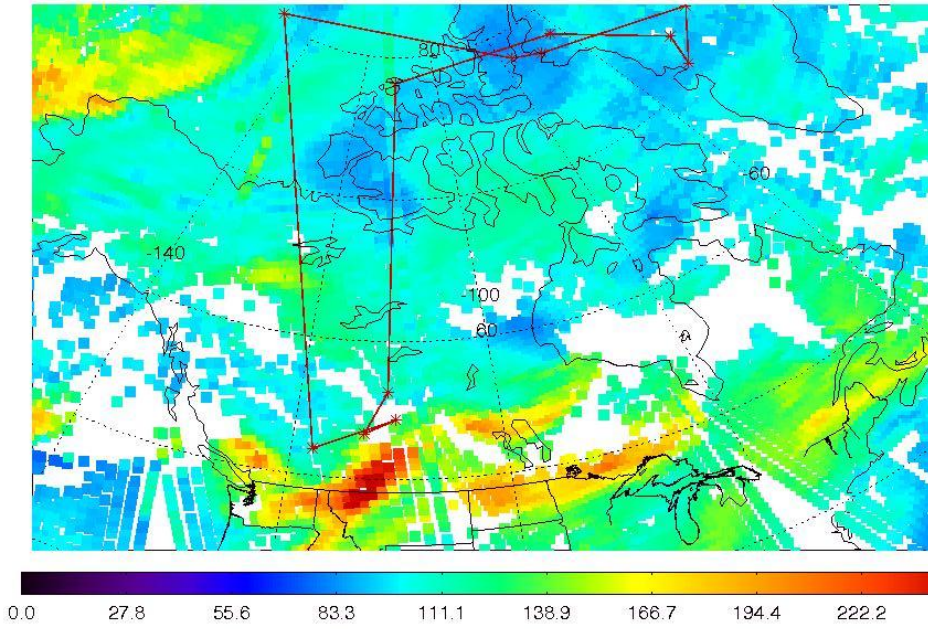
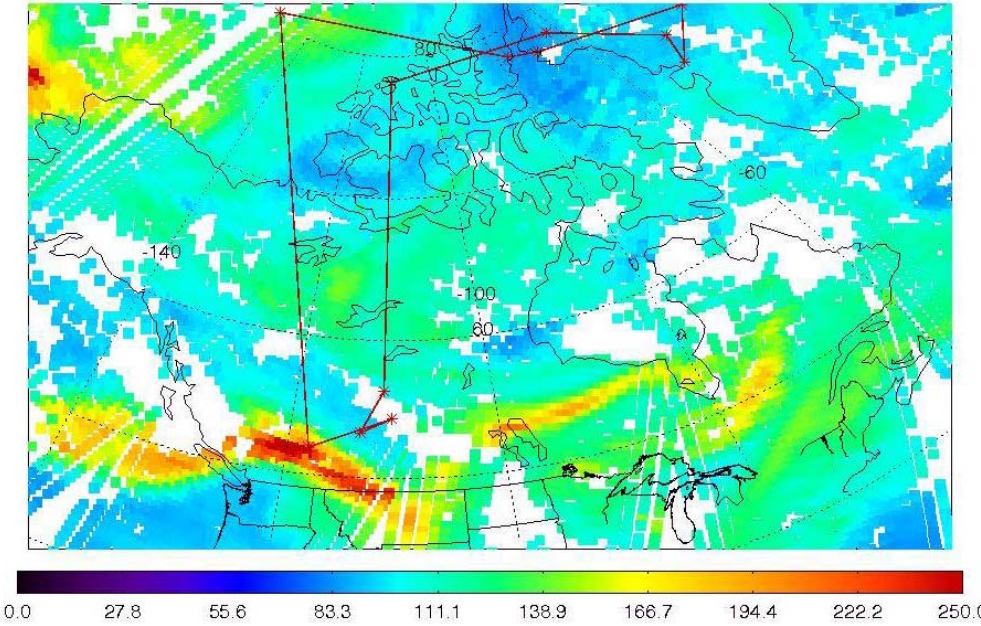
AIRS Support for ARCTAS

AIRS CO VMR (ppbv) at 500mb on 20080706 for ARCTAS

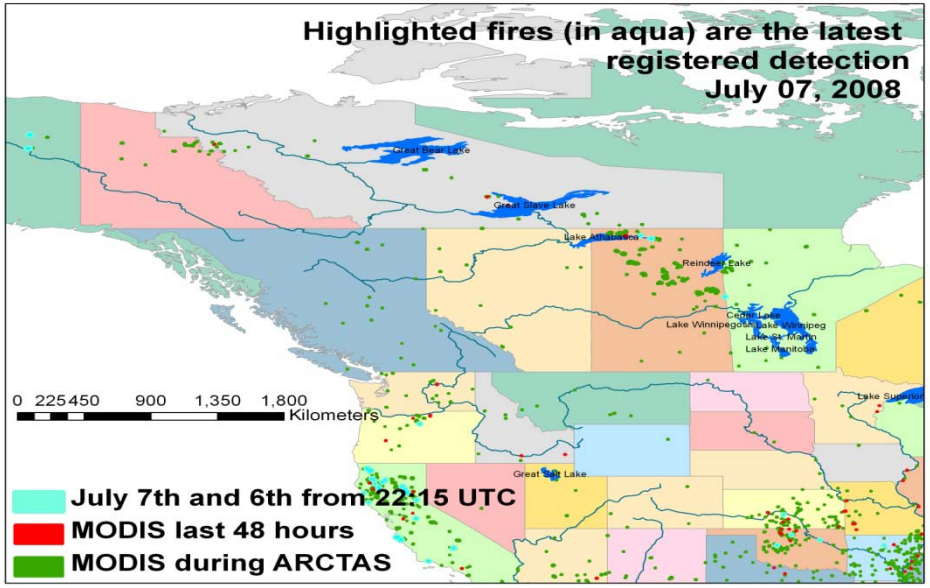


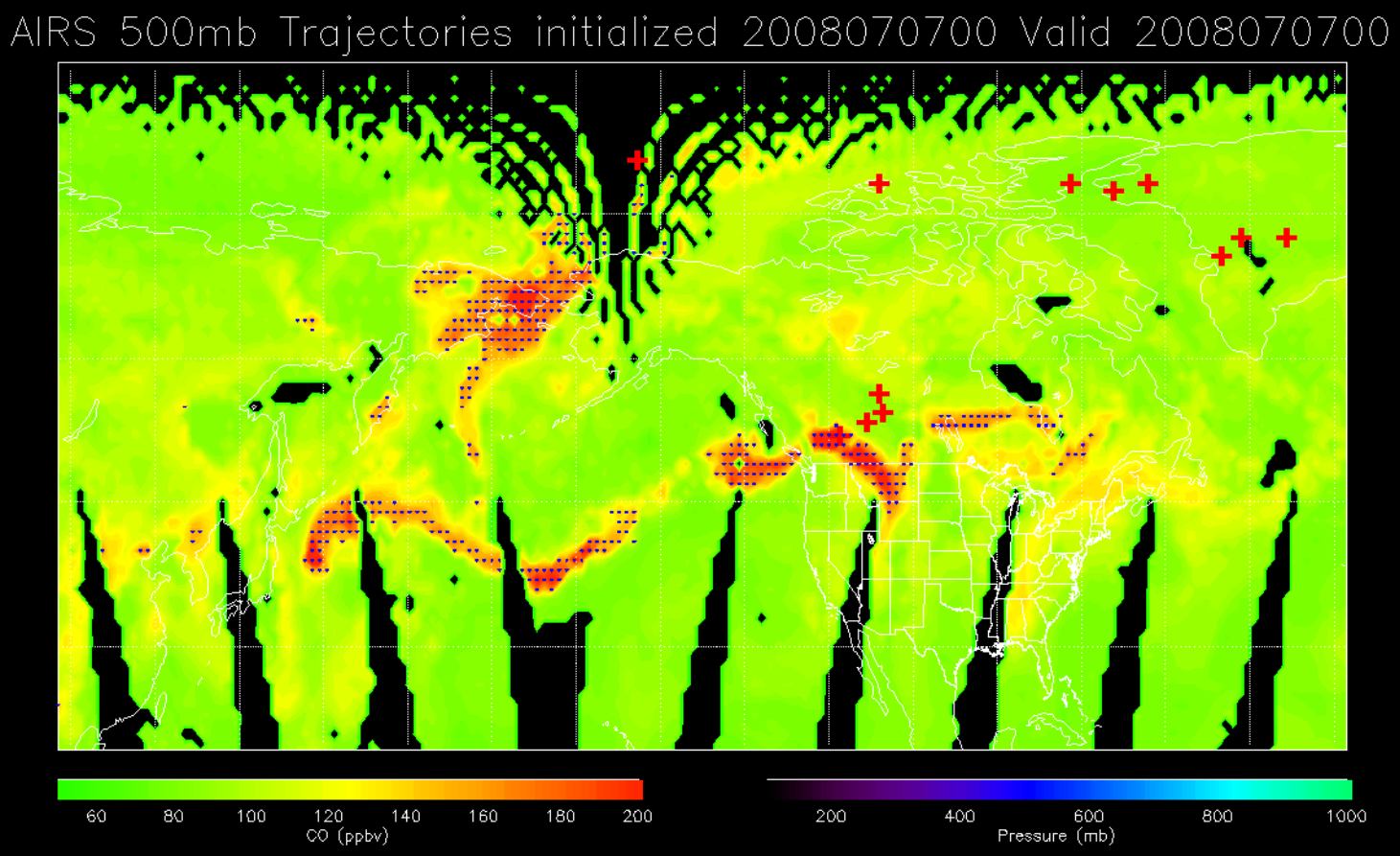
AIRS CO VMR (ppbv) at 500mb on 20080707 for ARCTAS



ACKNOWLEDGEMENT: AIRS NRT products by NASA DAAC

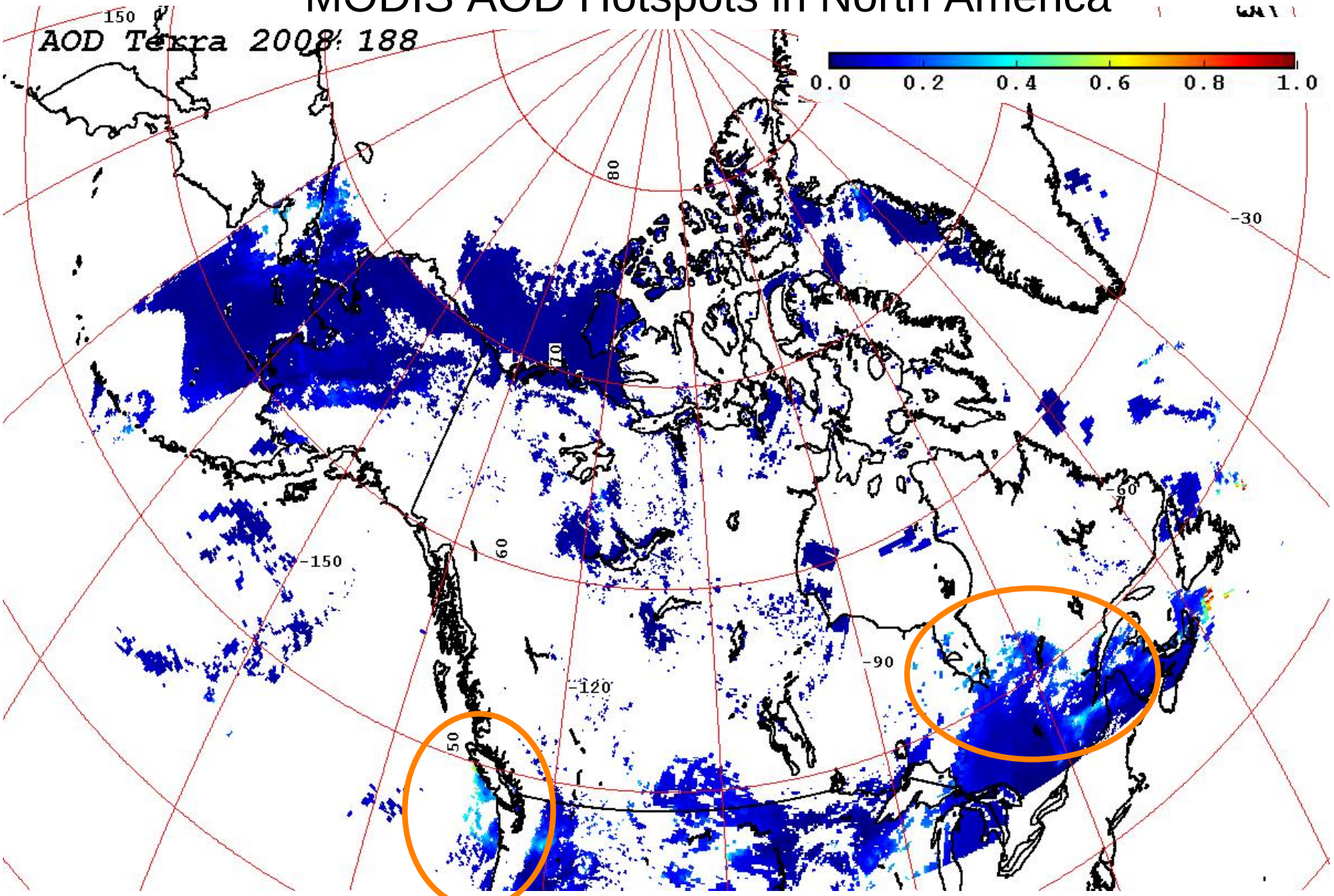
- Long-range transported plumes show high CO due to dynamical uplifting.
- High CO over Manitoba may be a mixed transport and local fire emissions.
- Some signatures of Alaskan fire emission, but too low in altitude to show clearly.




AIRS 500mb Trajectories initialized 2008070700 Valid 2008070700
60
80
100
120
140
160
180
200
CO (ppbv)
200
400
600
800
1000
Pressure (mb)

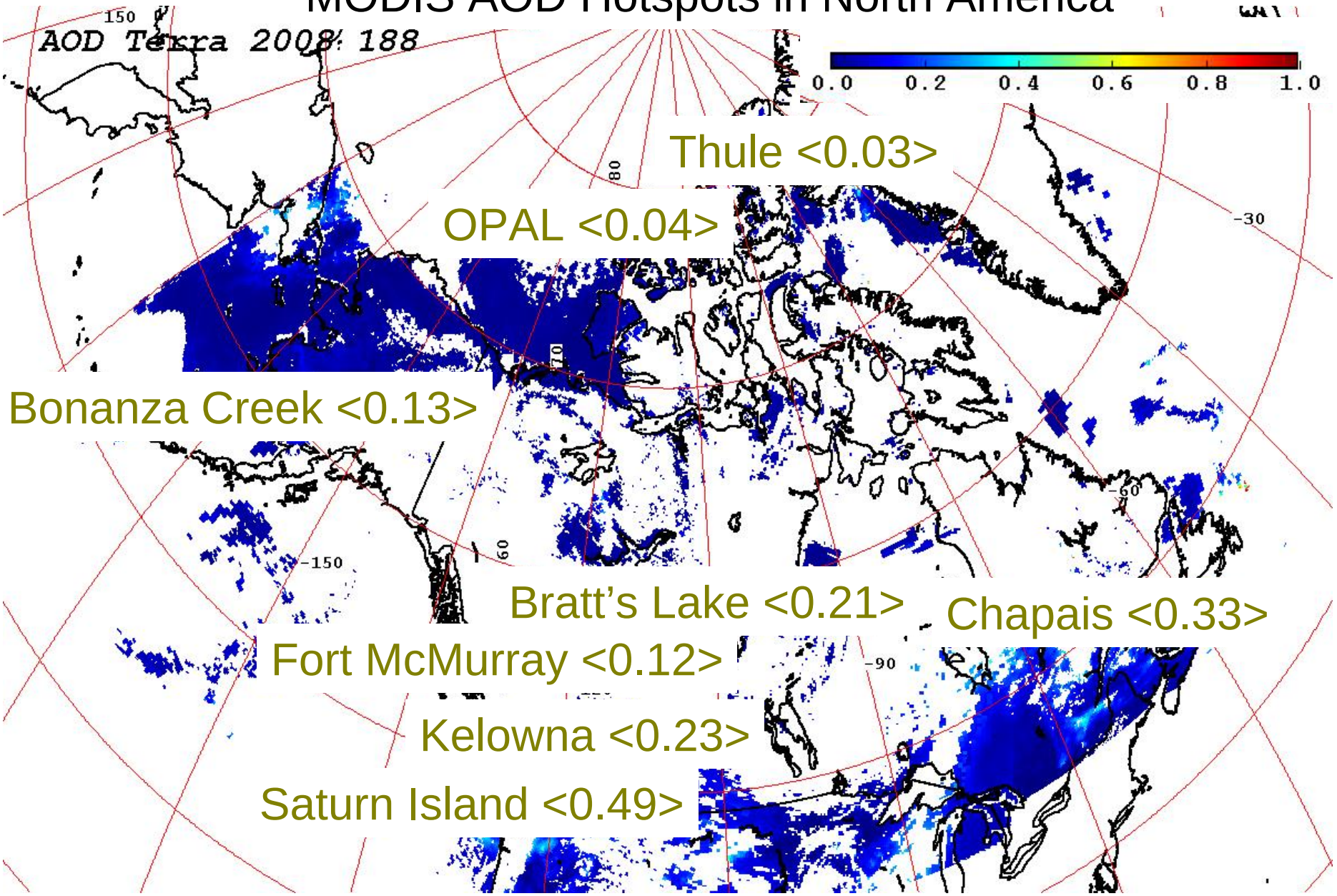
Day 188 (Sunday) July 6

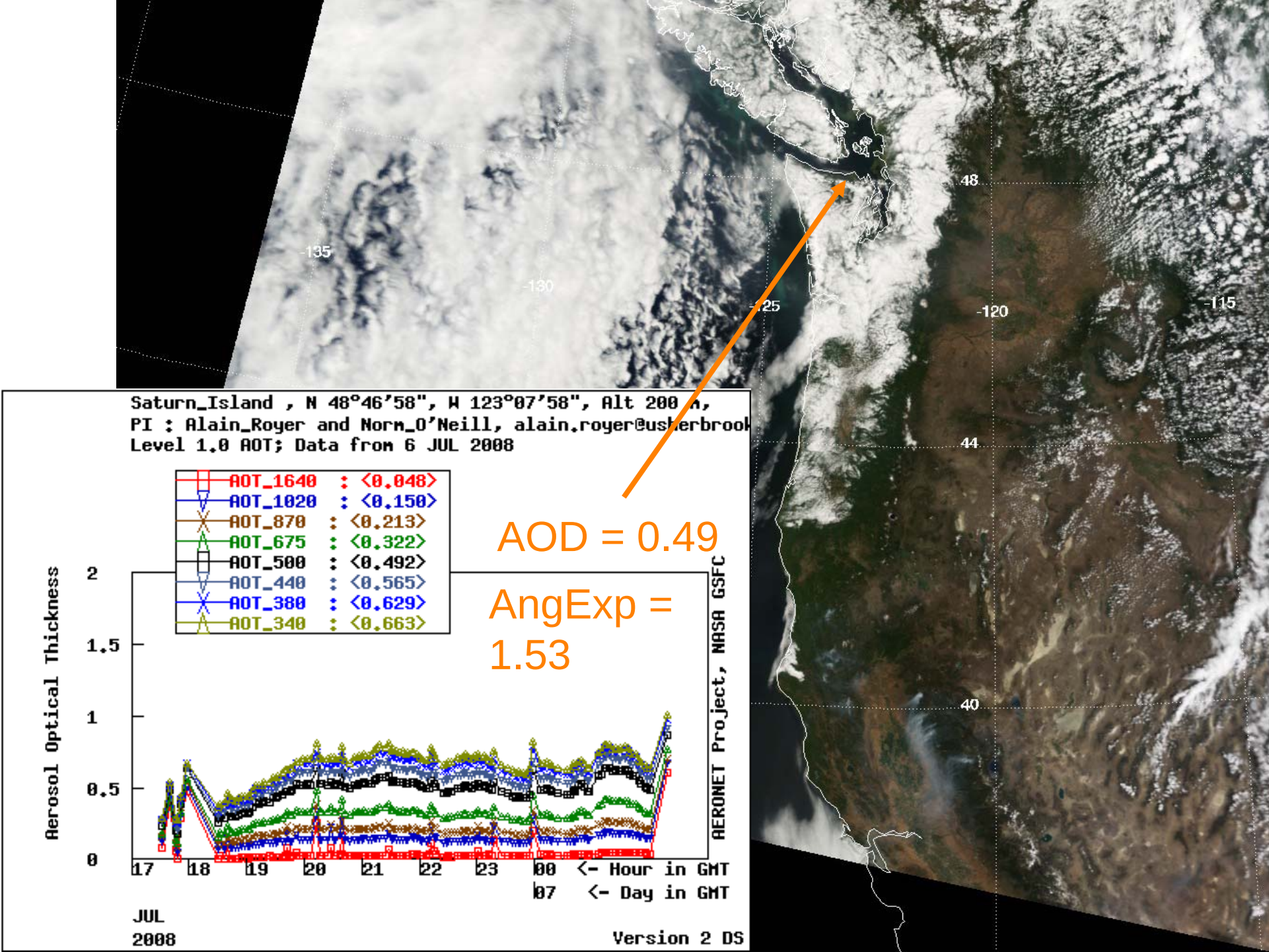
MODIS AOD Hotspots in North America



Day 188 (Sunday) July 6

MODIS AOD Hotspots in North America




Saturn_Island , N 48°46'58", W 123°07'58", Alt 200 m,
PI : Alain_Royer and Norm_O'Neill, alain.royer@usherbrook
Level 1.0 AOT; Data from 6 JUL 2008
AOT_1640 : <0.048>
AOT_1020 : <0.150>
AOT_870 : <0.213>
AOT_675 : <0.322>
AOT_500 : <0.492>
AOT_440 : <0.565>
AOT_380 : <0.629>
AOT_340 : <0.663>
AOD = 0.49
AngExp = 1.53
Aerosol Optical Thickness
2
1.5
1
0.5
0
17
18
19
20
21
22
23
00 <- Hour in GMT
07 <- Day in GMT
JUL
2008
Version 2 DS
AERONET Project, NASA GSFC
-135
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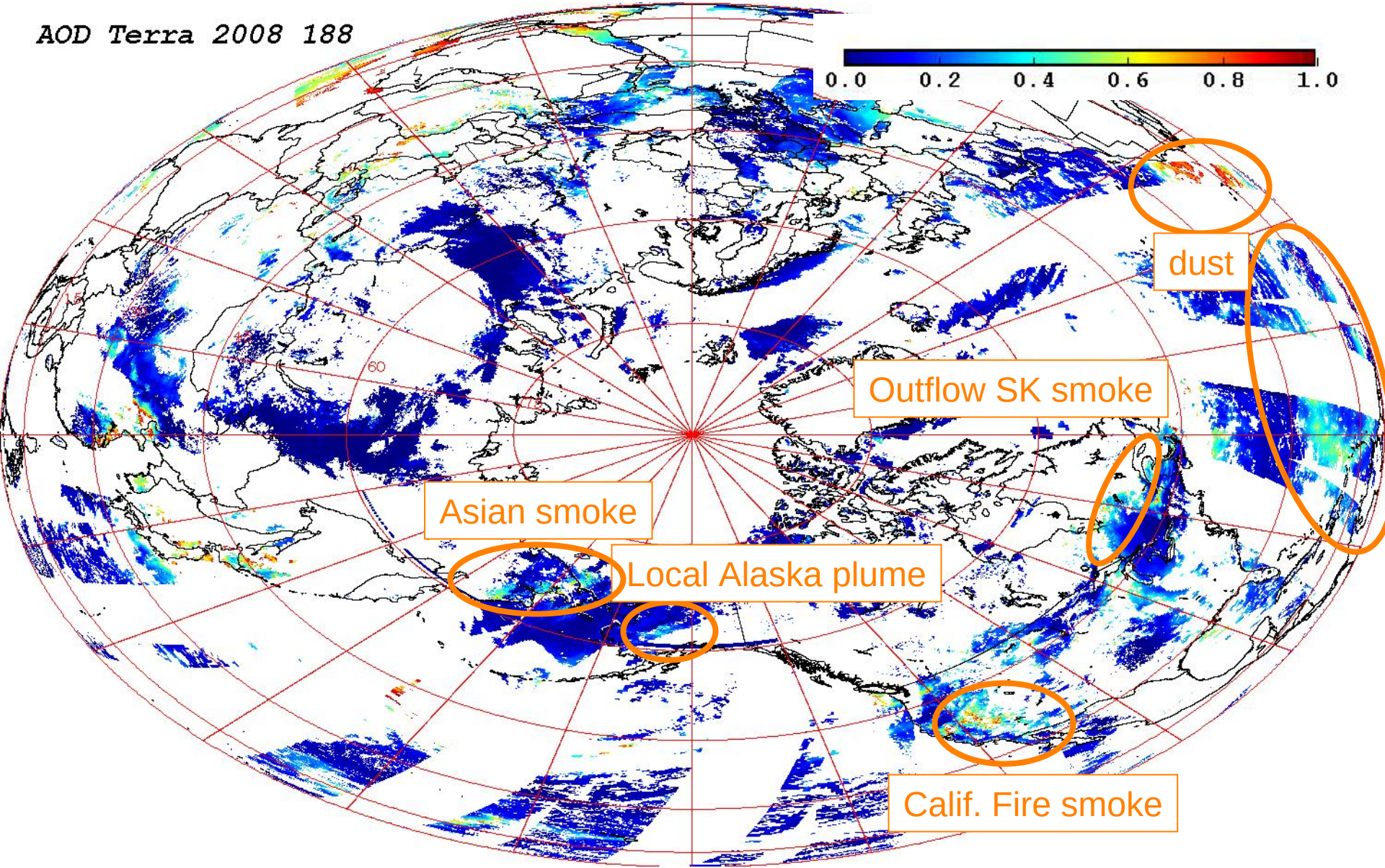
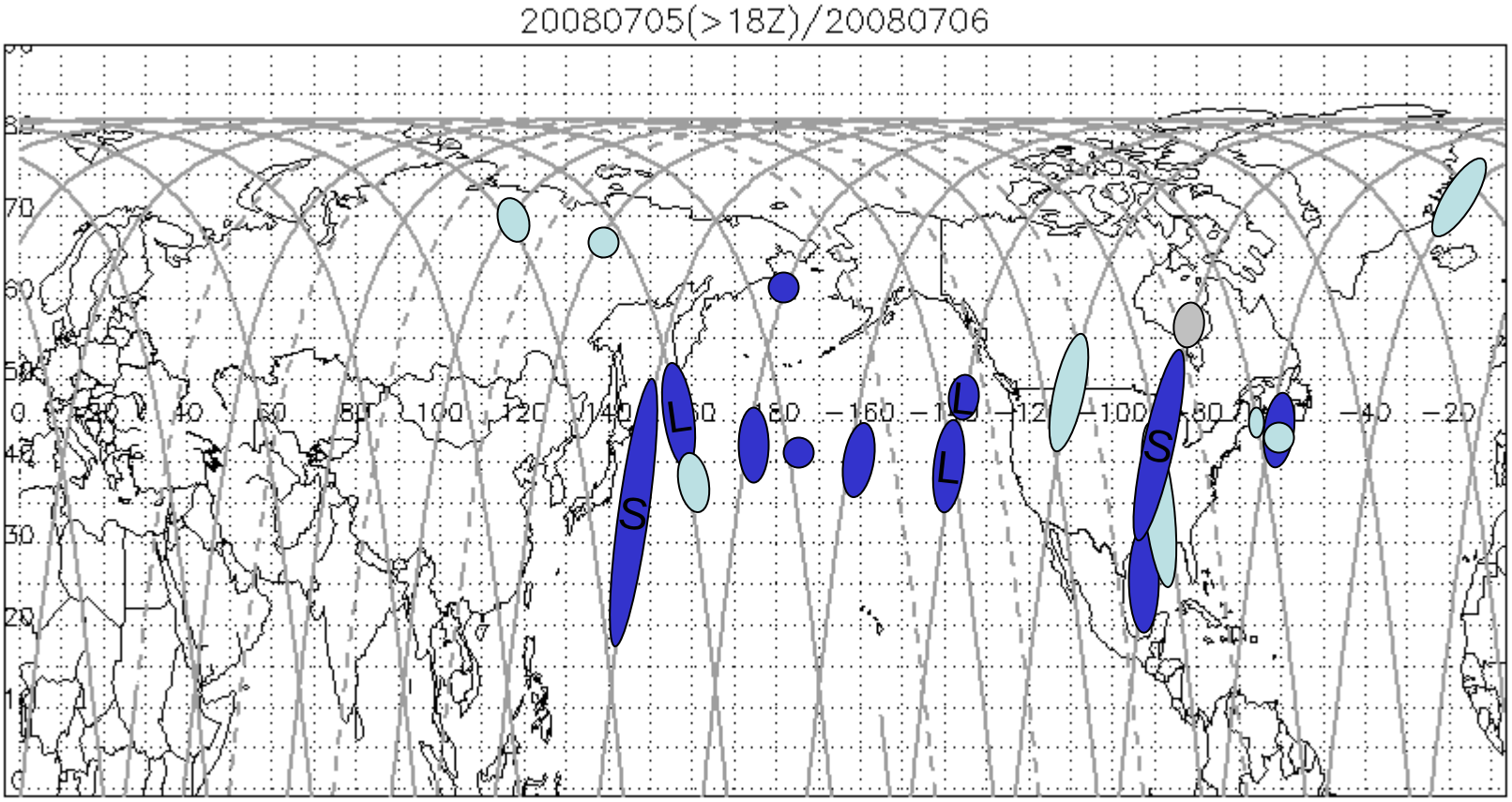
-125
-120
-115
48
44
40

