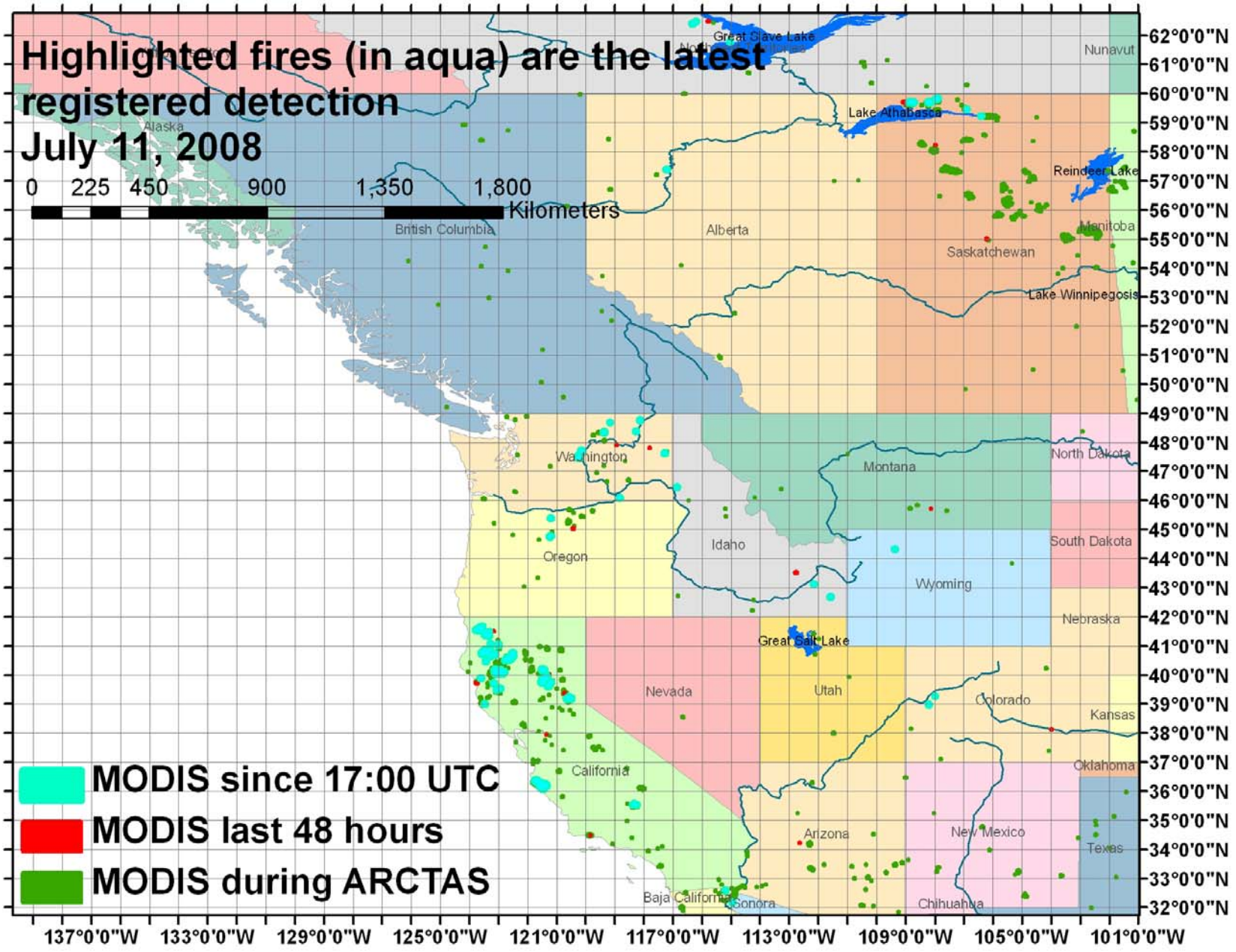
Fire Activity/Potential July 11/08

- Focus on California for transit flight
- Fires will be burning for days
- Higher altitude sampling – restrictions?
- Many new targets in Washington State
- Athabasca still burning – made the most of SK Fires during ARCTAS
- pyroCu versus pyroCb
- Alaska season warming up

Historic Perspective




Highlighted fires (in aqua) are the latest registered detection
July 11, 2008
Great Bear Lake
Great Slave Lake
Lake Athabasca
Reindeer Lake
Great Salt Lake
0 312.5 625 1,250 1,875 2,500
Kilometers
MODIS since 17:00 UTC
MODIS last 48 hours
MODIS during ARCTAS


Highlighted fires (in aqua) are the latest registered detection
July 11, 2008
0 225 450 900 1,350 1,800
Kilometers
MODIS since 17:00 UTC
MODIS last 48 hours
MODIS during ARCTAS
Great Slave Lake
Nunavut
Lake Athabasca
Alaska
Reindeer Lake
British Columbia
Alberta
Manitoba
Saskatchewan
Lake Winnipegosis
Washington
Montana
North Dakota
Idaho
Oregon
South Dakota
Wyoming
Nebraska
Great Salt Lake
Nevada
Utah
Colorado
Kansas
California
Oklahoma
Arizona
New Mexico
Texas
Baja California
Sonora
Chihuahua
62°0'0"N
61°0'0"N
60°0'0"N
59°0'0"N
58°0'0"N
57°0'0"N
56°0'0"N
55°0'0"N
54°0'0"N
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47°0'0"N
46°0'0"N
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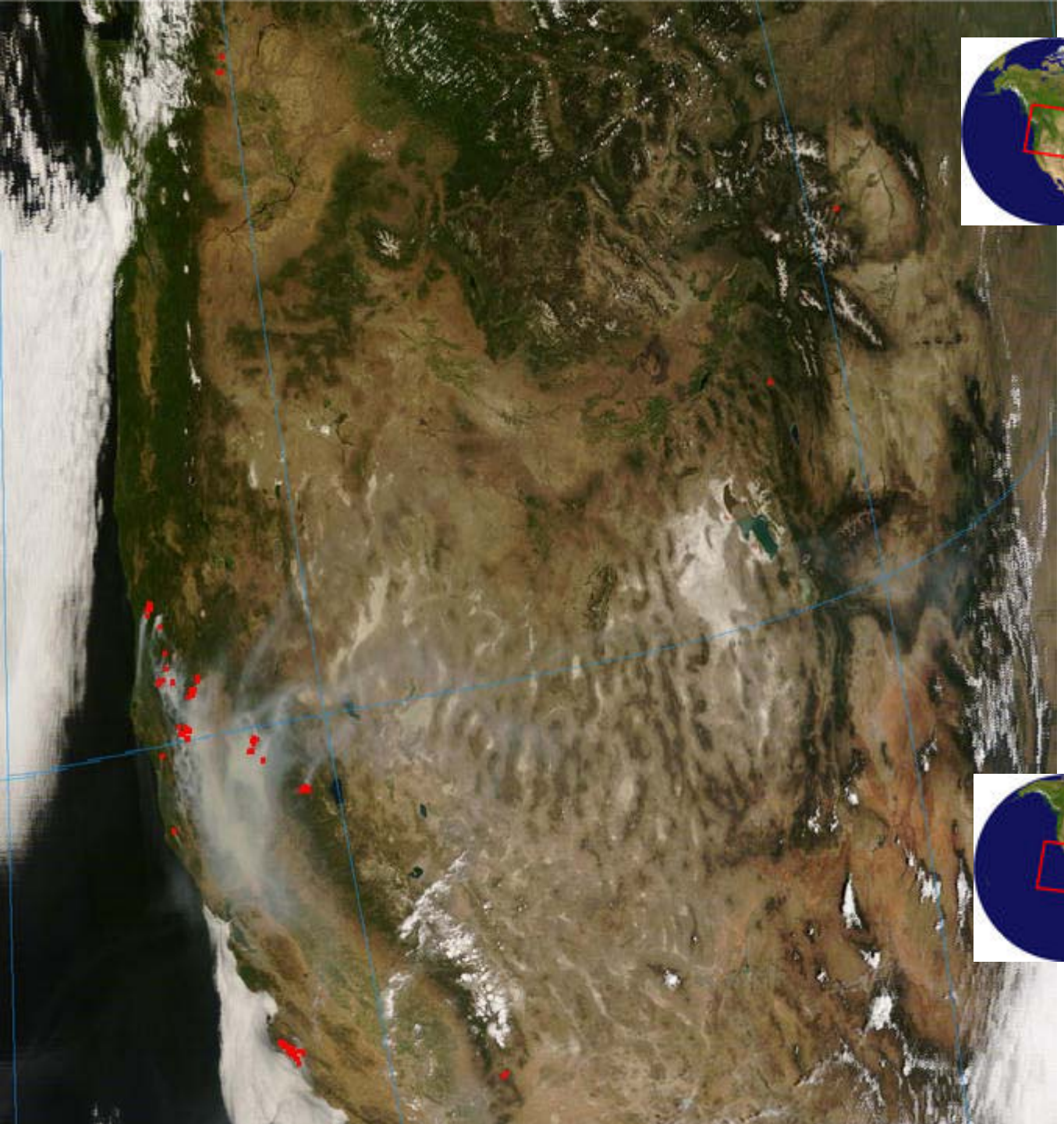
35°0'0"N
34°0'0"N
33°0'0"N
32°0'0"N
137°0'0"W
133°0'0"W
129°0'0"W
125°0'0"W
121°0'0"W
117°0'0"W
113°0'0"W
109°0'0"W
105°0'0"W
101°0'0"W

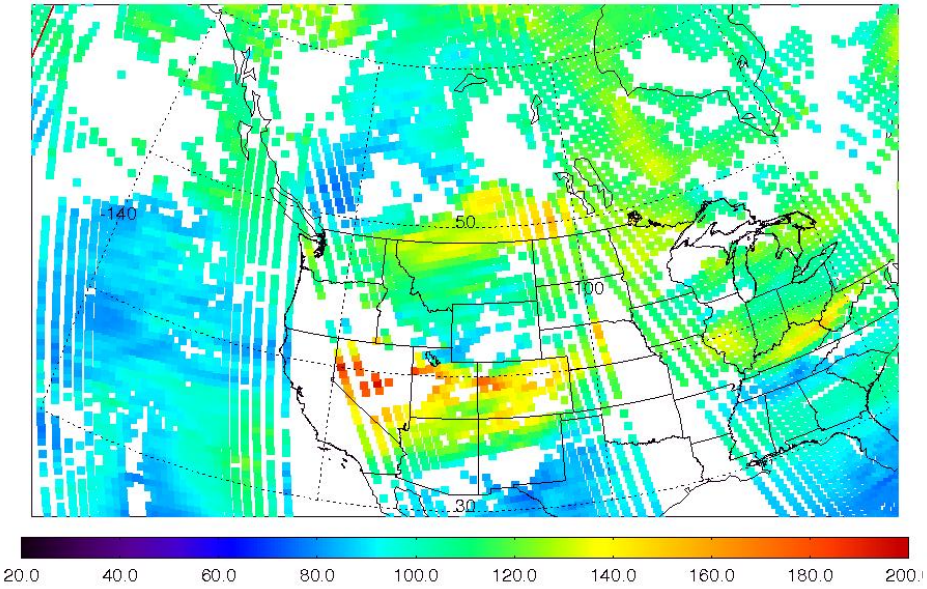


MODIS
July 10 2008

1840 UTC
18:45 UTC

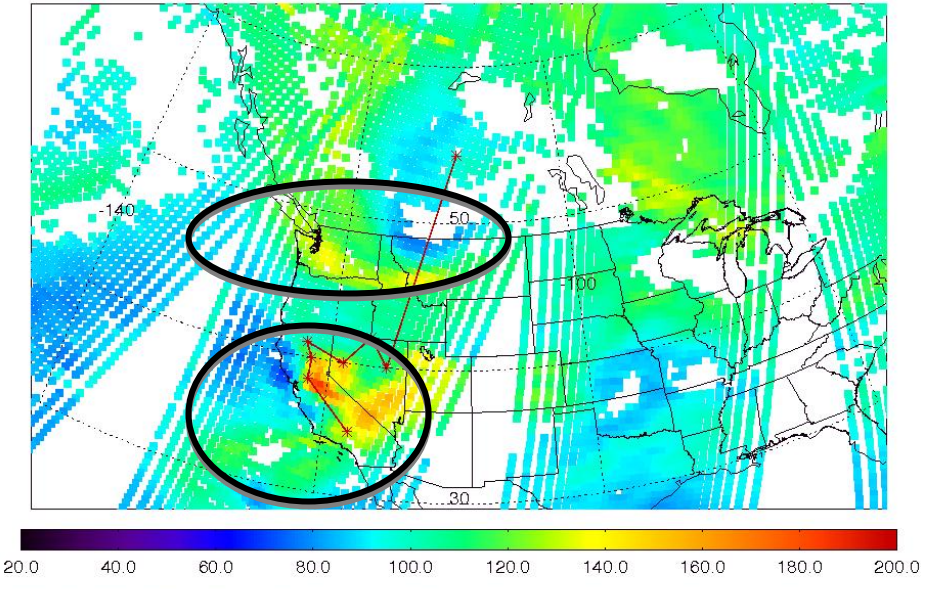
AIRS Support for ARCTAS

AIRS CO VMR (ppbv) at 500mb on 20080710 for ARCTAS



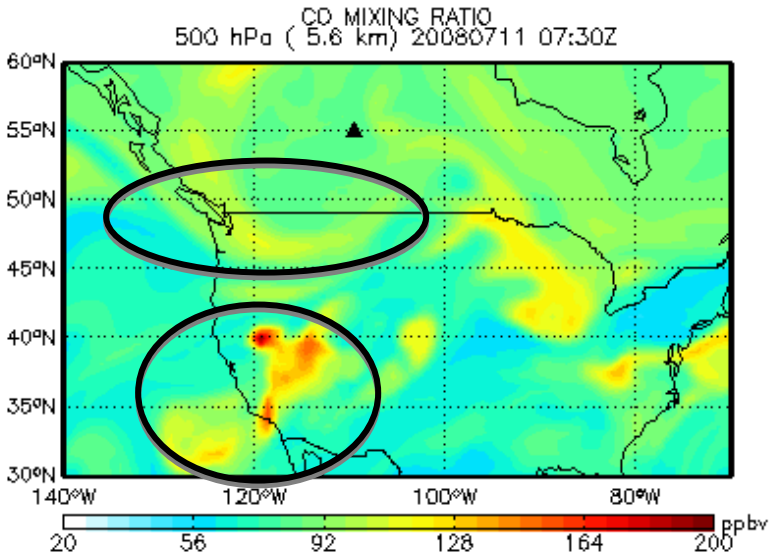
ACKNOWLEDGEMENT: AIRS NRT products by NASA DAAC

AIRS CO VMR (ppbv) at 500mb on 20080711 for ARCTAS

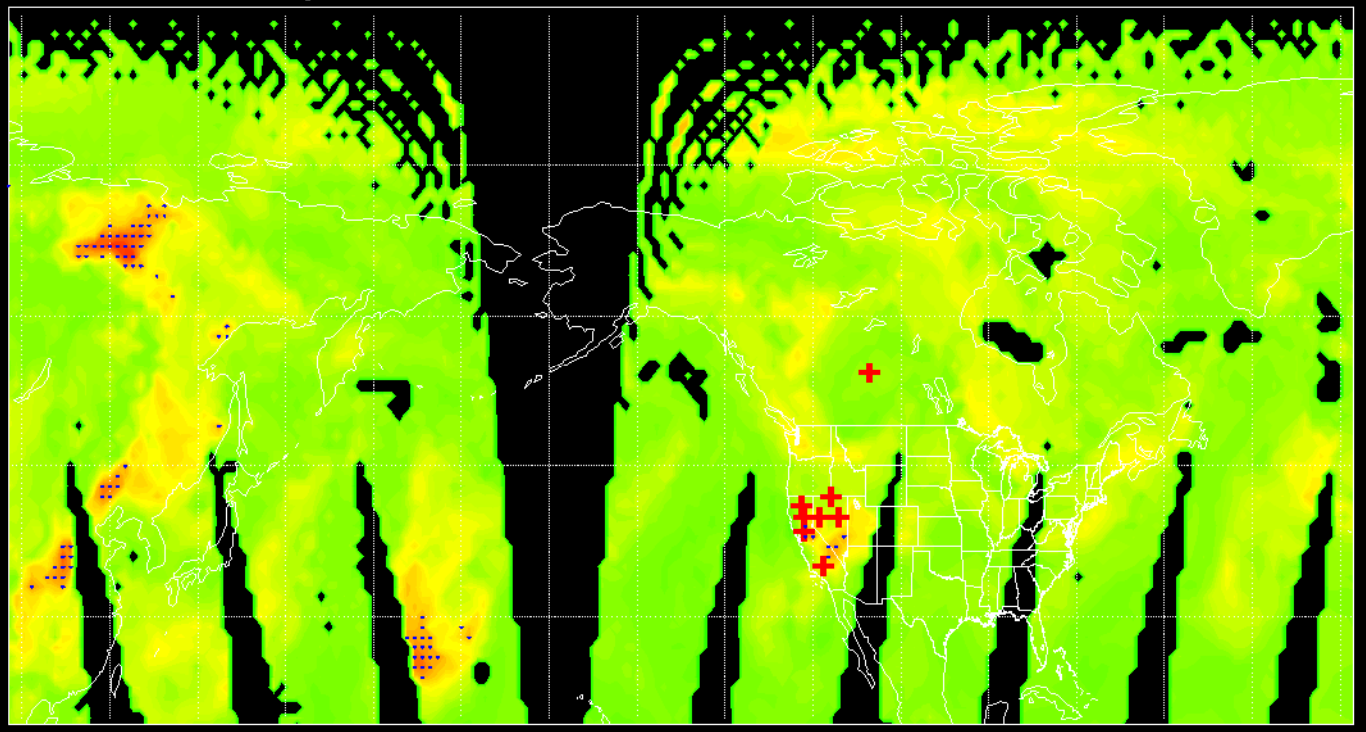


ACKNOWLEDGEMENT: AIRS NRT products by NASA DAAC

GEOS-5 CO



AIRS 500mb Trajectories initialized 2008071100 Valid 2008071100

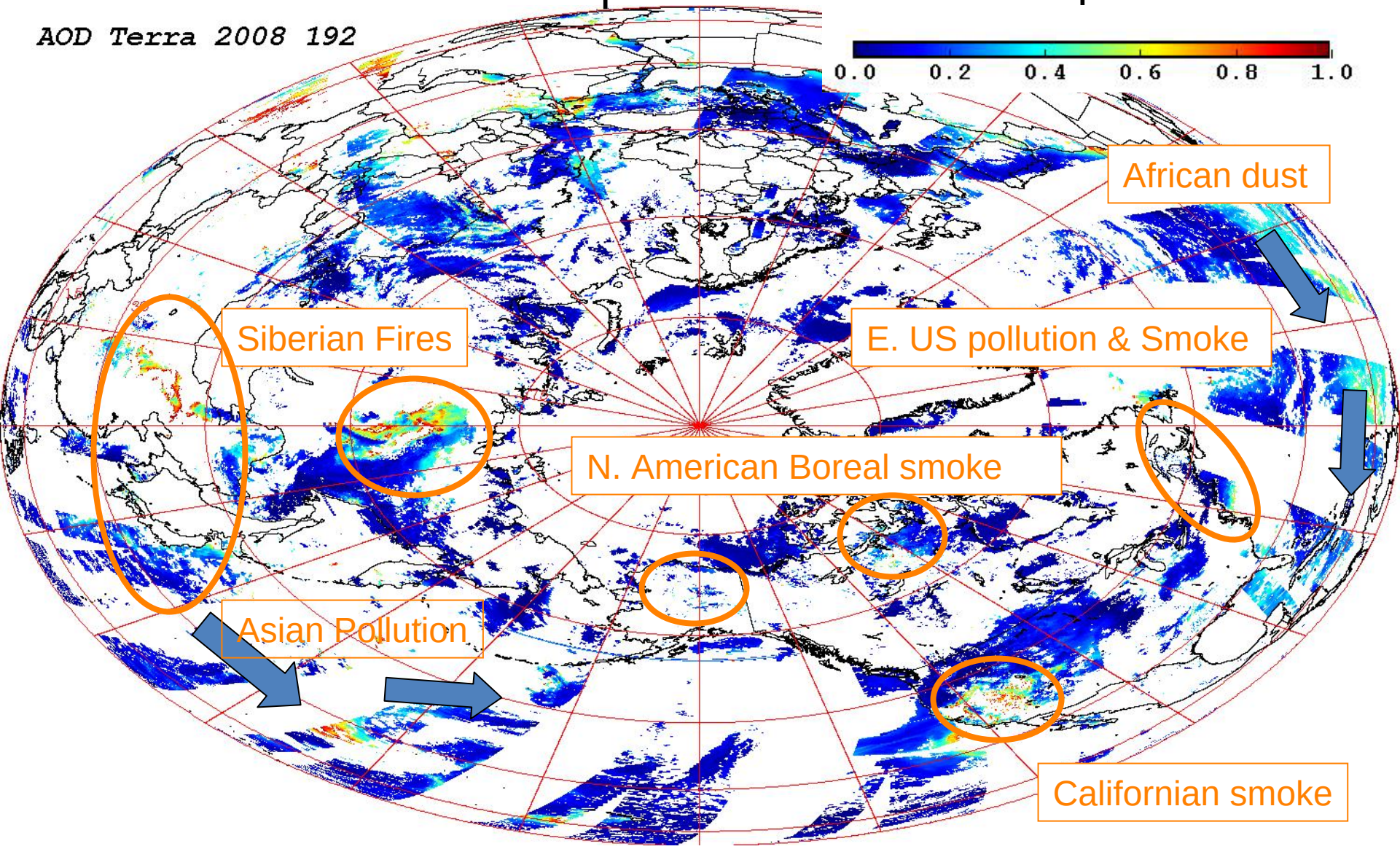


60 80 100 120 140 160 180 200
CO (ppbv)

200 400 600 800 1000
Pressure (mb)