Day 188 (July 6) Sunday

MODIS Hot Spots in Northern Hemisphere



Aerosol Layer Locations based on CALIPSO Obs 7/6



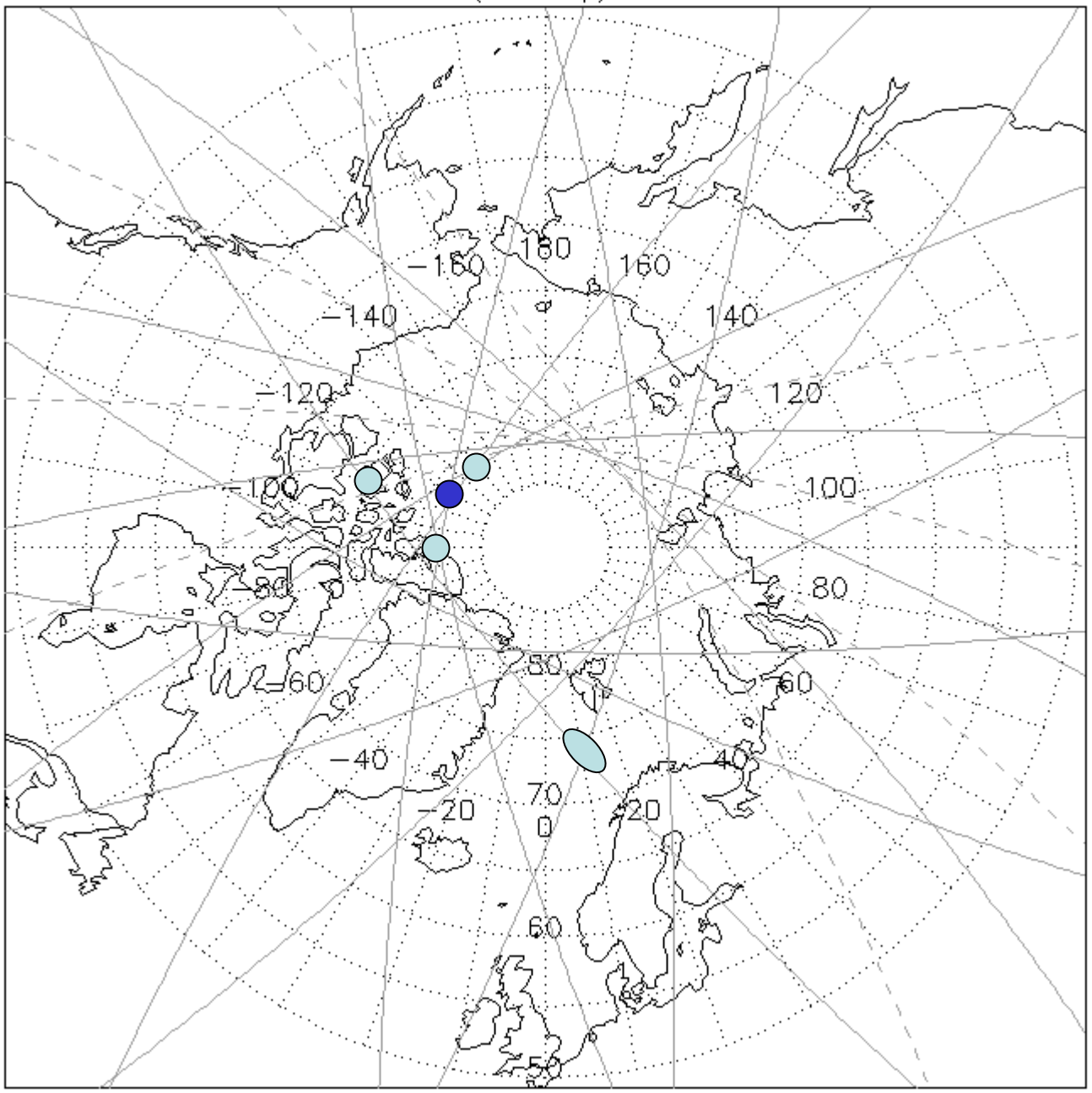
Cloud

Aerosol Layer- low aerosol loading

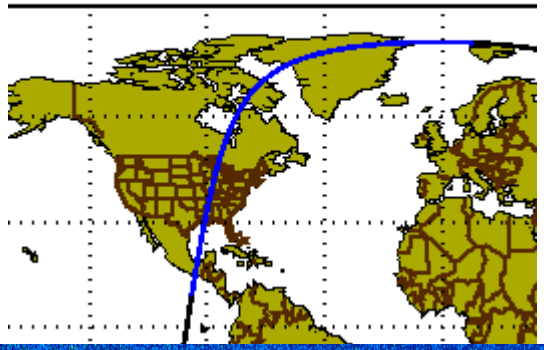
Aerosol Layer- medium aerosol loading

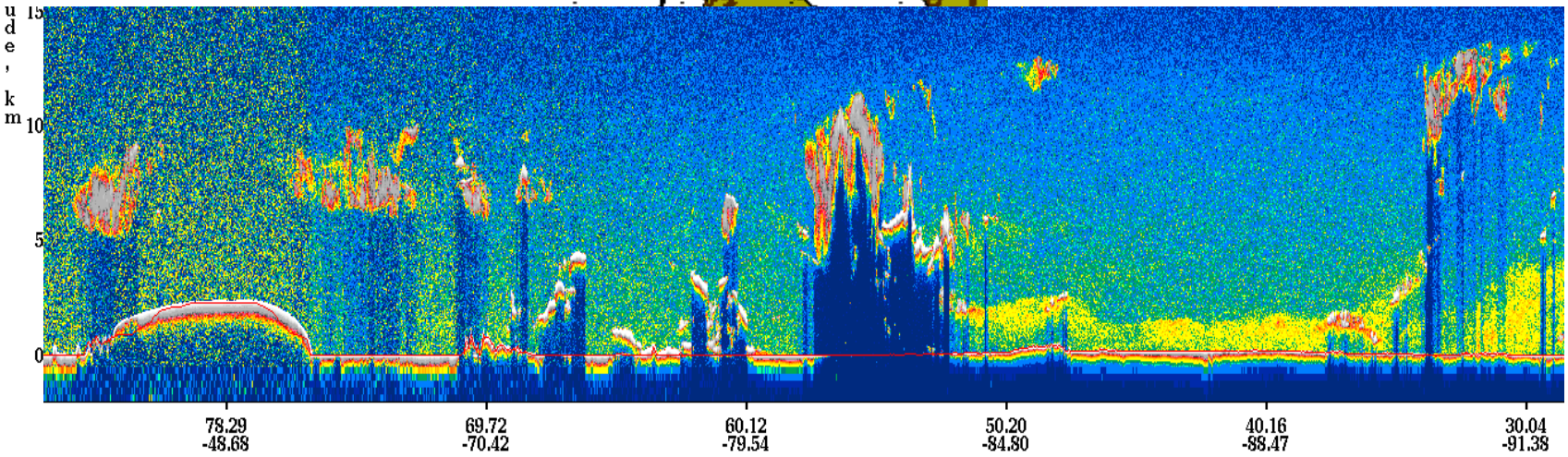
Aerosol Layer- high aerosol loading

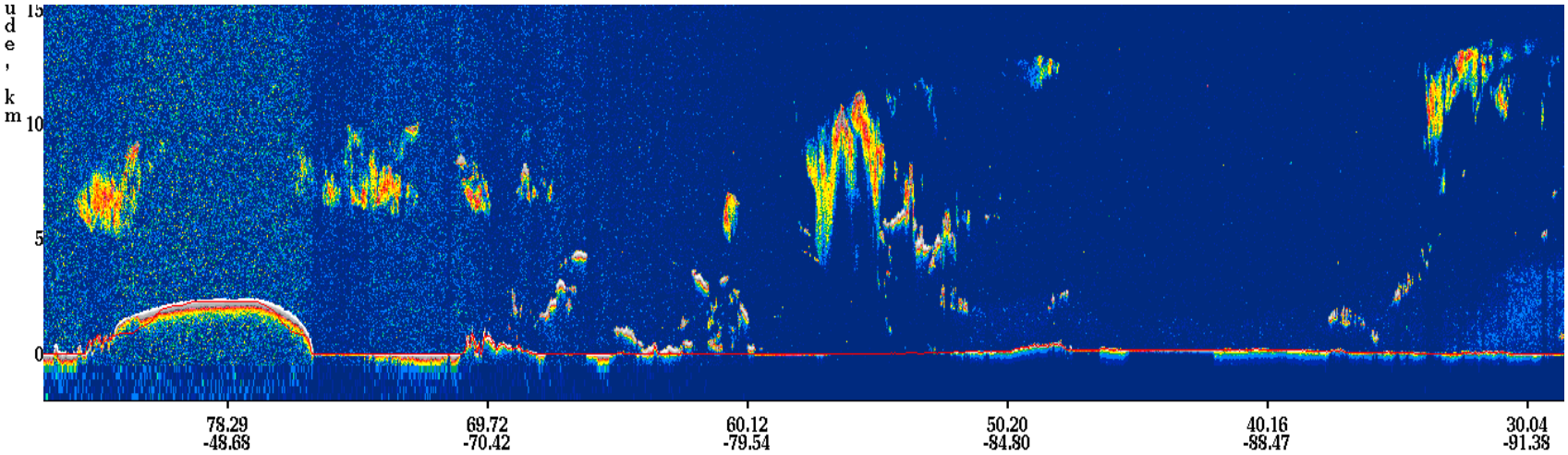
20080705(>18Z)/20080706

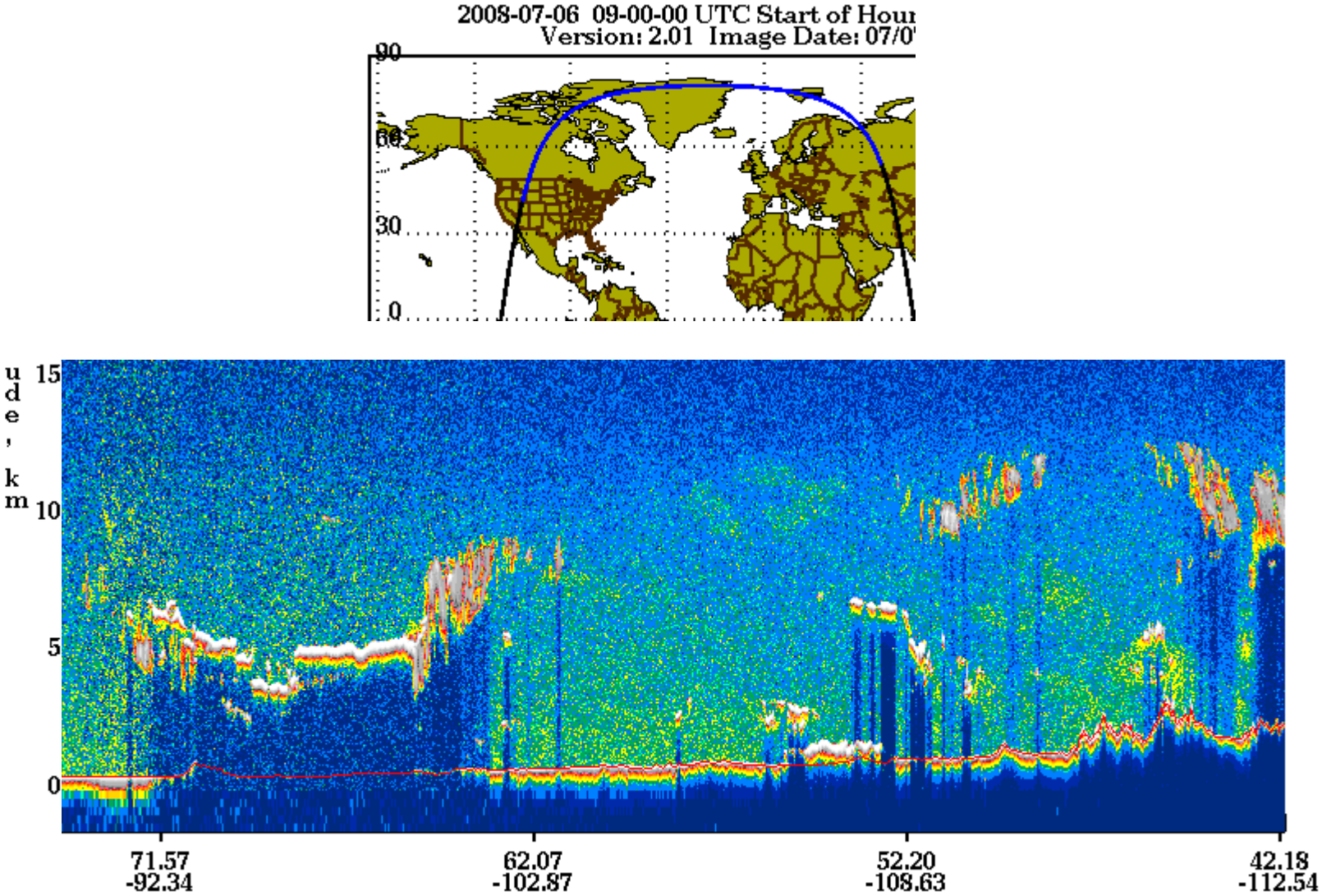


2008-07-06 07-30-00 UTC Half of
Version: 2.01 Image Dat








2008-07-06 09-00-00 UTC Start of Hour
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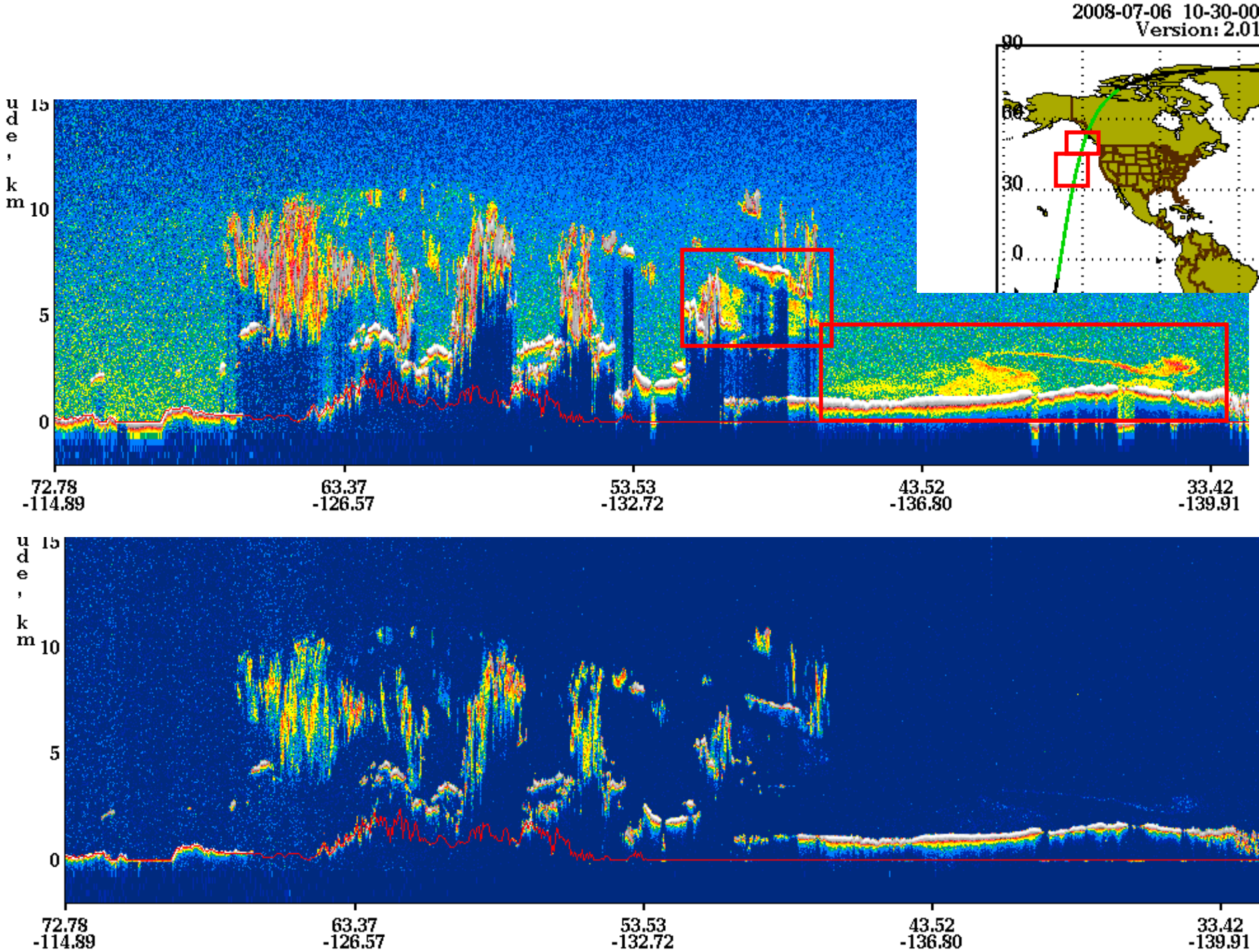
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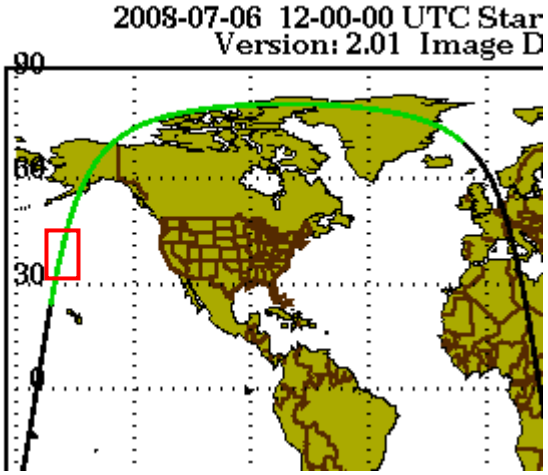
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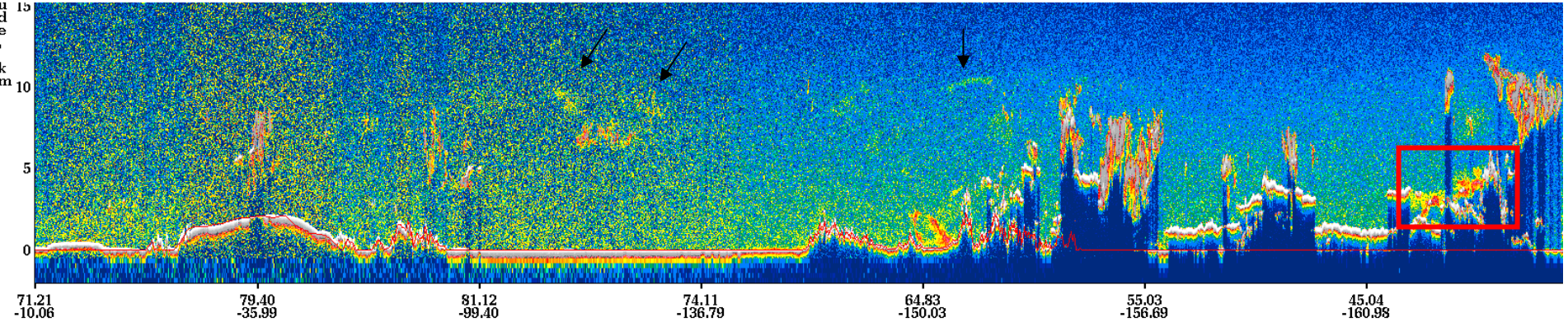
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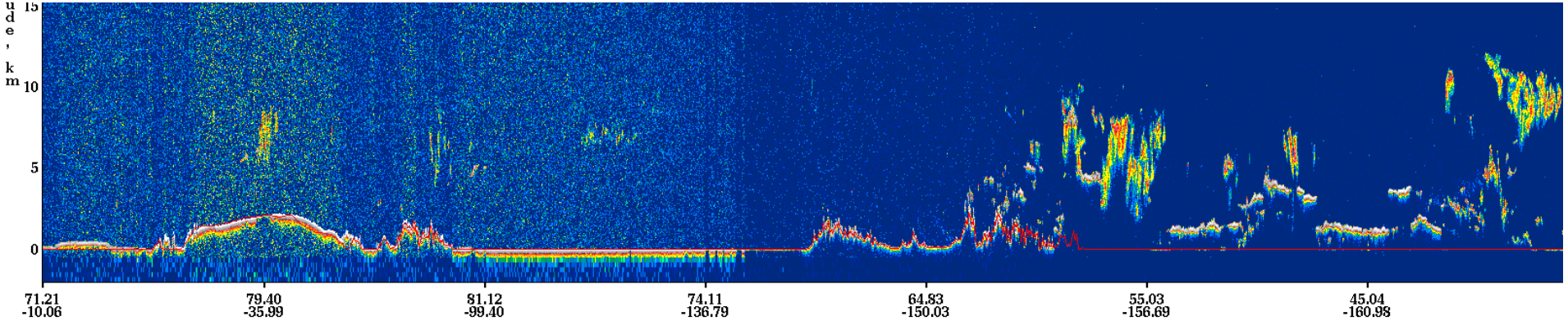
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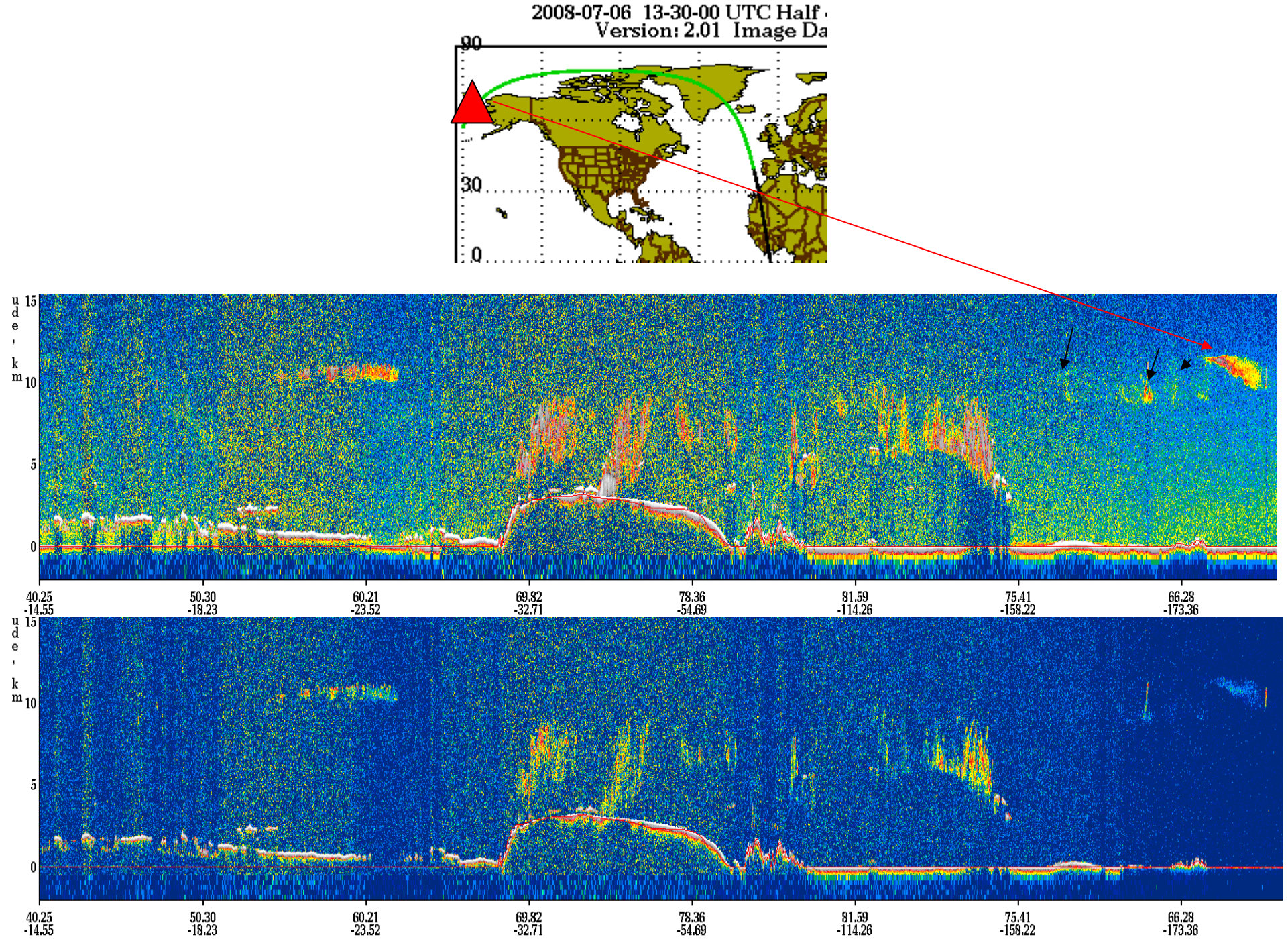
2008-07-06 13-30-00 UTC Half
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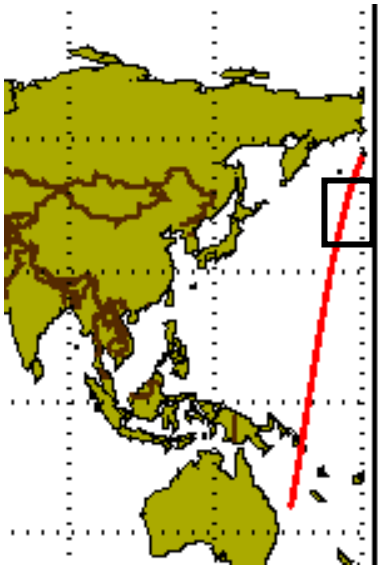

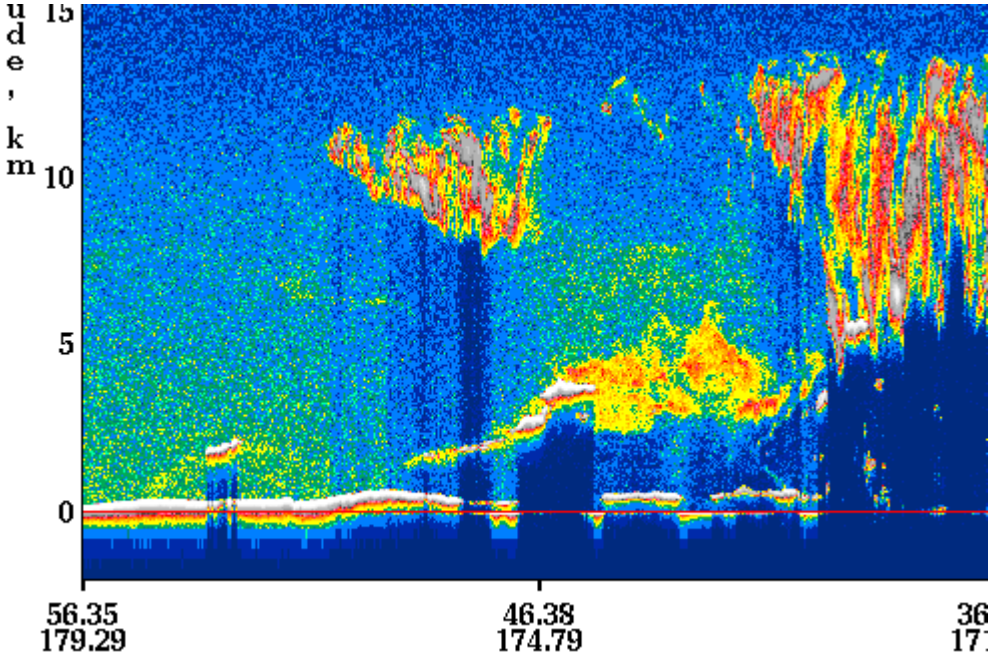
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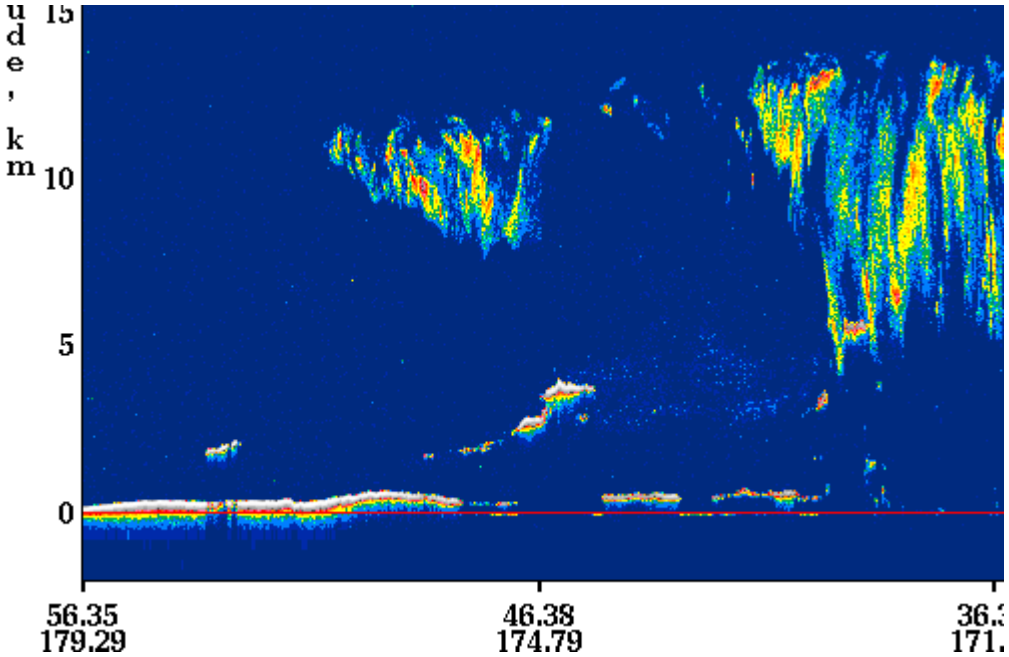
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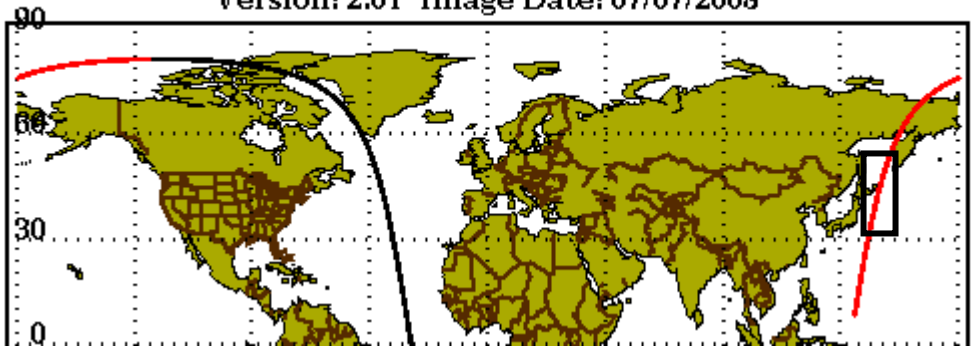
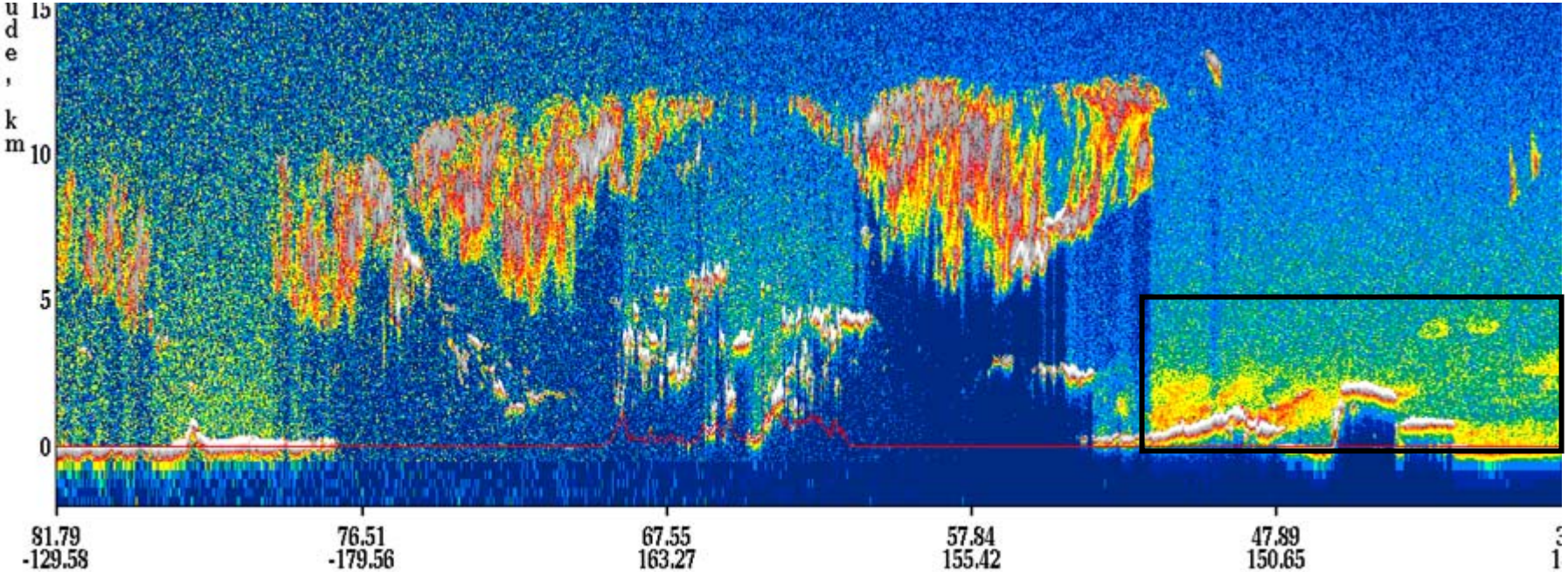
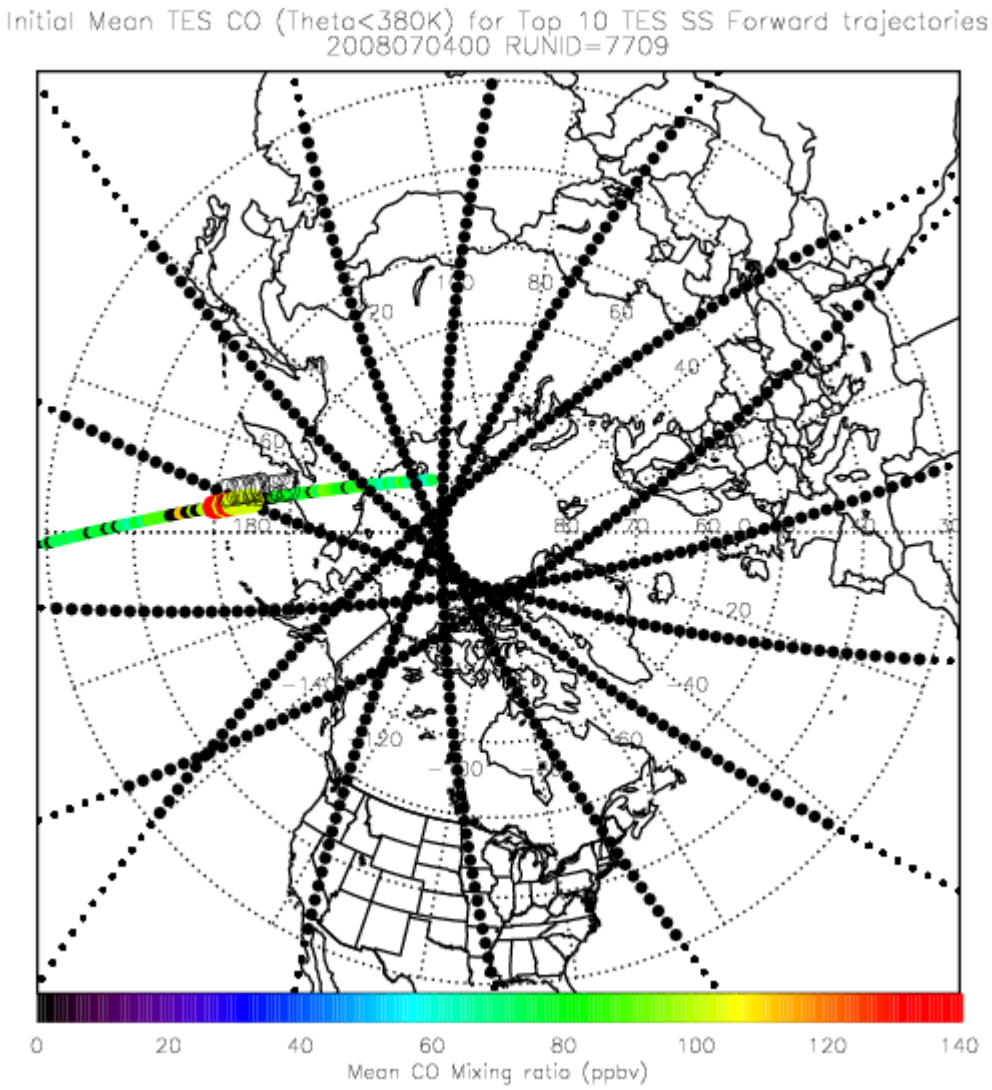
2008-07-06 15-00-00 UTC Start of Hour Conditions
Version: 2.01 Image Date: 07/07/2008

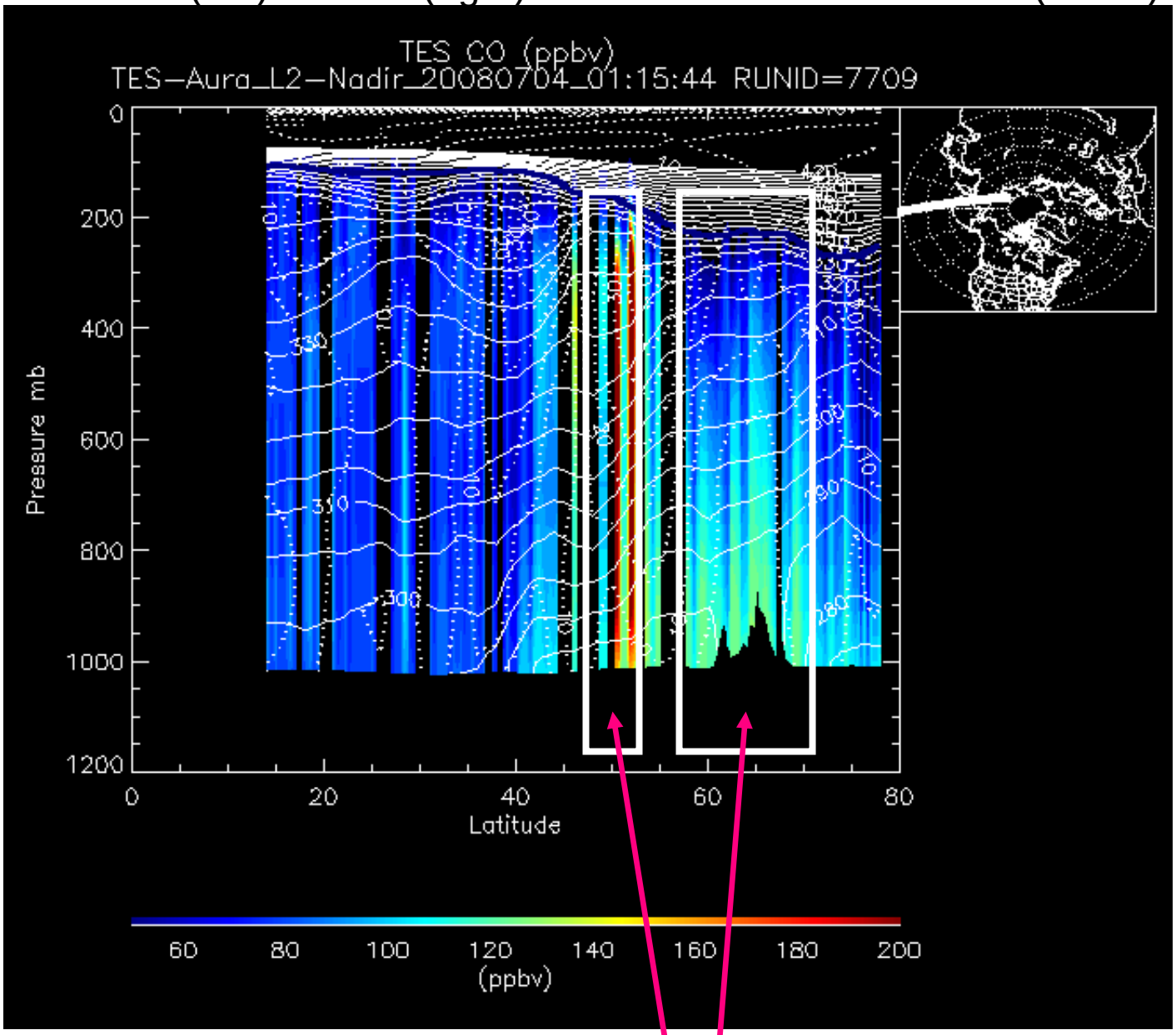




TES Step&Stare Obs 07/04 (Run ID 7709): Mean CO below 380K

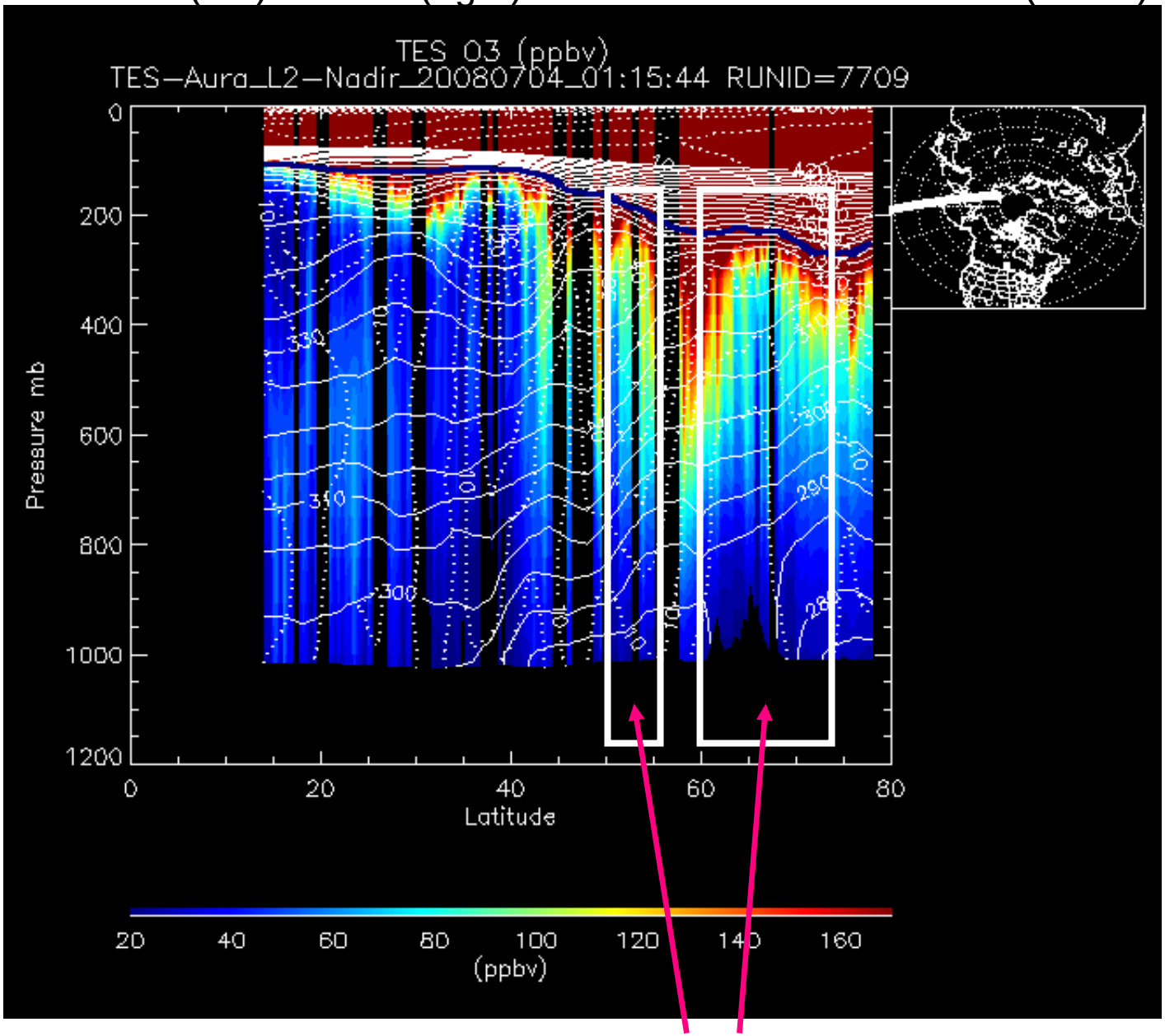


TES CO (left) and O3 (right) curtains from SS orbit 7709 (07/04)



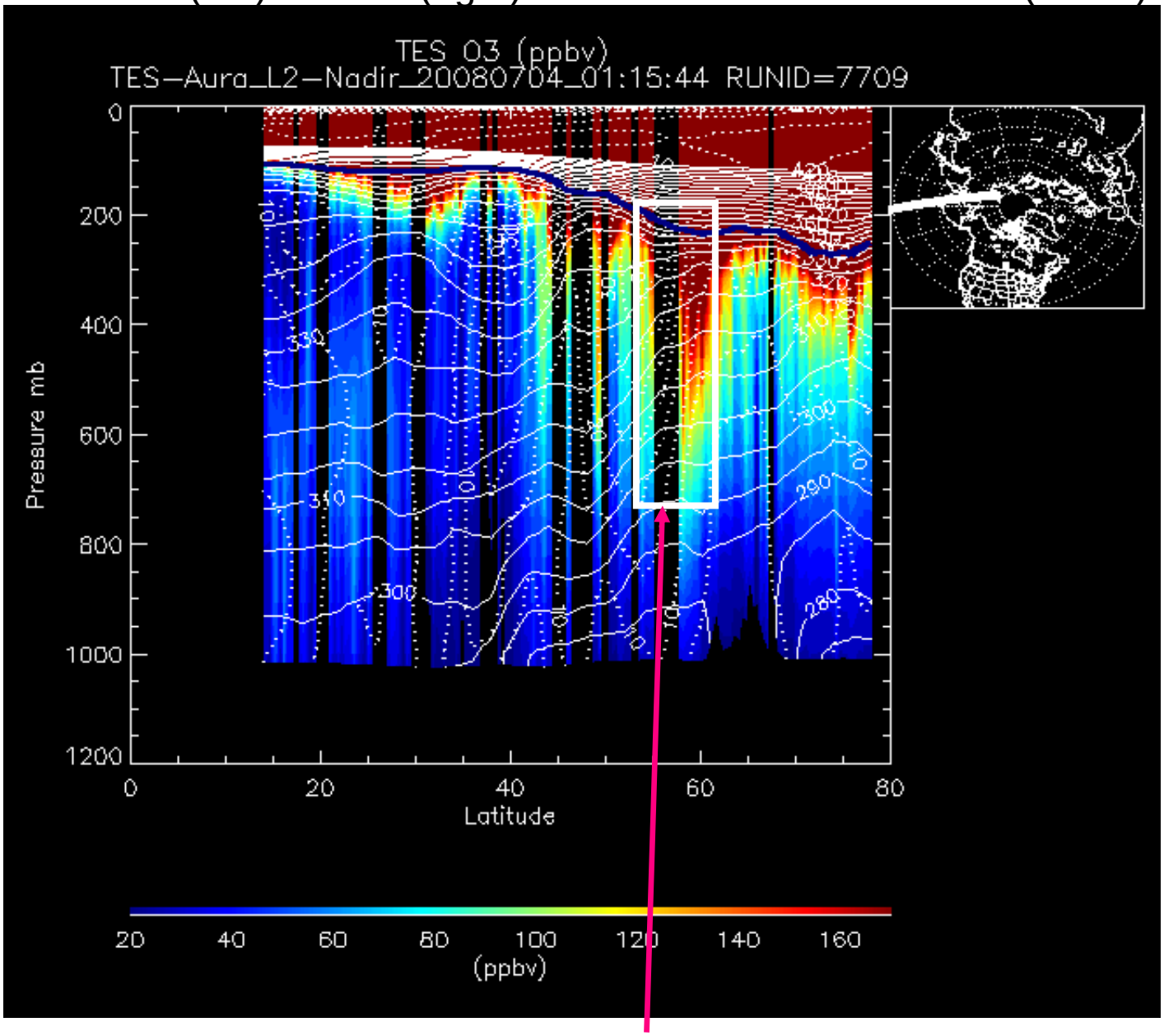
TES observes the leading edge of 2 branches of the Siberian plume 07/04 01:15 UTC.

TES CO (left) and O3 (right) curtains from SS orbit 7709 (07/04)



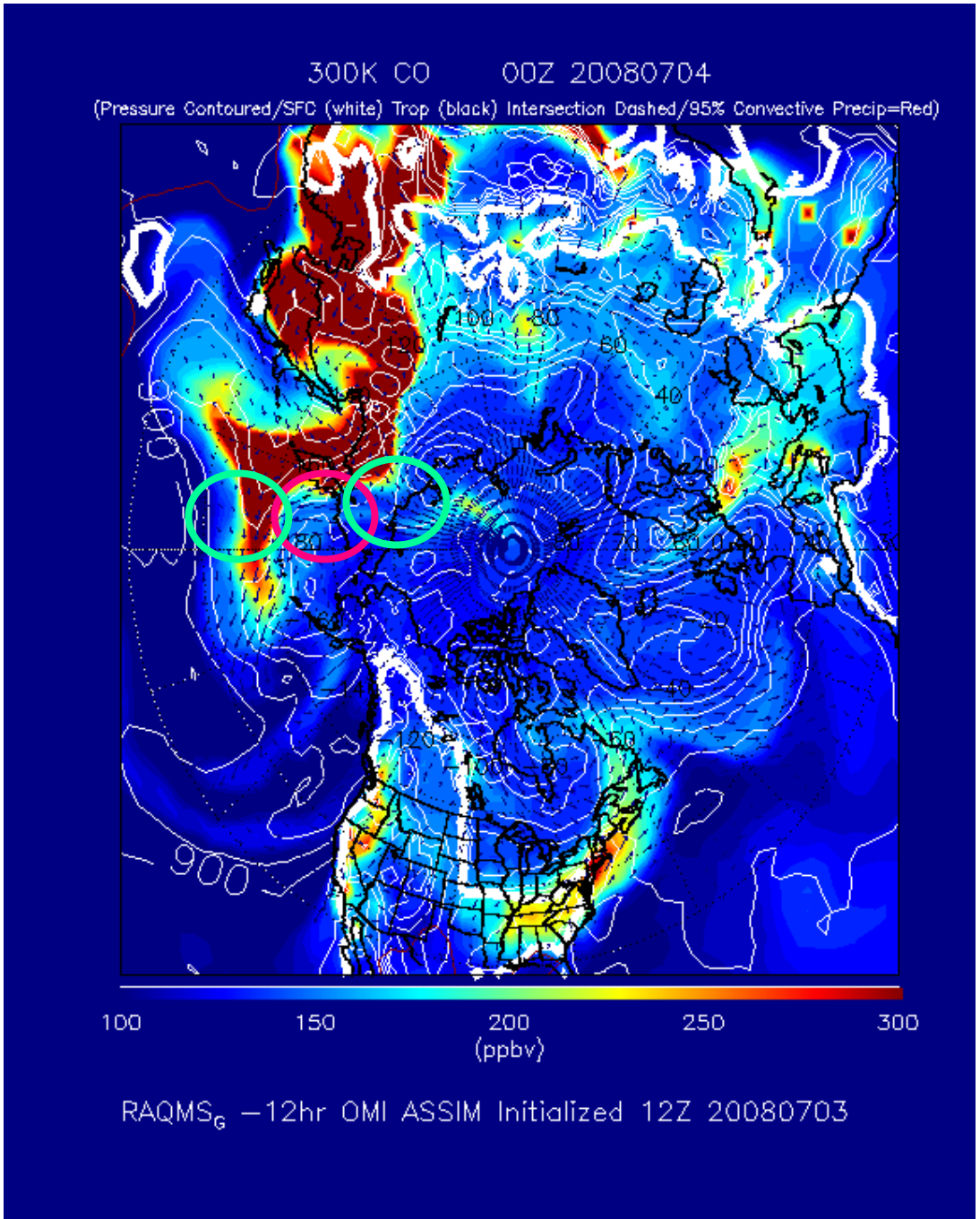
Ozone is generally suppressed in both branches of the plume

TES CO (left) and O3 (right) curtains from SS orbit 7709 (07/04)

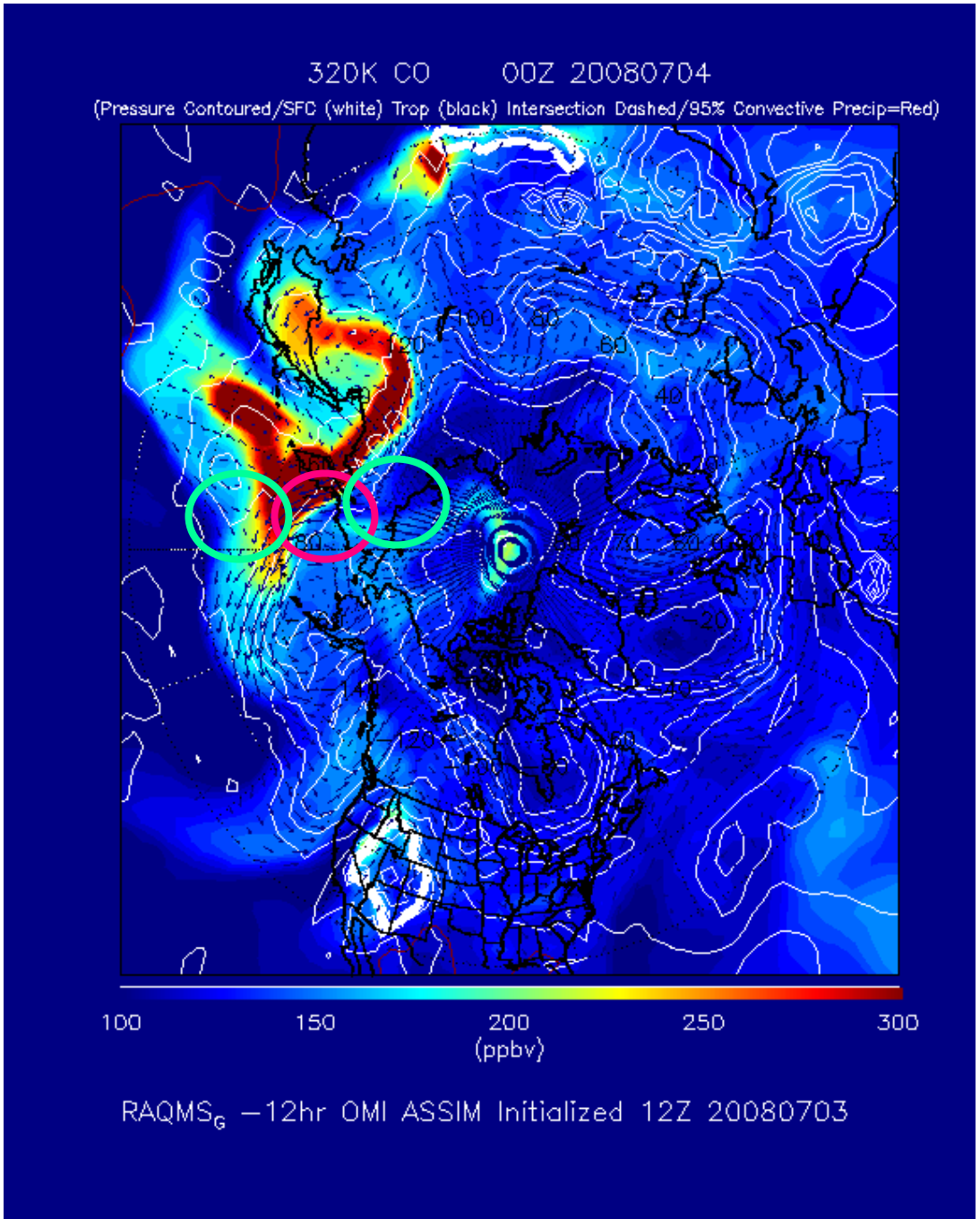


Ozone maxima co-located with low CO between the 2 branches, suggestive of stratospherically influenced air

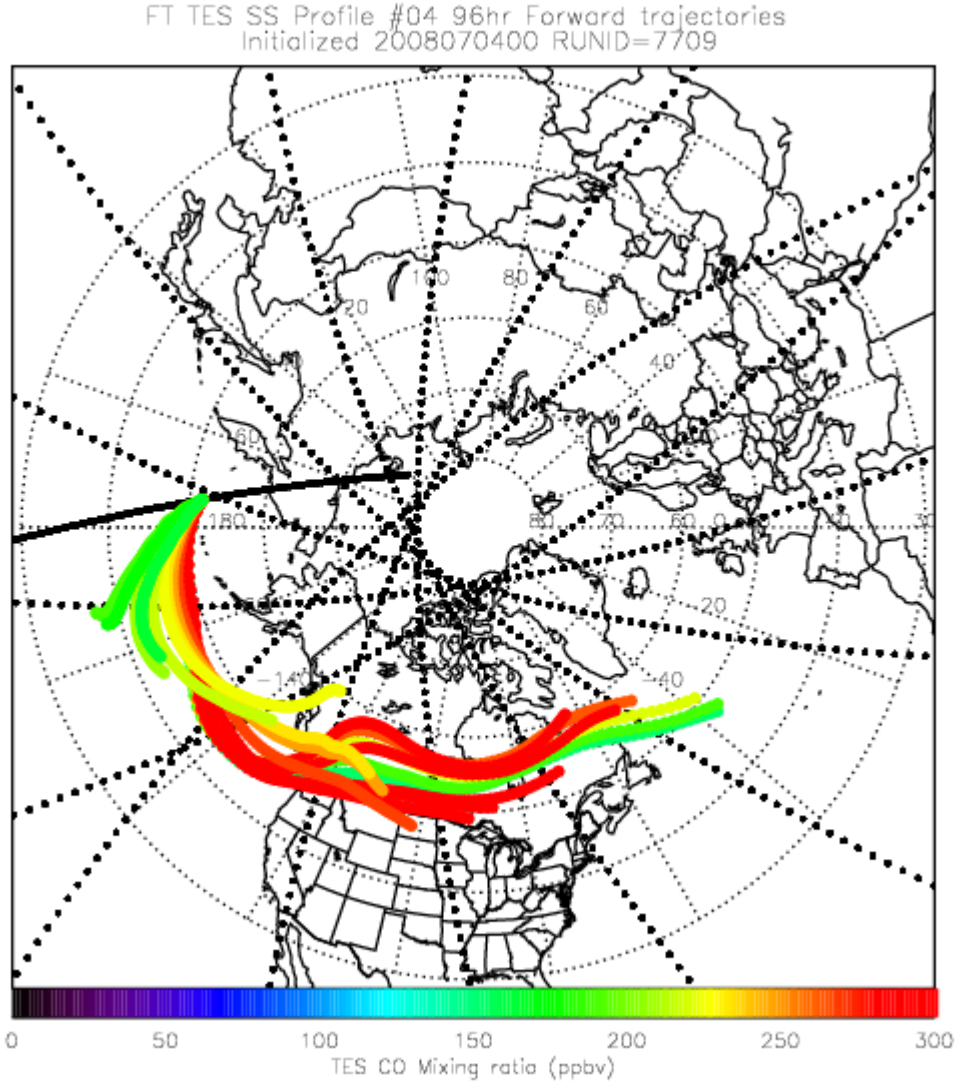
RAQMS CO Analysis 07/04 00Z on 300K Isentrope