Day 192 (July 10) Thursday

MODIS Hot Spots in Northern Hemisphere

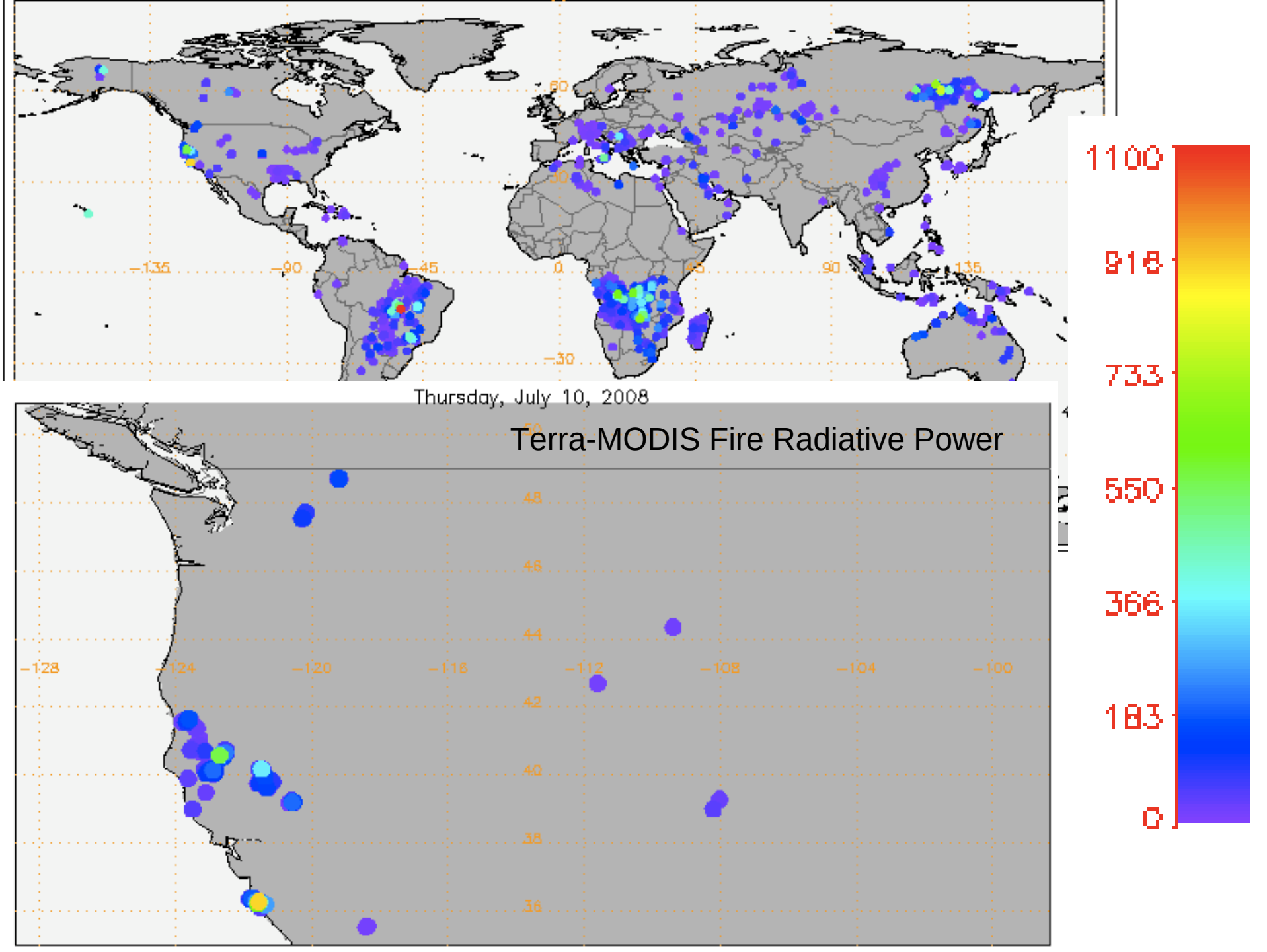


Day 192 (Thursday) July 10

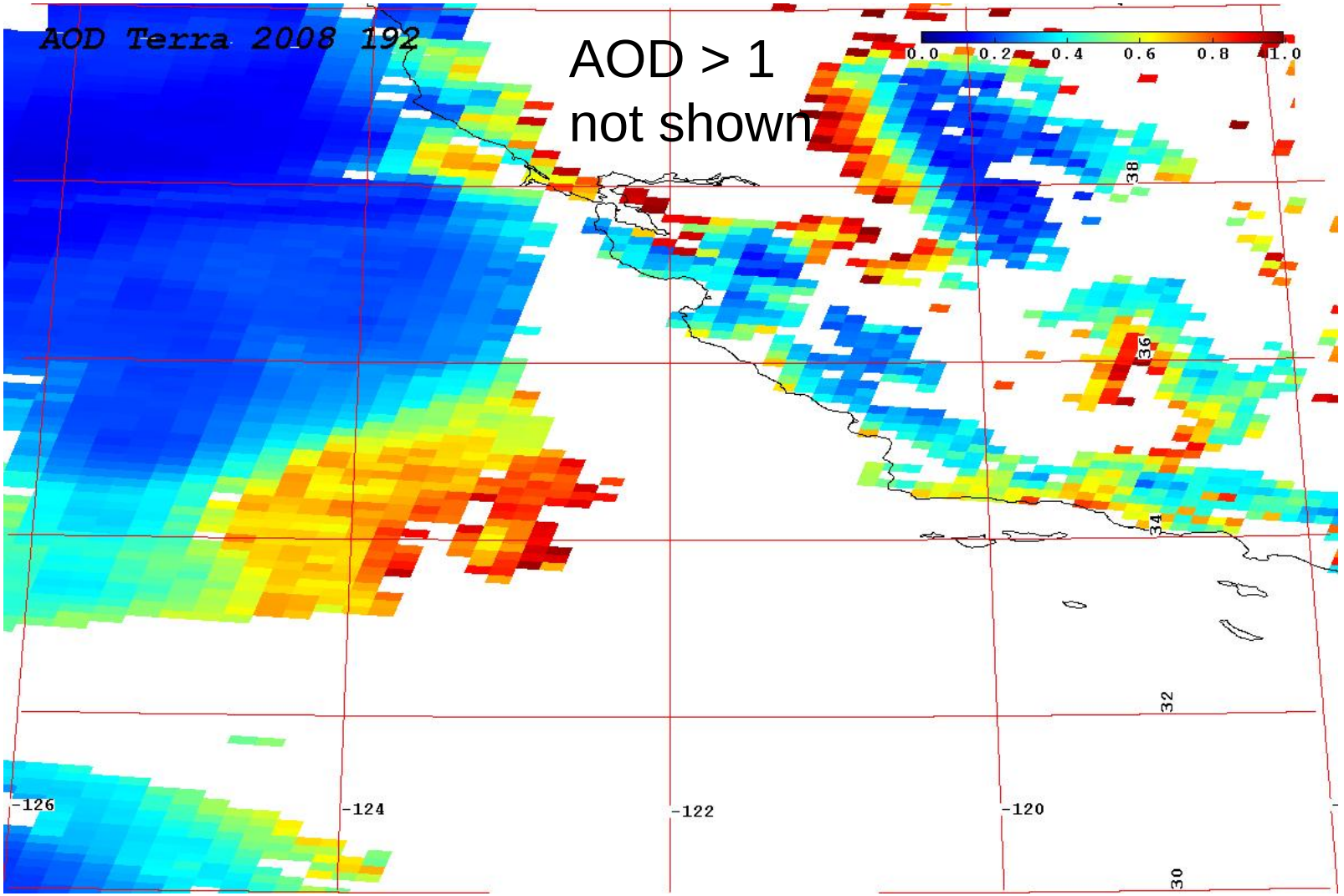
Terra MODIS

Aqua MODIS

Wind shifting to southerly
in the afternoon

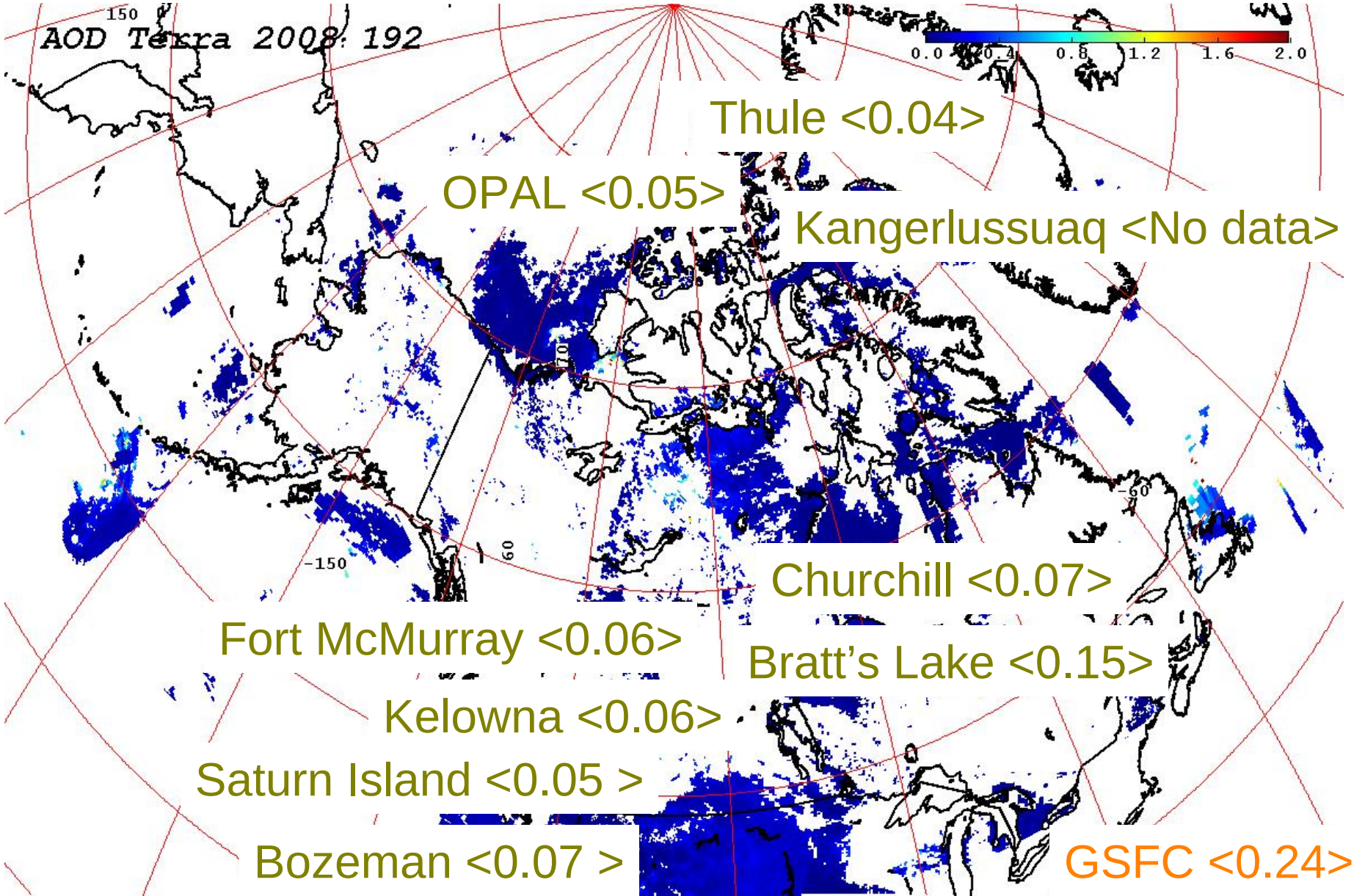

Thursday, July 10, 2008
Terra-MODIS Fire Radiative Power
1100
916
733
550
366
183
0

MODIS AOD Hotspots in California



Day 192 (Thursday) July 10

MODIS AOD Hotspots in North America



Day 192 (Thursday) July 10

MODIS AOD Hotspots in N America

Asian

AK Fires

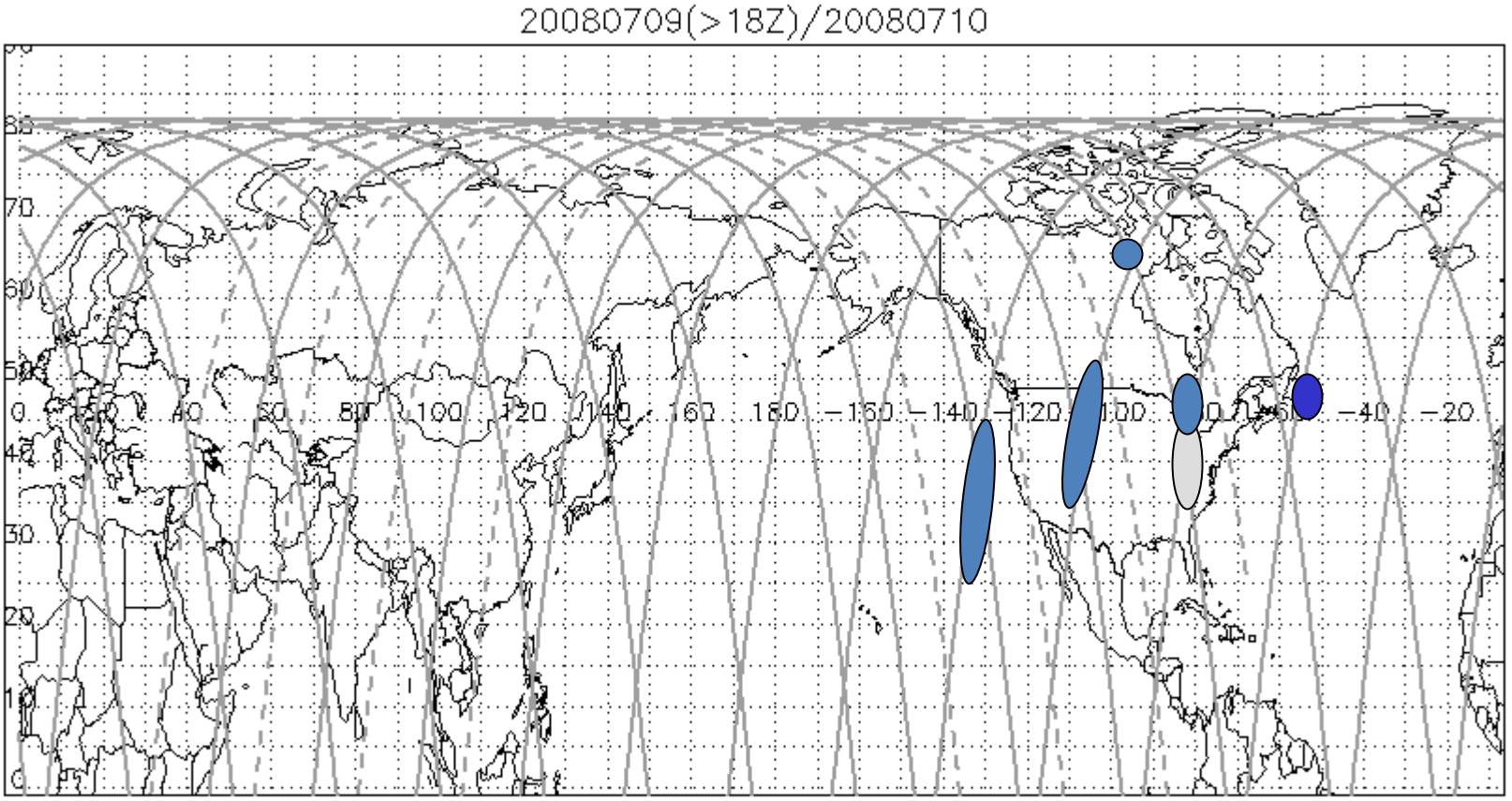
Local Fires!

Much lower AOD (< 0.3) in the E. US for P-3 and B-200 to Wallops (mostly cloudy yesterday; can't rule out possibility of smoke from wild fires)

Smoke from Californian wild fires

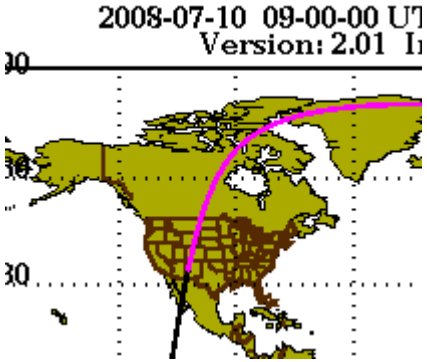
Plenty of smoke for DC-8 to sample on the way to Palmdale

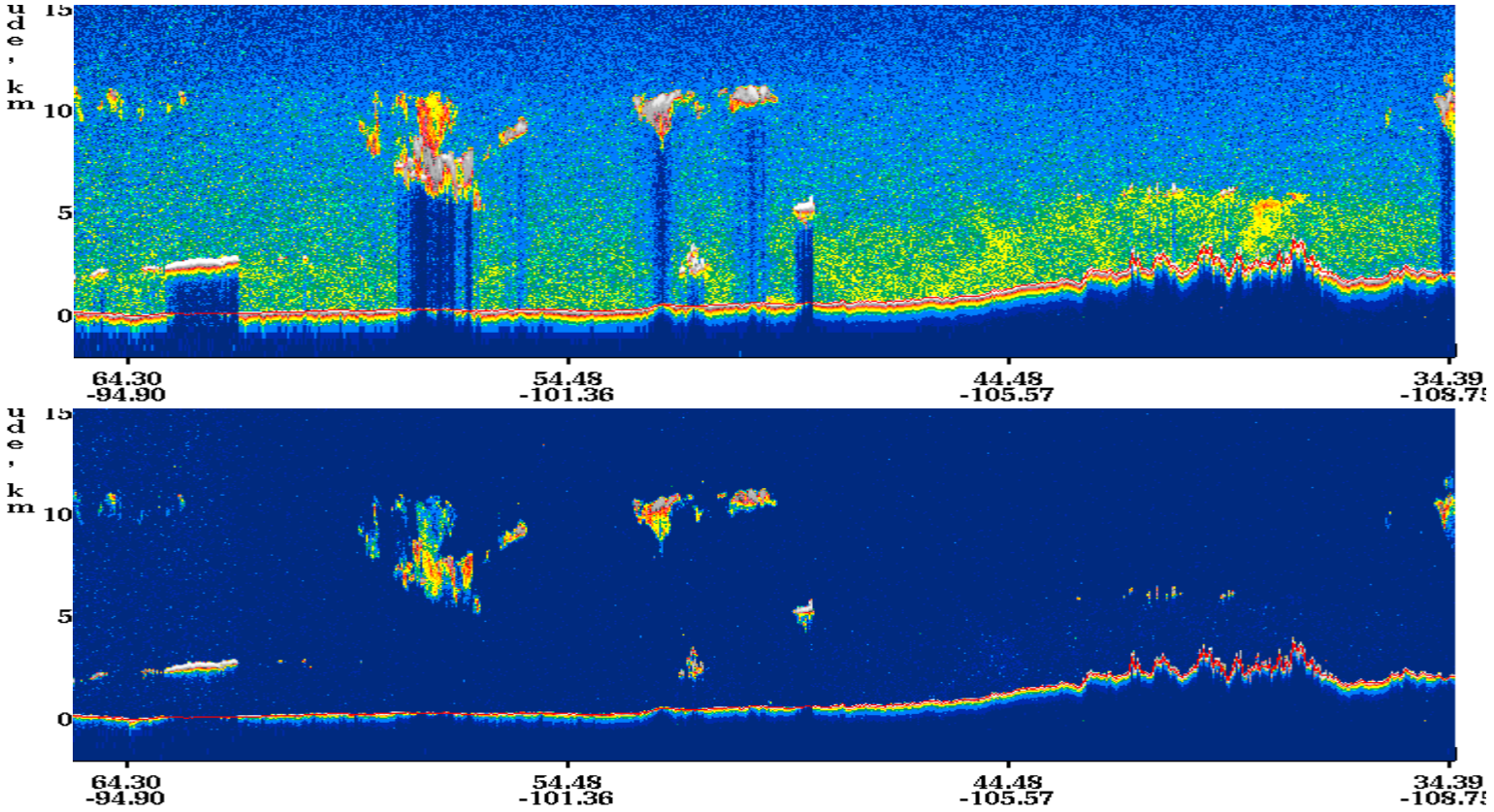
Aerosol Layer Locations based on CALIPSO observations on 7/10

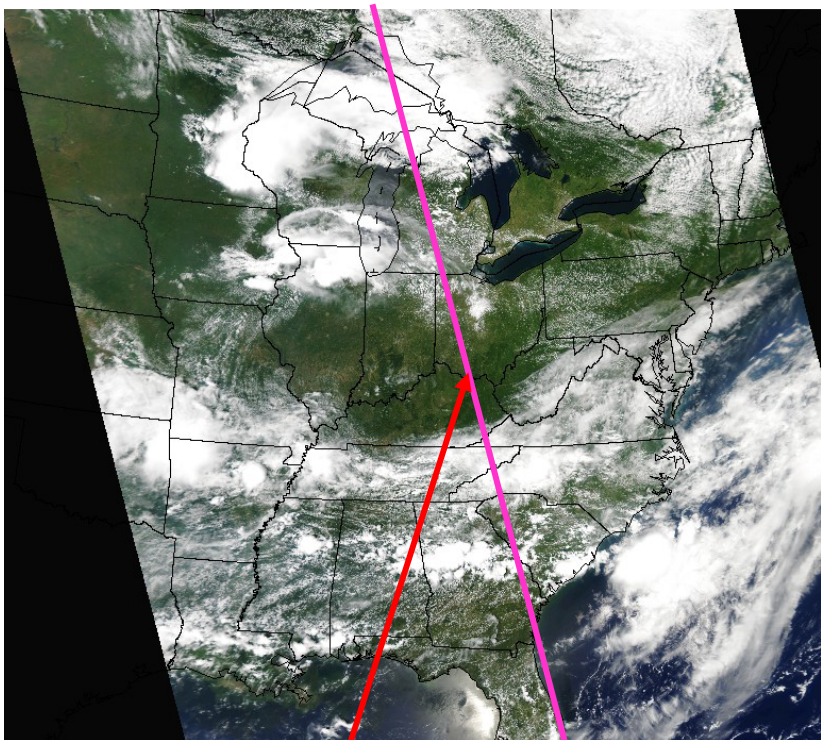


- Cloud
- Aerosol Layer- low aerosol loading
- Aerosol Layer- medium aerosol loading
- Aerosol Layer- high aerosol loading

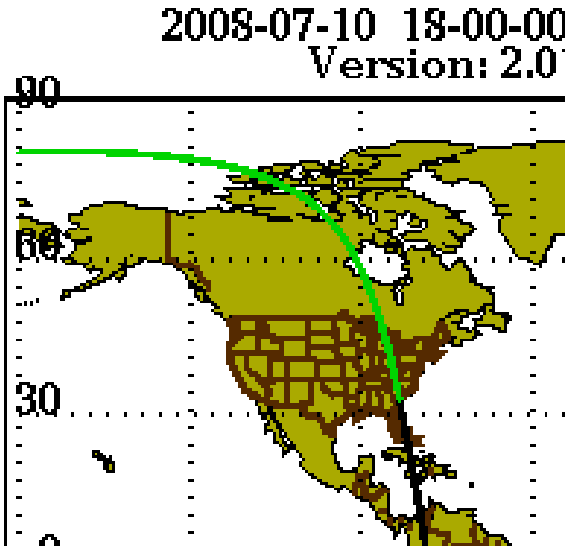
CALIPSO Obs 7/10

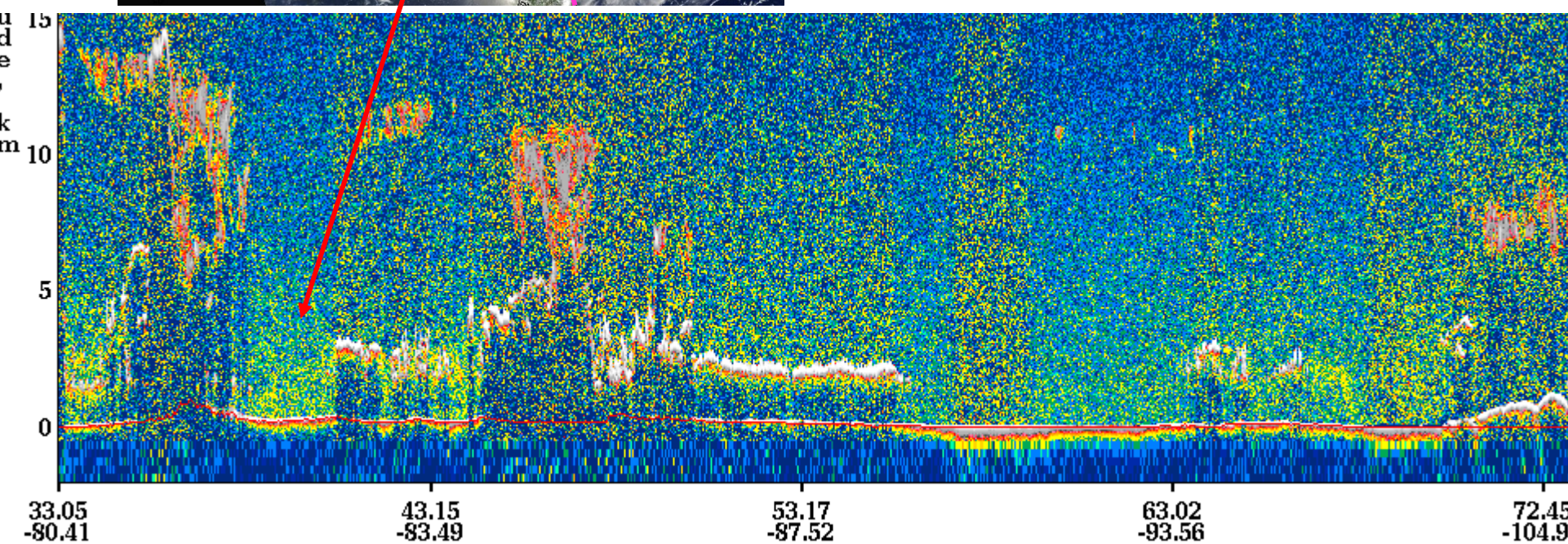




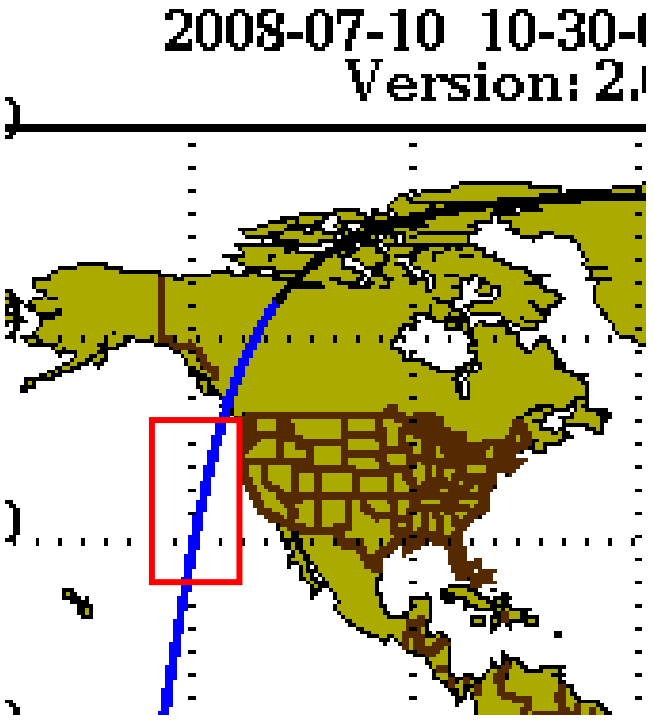


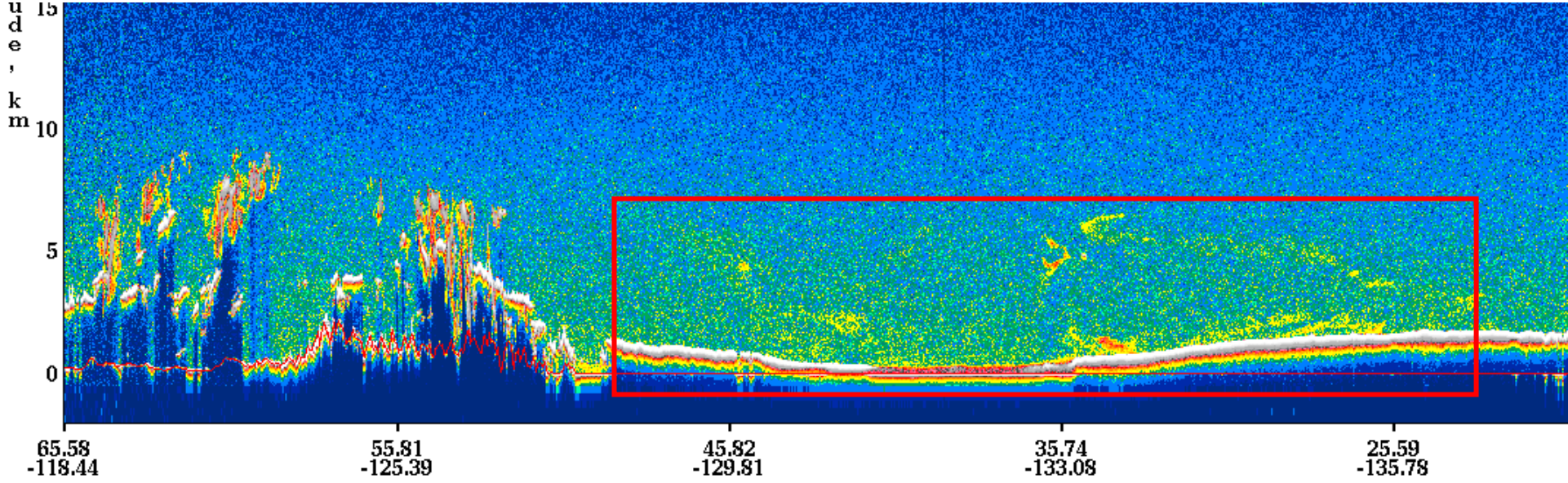
CALIPSO Obs 7/10

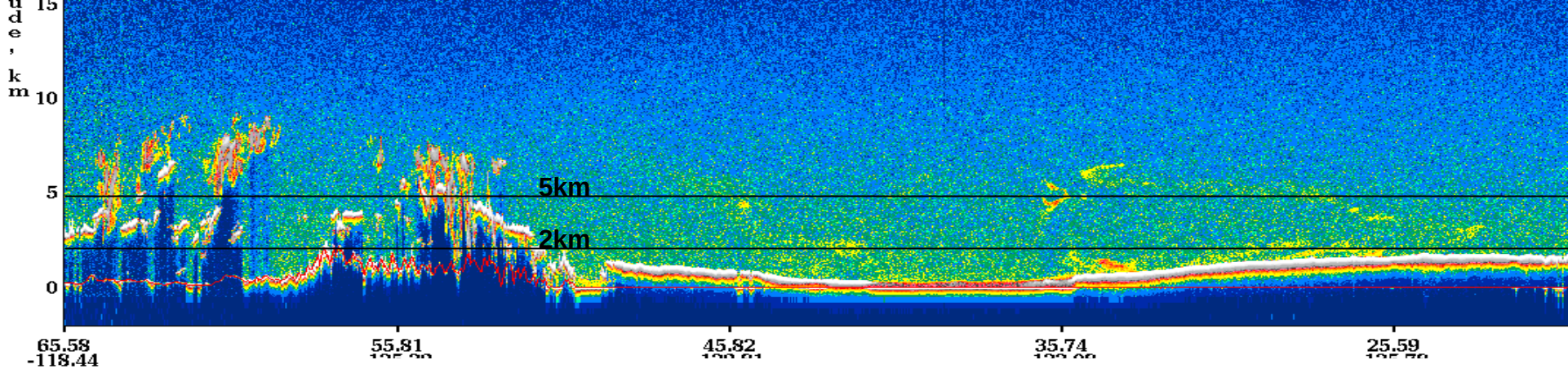




CALIPSO Obs 7/10

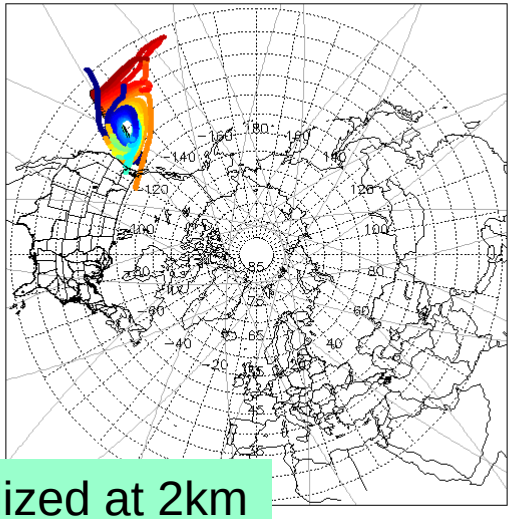




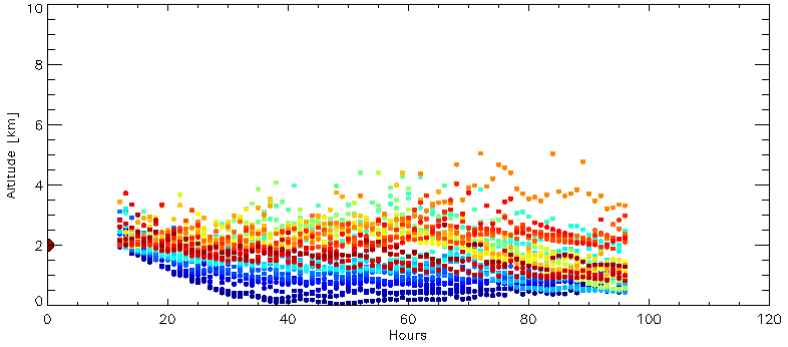


96hr CALIPSO Trajectories Initialized 2008071000 Valid 2008071400

Initial Altitude: 2000m

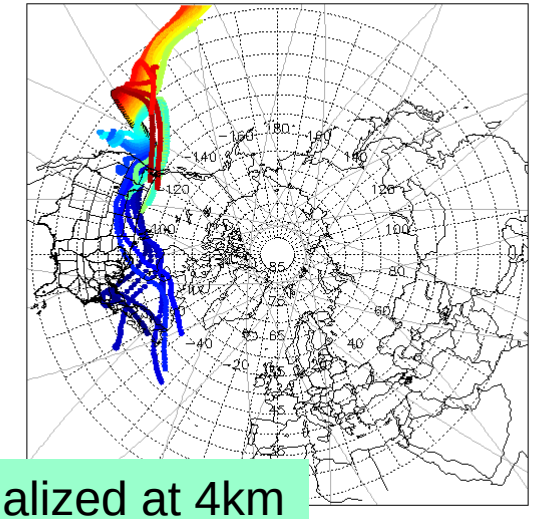


Initialized at 2km

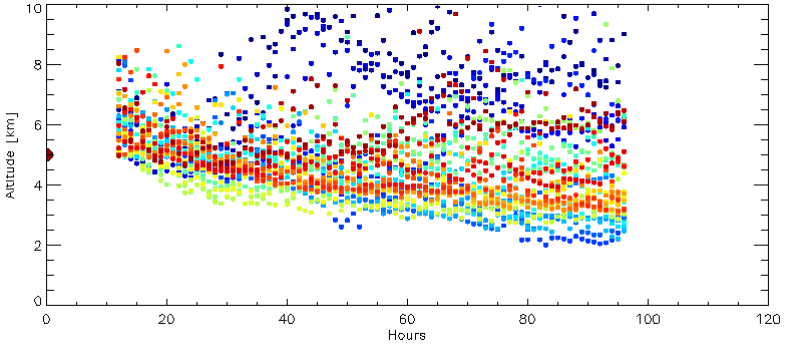


96hr CALIPSO Trajectories Initialized 2008071000 Valid 2008071400

Initial Altitude: 5000m



Initialized at 4km



P-3 Transit - July 12

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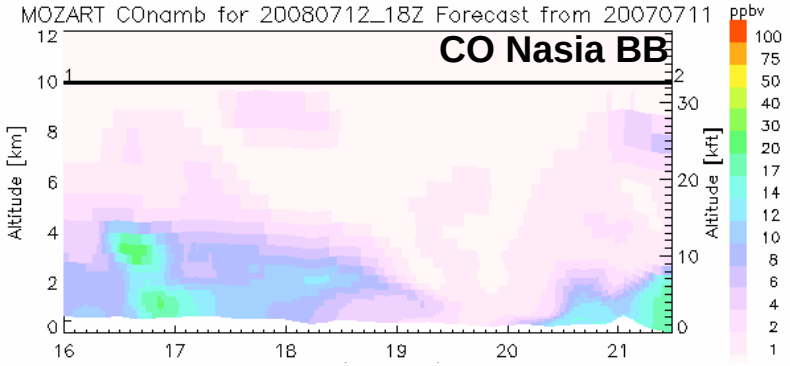

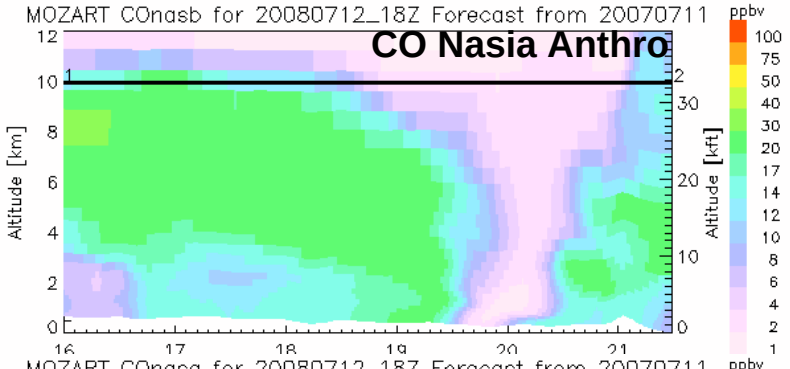

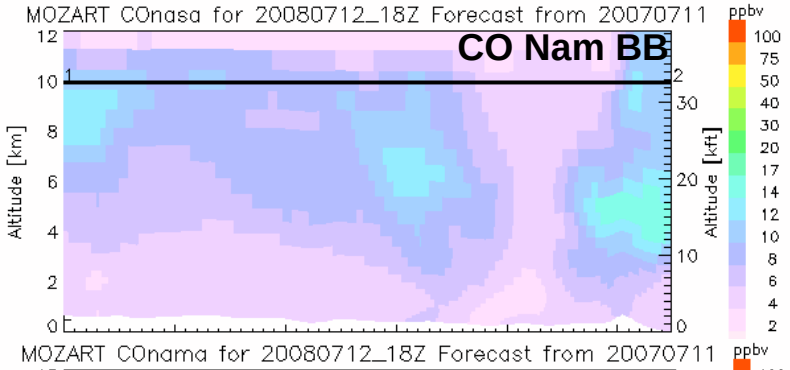

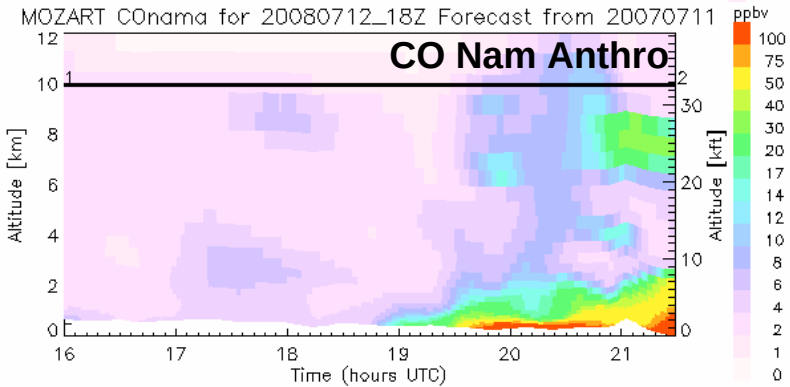

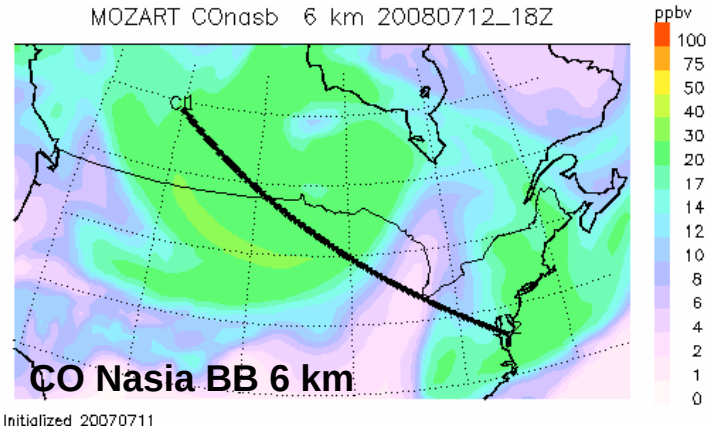

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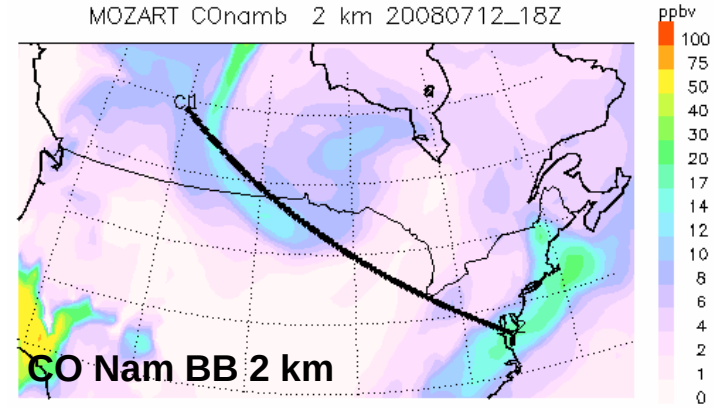

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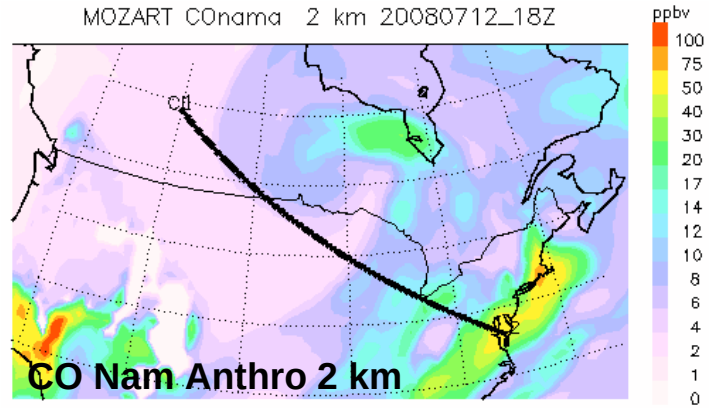

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P-3 Transit - July 12

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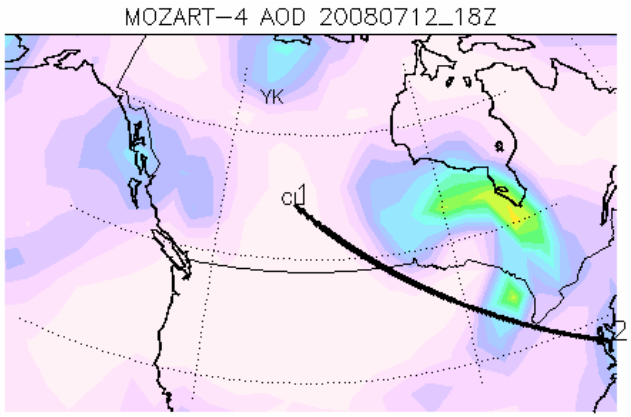
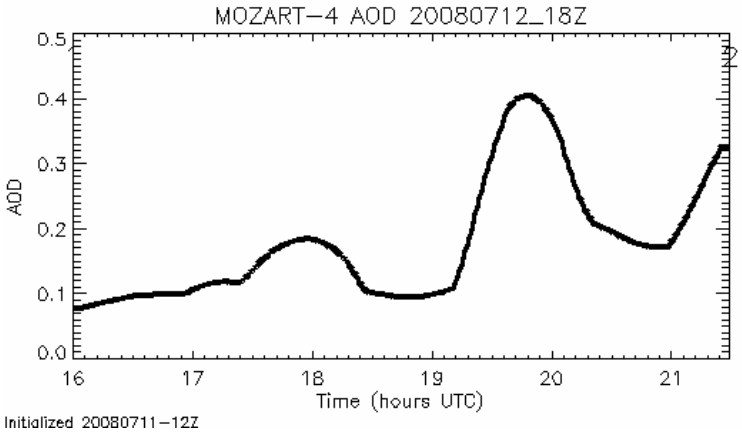
AOD





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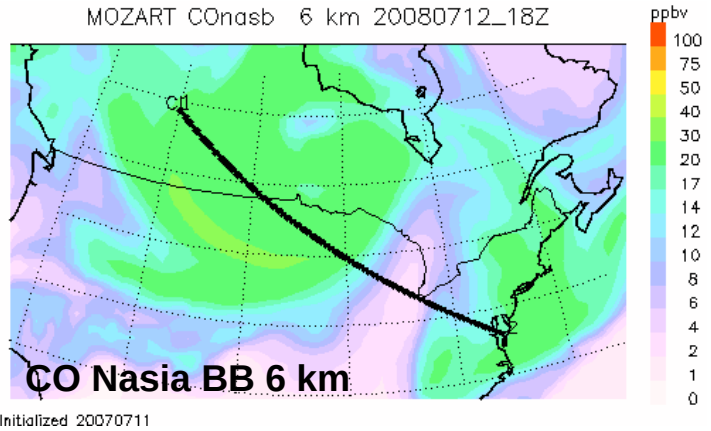

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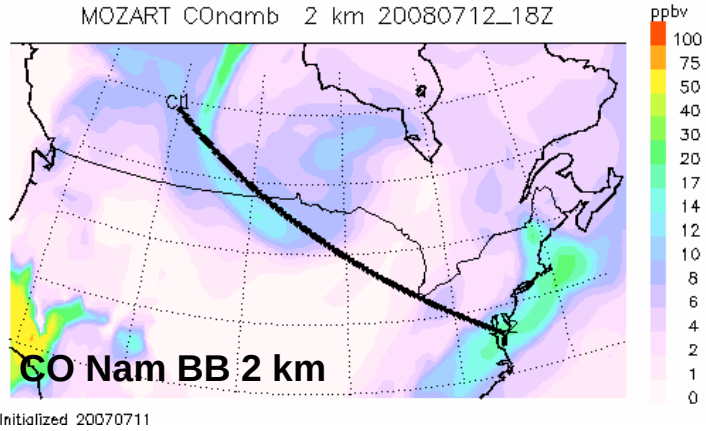

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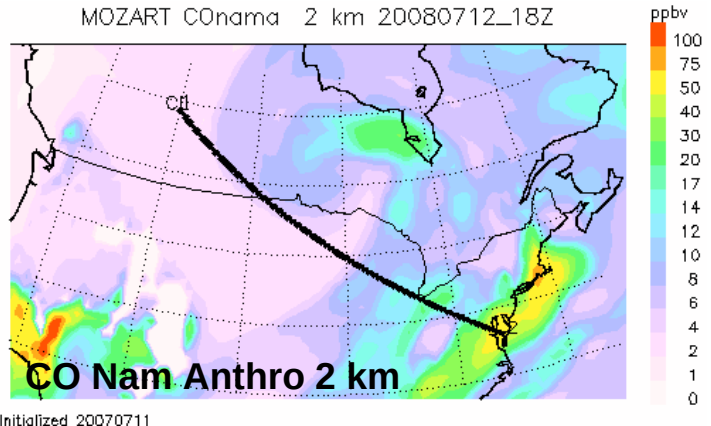