RAQMS CO Analysis 07/04 00Z on 320K Isentrope

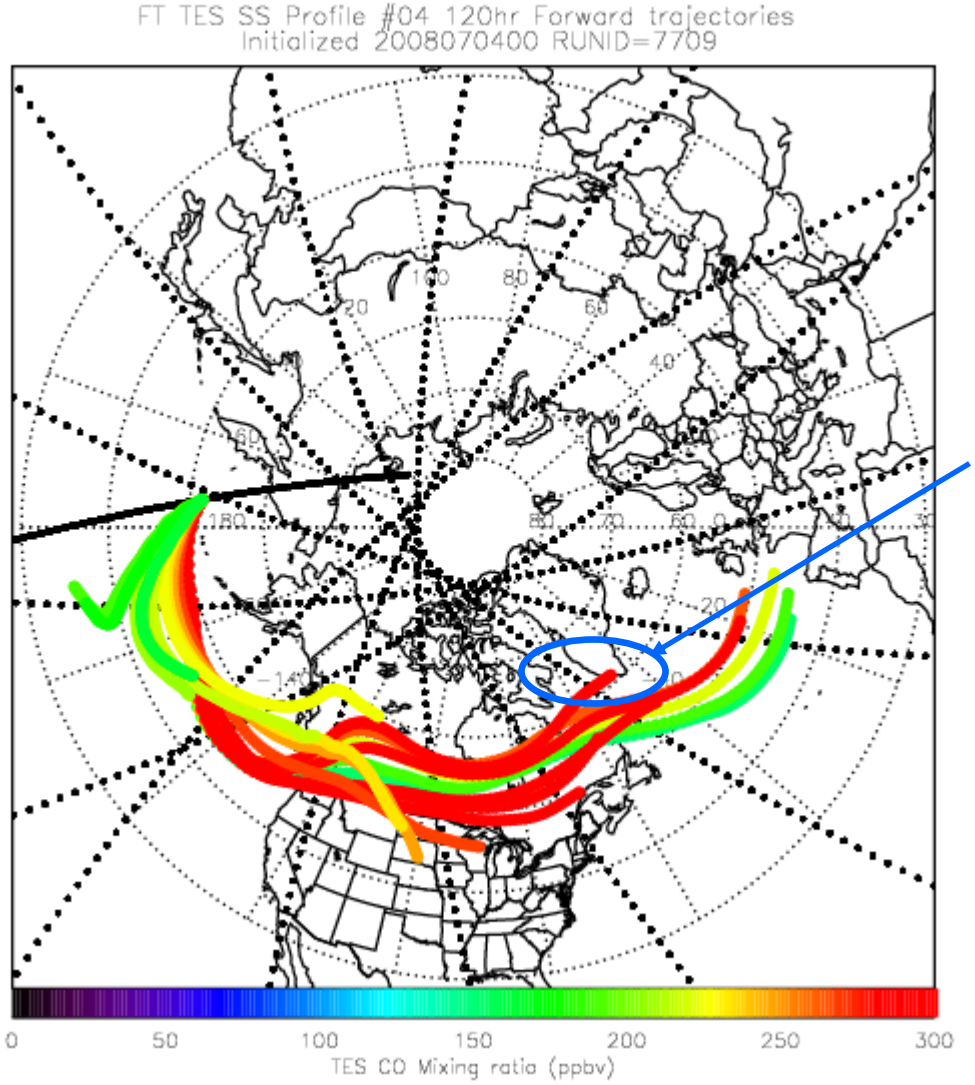


TES SS Forward Trajectories initialized from “Profile 4” of the Southern branch
Valid 00Z 07/08 (afternoon 07/07 MDT)



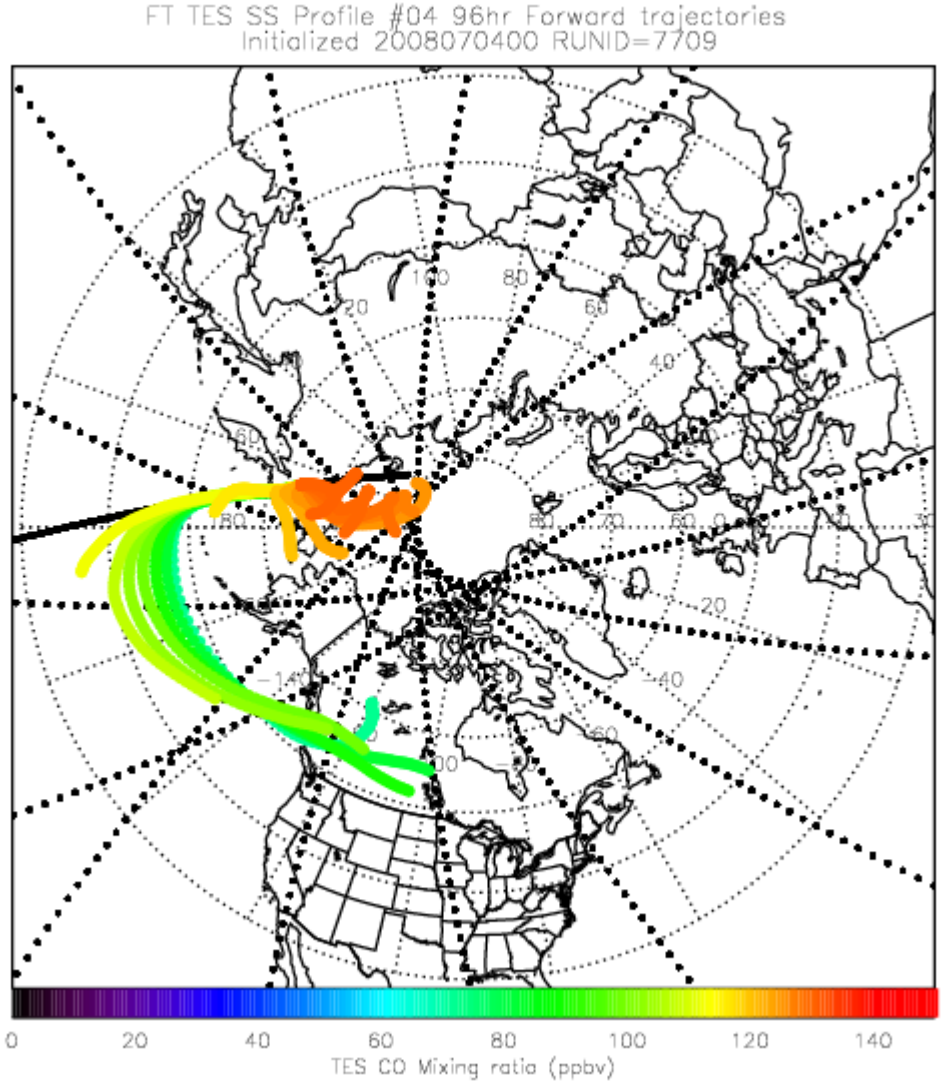
Siberian plumes rapidly transported eastward in upper troposphere (note CO scale up to 300 ppbv)

TES SS Forward Trajectories initialized from “Profile 4” of the Southern branch
Valid 00Z 07/09



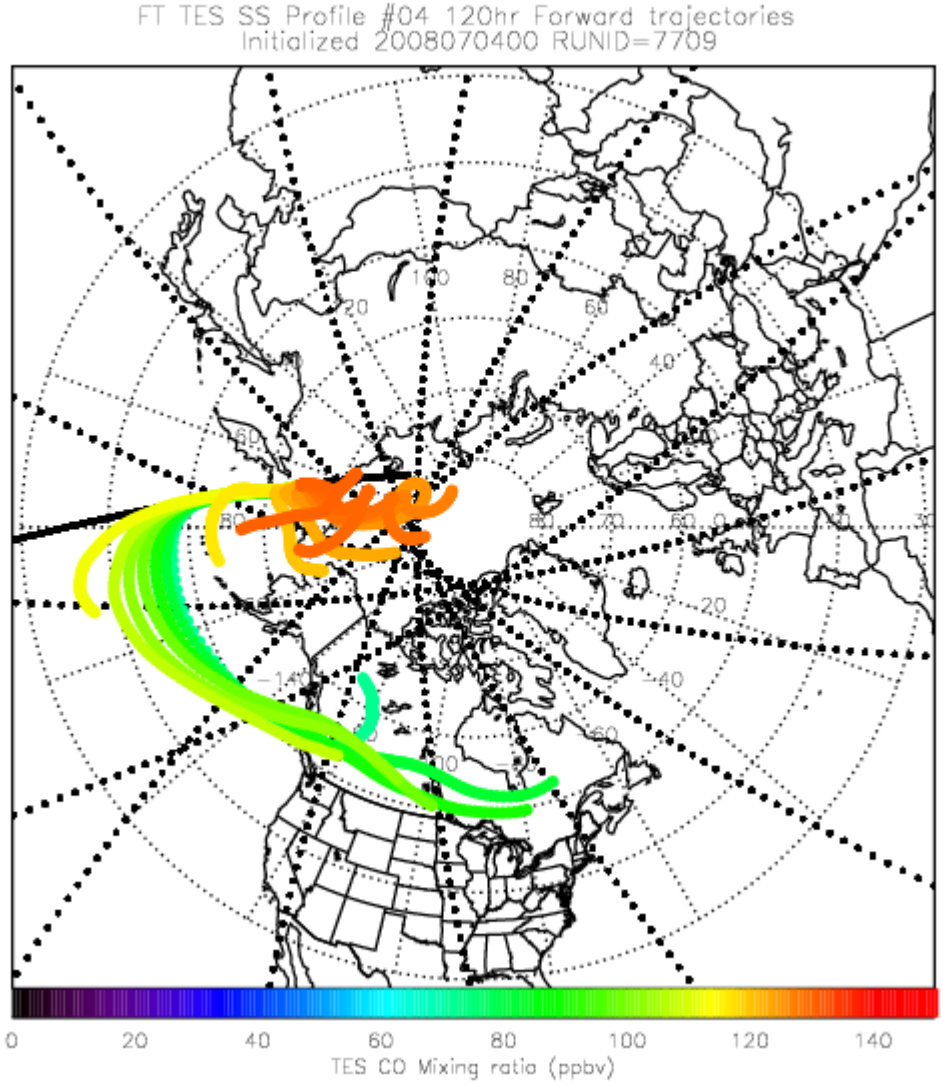
Siberian plumes near southern tip of Greenland at about 9km

TES SS Forward Trajectories initialized from “Profile 4” of the Northern branch
Valid 00Z 07/08 (afternoon 07/07 MDT)



Highest mixing ratios at about 700 hPa, advected poleward and stagnate (note CO scale up to 150 ppbv)

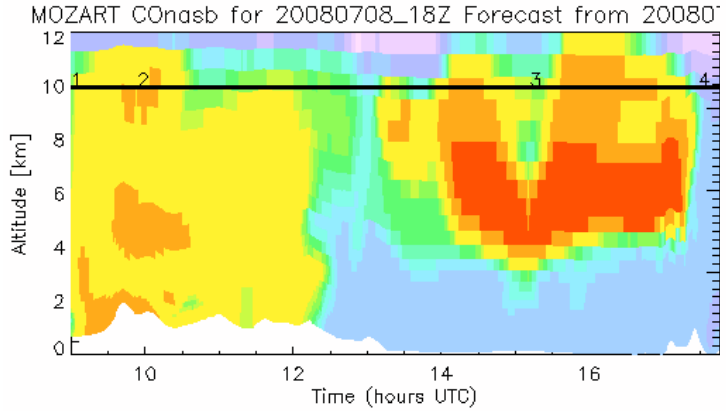
TES SS Forward Trajectories initialized from “Profile 4” of the Northern branch
Valid 00Z 07/09

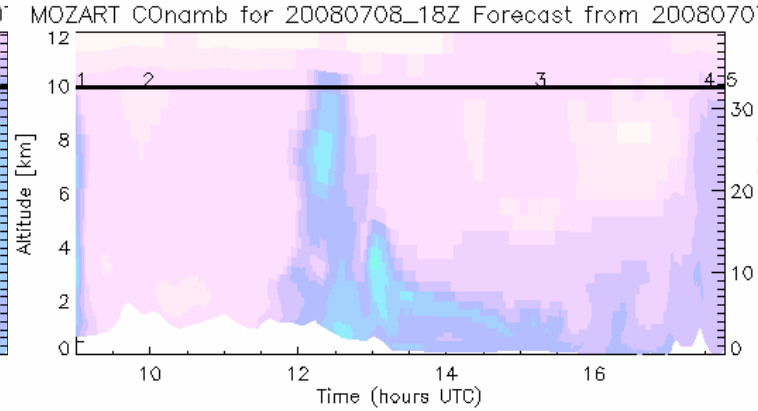


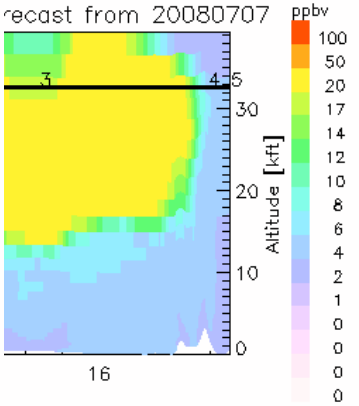
Highest mixing ratios at about 700 hPa, advected poleward and stagnate (note CO scale up to 150 ppbv)

DC-8 Flight Plan to Thule July 8

MOZART Fx for 8 July 18Z



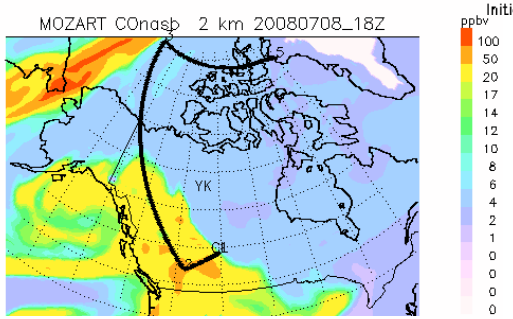


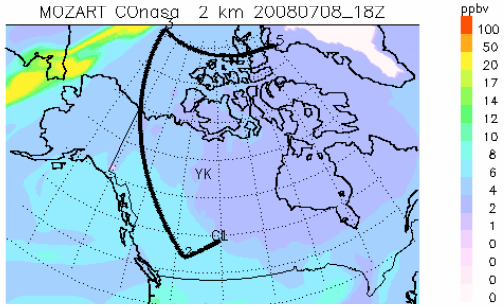


N-Asia BB

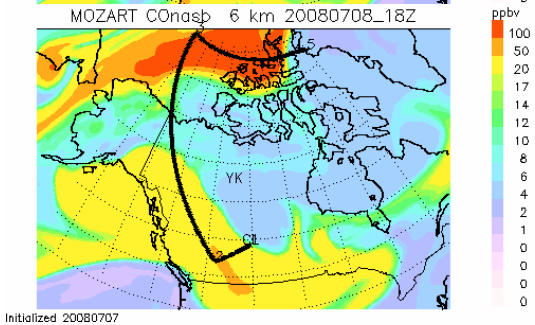
N-Asia Anthro

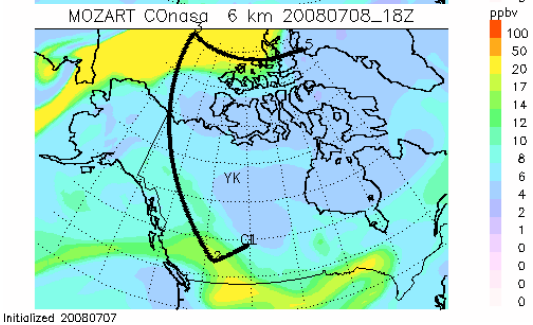
2 km



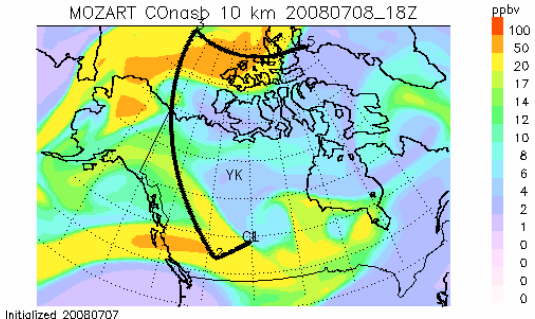


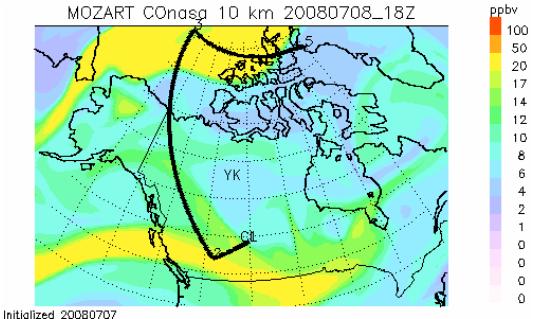
6 km





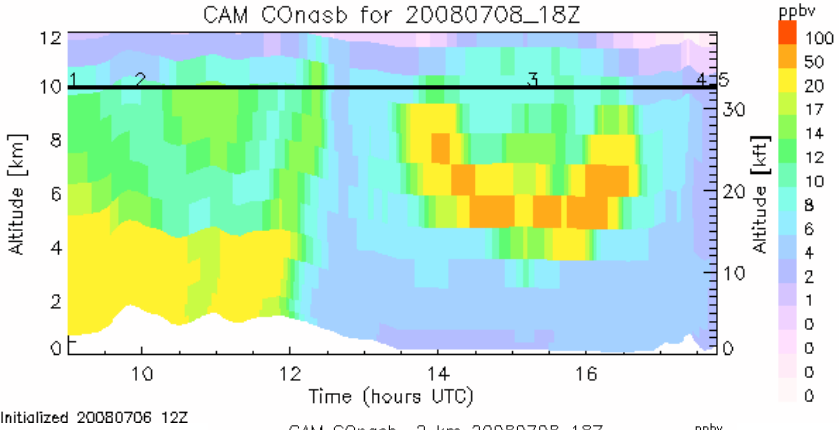
10 km

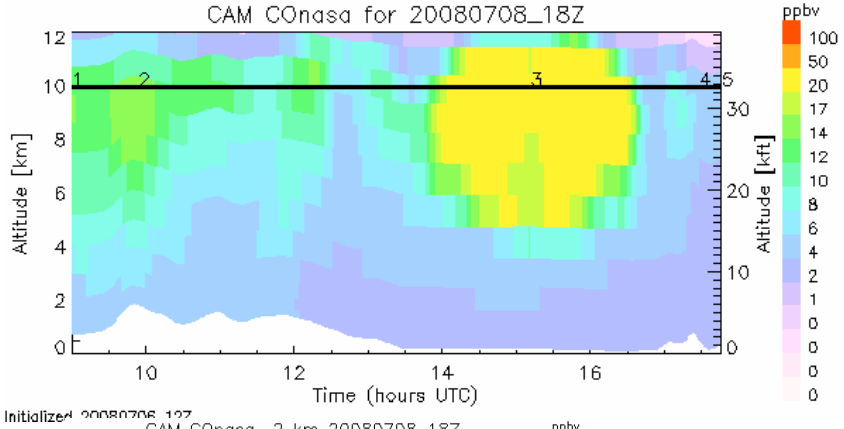




DC-8 Flight Plan to Thule July 8

CAM Fx for 8 July 18Z

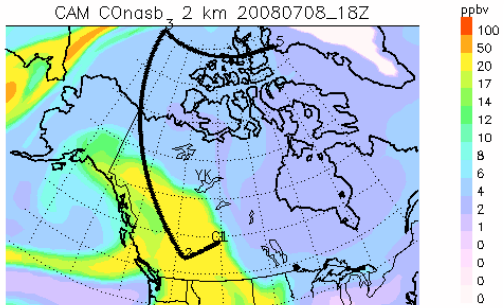


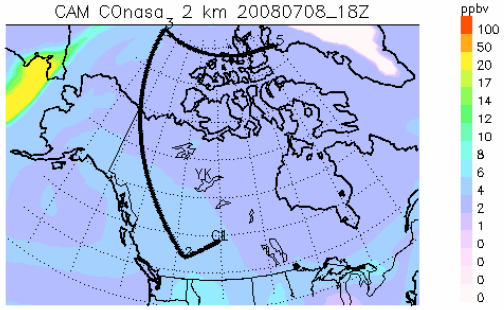


N-Asia BB

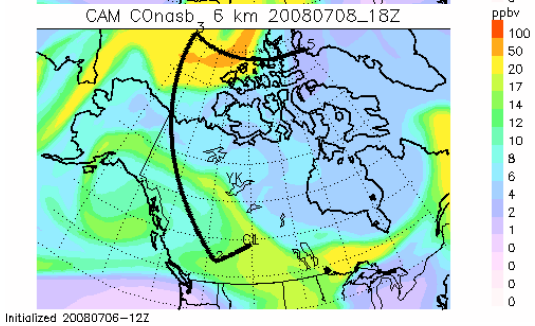
N-Asia Anthro

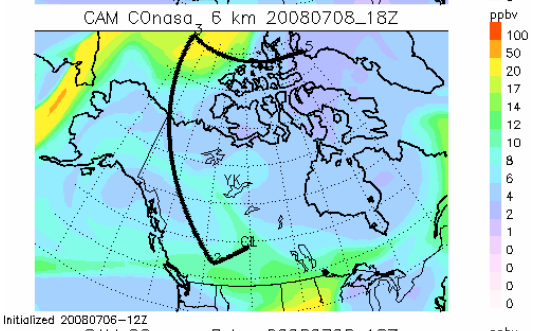
2 km



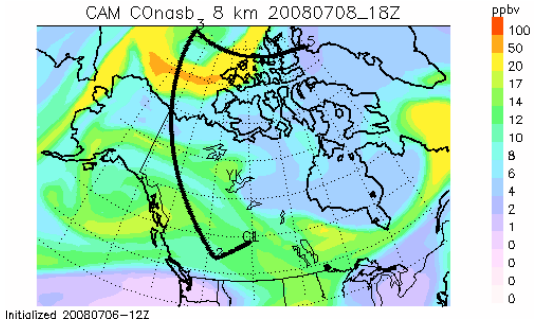


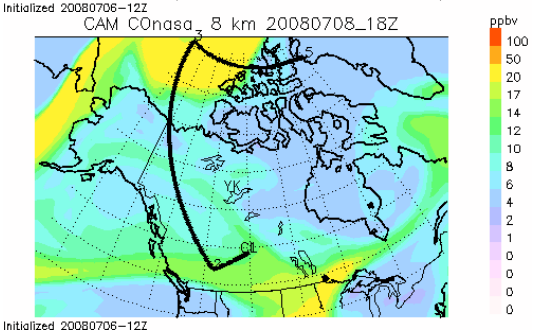
6 km





8km

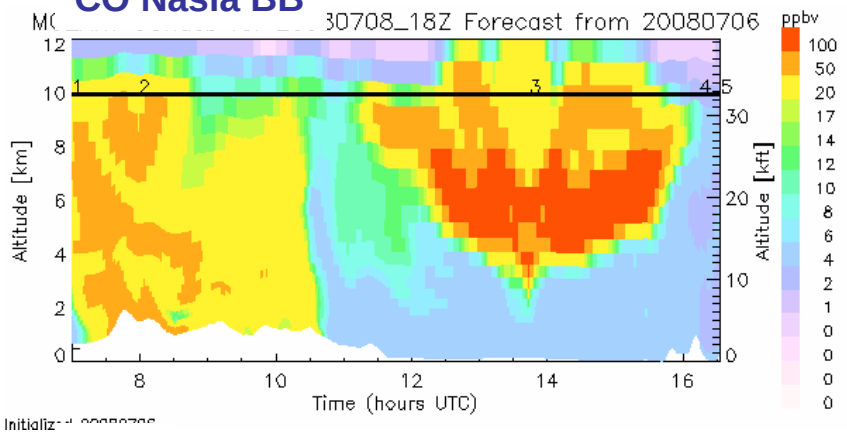




DC-8 Flight Plan to Thule July 8

MOZART Fx for 8 July 18Z

CO Nasia BB



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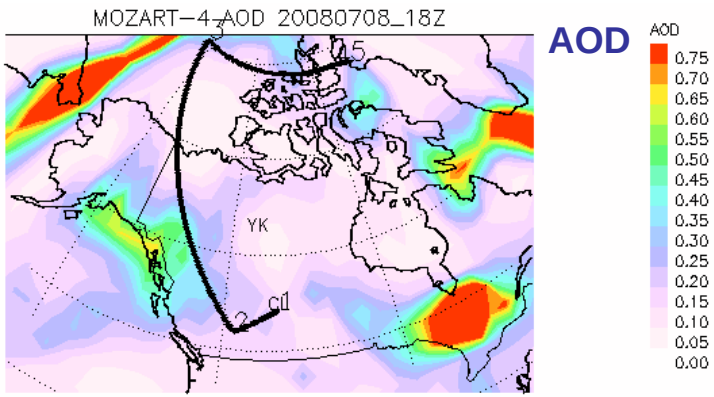
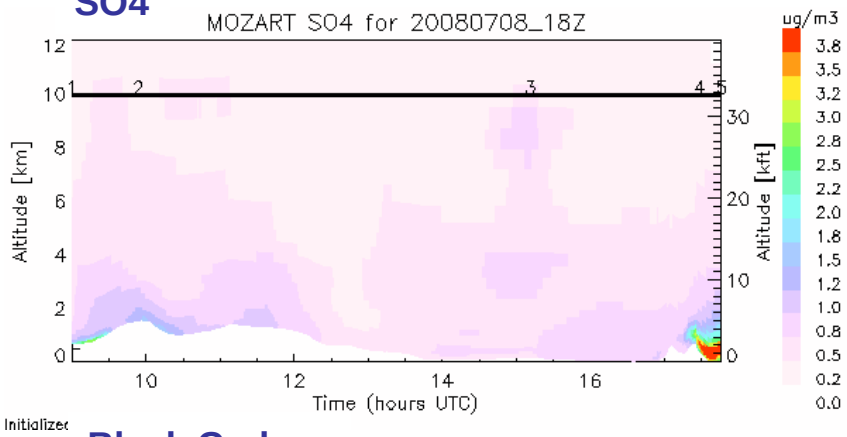
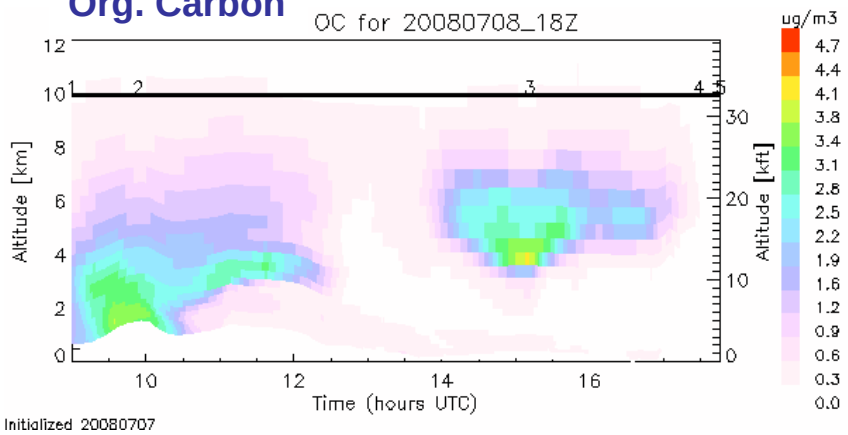


SO4



Org. Carbon



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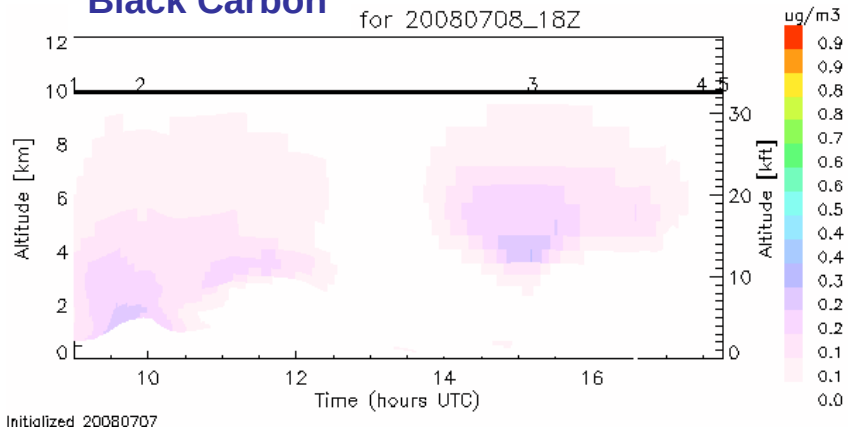
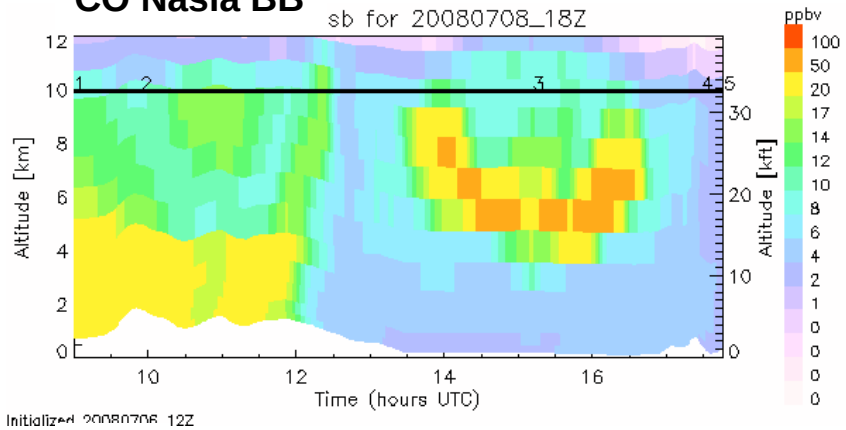
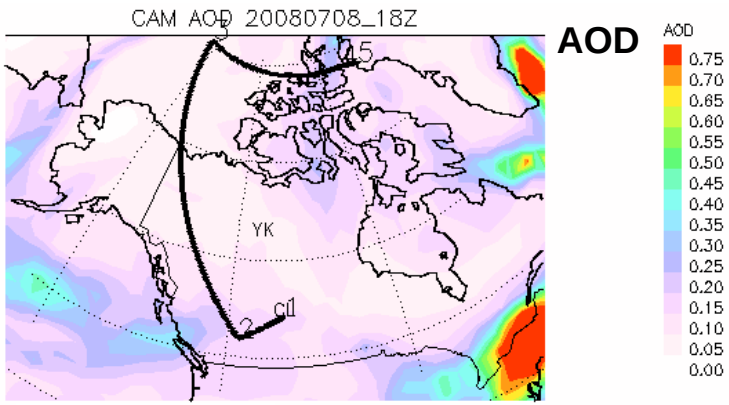


DC-8 Flight Plan to Thule July 8

CAM Fx for 8 July 18Z

CO Nasia BB





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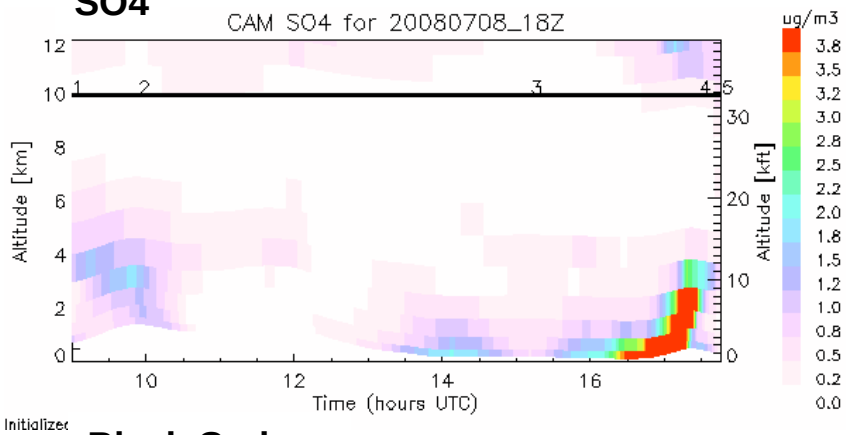

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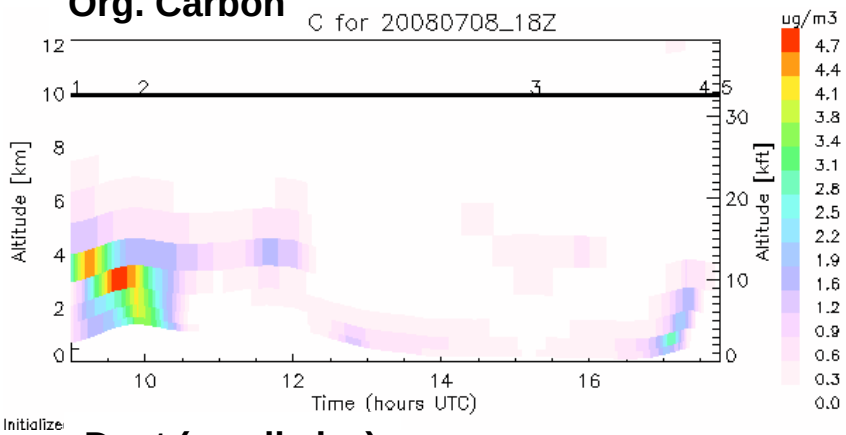

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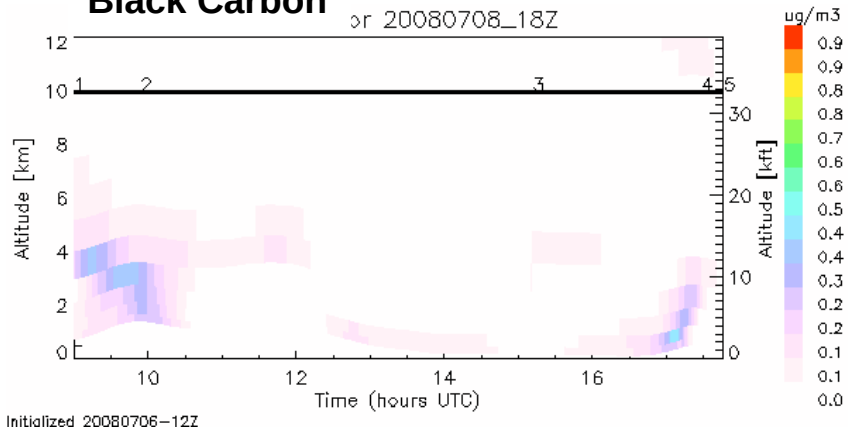
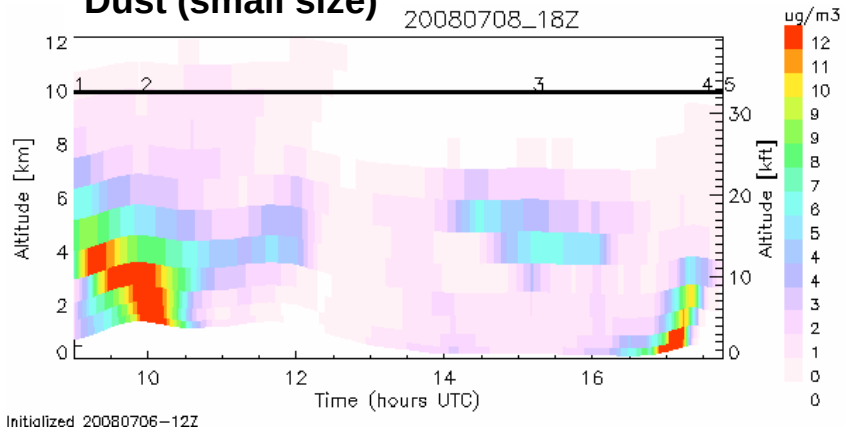
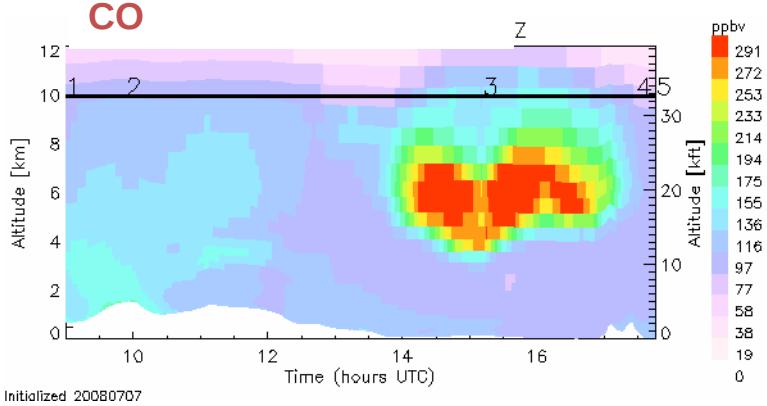


Dust (small size)



DC-8 Flight Plan to Thule July 8 MOZART

CO



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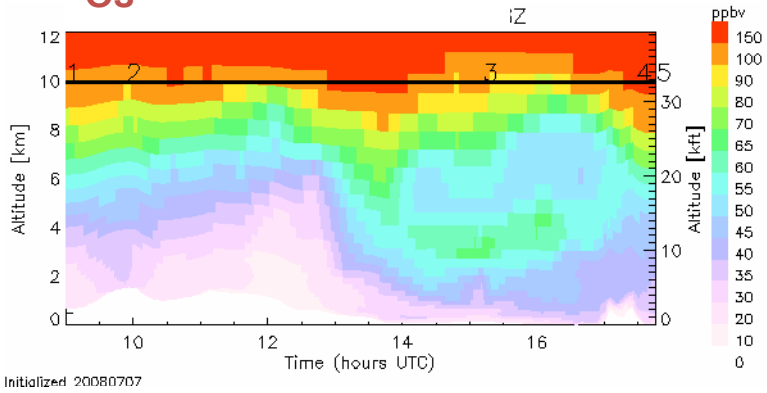
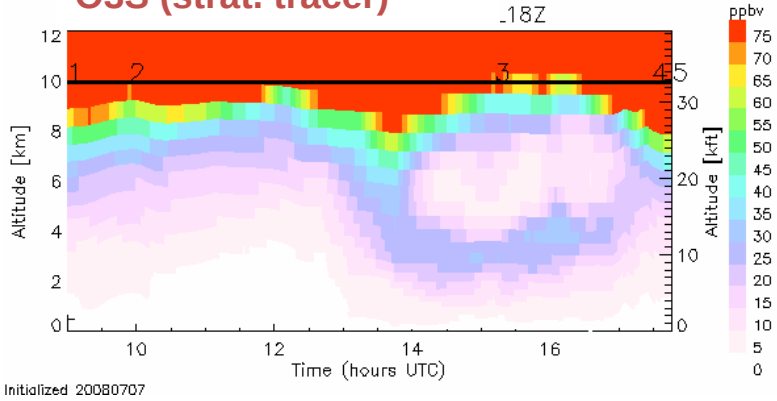
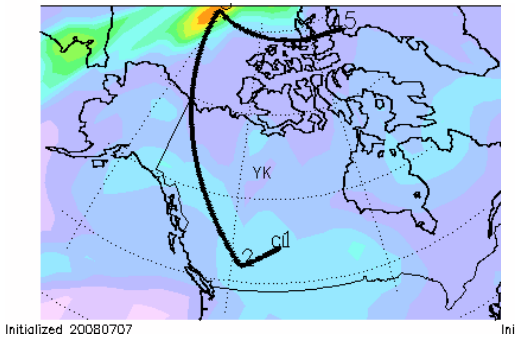


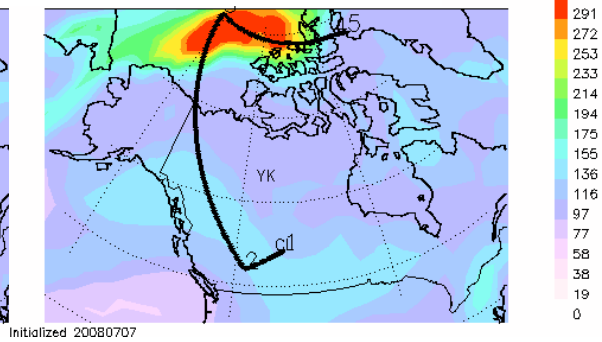
O3S (strat. tracer)



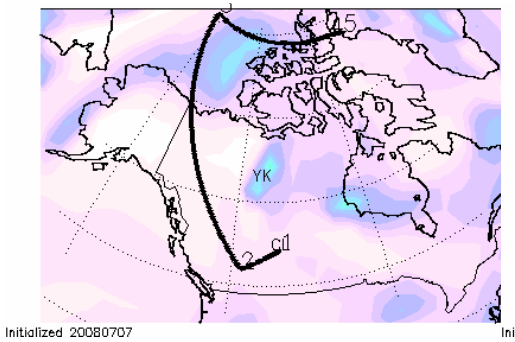
CO @ 4 km



CO @ 6 km



O3S @ 4 km



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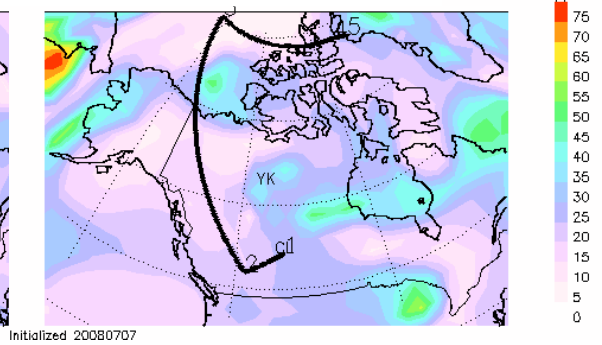
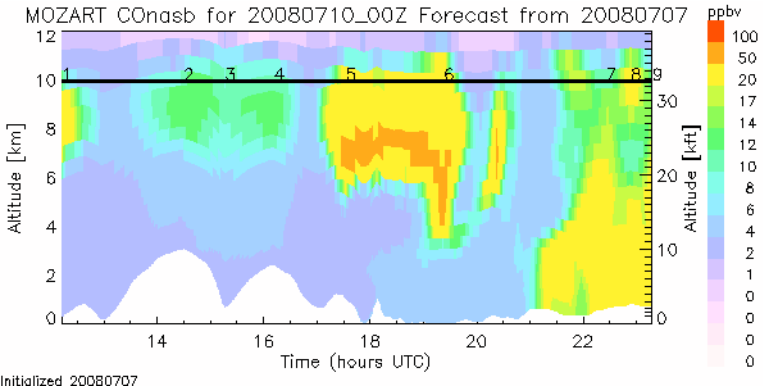
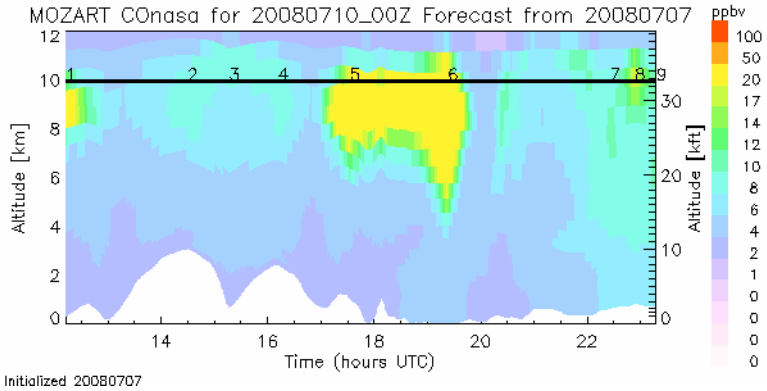


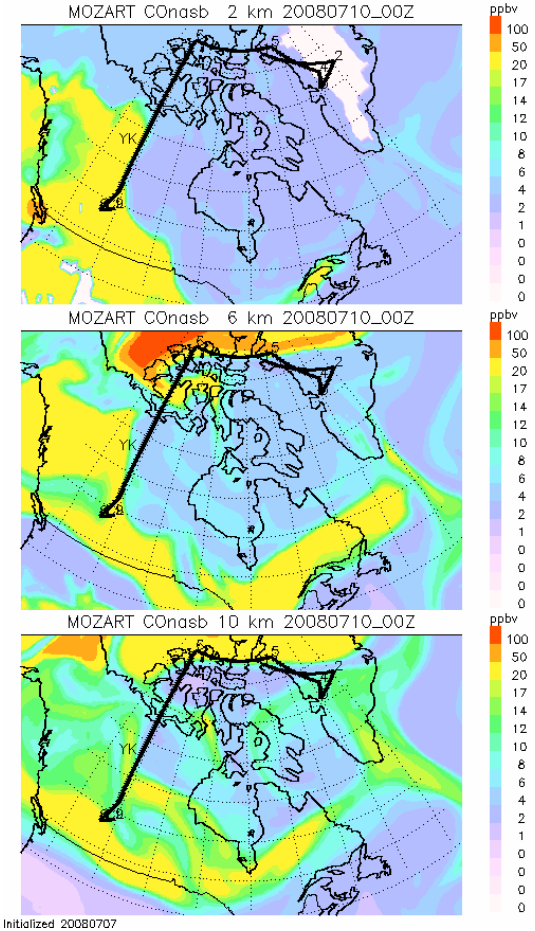
DC-8 Flight Plan from Thule July 9

MOZART Fx for 10 July 0Z





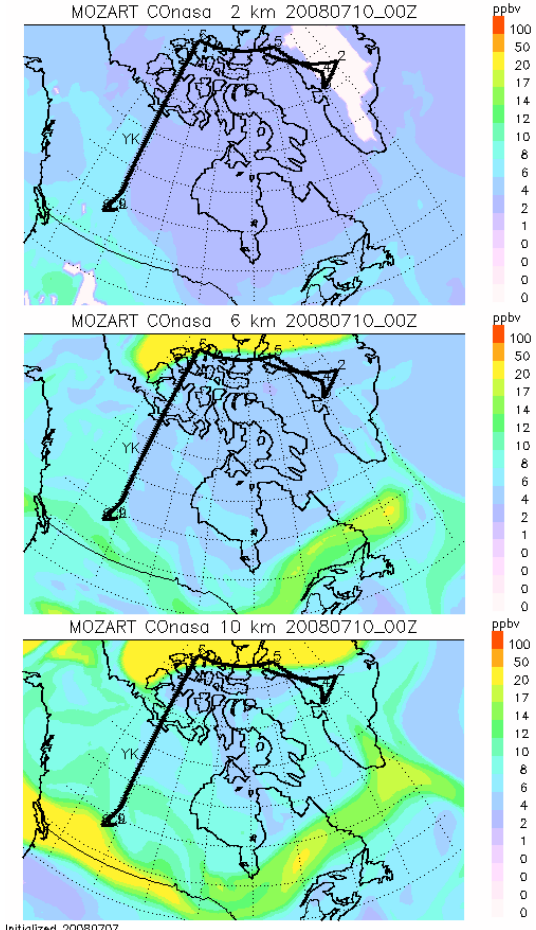
N-Asia BB



2 km

6 km

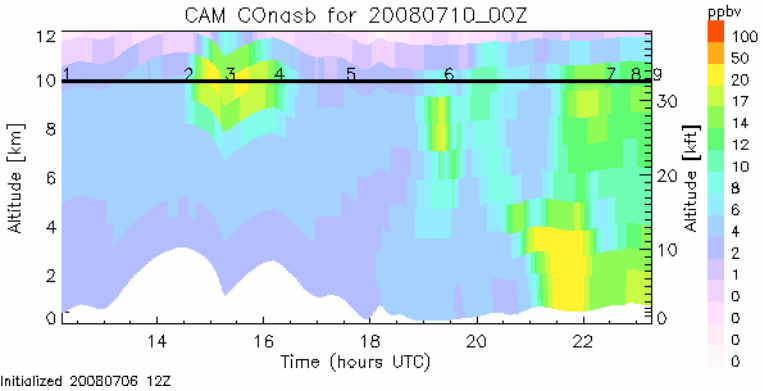
10 km

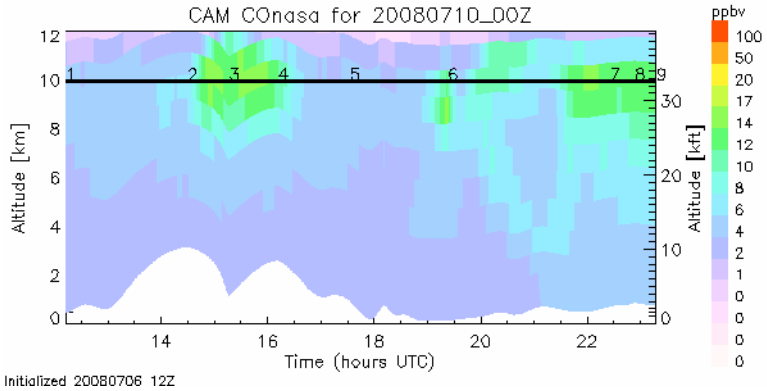


N-Asia Anthro

DC-8 Flight Plan from Thule July 9

CAM Fx for 10 July 0Z





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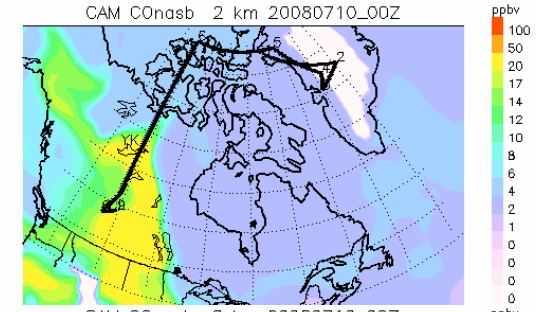
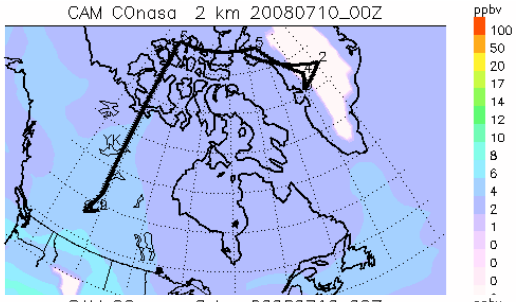


2 km



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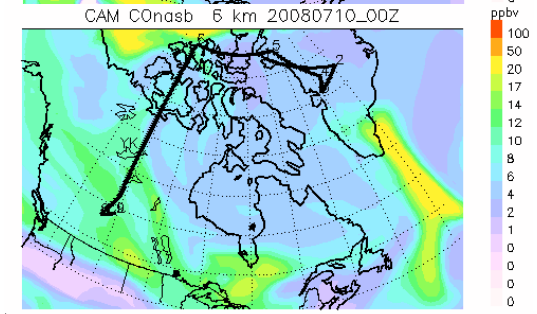

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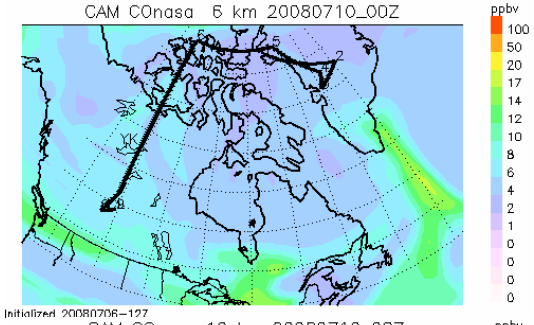
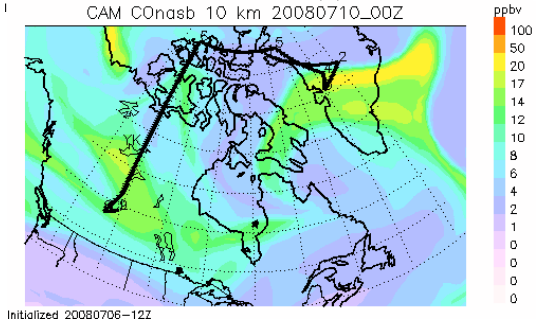
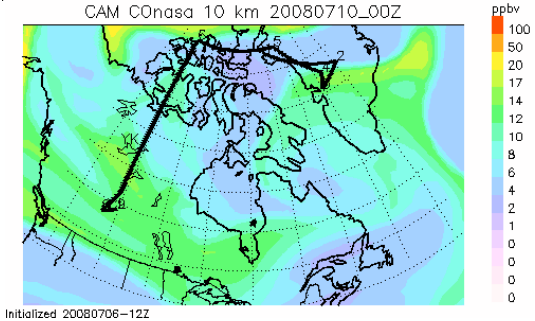




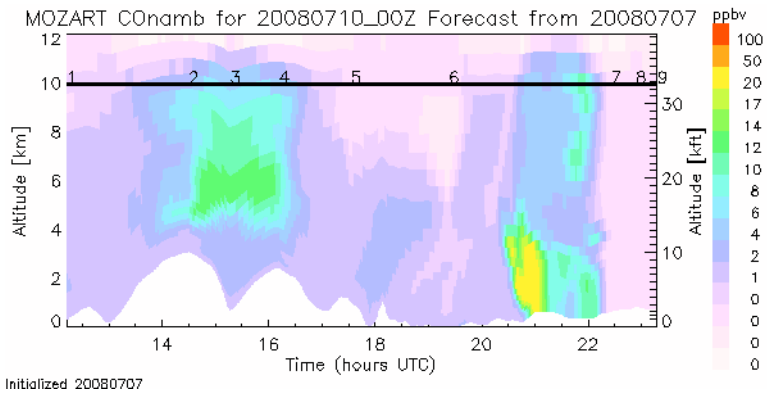
10km

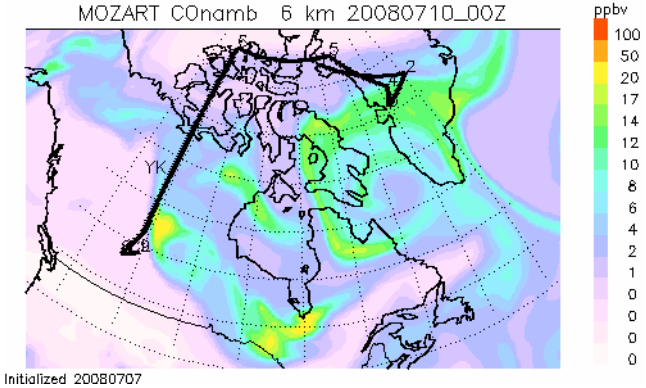


DC-8 Flight Plan from Thule July 9

MOZART Fx for 10 July 0Z

CO Nam. BB





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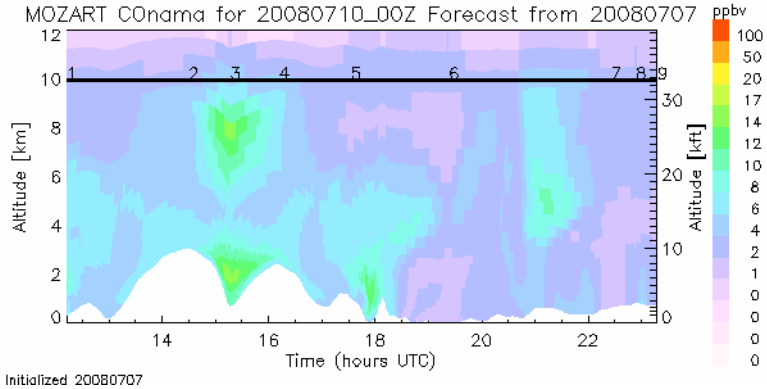