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DC-8 Transit - July 12

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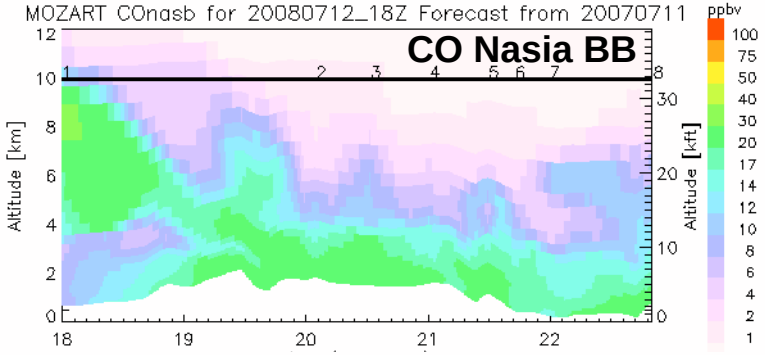
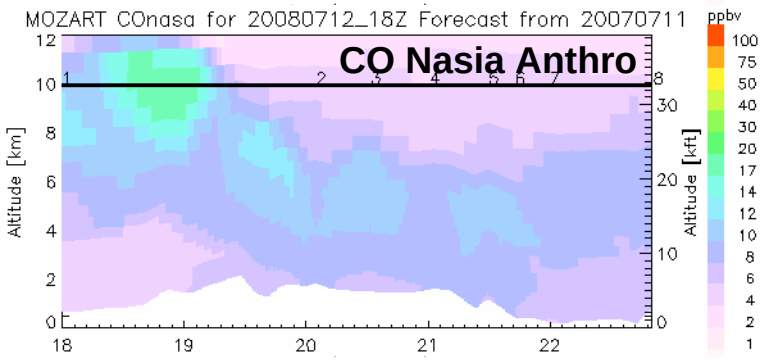
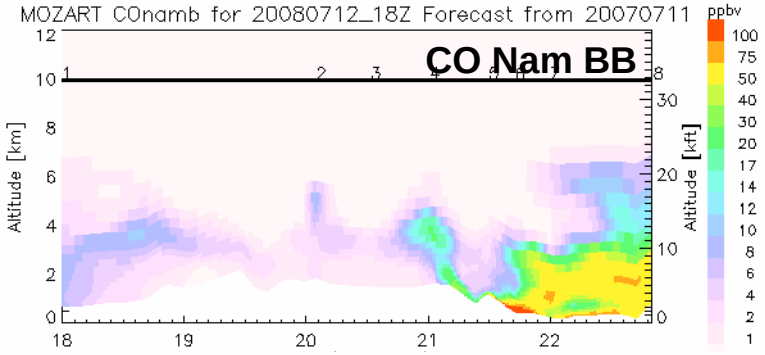
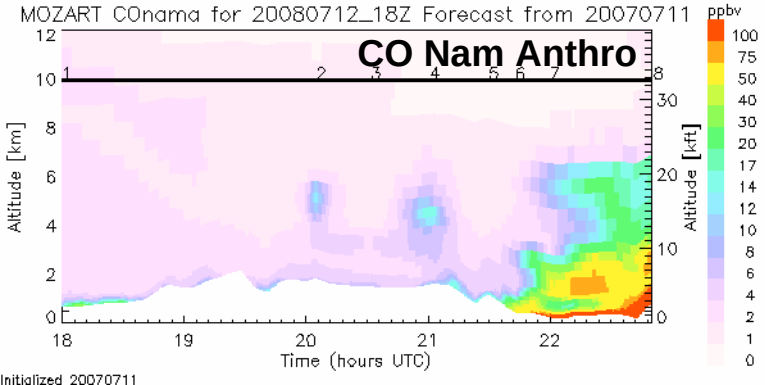
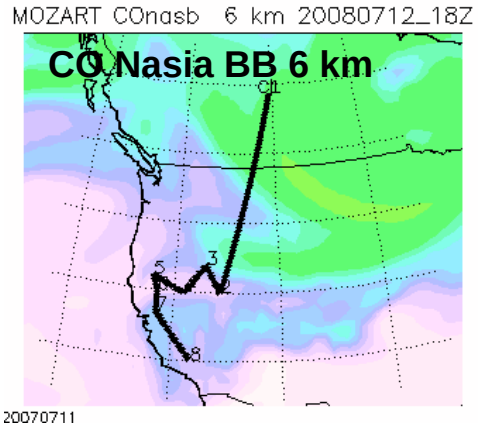
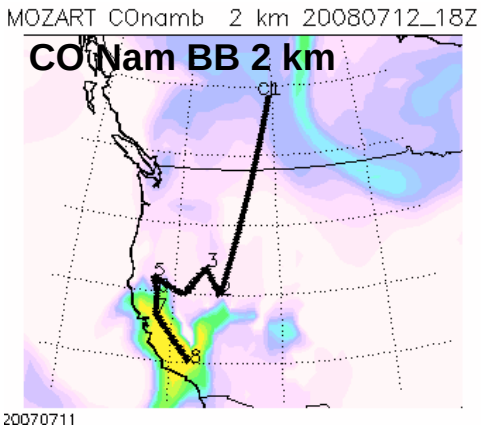


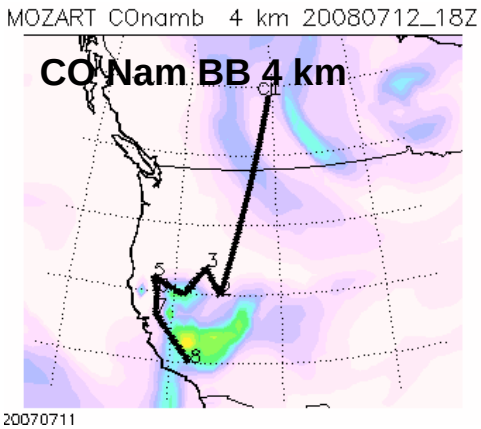


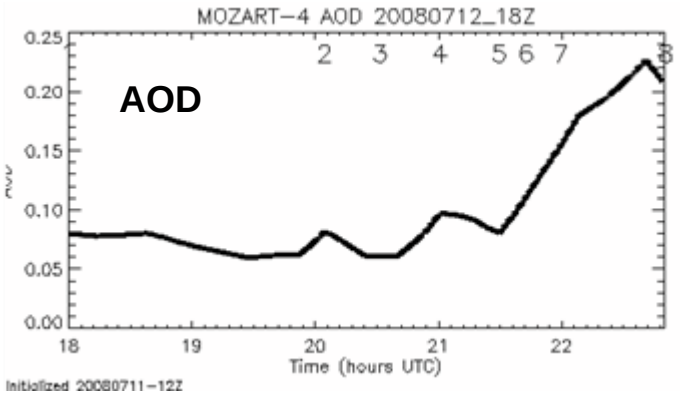




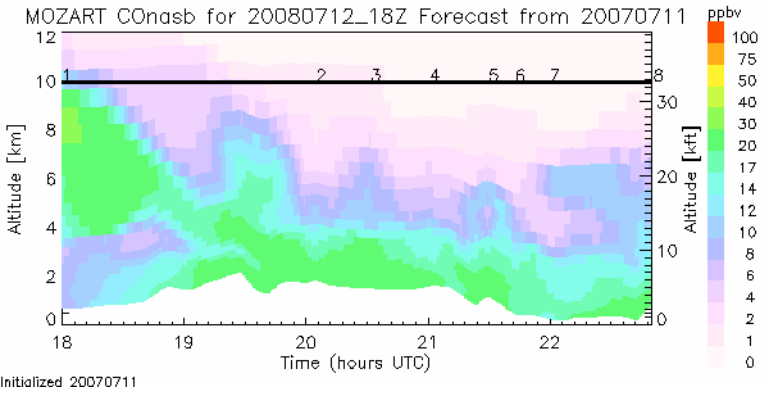


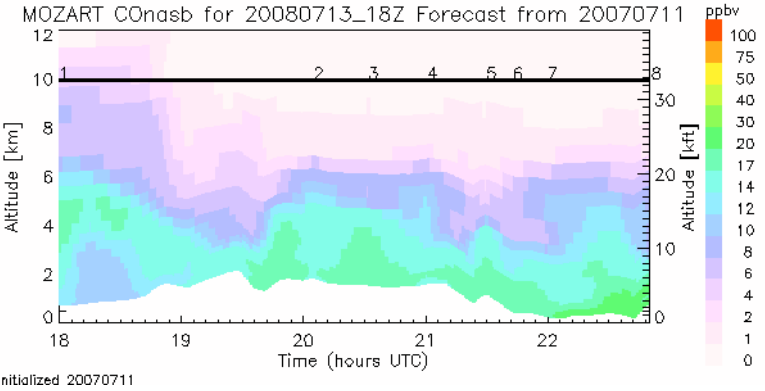


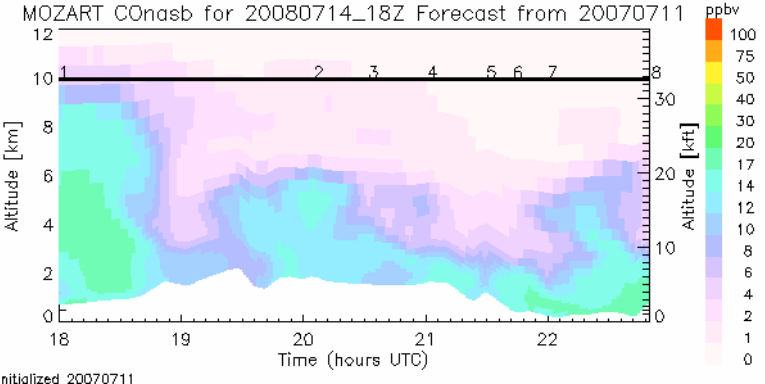




CO Nasia BB







DC-8 Transit

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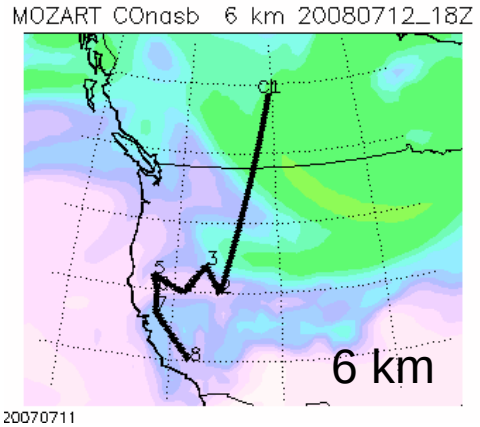
Jul 12



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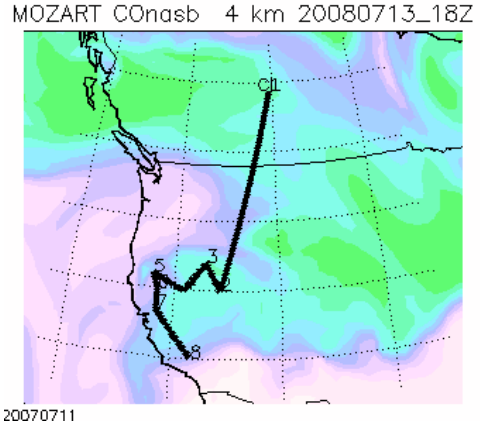

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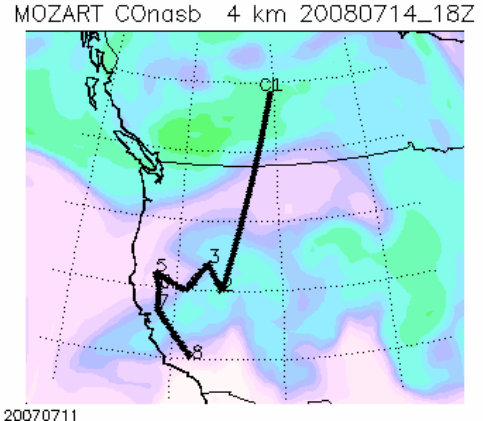
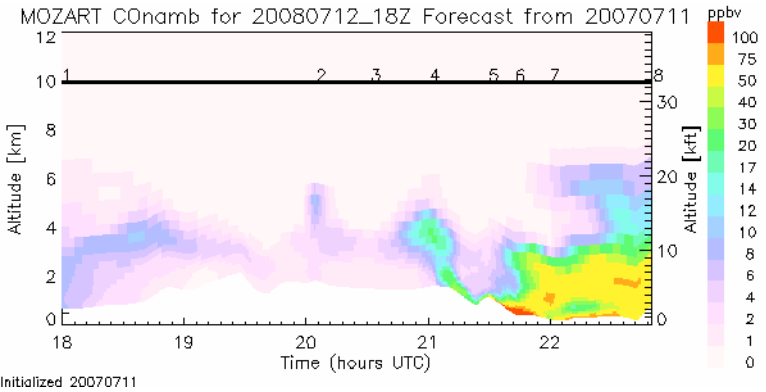
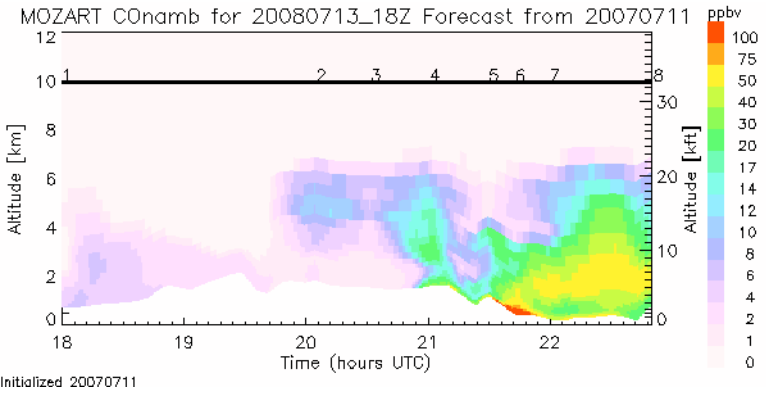