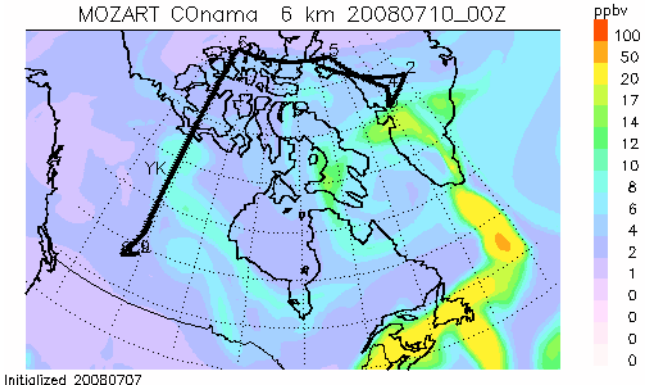

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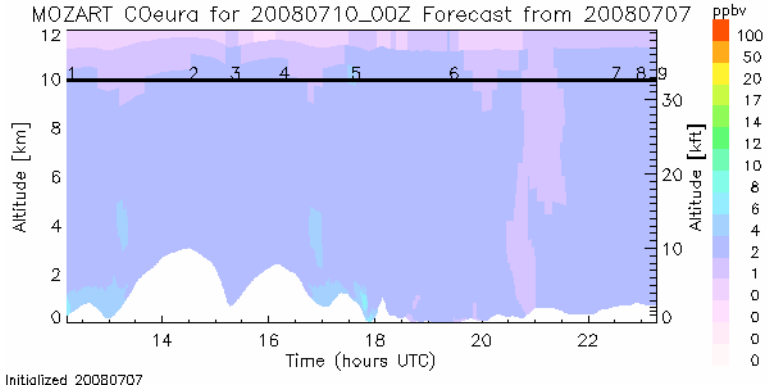
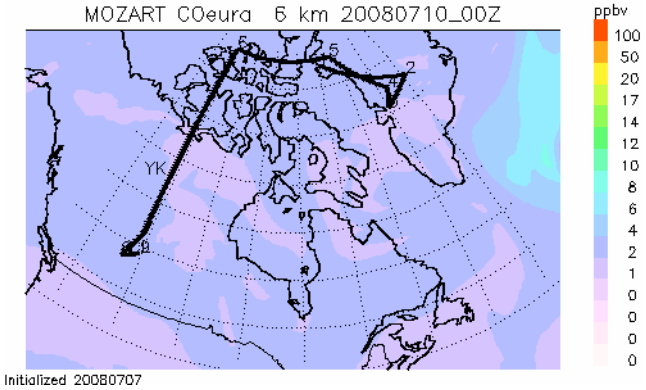
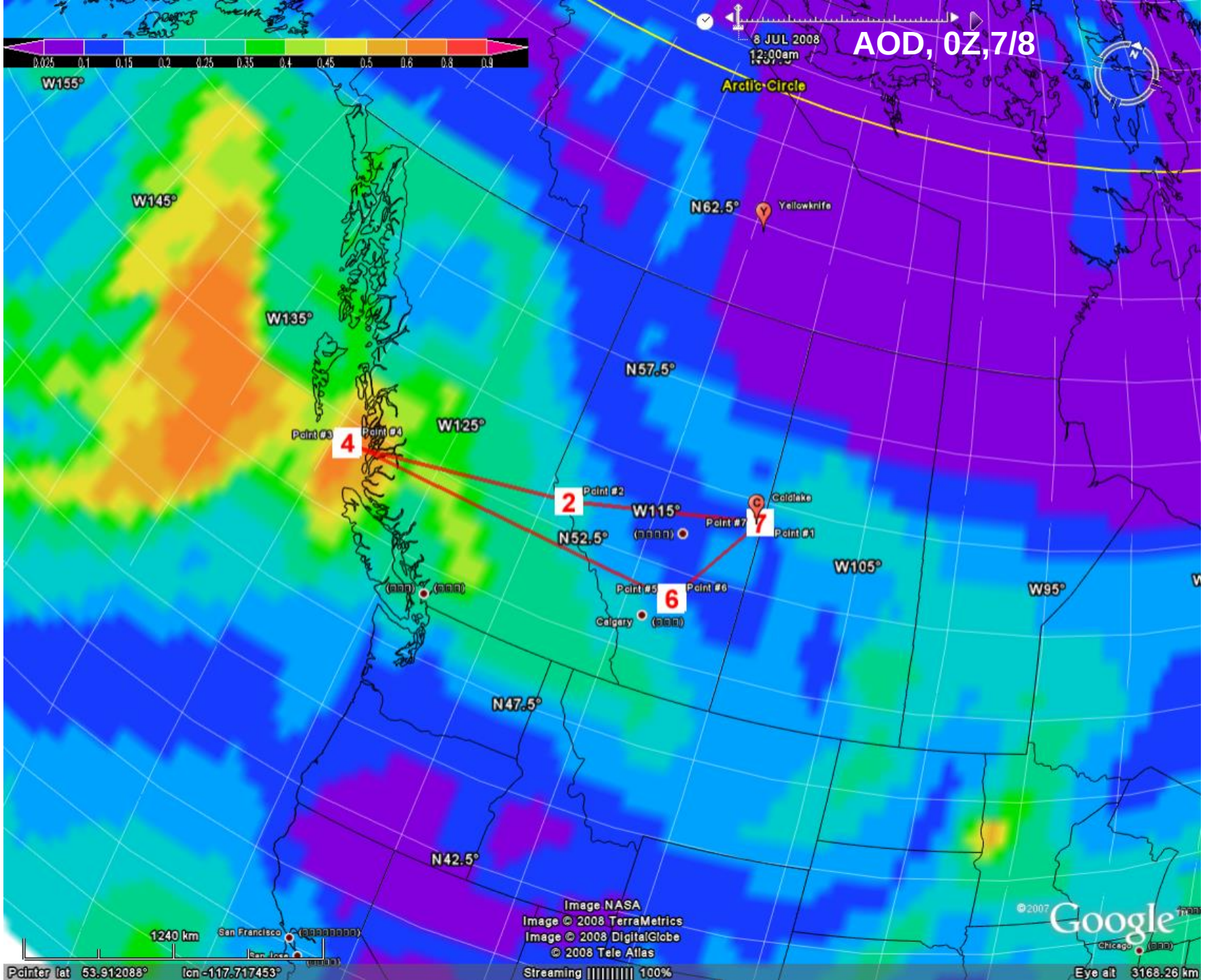
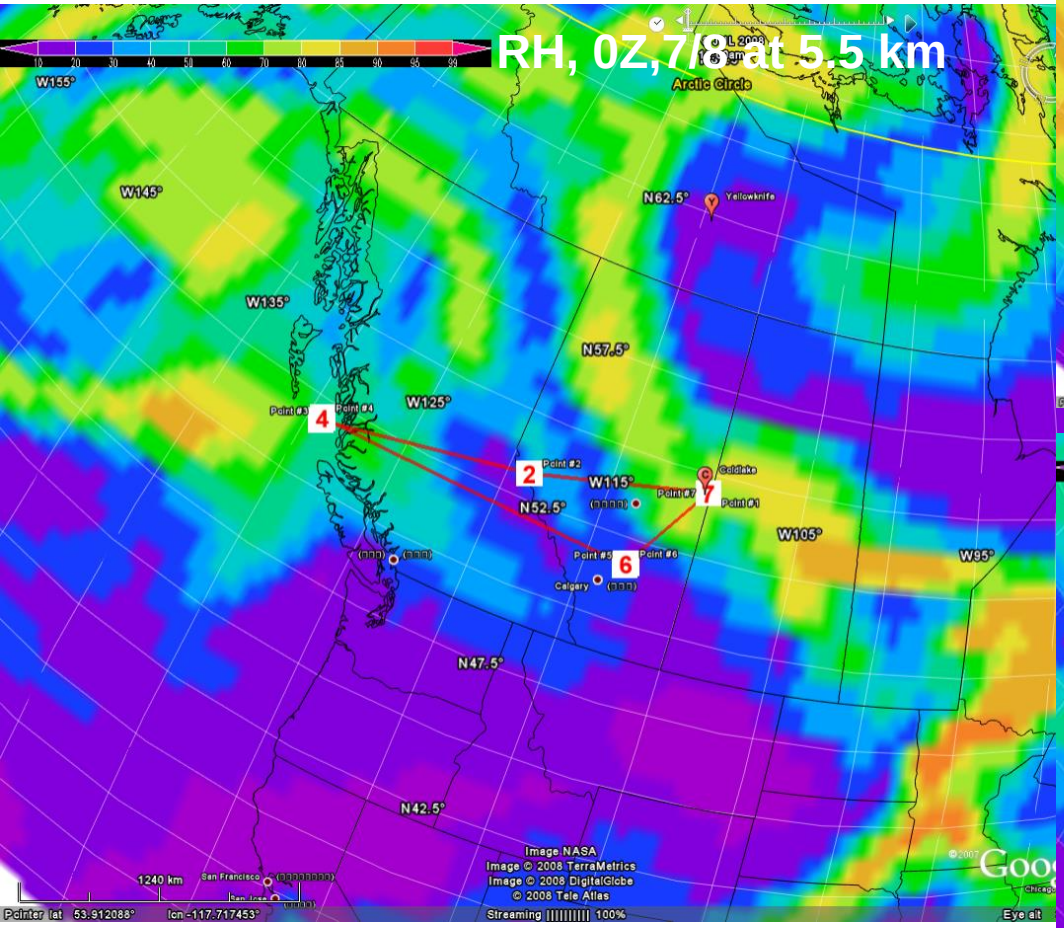
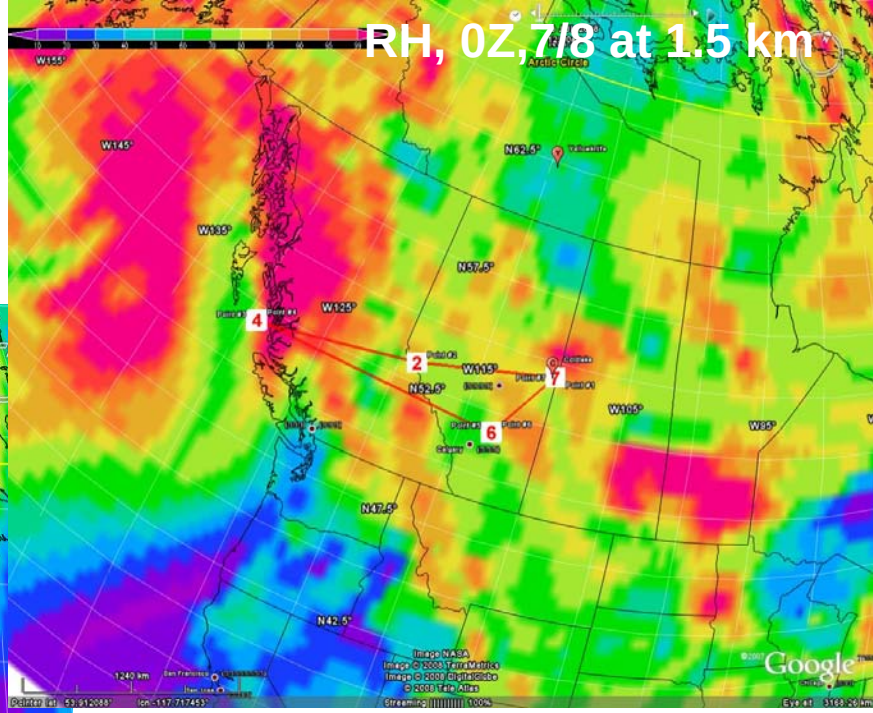
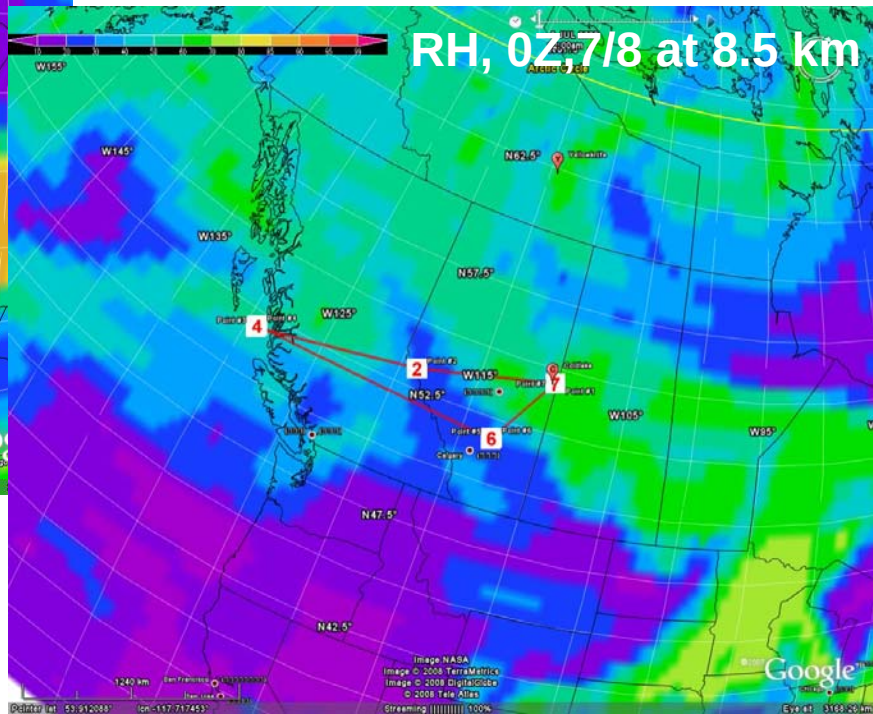




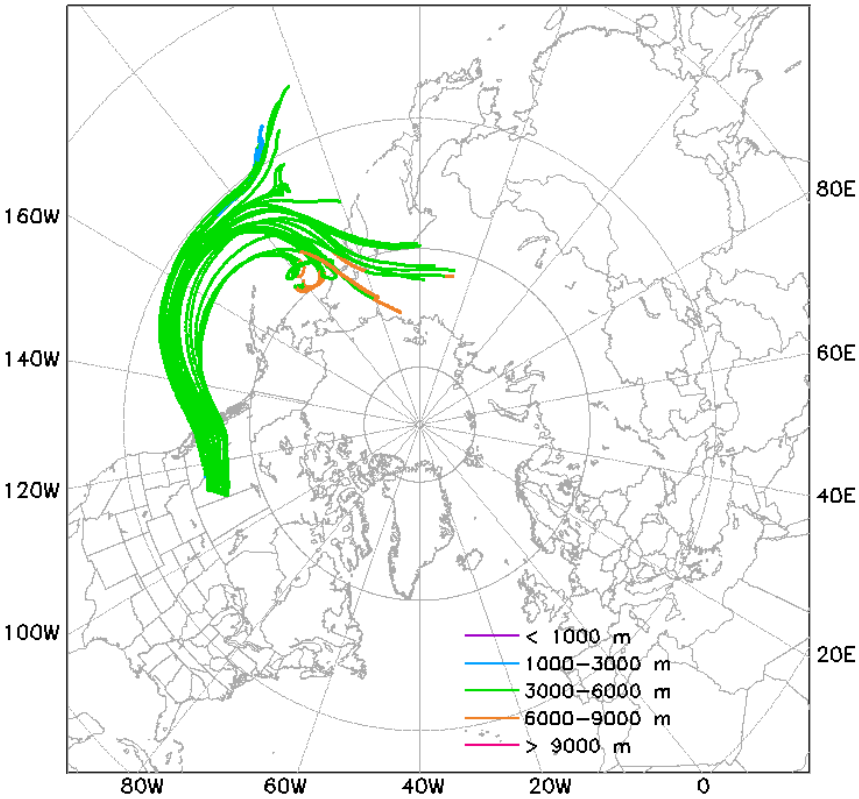

AOD, 0Z,7/8
8 JUL 2008
12:00am
Arctic Circle
0.025 0.1 0.15 0.2 0.25 0.35 0.4 0.45 0.5 0.6 0.8 0.9
W155°
W145°
W135°
W125°
W115°
W105°
W95°
N62.5°
N57.5°
N52.5°
N47.5°
N42.5°
Yellowknife
Coldlake
Calgary
San Francisco
San Jose
Chicago
Point #1
Point #2
Point #3
Point #4
Point #5
Point #6
Point #7
2
4
6
7
1240 km
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
©2007 Google
Pointer lat 53.912088° lon -117.717453°
Streaming 100%
Eye alt 3168.26 km


RH, 0Z,7/8 at 5.5 km
Arctic Circle
Yellowknife
W155°
W145°
W135°
W125°
W115°
W105°
W95°
N62.5°
N57.5°
N52.5°
N47.5°
N42.5°
Point #1
Point #2
Point #3
Point #4
Point #5
Point #6
Point #7
Calgary
Goldlake
1240 km
San Francisco
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
Streaming 100%

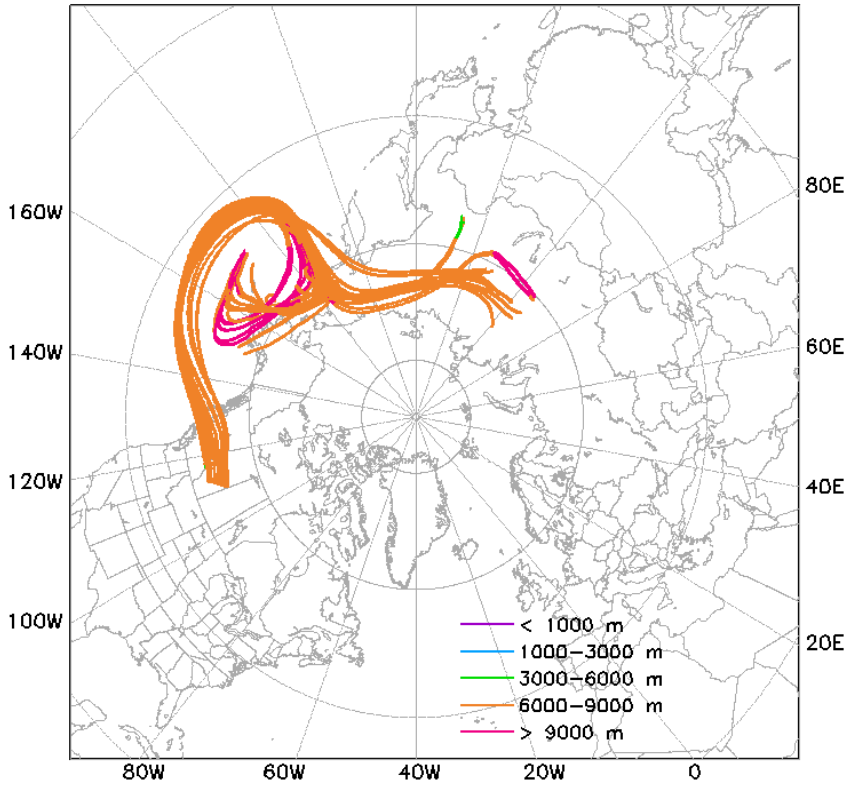

RH, 0Z,7/8 at 1.5 km
Arctic Circle
Yellowknife
W155°
W145°
W135°
W125°
W115°
W105°
W95°
N62.5°
N57.5°
N52.5°
N47.5°
N42.5°
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
© 2008 Tele Atlas


RH, 0Z,7/8 at 8.5 km
Arctic Circle
Yellowknife
W155°
W145°
W135°
W125°
W115°
W105°
W95°
N62.5°
N57.5°
N52.5°
N47.5°
N42.5°
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
© 2008 Tele Atlas

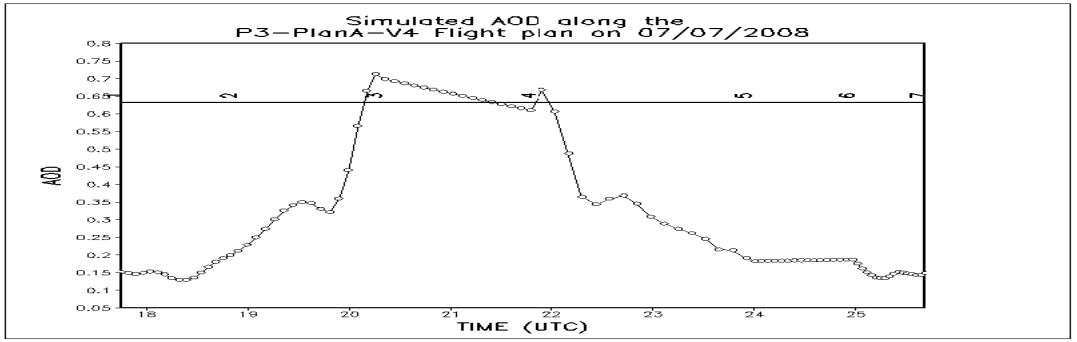
ARCTAS backtraj P3-PlanA-V4 07/07/2008 at 5 km

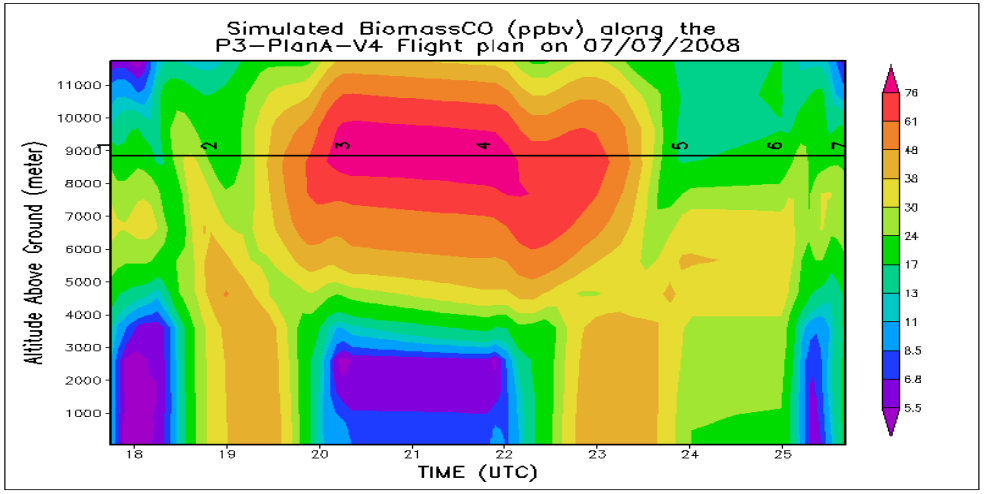


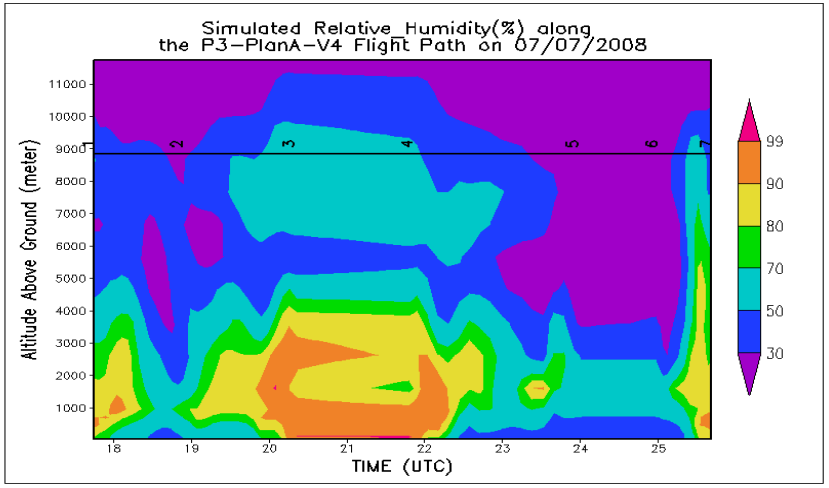
ARCTAS backtraj of P3-PlanA-V4 07/07/2008 at 8 km

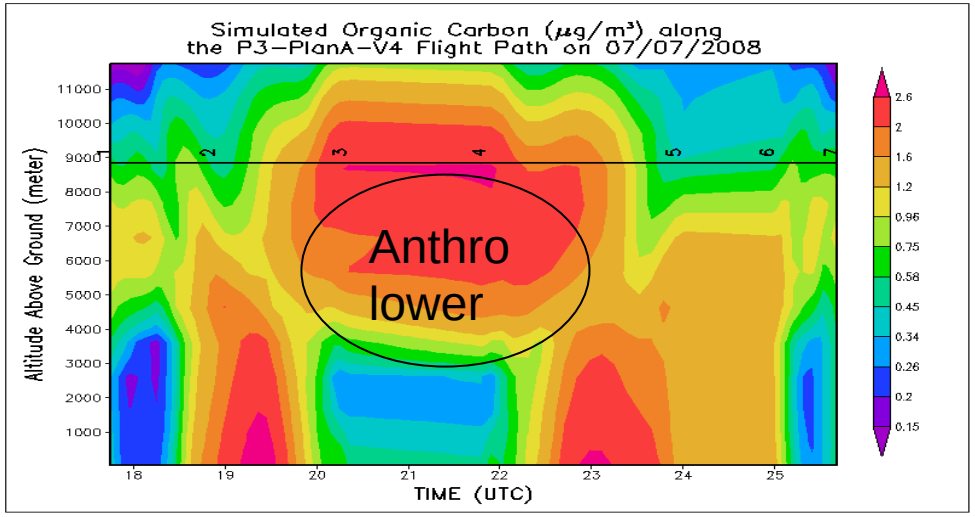


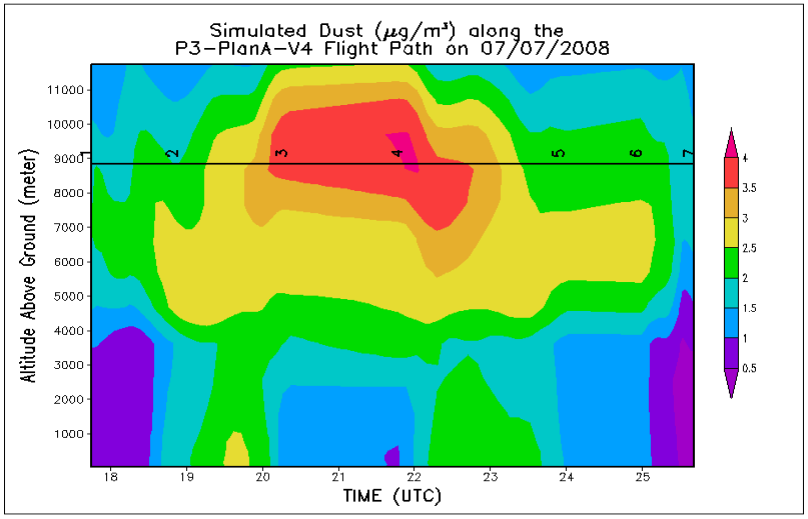
P3 For July 7, 2007





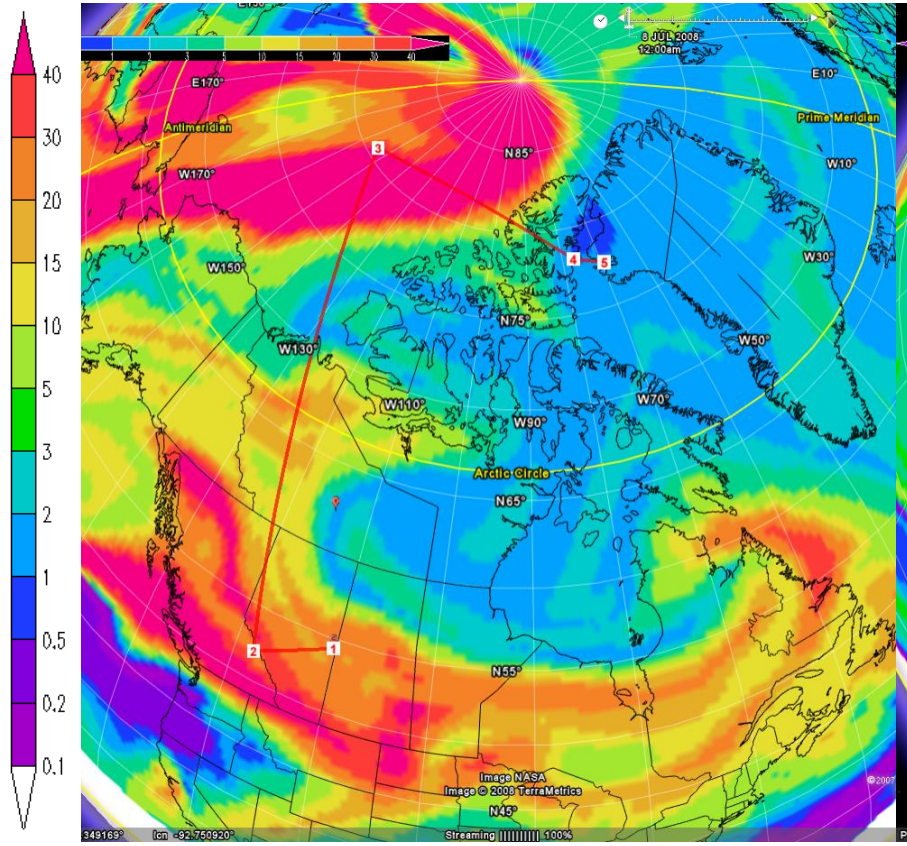


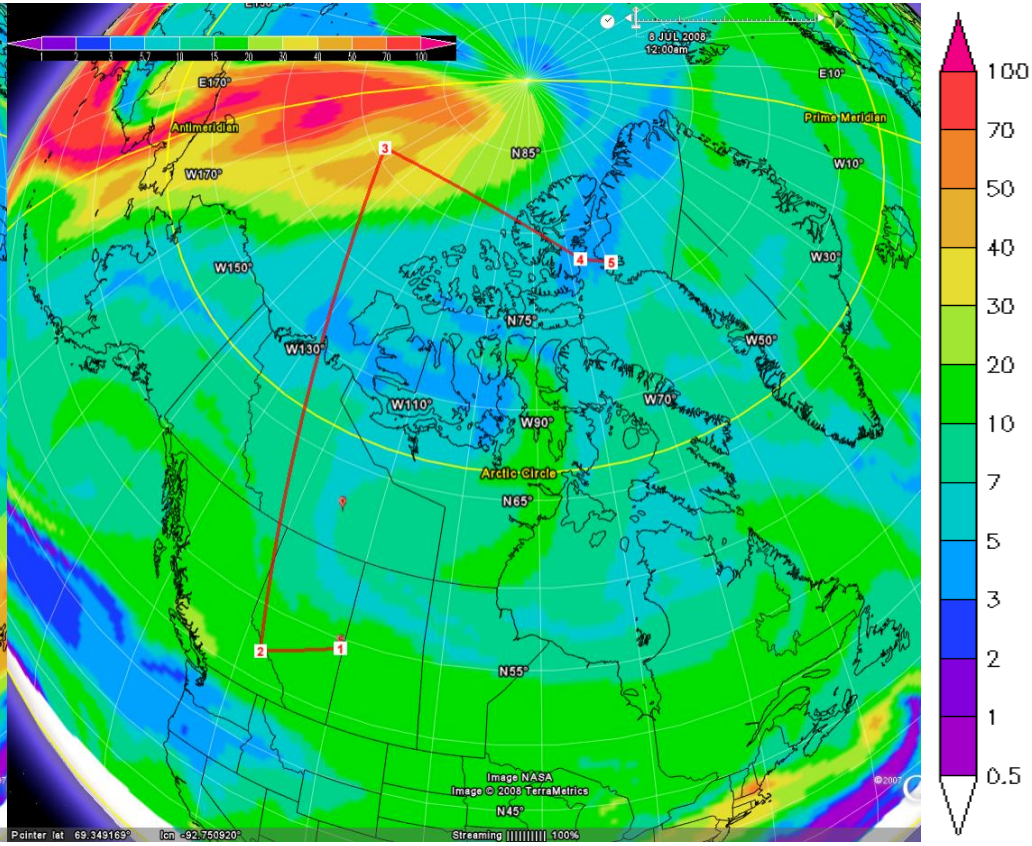




DC 8 Flight To Thule

5.5km layer

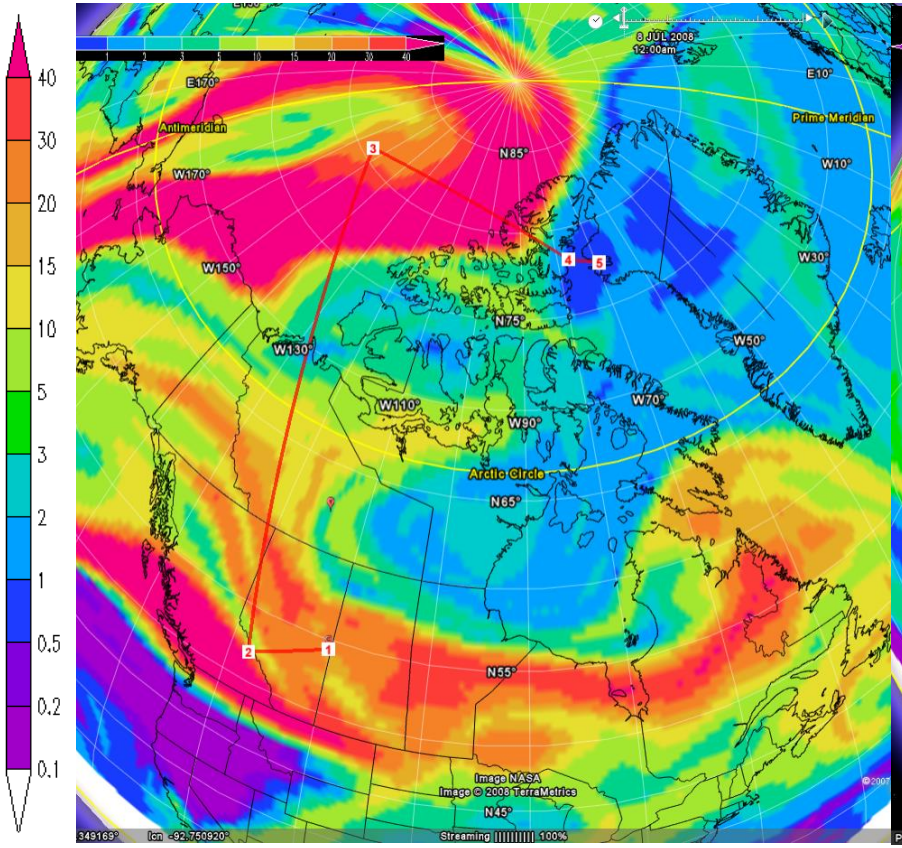


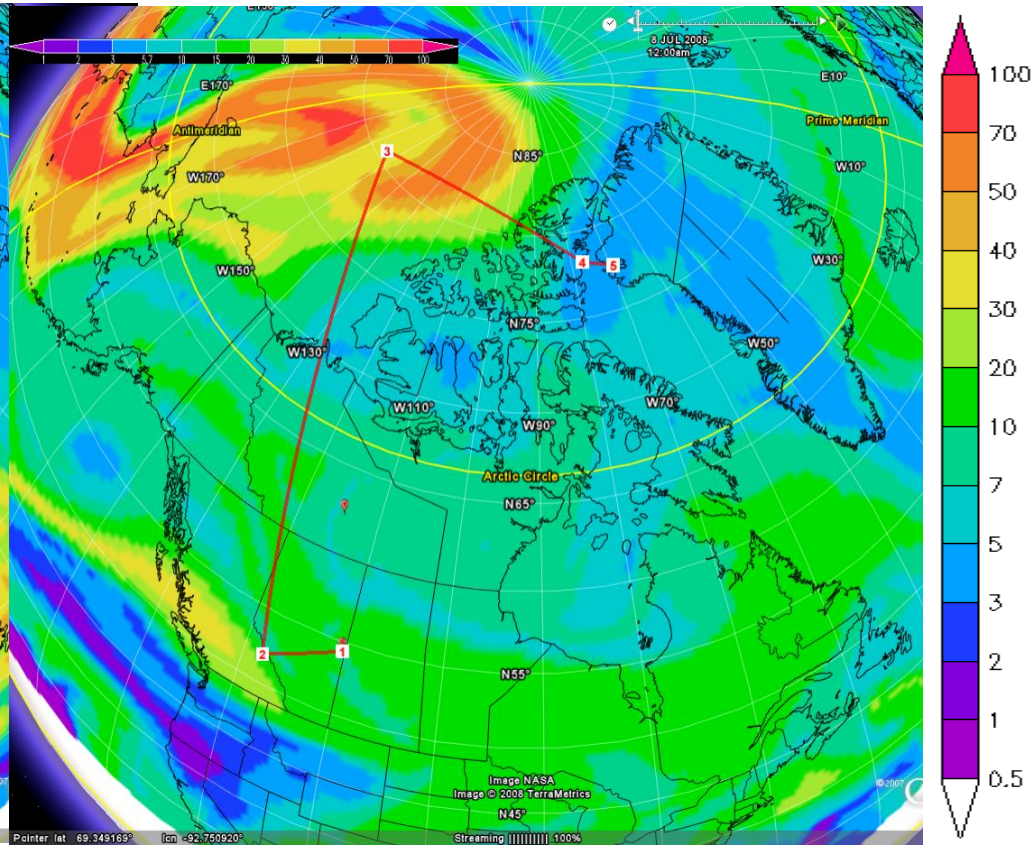


Biomass CO, 0Z, 7/8

Anthropogenic CO, 0Z, 7/8

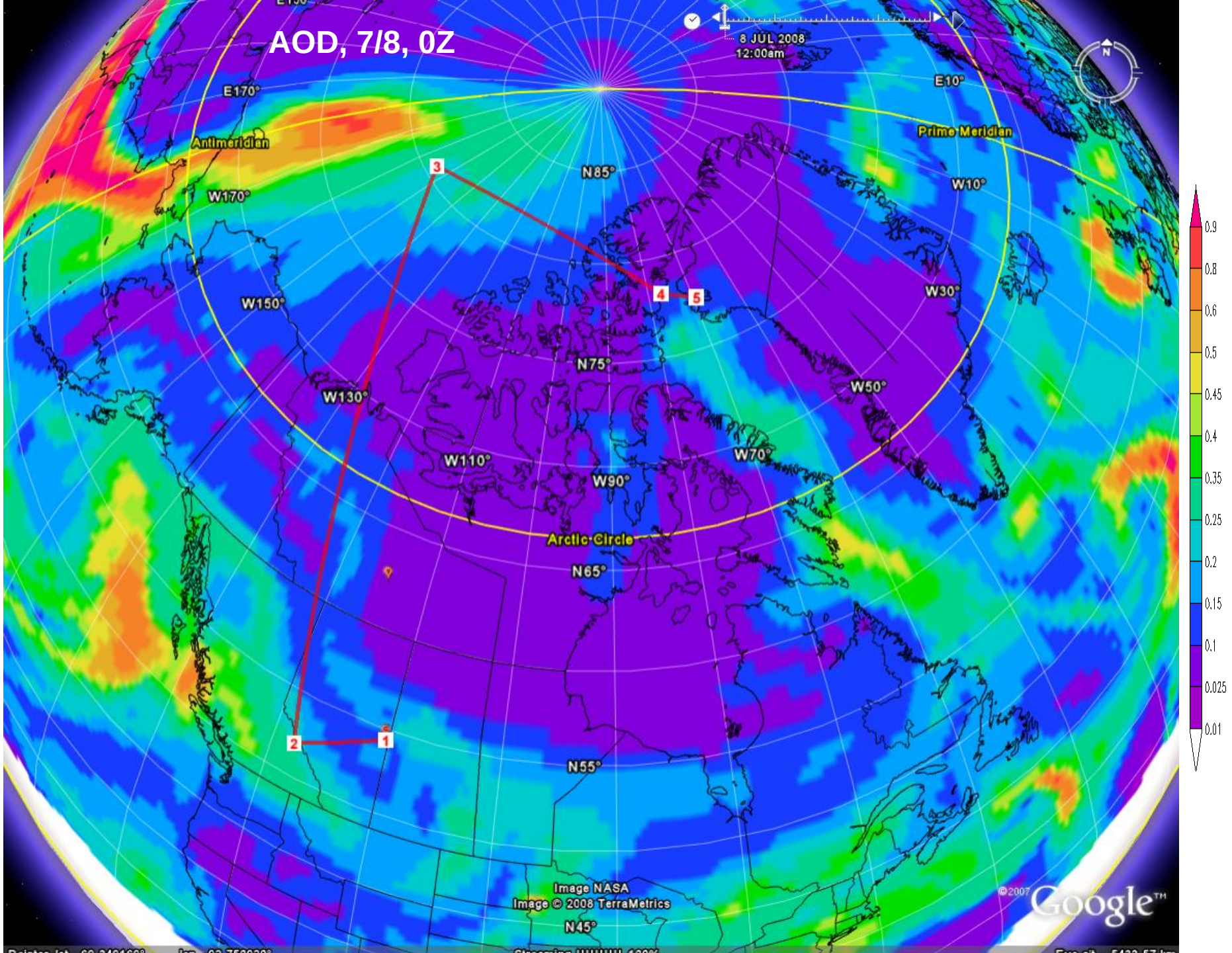
8.4 km layer

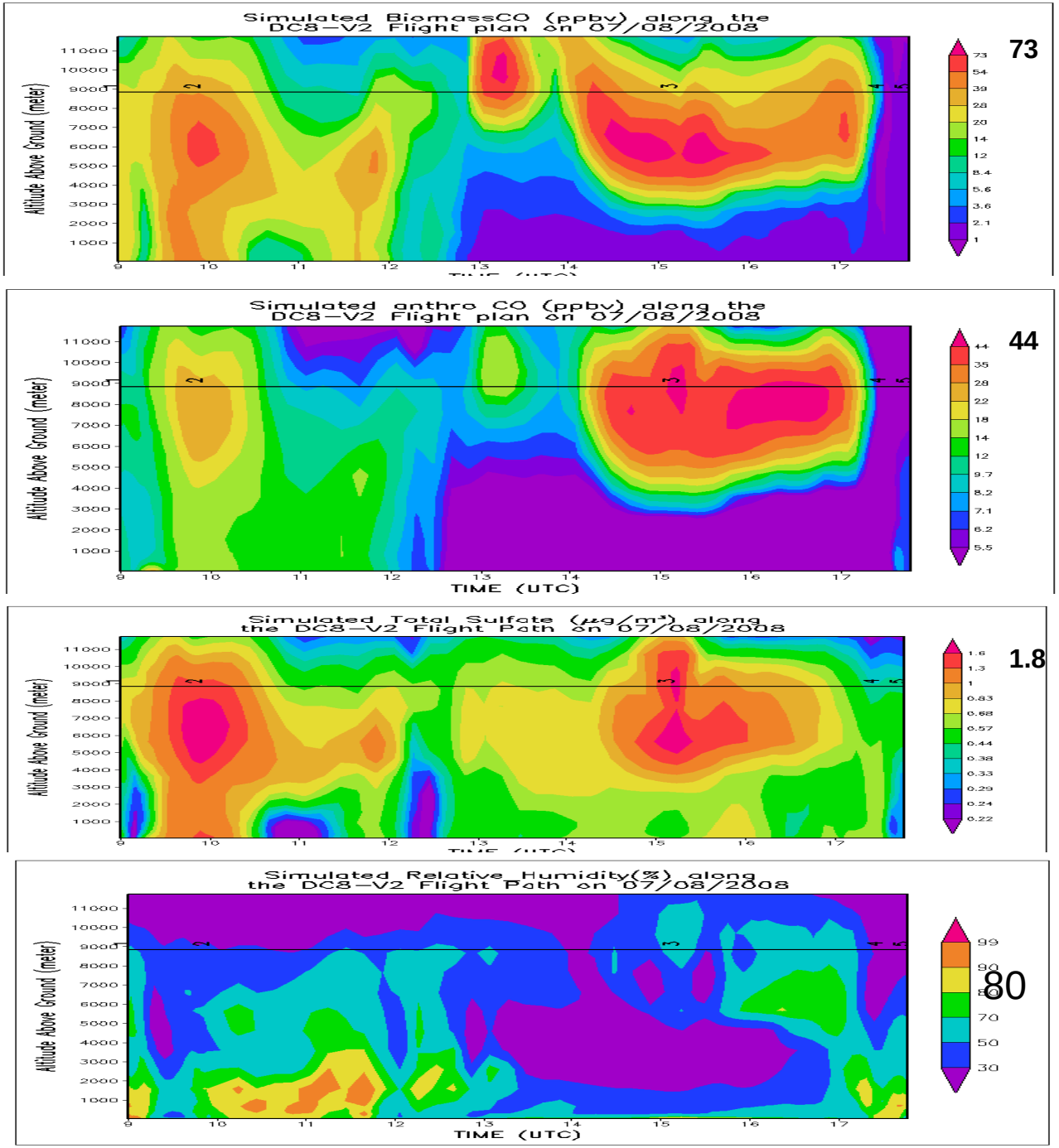




Biomass CO, 0Z, 7/8

Anthropogenic CO, 0Z, 7/8

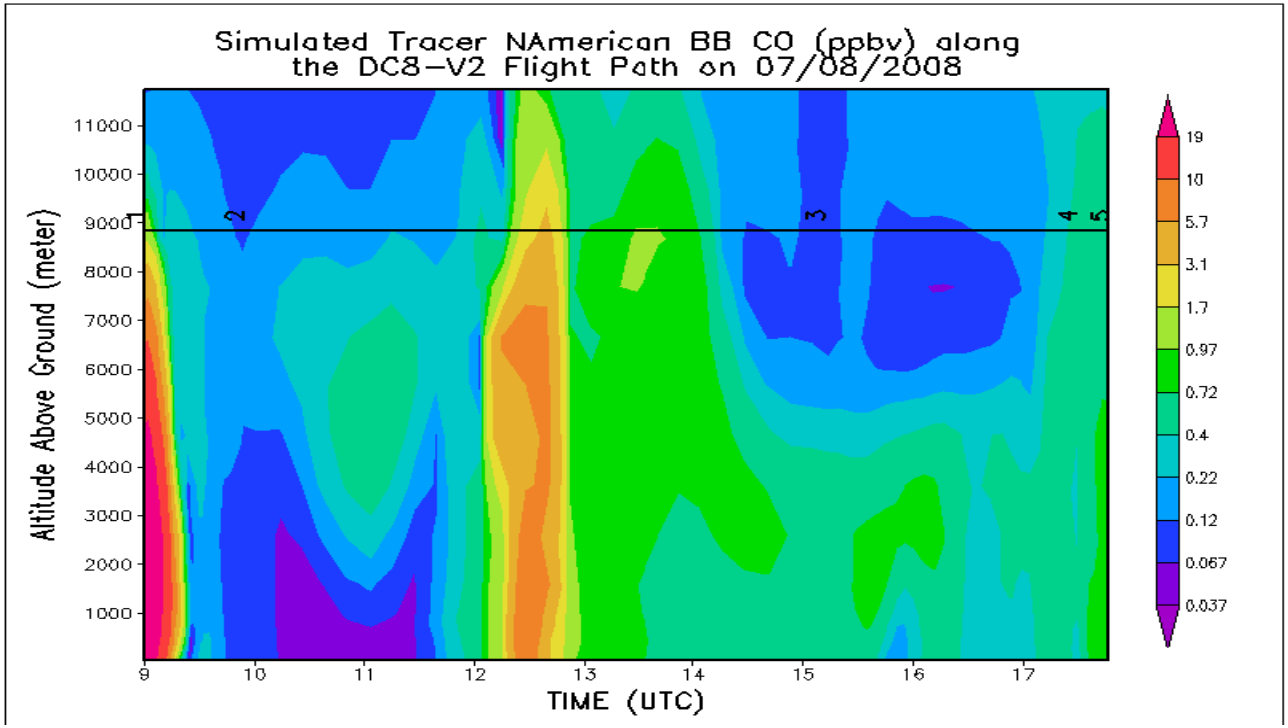

AOD, 7/8, 0Z
8 JUL 2008
12:00am
E170°
Antimeridian
W170°
W150°
W130°
W110°
W90°
W70°
W50°
W30°
W10°
E10°
Prime Meridian
N85°
N75°
Arctic Circle
N65°
N55°
N45°
1
2
3
4
5
0.9
0.8
0.6
0.5
0.45
0.4
0.35
0.25
0.2
0.15
0.1
0.025
0.01
Image NASA
Image © 2008 TerraMetrics
©2007 Google™

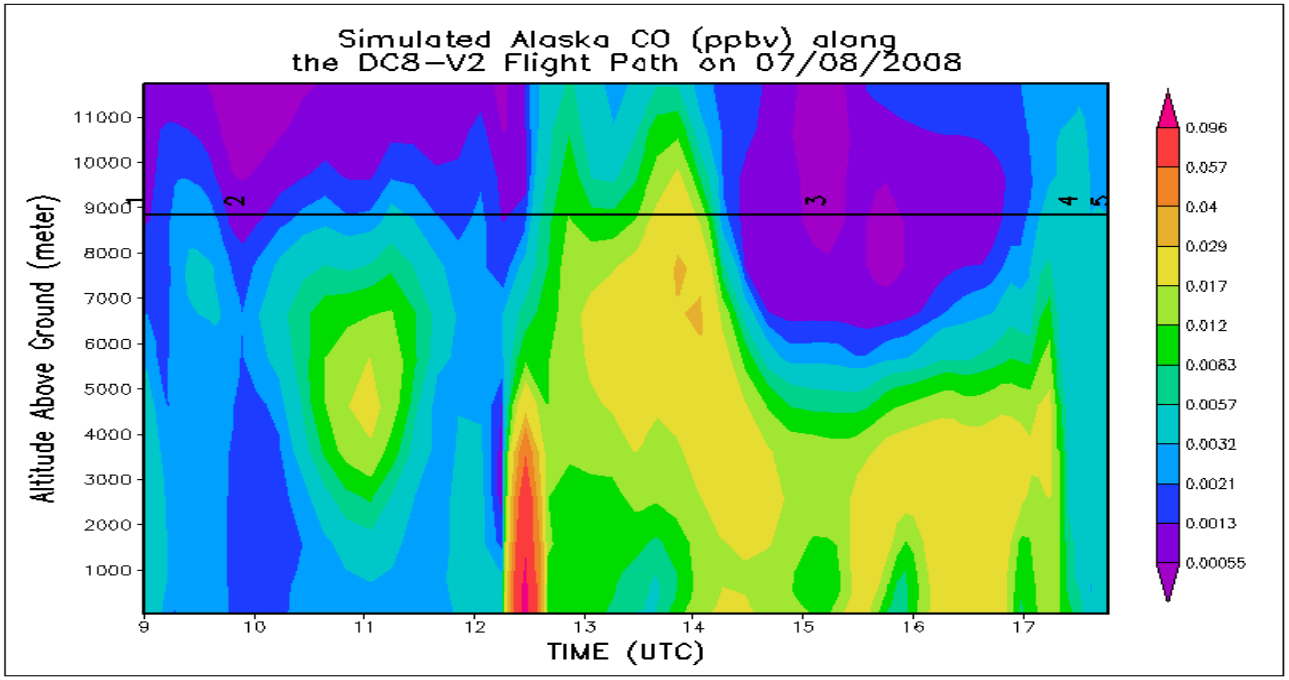


DC8 Outbound Flight

Mixture of Anthro and Biomass at point 3 (northern most point)

Sulfate relatively similar amount at 2 and 3 unlike anthro CO.



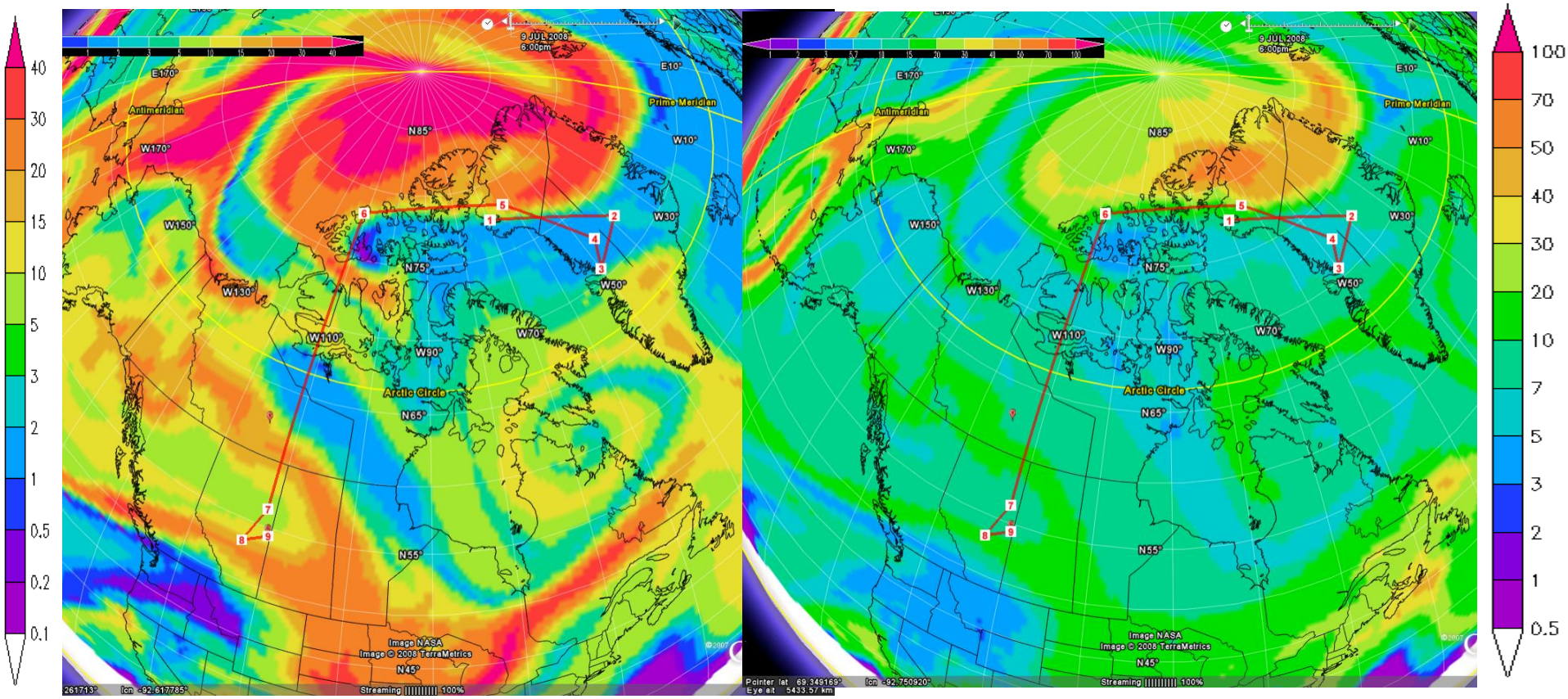


Alaskan Fires ??