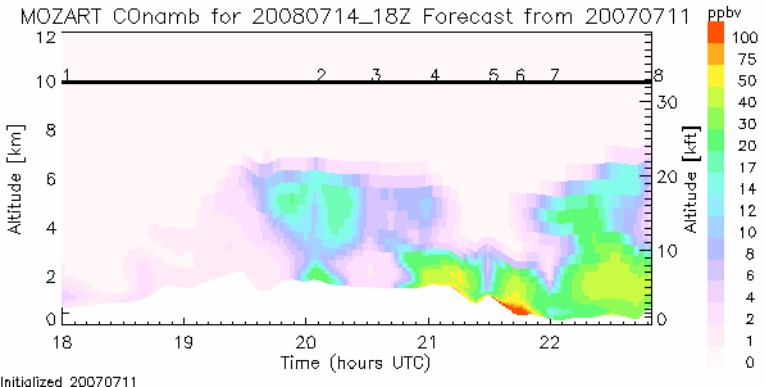
CO Namerica BB

DC-8 Transit

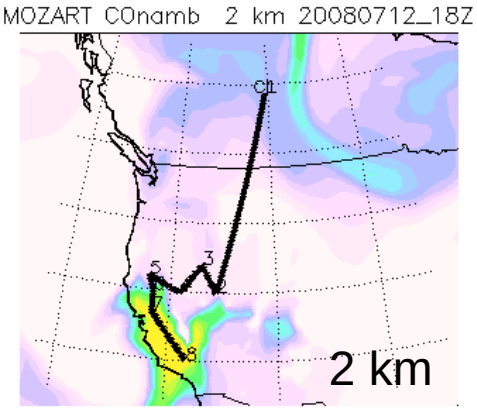
MOZART Fx 07/12 18Z

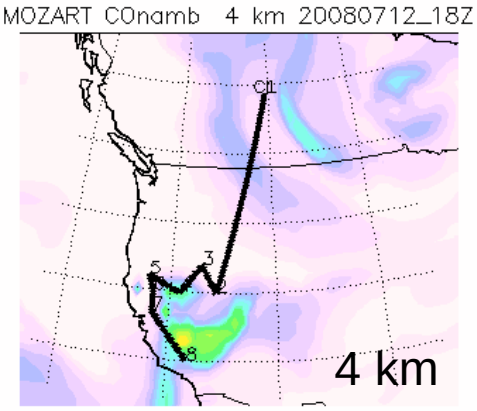




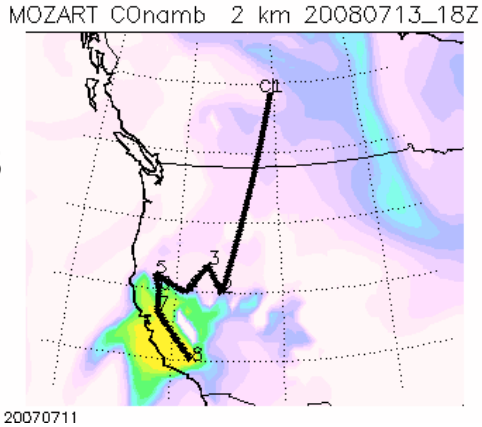


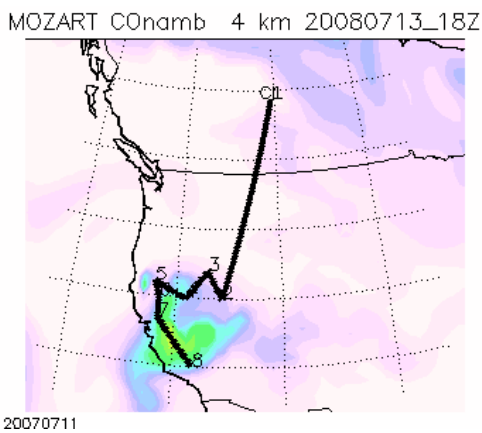
Jul 12



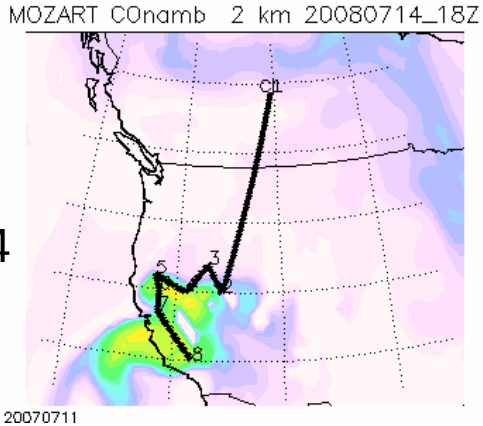


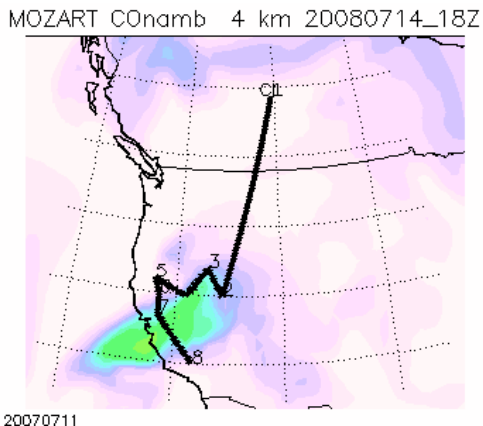
Jul 13





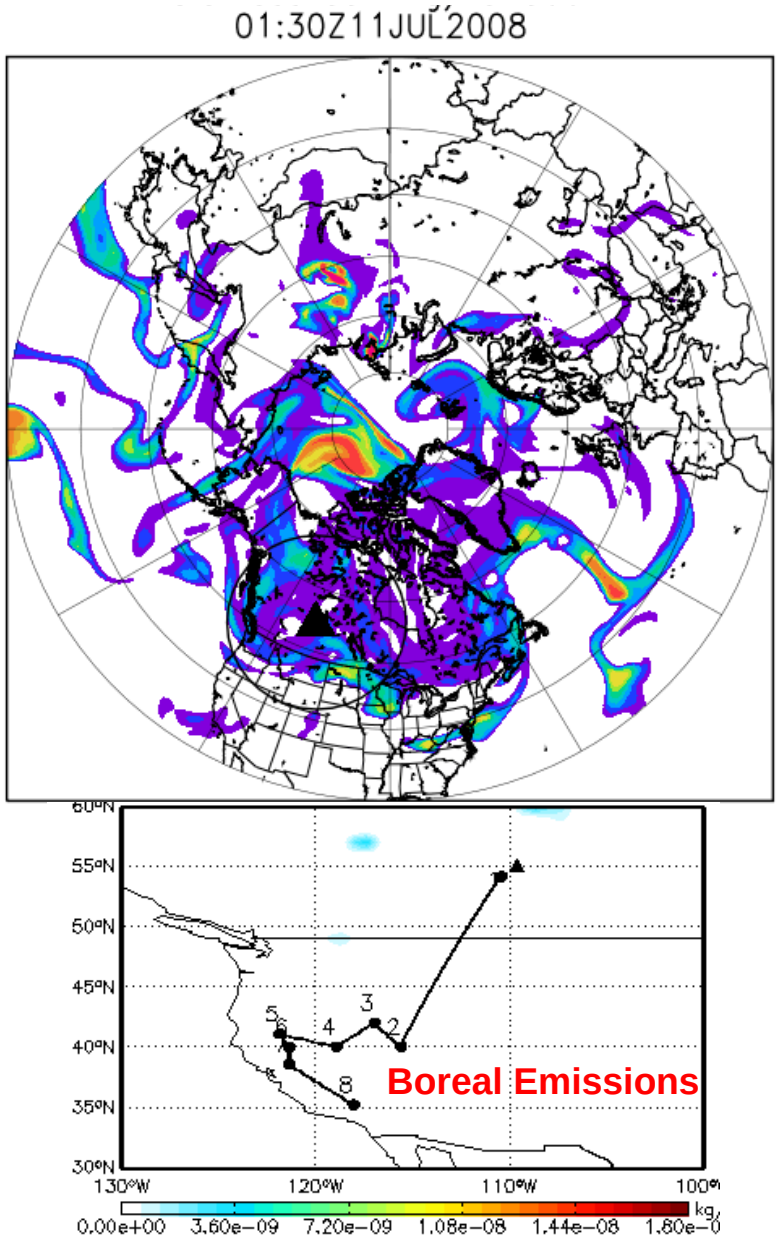
Jul 14



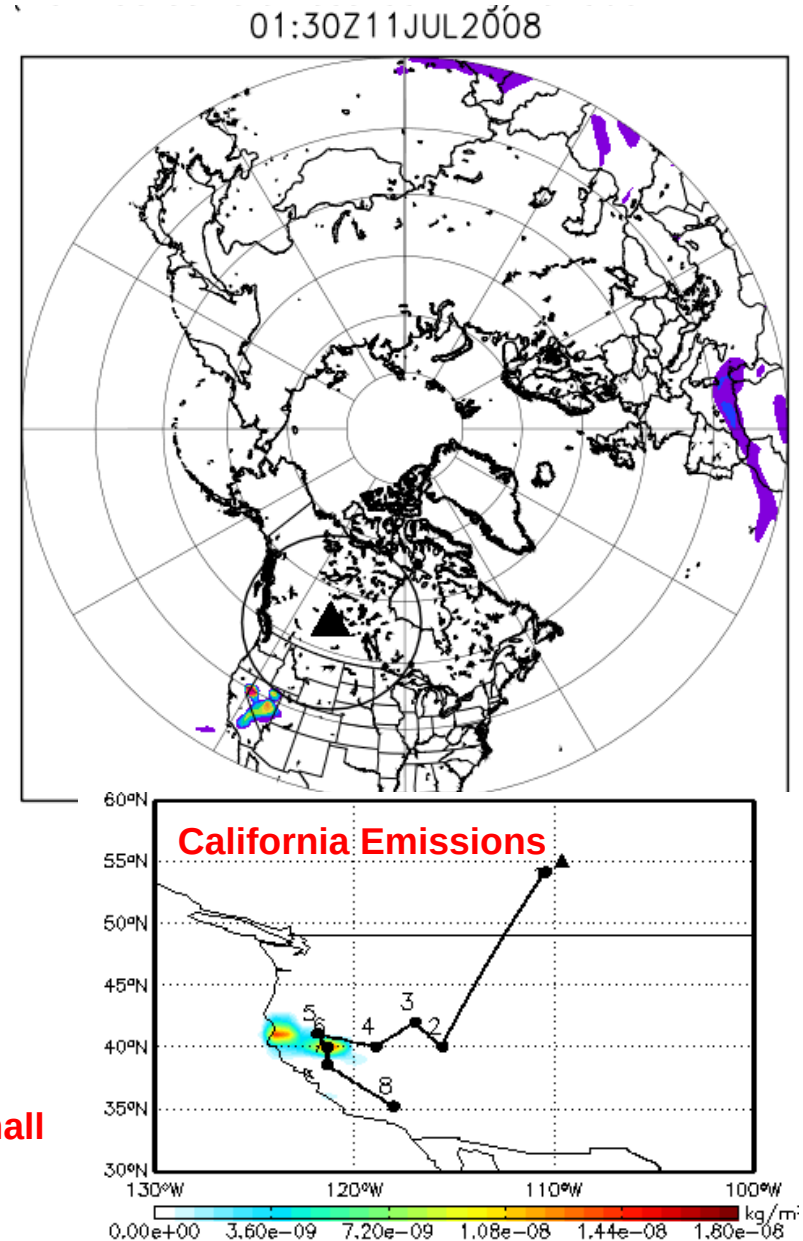


GEOS-5 20080711_06Z Fcst: 5-Day Animation: July 11th – 15th

Boreal CO 500 mb

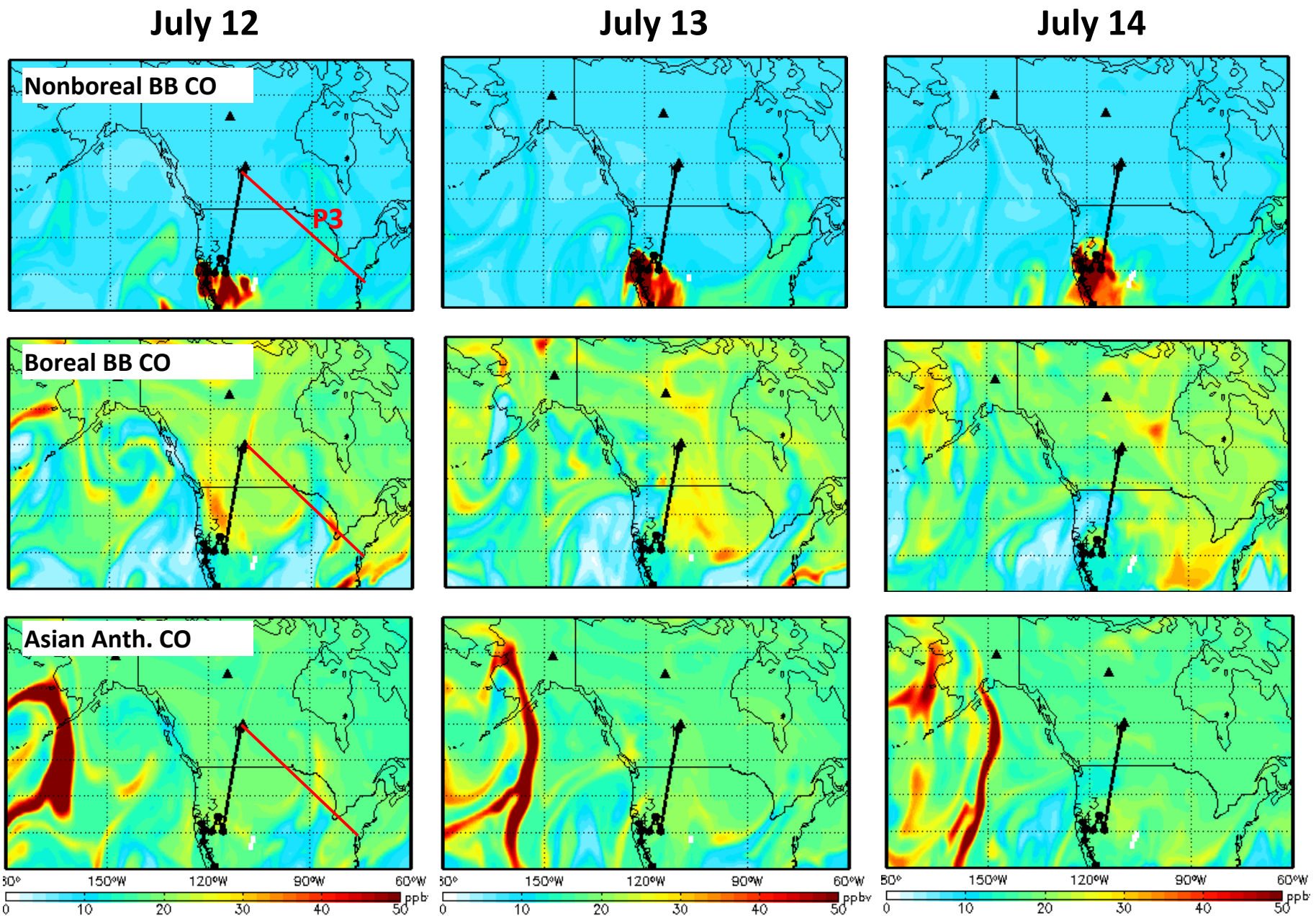


California Fire CO 500 mb

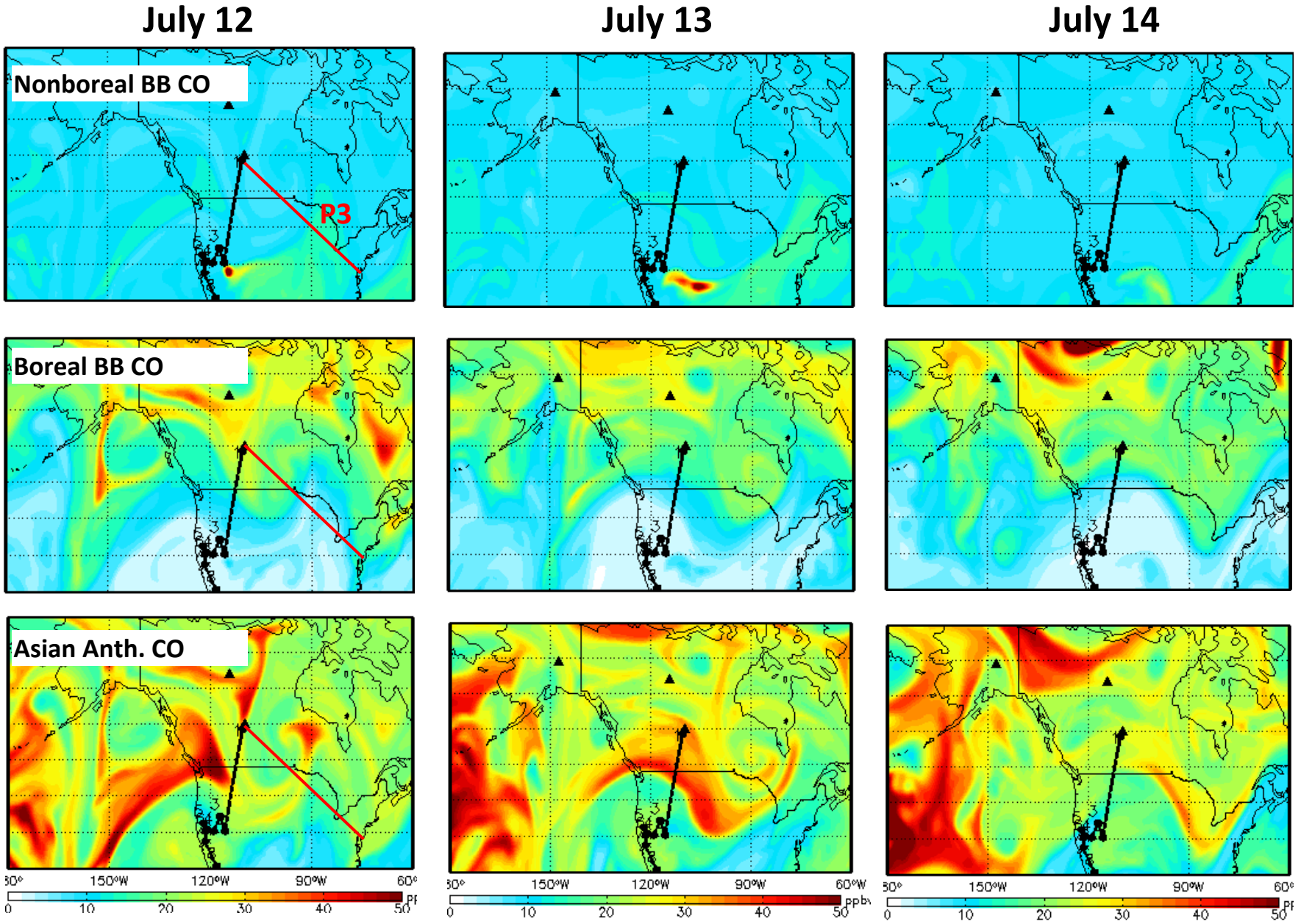


Big Sur fires relatively small in model.

GEOS-5 20080711_06Z Fcst: CO Outlook @ 700 mb

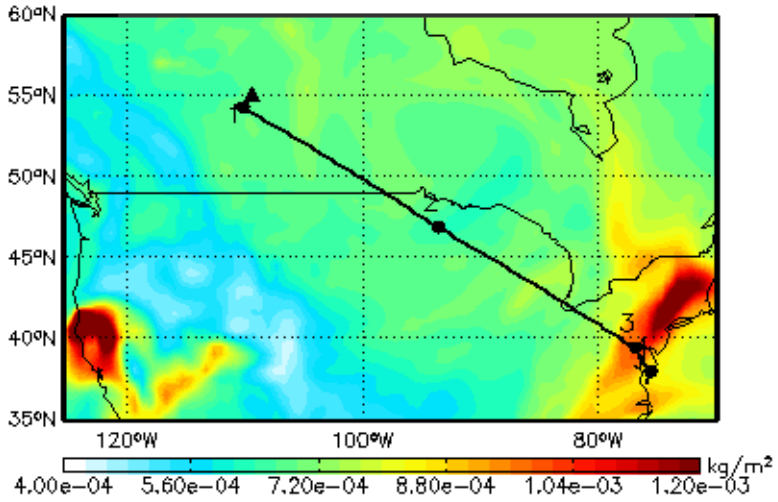


GEOS-5 20080711_06Z Fcst: CO Outlook @ 300 mb

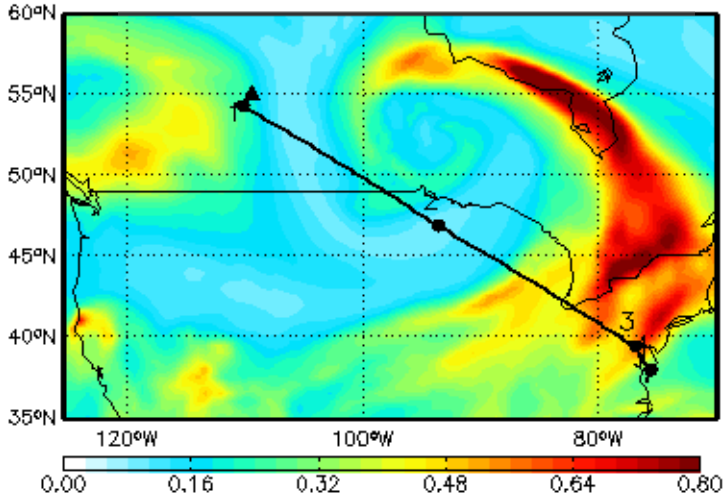


GEOS-5 Forecast for P3 20080712 @19:30Z
(Initialized 10080711_06Z)

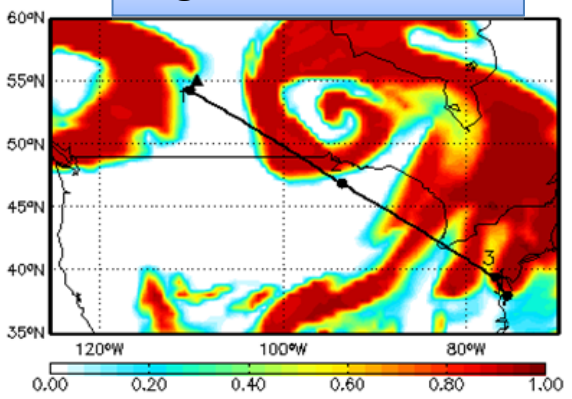
CO column



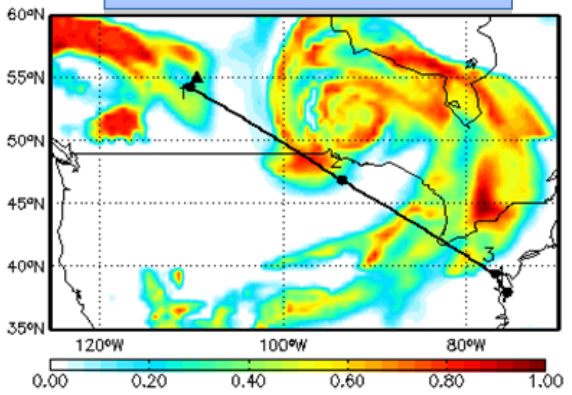
AOT



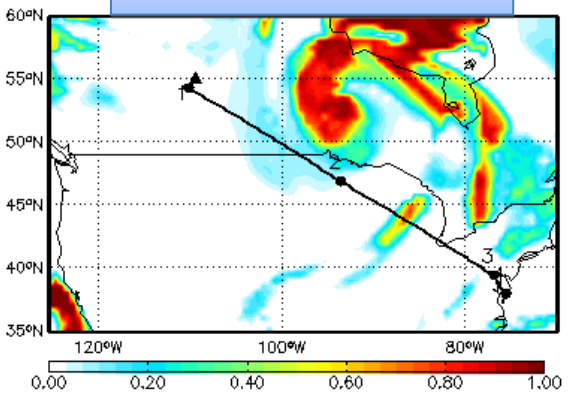
High cloud fraction



Mid cloud fraction

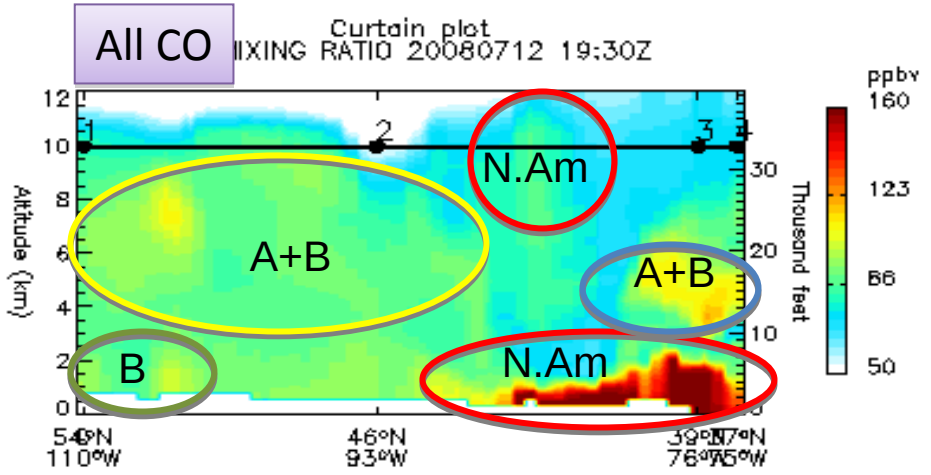


Low cloud fraction

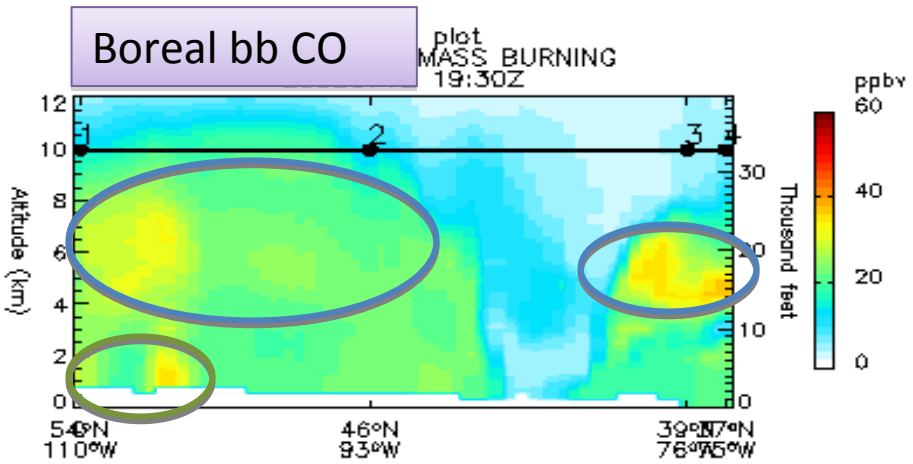


GEOS-5 CO 20080712 19:30Z

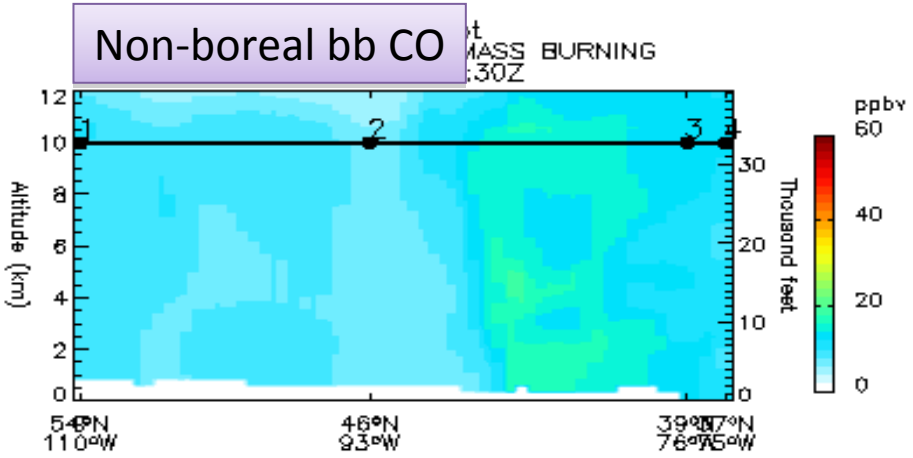
All CO



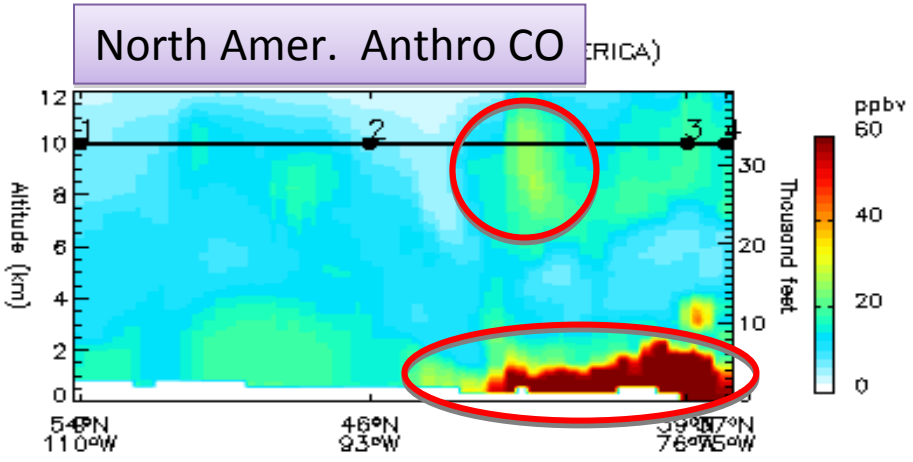
Boreal bb CO



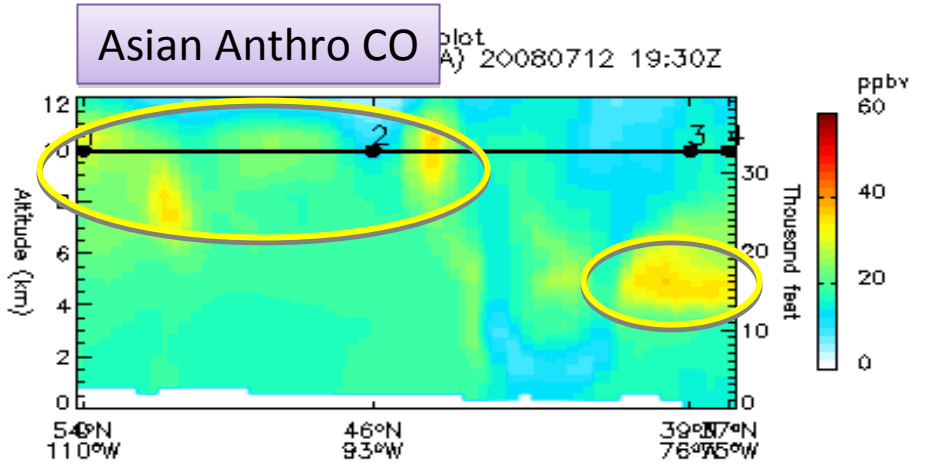
Non-boreal bb CO

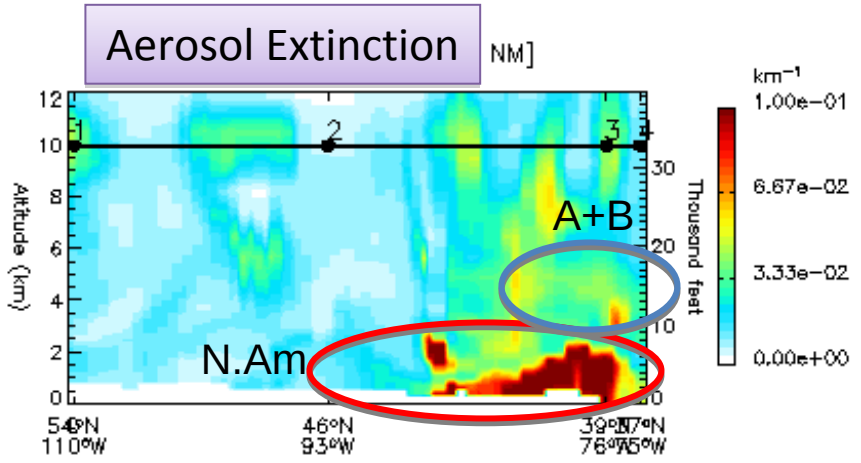


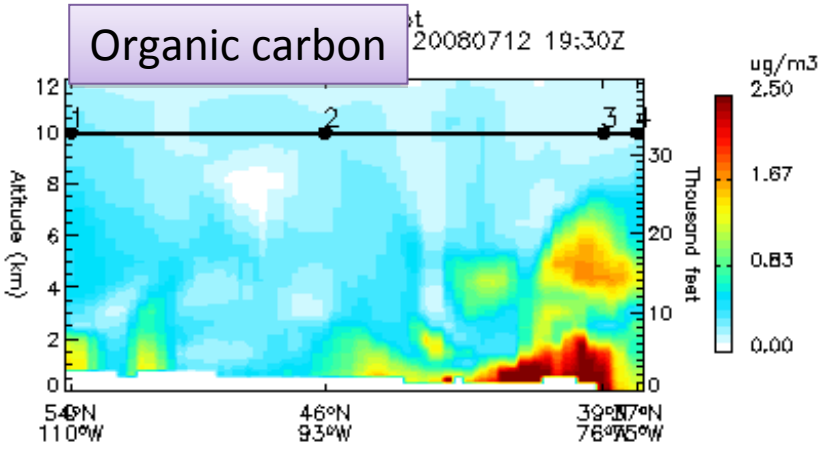
North Amer. Anthro CO

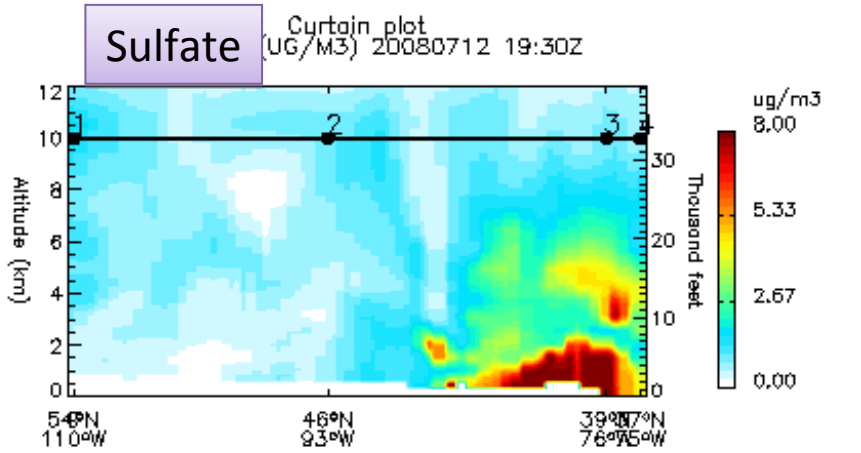


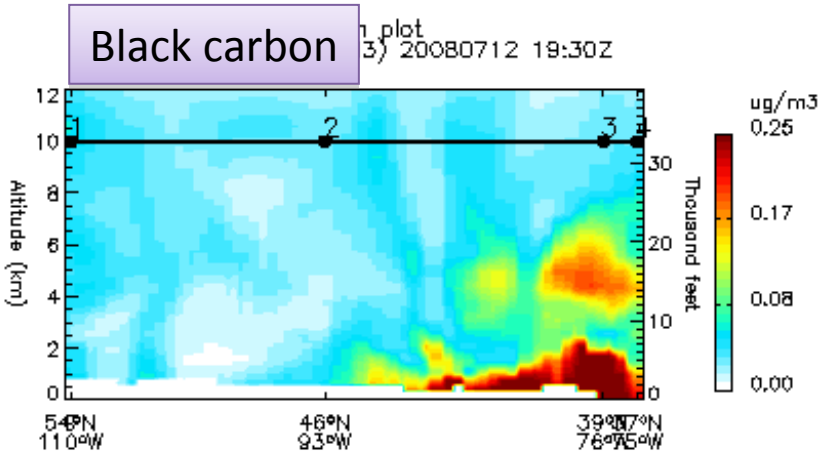
Asian Anthro CO

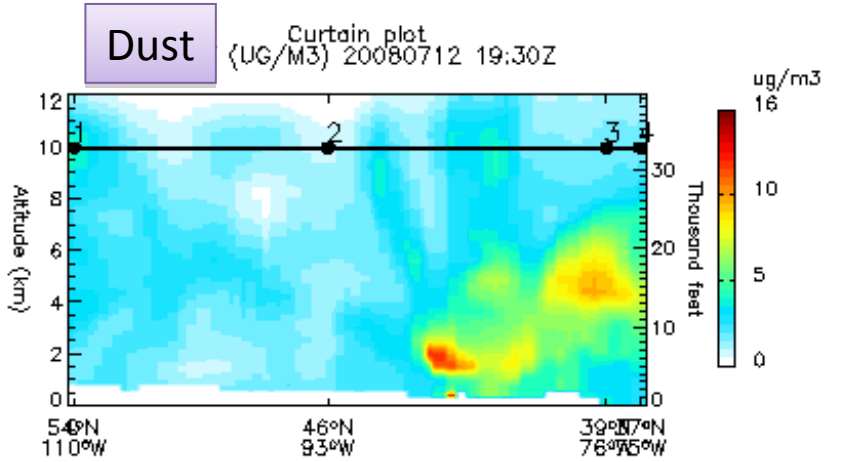


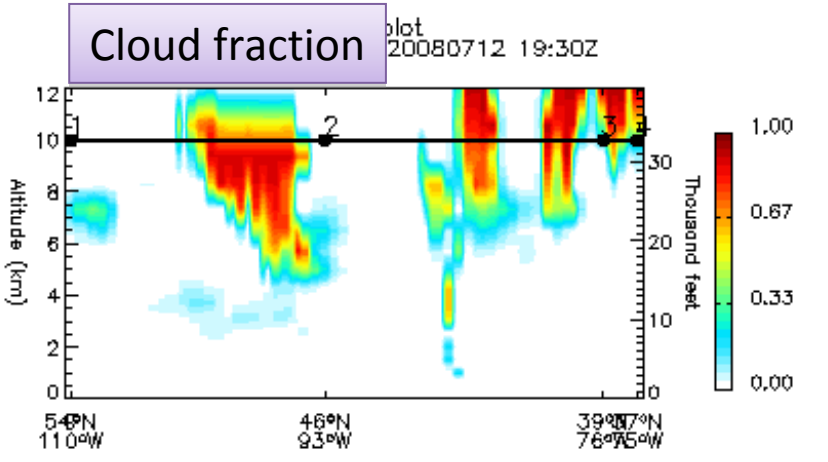

Aerosol Extinction
NM]
km⁻¹
1.00e-01
6.67e-02
3.33e-02
0.00e+00
A+B
N.Am
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W


Organic carbon
20080712 19:30Z
ug/m3
2.50
1.67
0.83
0.00
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W


Sulfate
Curtain plot
(UG/M3) 20080712 19:30Z
ug/m3
8.00
5.33
2.67
0.00
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W


Black carbon
20080712 19:30Z
ug/m3
0.25
0.17
0.08
0.00
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W

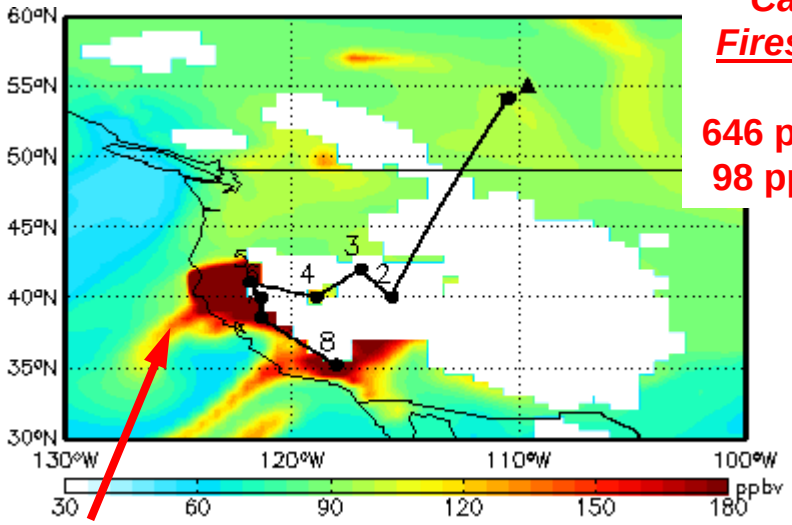

Dust
Curtain plot
(UG/M3) 20080712 19:30Z
ug/m3
16
10
5
0
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W


Cloud fraction
20080712 19:30Z
1.00
0.67
0.33
0.00
Altitude (km)
Thousand feet
54°N 110°W
46°N 93°W
39°N 76°W

GEOS5 Forecast: DC-8 Flight : Cold Lake to Palmdale

July 12th 19:30Z (July 11th 06Z forecast)

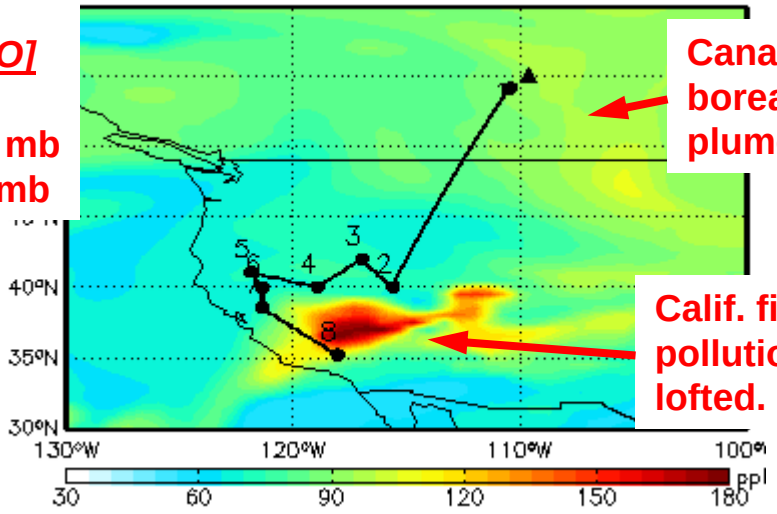
Total CO 850 mb



Californian Fires Max [CO]

646 ppb : 850 mb
98 ppb : 500 mb

Total CO 500 mb



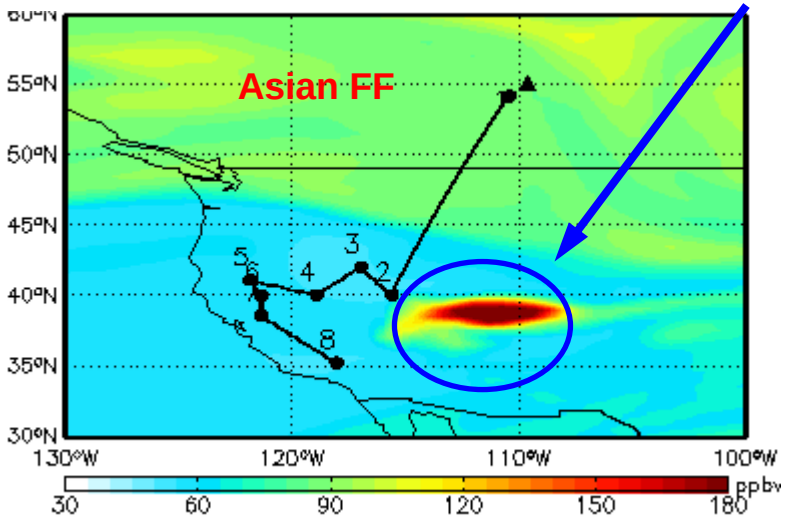
Canadian boreal plume

Calif. fire pollution lofted.

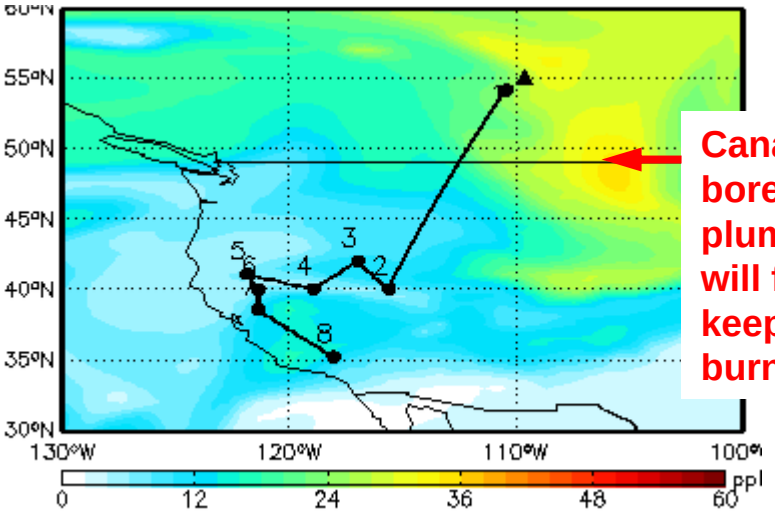
California Fires

Convection over Arizona lofts pollution to UT.

Total CO 300 mb



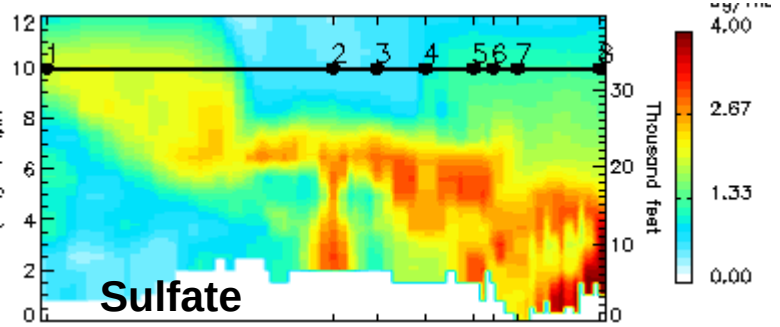
Boreal CO 500 mb

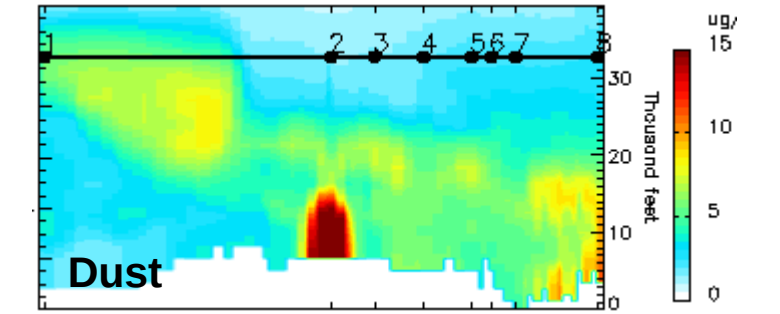


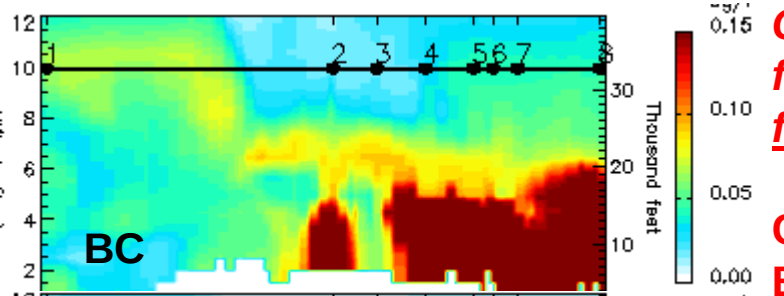
Canadian boreal plume – will fires keep burning?

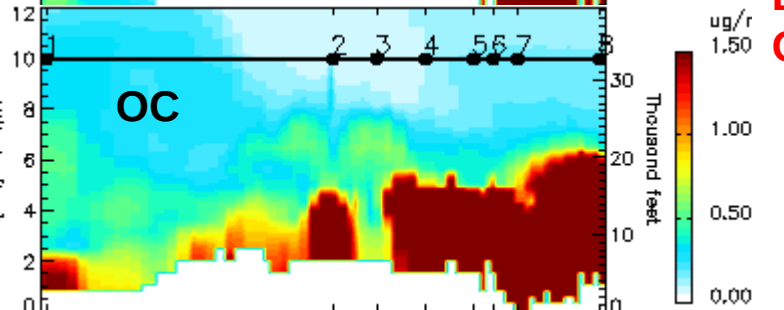
GEOS-5 Forecast 20080711_06Z

July 12th Cold Lake -> Palmdale







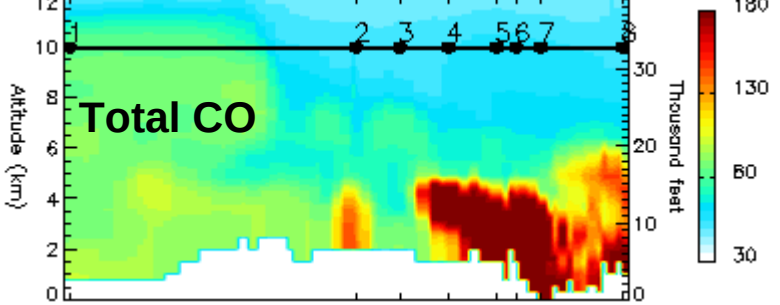


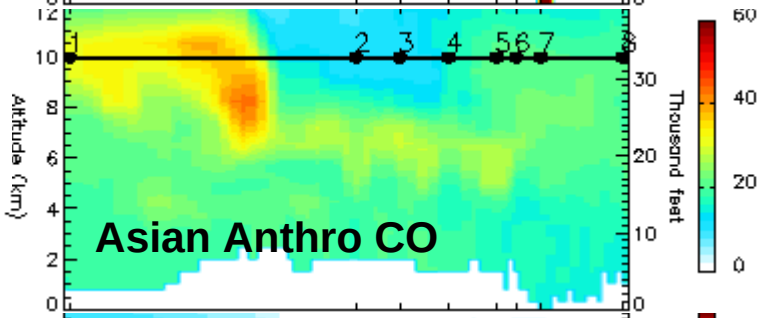
Californian Fires Max [CO]

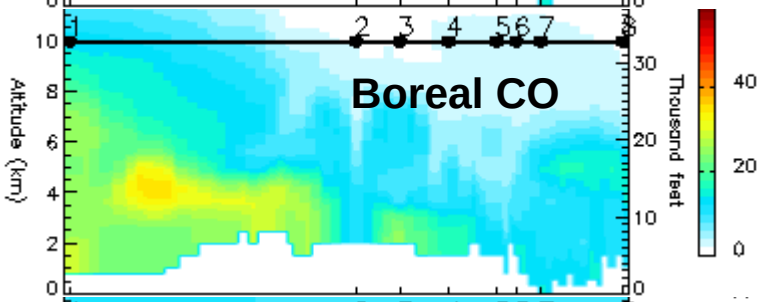
646 ppb : 850 mb
98 ppb : 500 mb

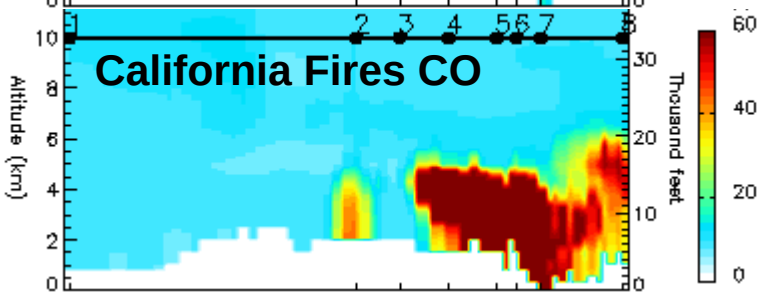
Californian fires max along flight track

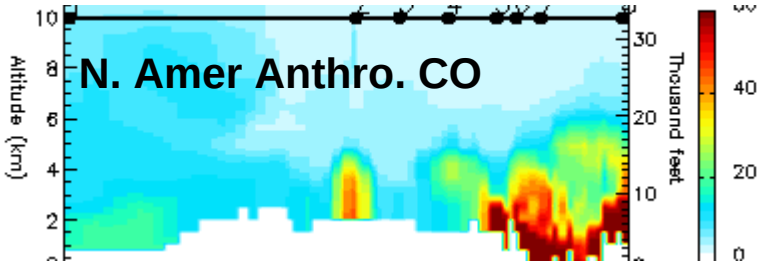
CO = 466 ppb
BC = 2.21 ug/m^3
OC = 43 ug/m^3



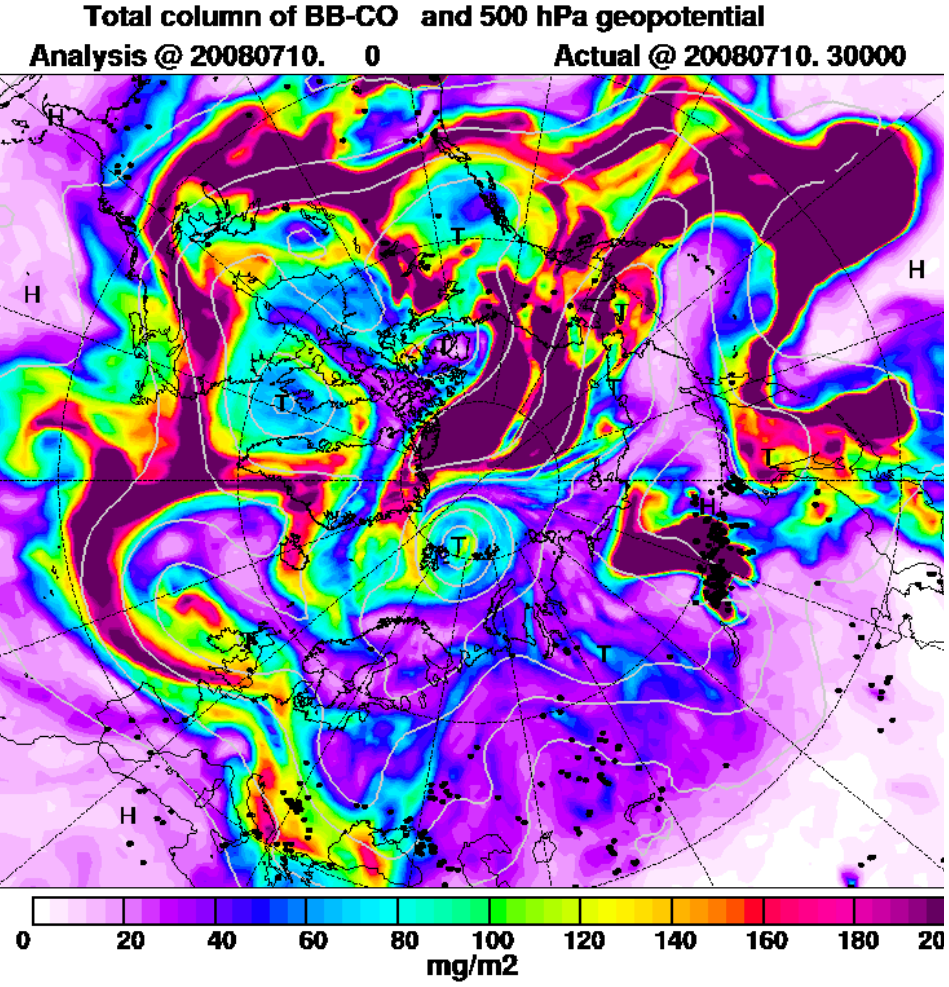


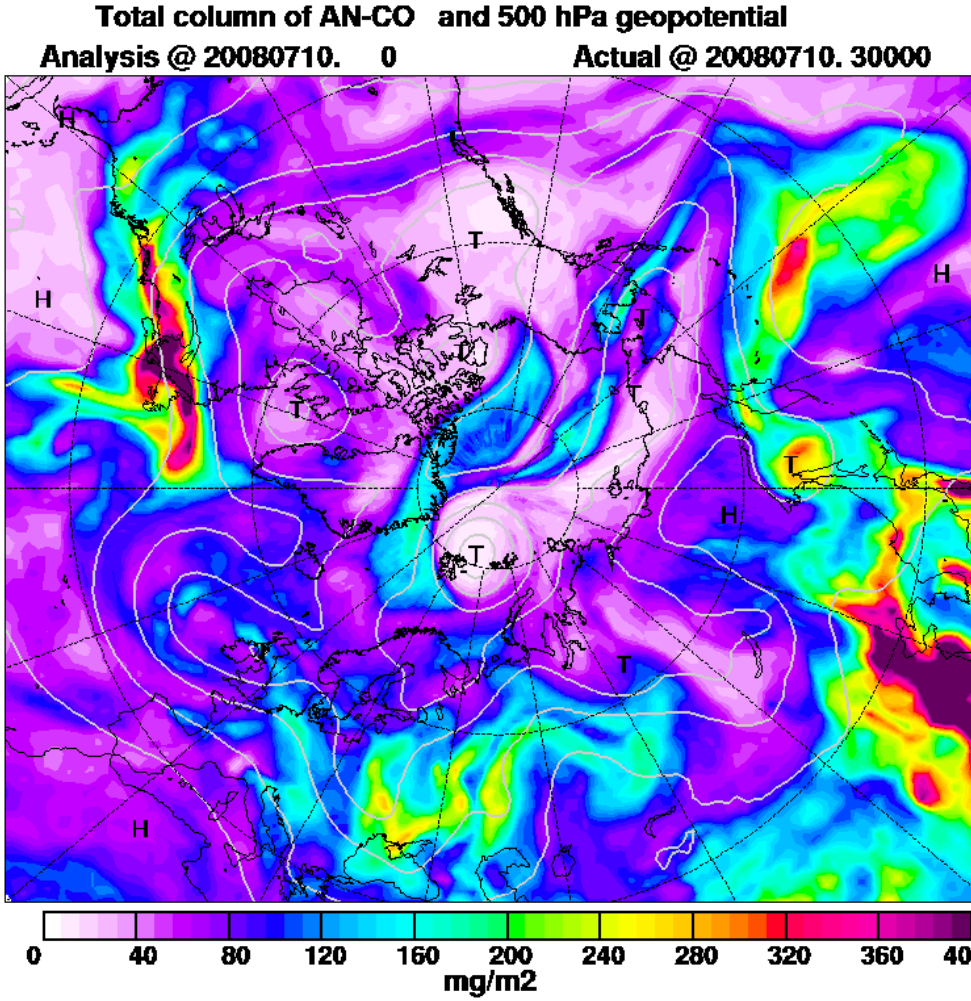




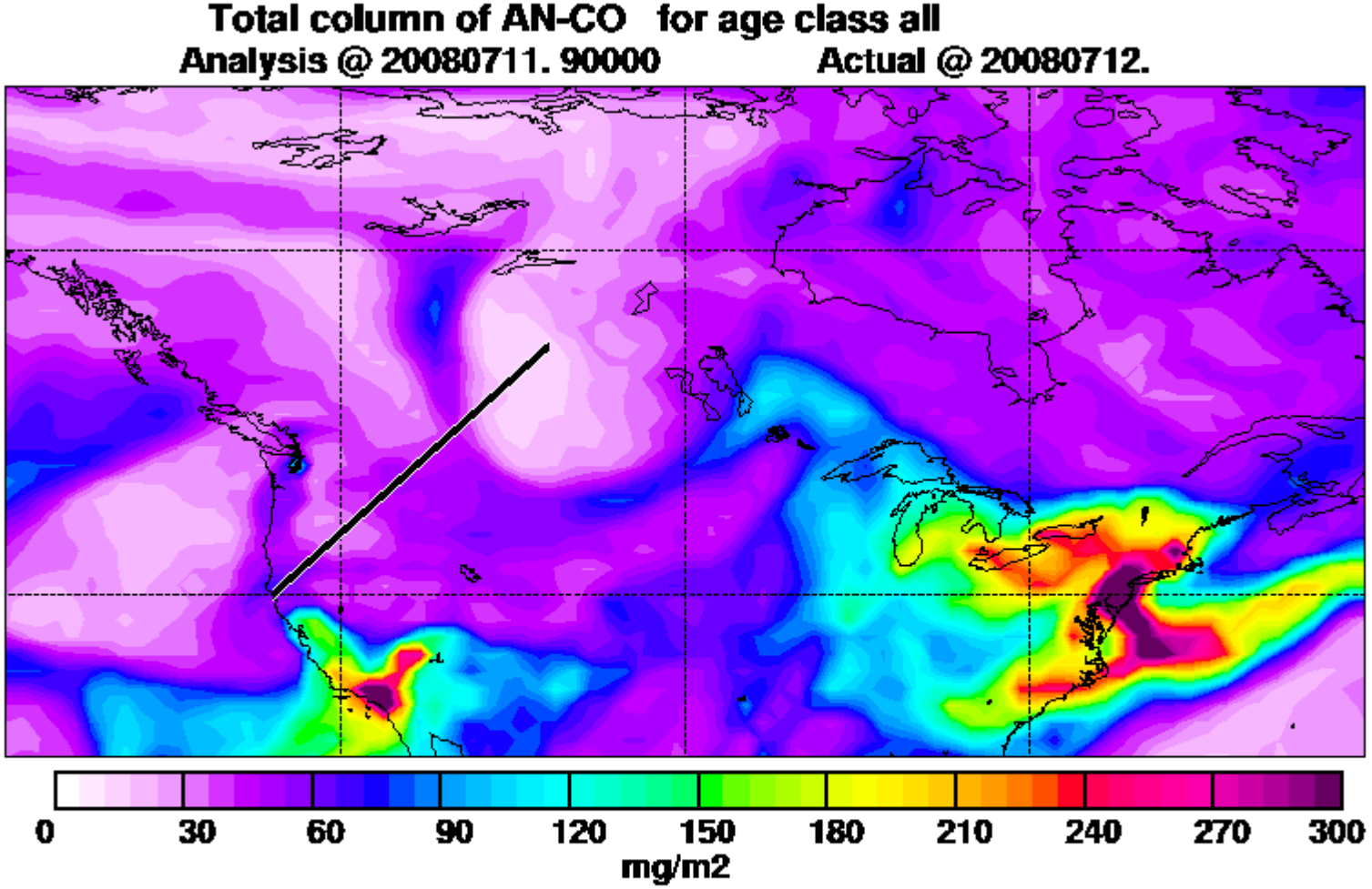


Biomass and Anthropogenic CO Tracers

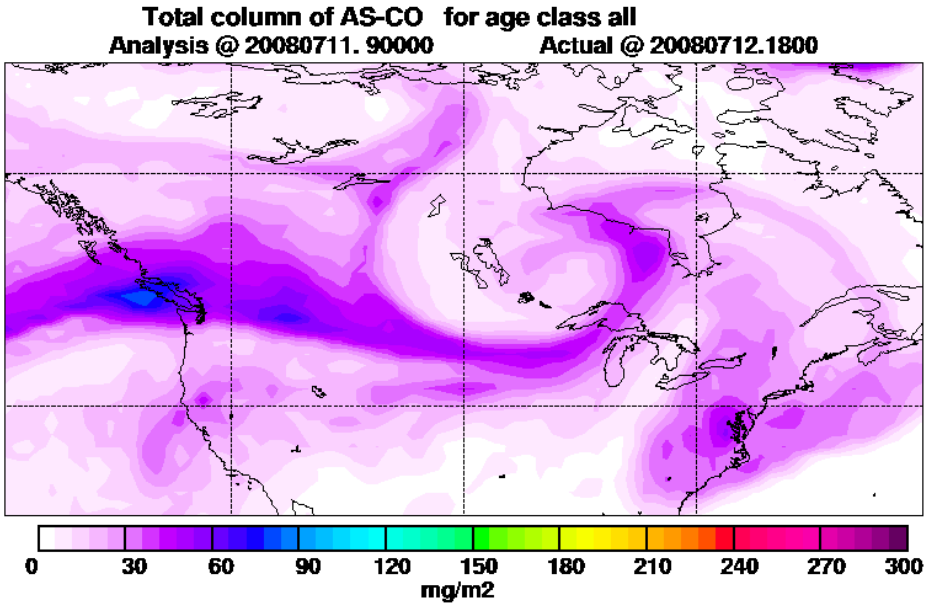


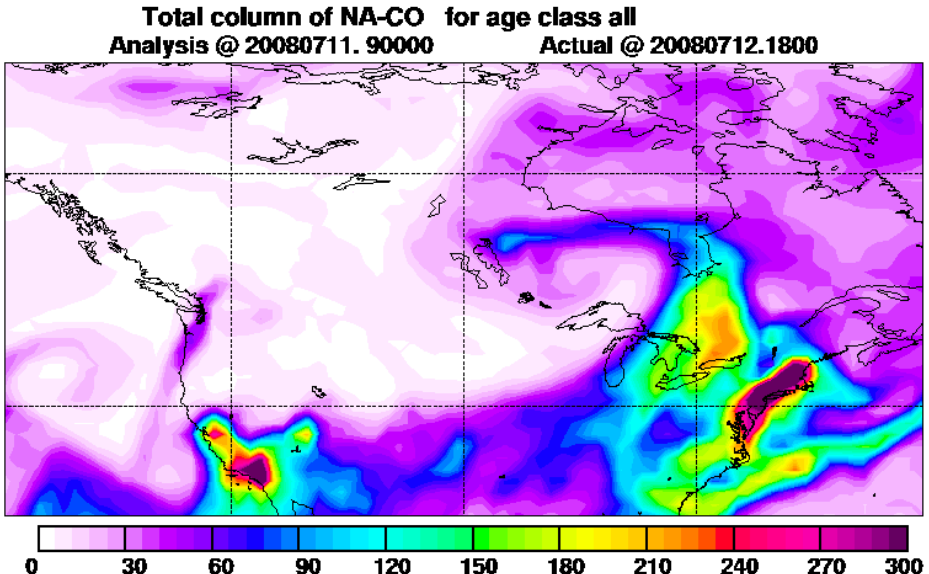


Anthropogenic CO: 12 July Overview

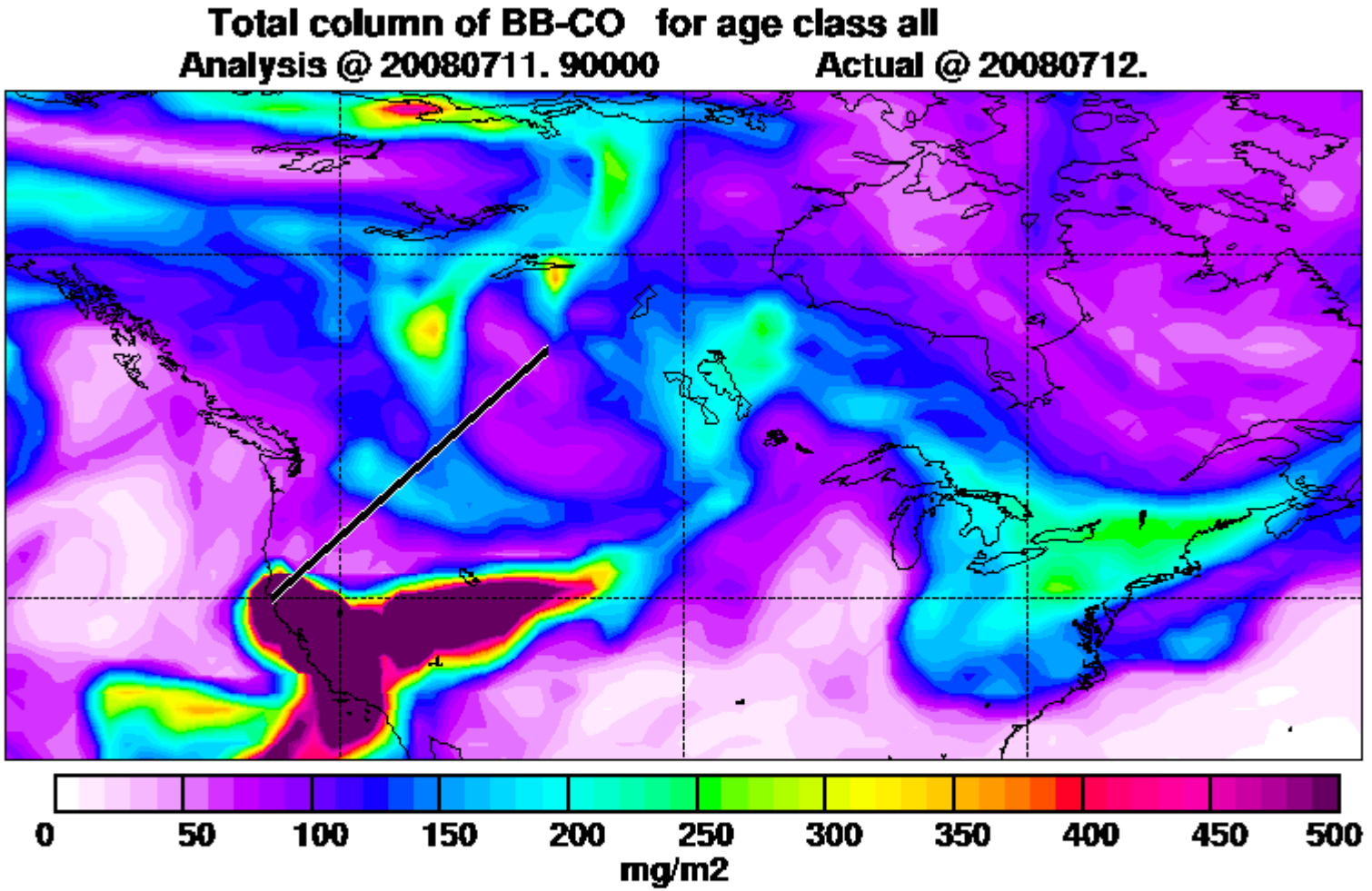


Overview

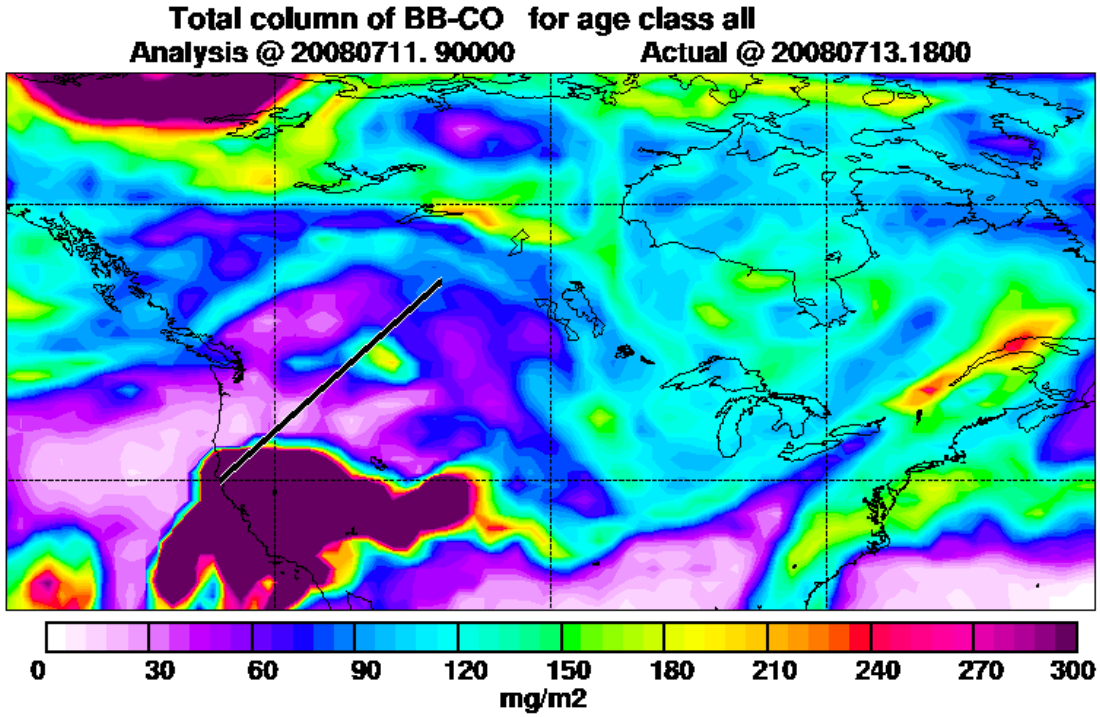

Total column of AS-CO for age class all
Analysis @ 20080711. 90000
Actual @ 20080712.1800
0
30
60
90
120
150
180
210
240
270
300
mg/m2


Total column of NA-CO for age class all
Analysis @ 20080711. 90000
Actual @ 20080712.1800
0
30
60
90
120
150
180
210
240
270
300

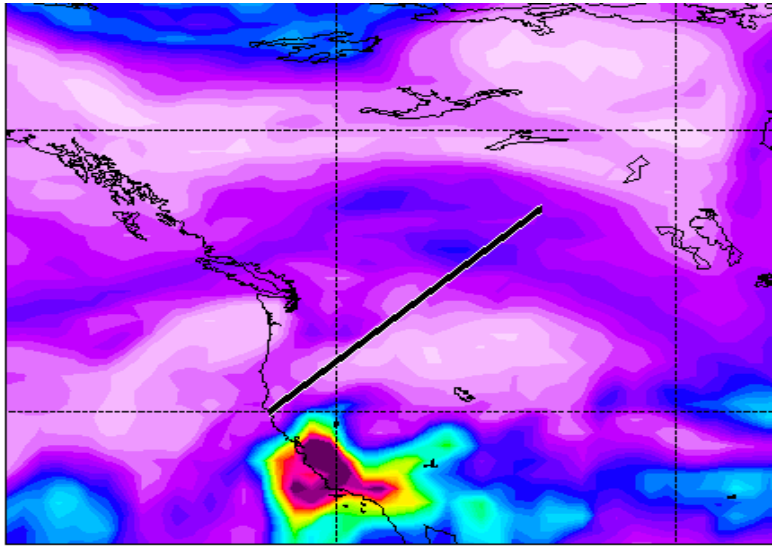
Biomass Burning: Overview



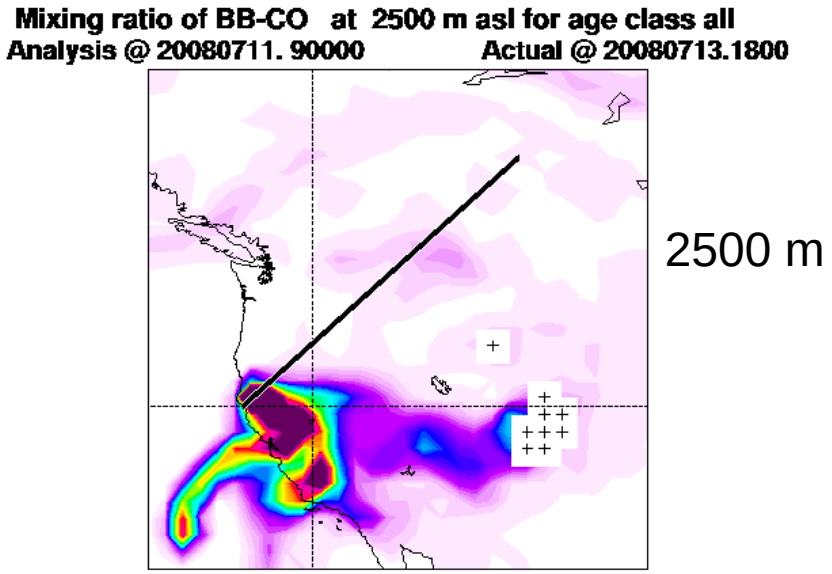
13 July – BB, Anthro CO



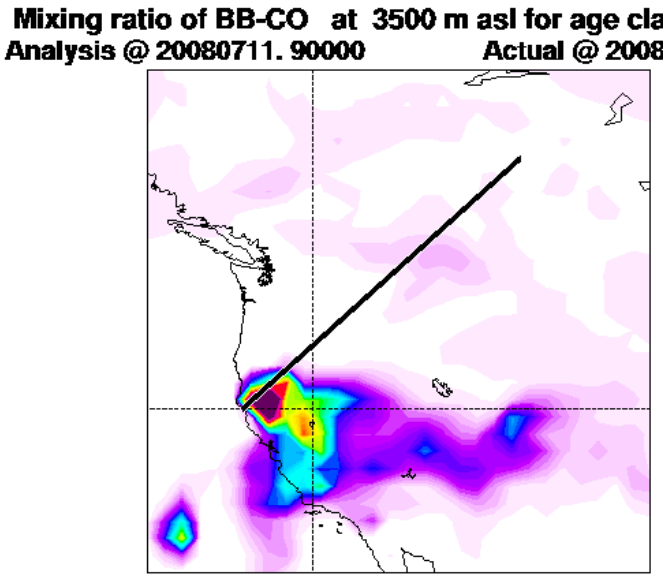
TOTAL ANTHRO



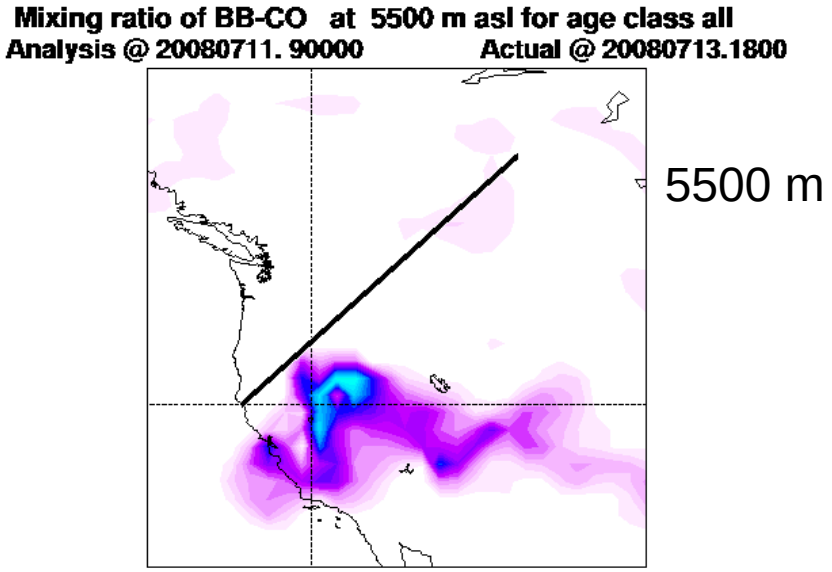
13 July BB, CO



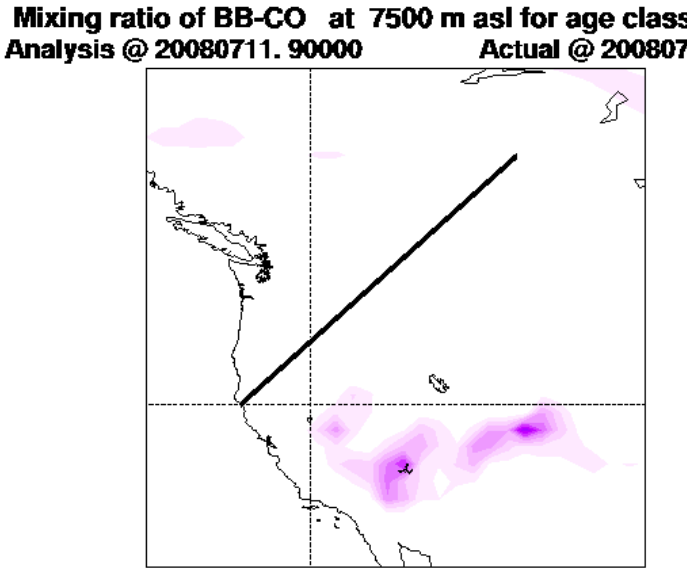
2500 m



3500 m

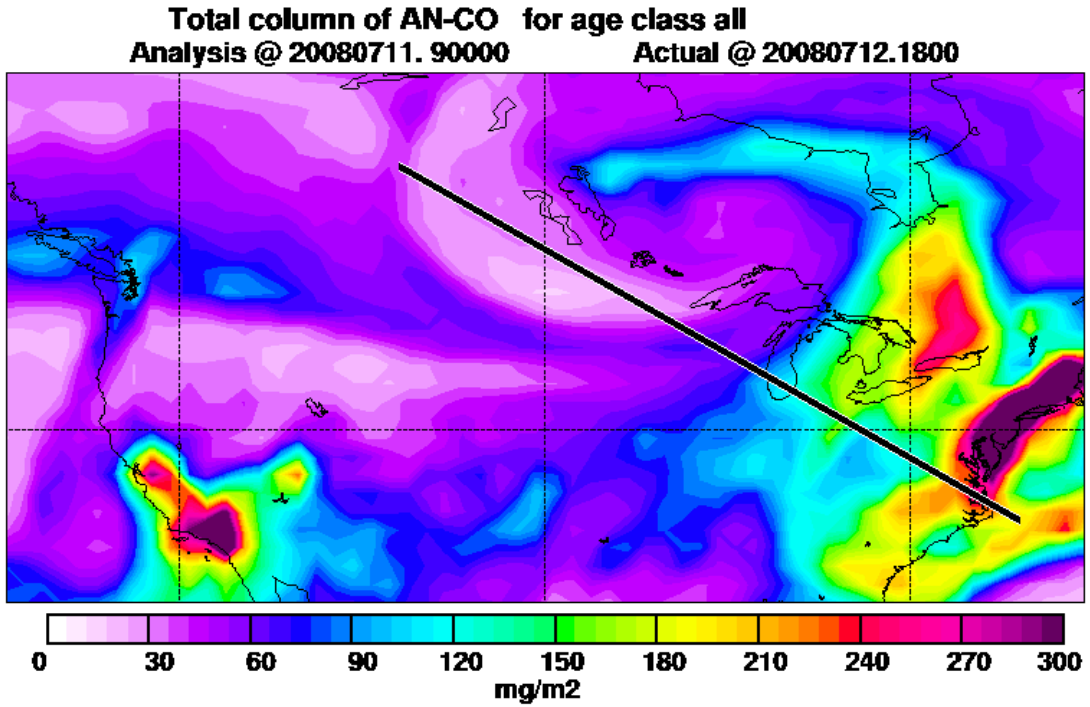


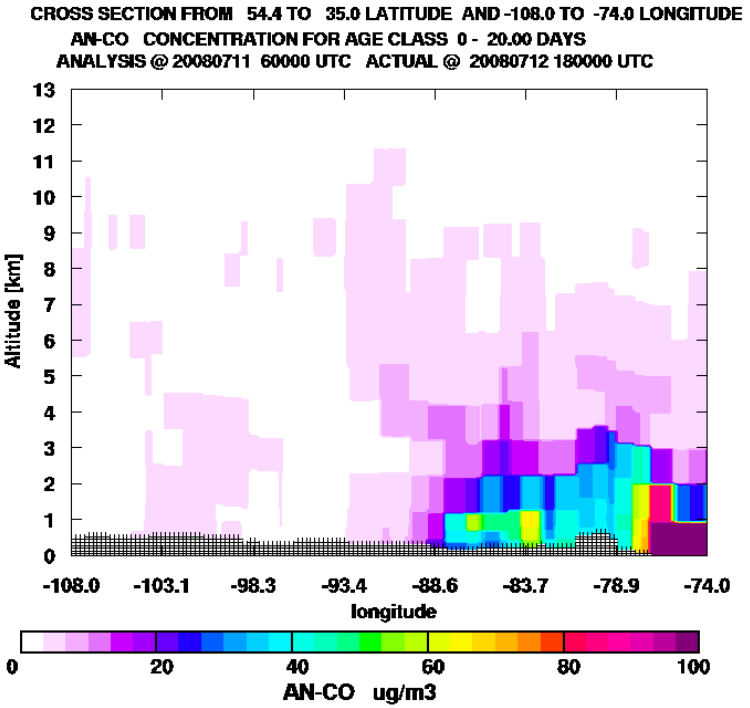
5500 m

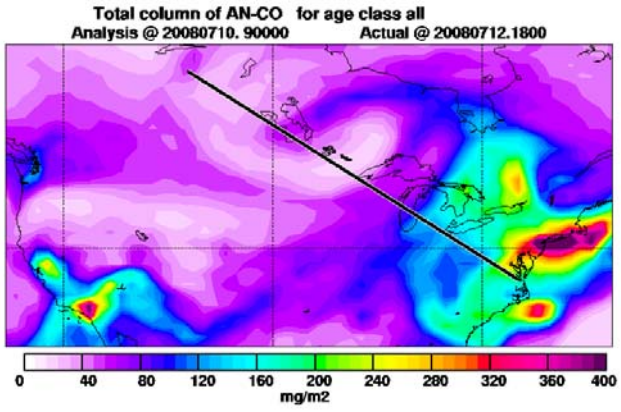


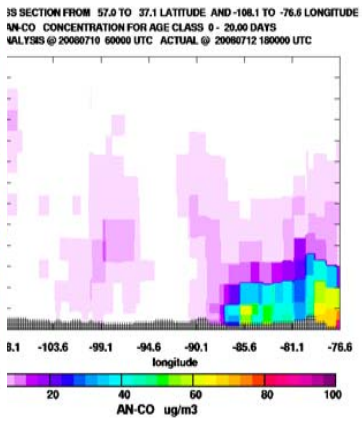
7500 m

P3 12 July Transit: Anthro CO

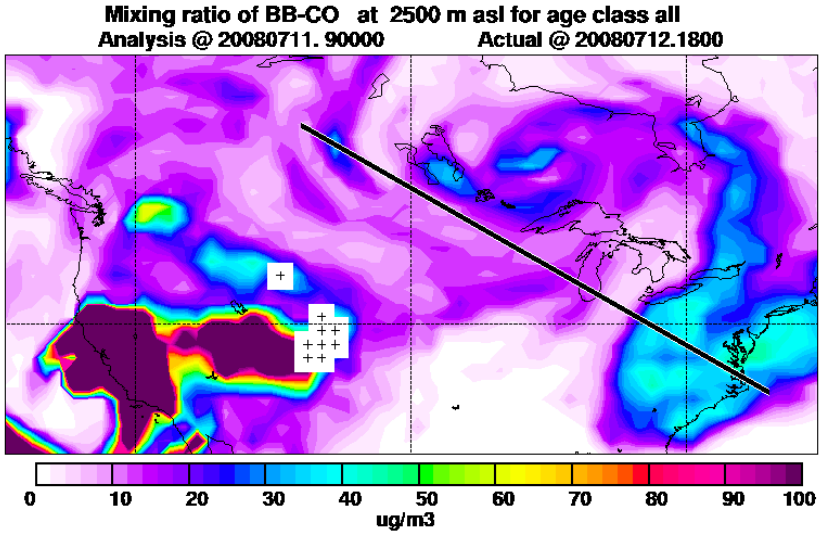


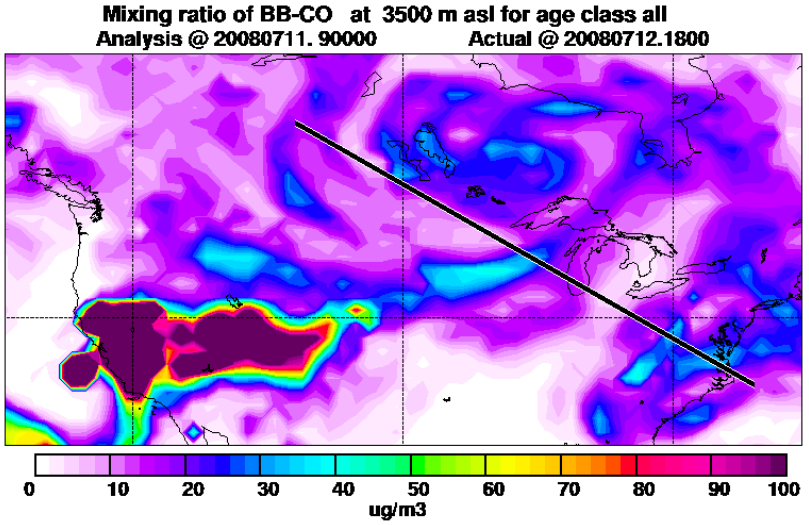


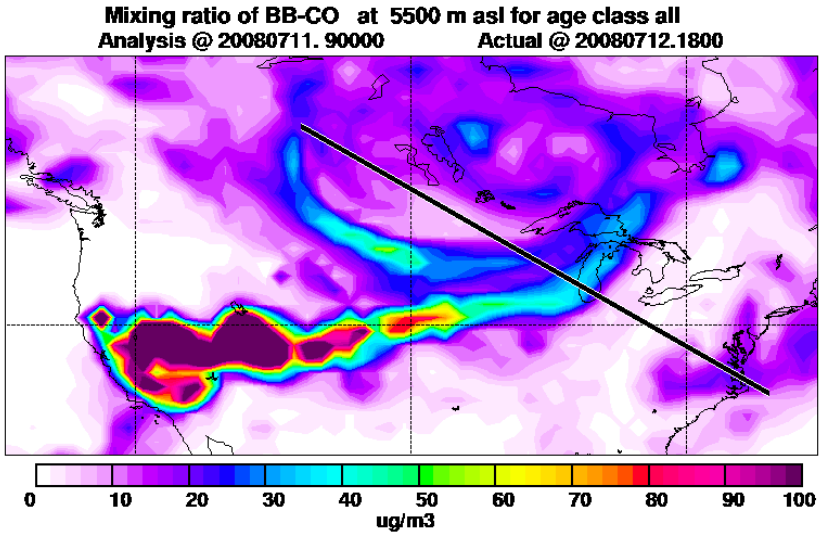


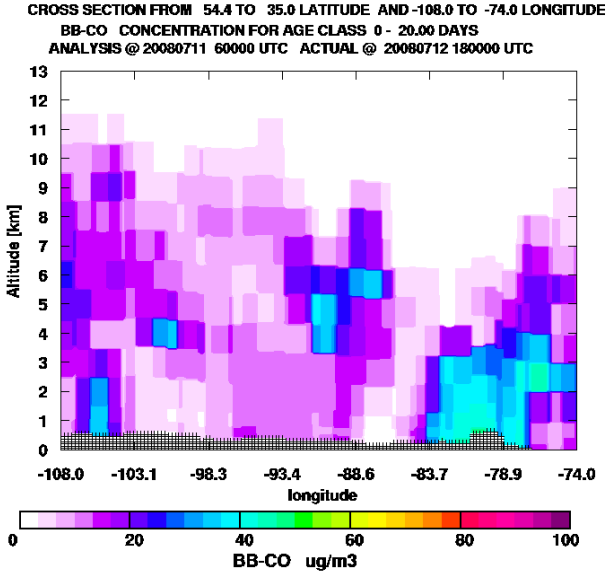


P3 12 July Transit : BBCO

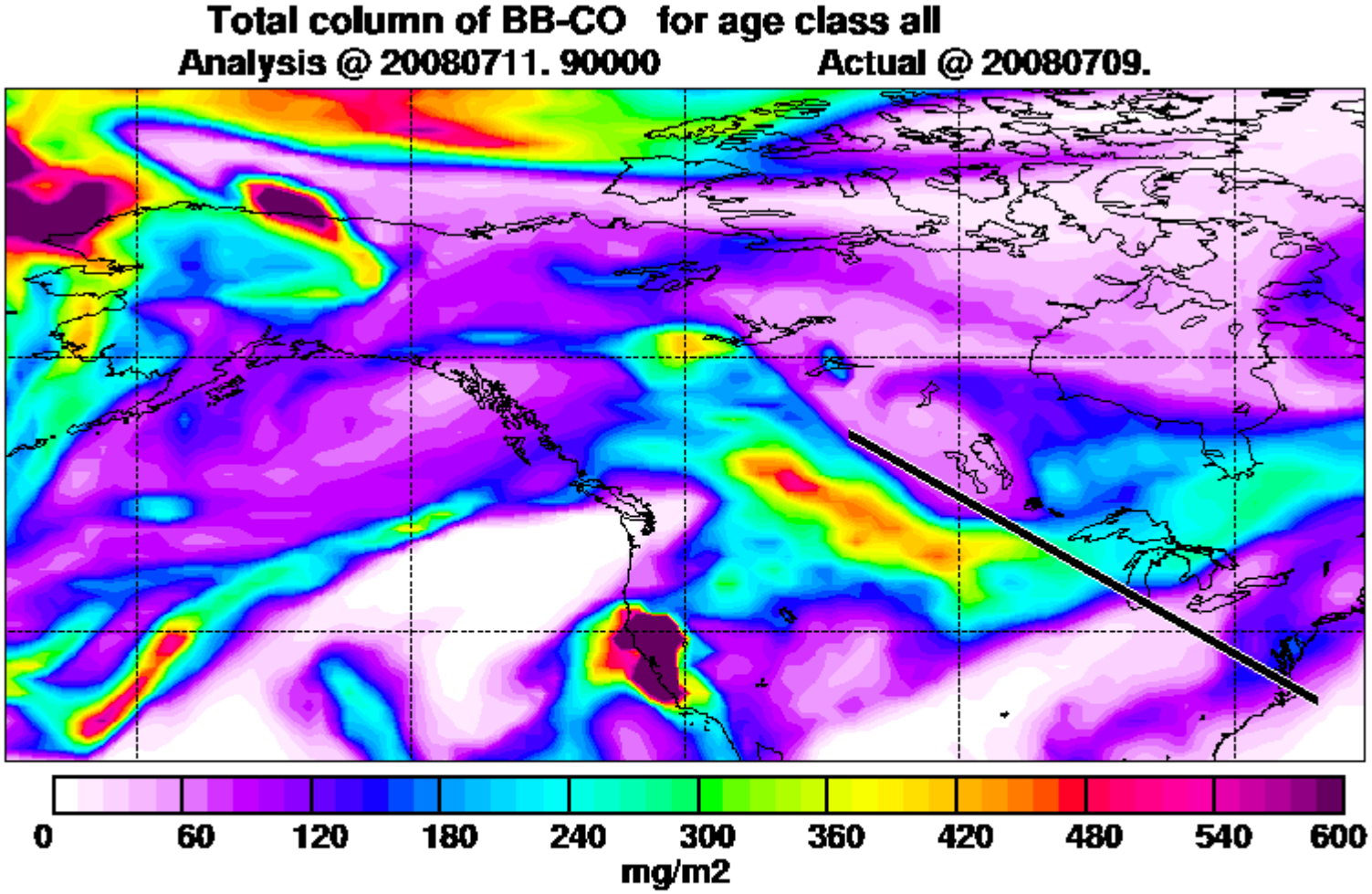




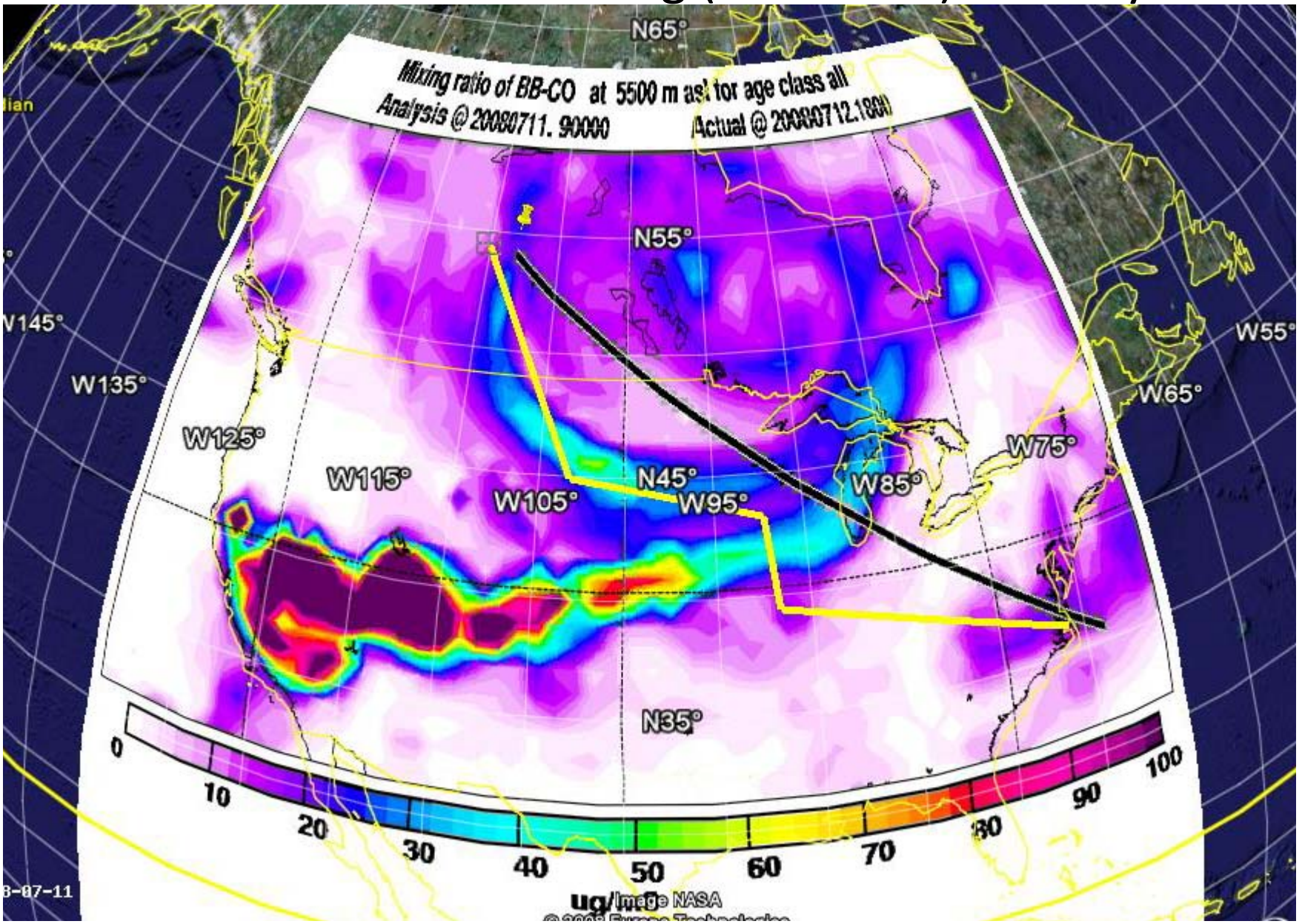
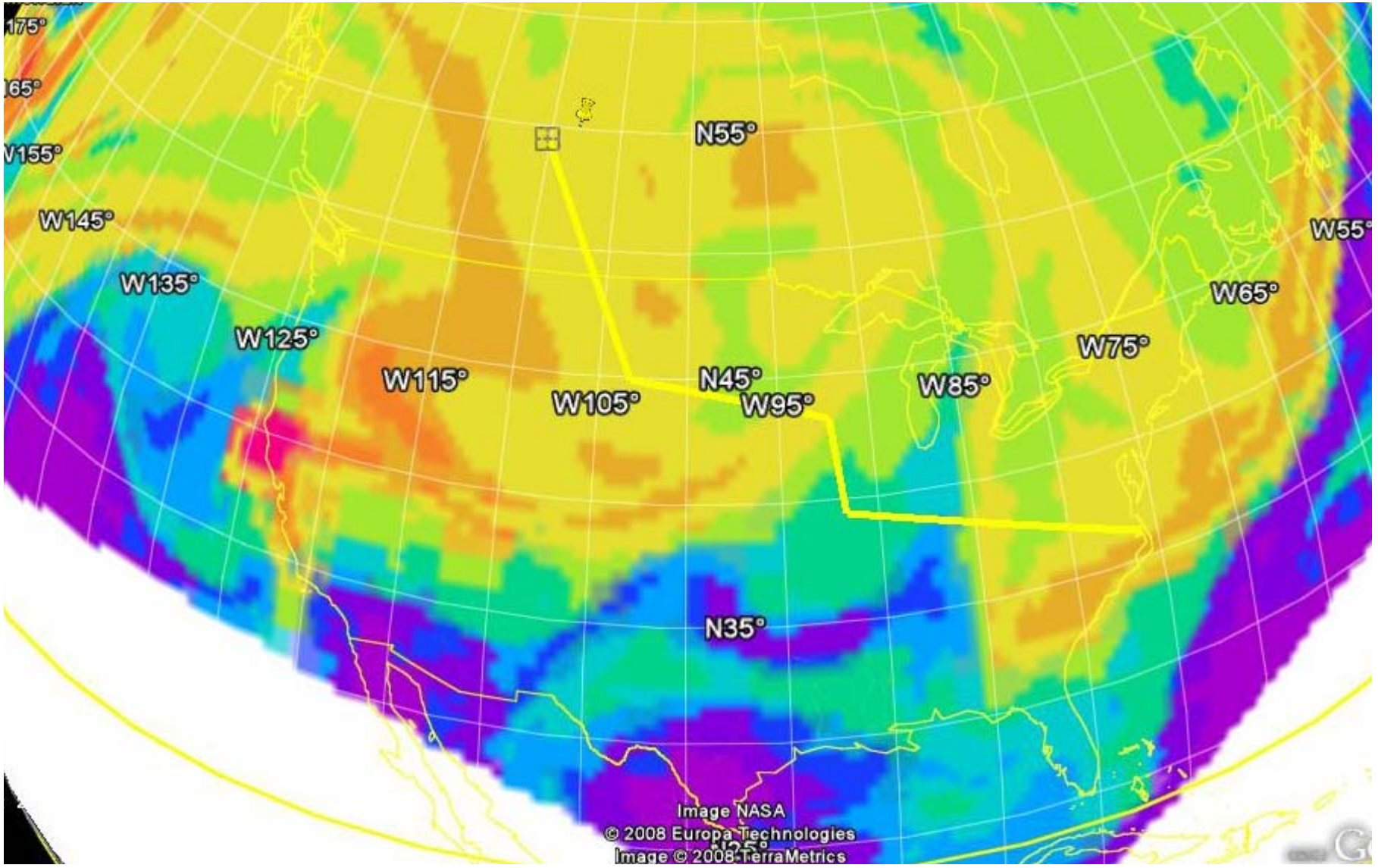




Biomass Burning: 12 July Overview



5500m Biomass Burning (FLEXPART) : 12 July



Total Column Biomass Burning (STEM): 12 July