On the way to Thule

Thule Return Flight

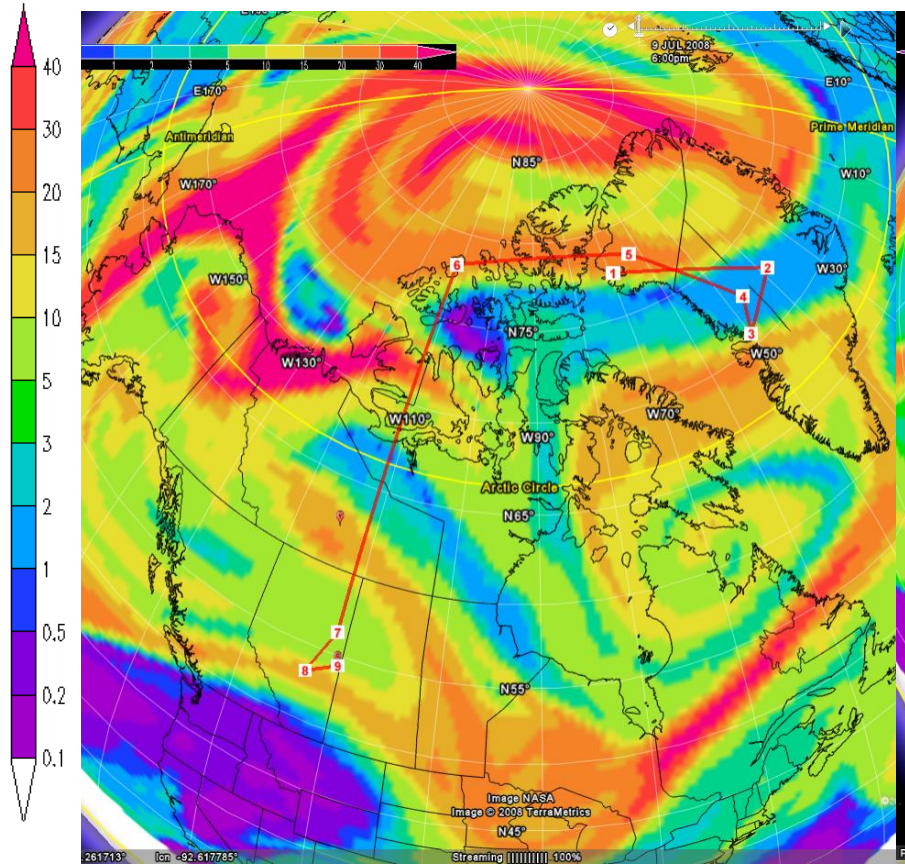
5.5km layer

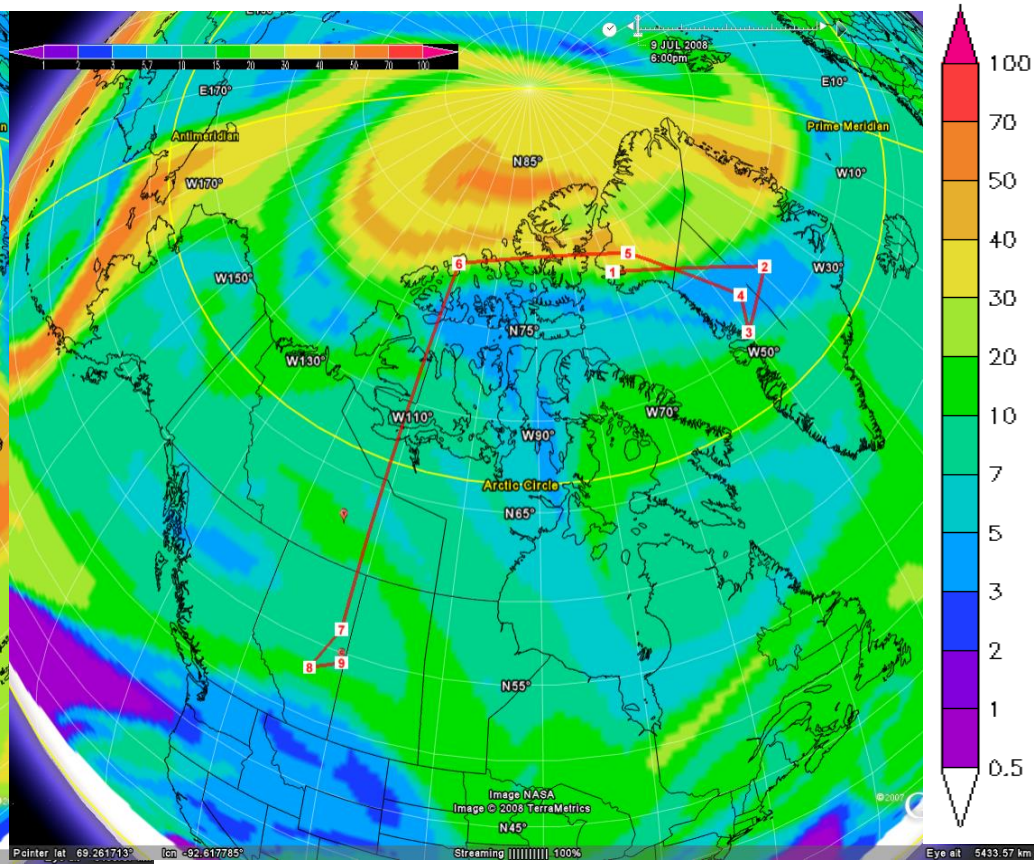


Biomass CO, 18Z, 7/9

Anthropogenic CO, 18Z, 7/9

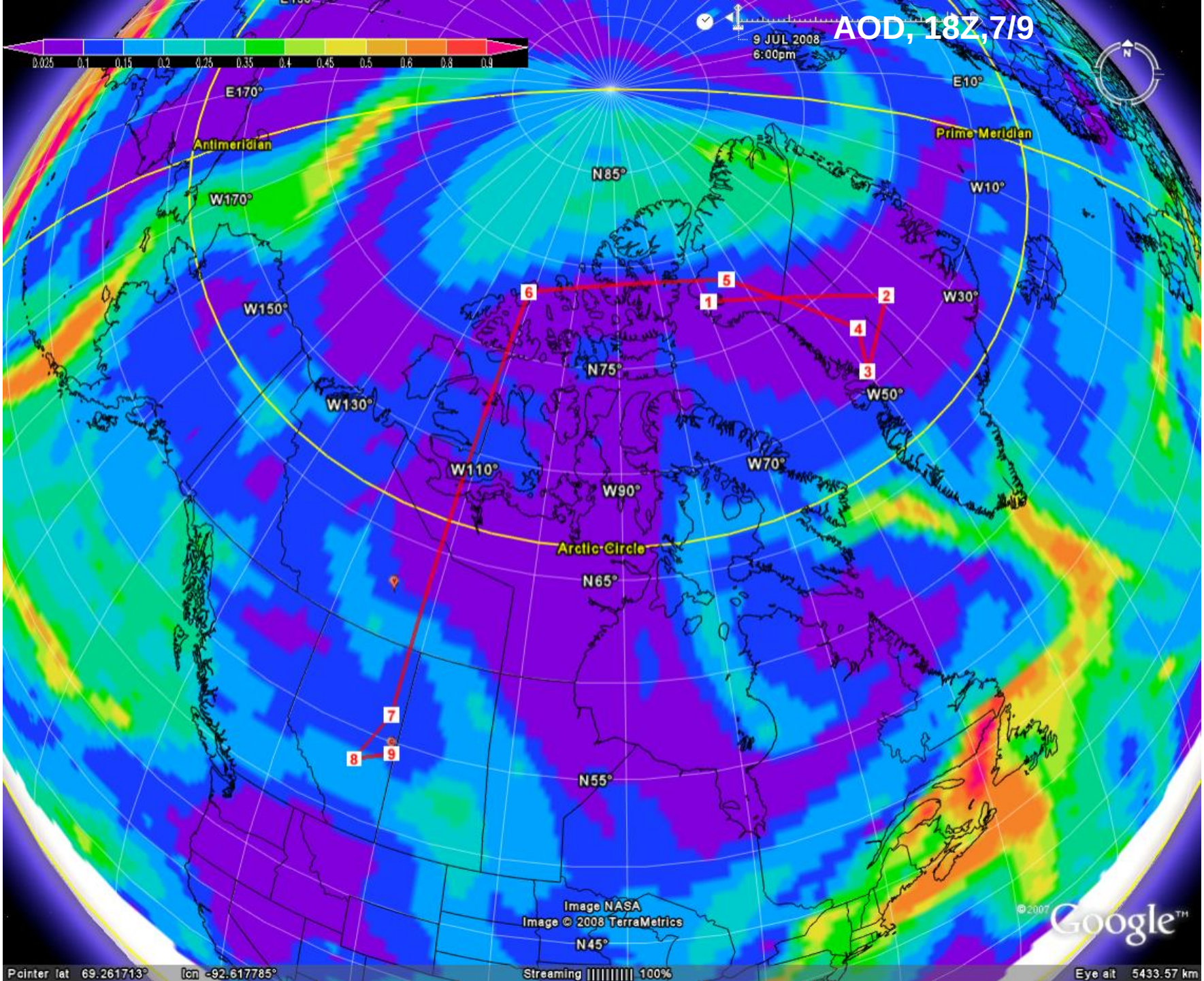
8.4km layer

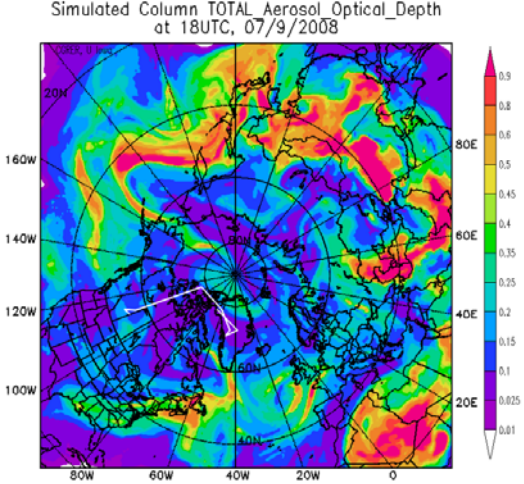


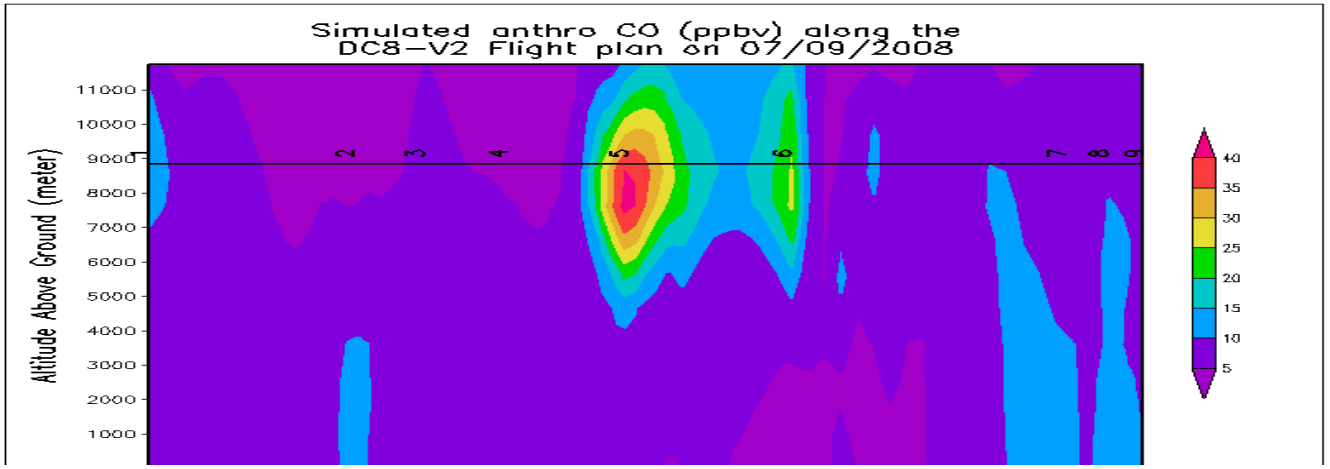


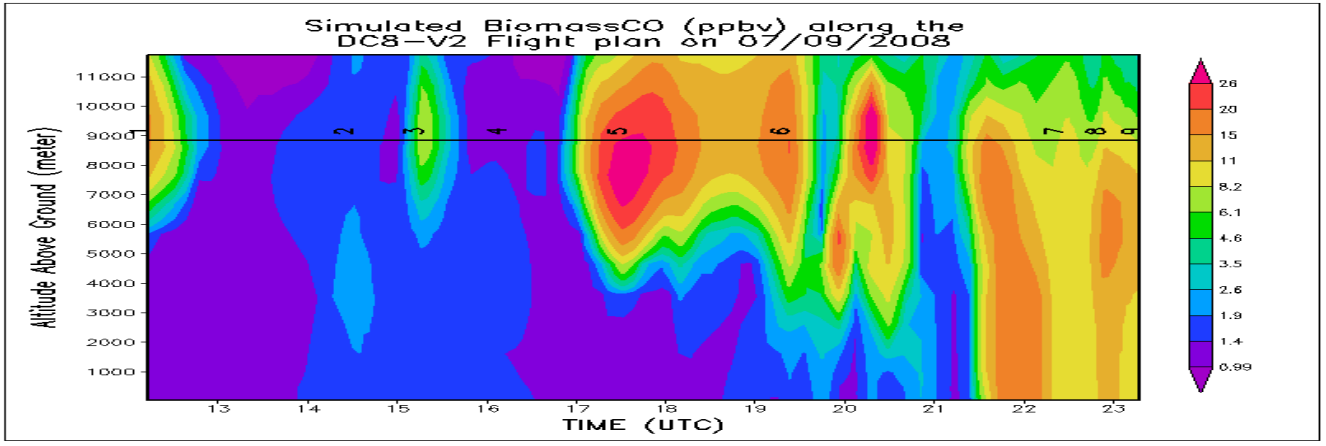
Biomass CO, 18Z, 7/9

Anthropogenic CO, 18Z, 7/9

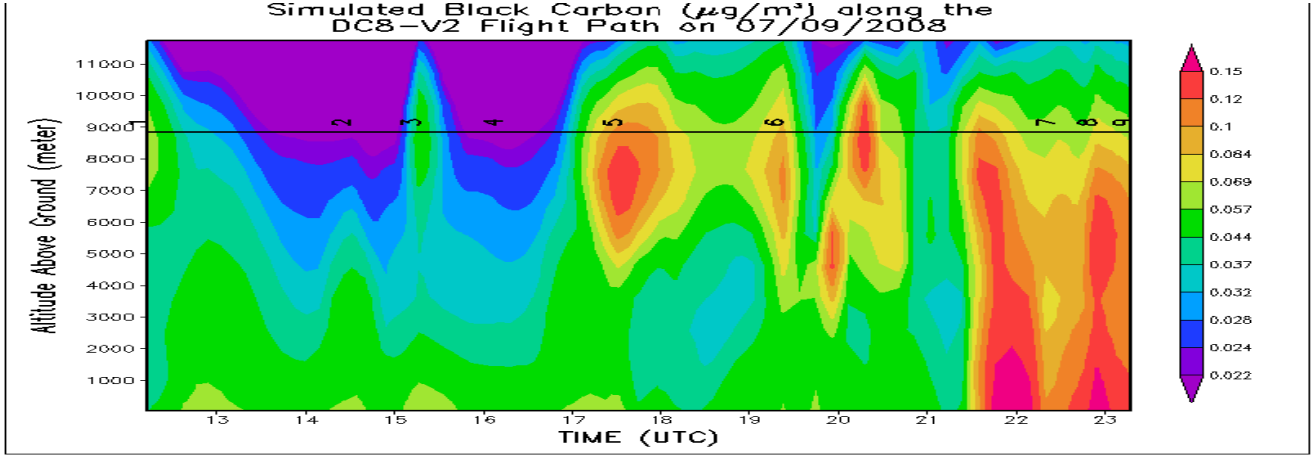

AOD, 18Z,7/9
9 JUL 2008
6:00pm
0.025
0.1
0.15
0.2
0.25
0.35
0.4
0.45
0.5
0.6
0.8
0.9
E170°
E10°
Antimeridian
Prime Meridian
N85°
W170°
W10°
W150°
W30°
W130°
W50°
W110°
W70°
W90°
N75°
Arctic Circle
N65°
N55°
N45°
1
2
3
4
5
6
7
8
9
Image NASA
Image © 2008 TerraMetrics
©2007 Google™
Pointer lat 69.261713° lon -92.617785°
Streaming |||||||||| 100%
Eye alt 5433.57 km

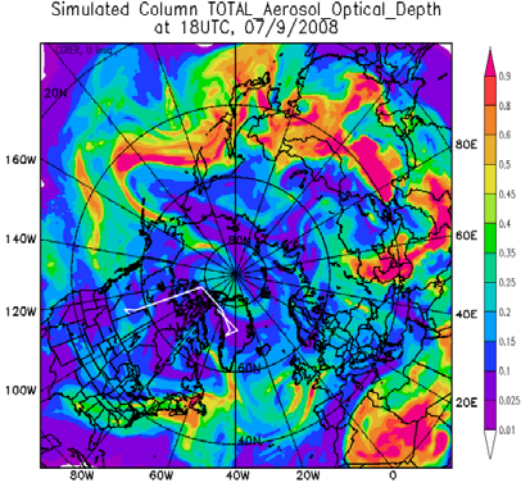


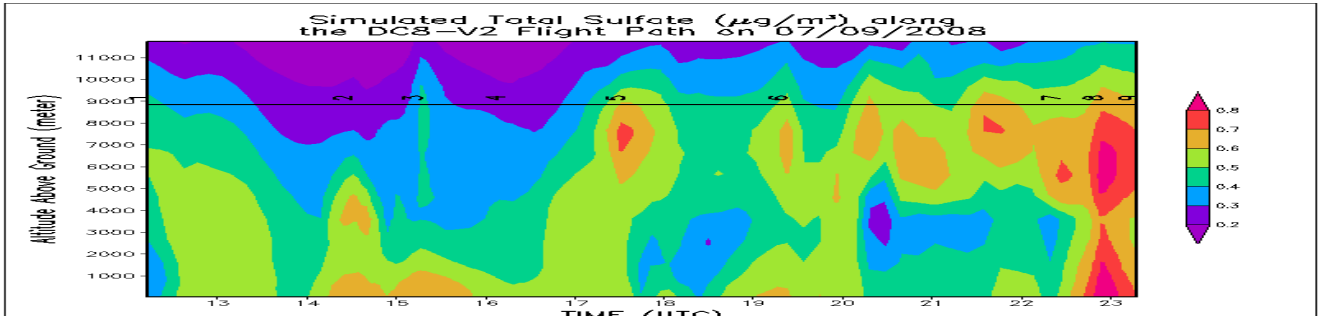


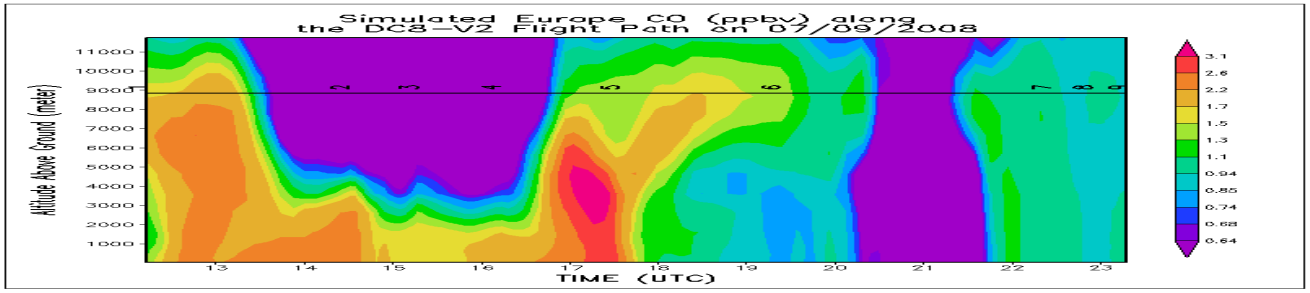


DC8 return July 9

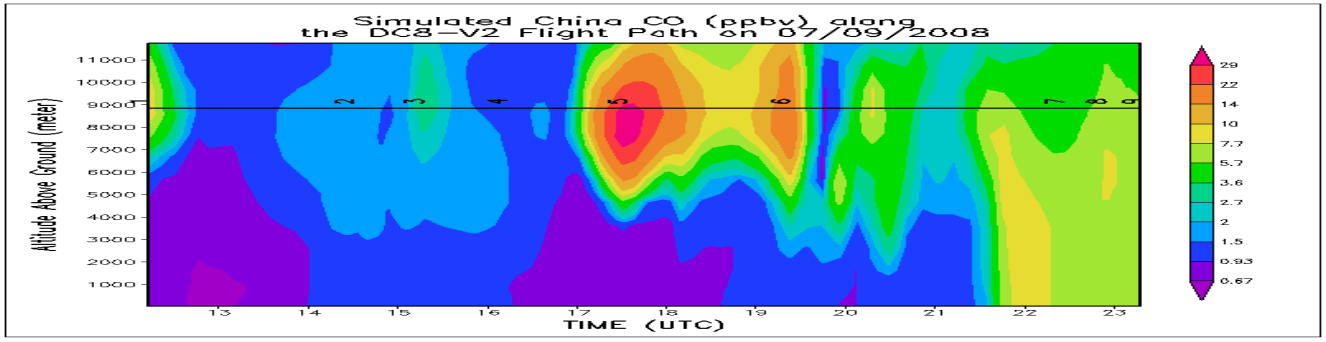


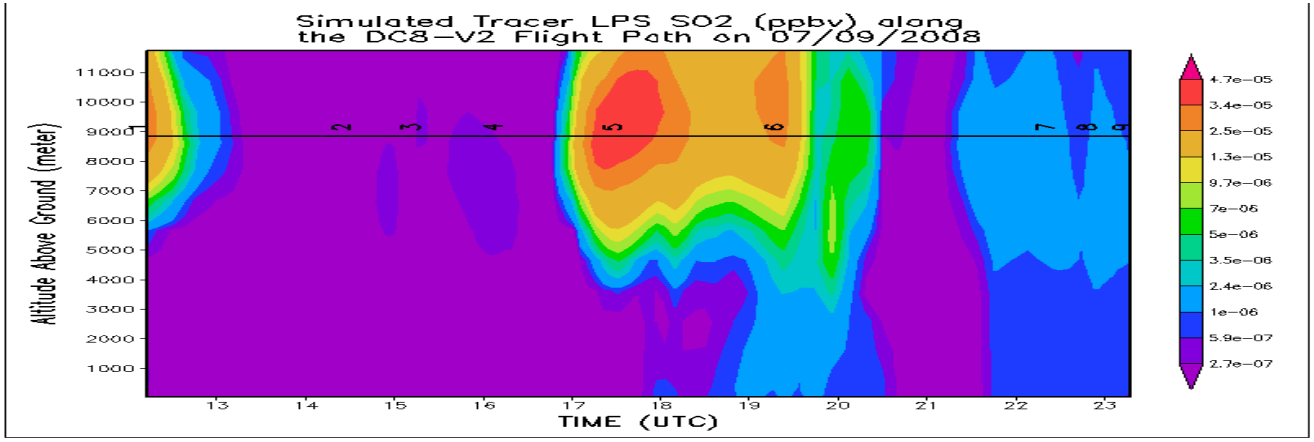




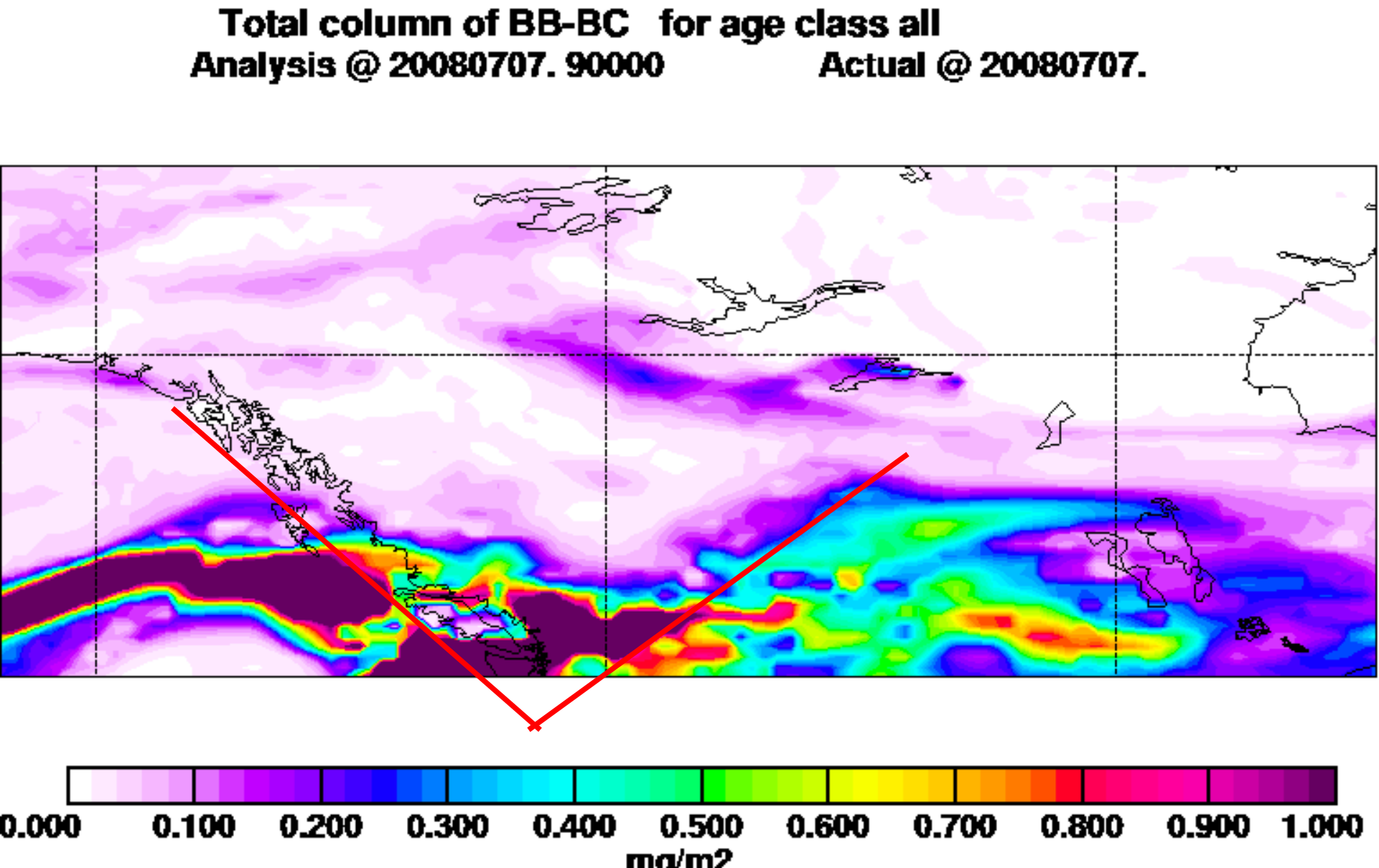


DC8 Return July 9

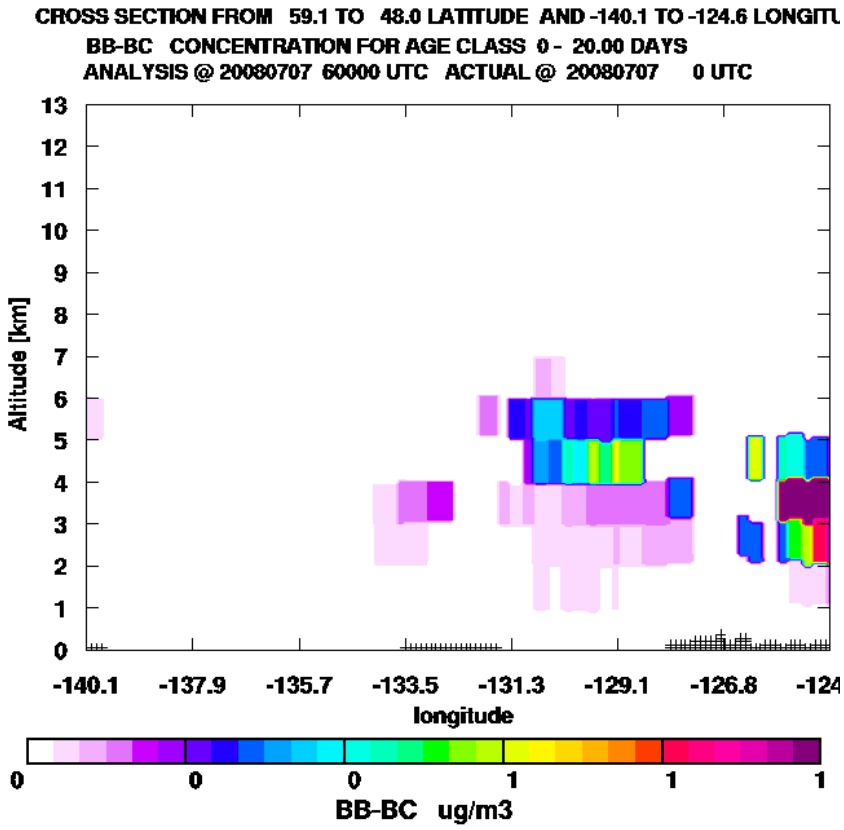


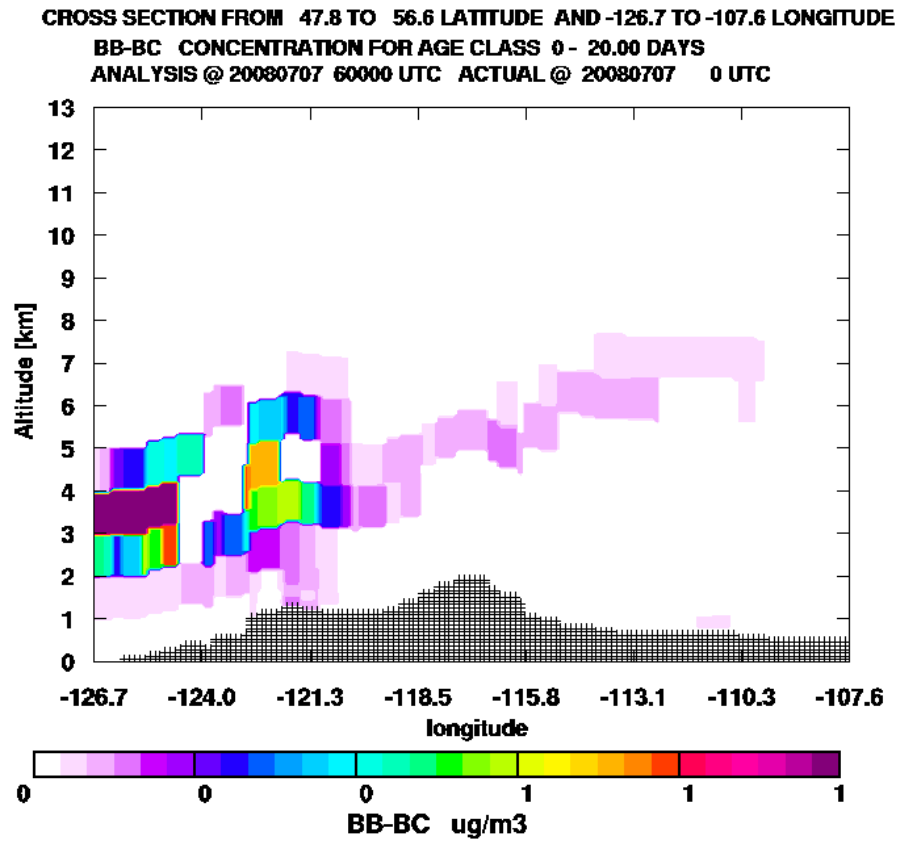


P3 Tracers: BC (wet dep)

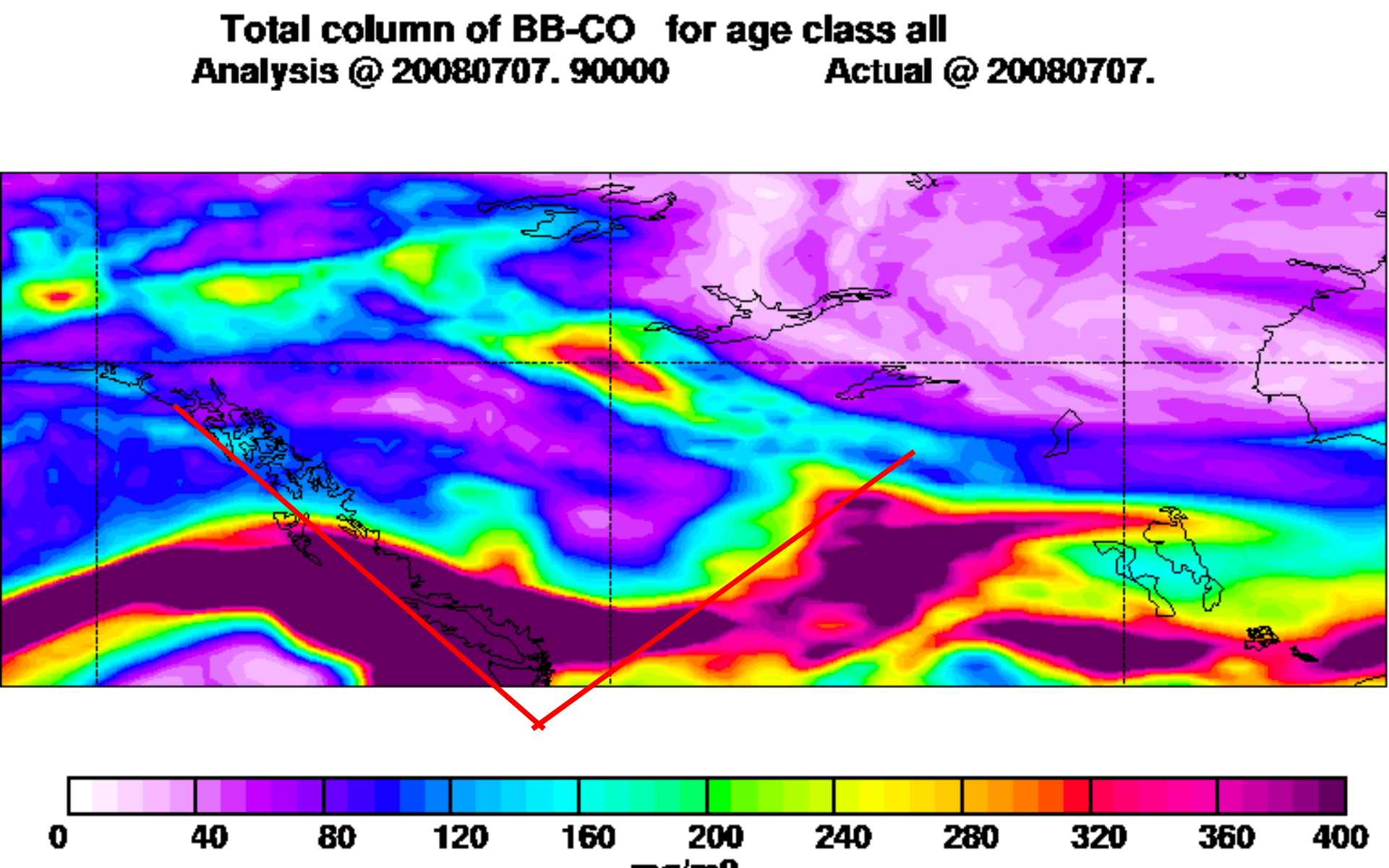


P3 Tracers: BC (wet dep)

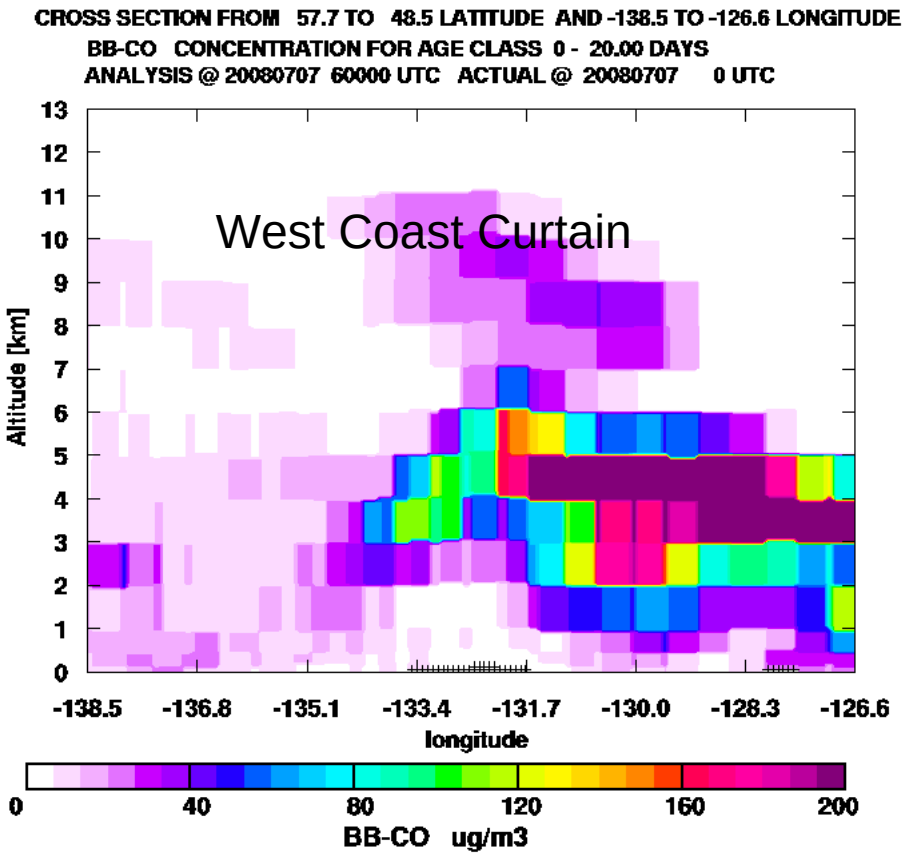


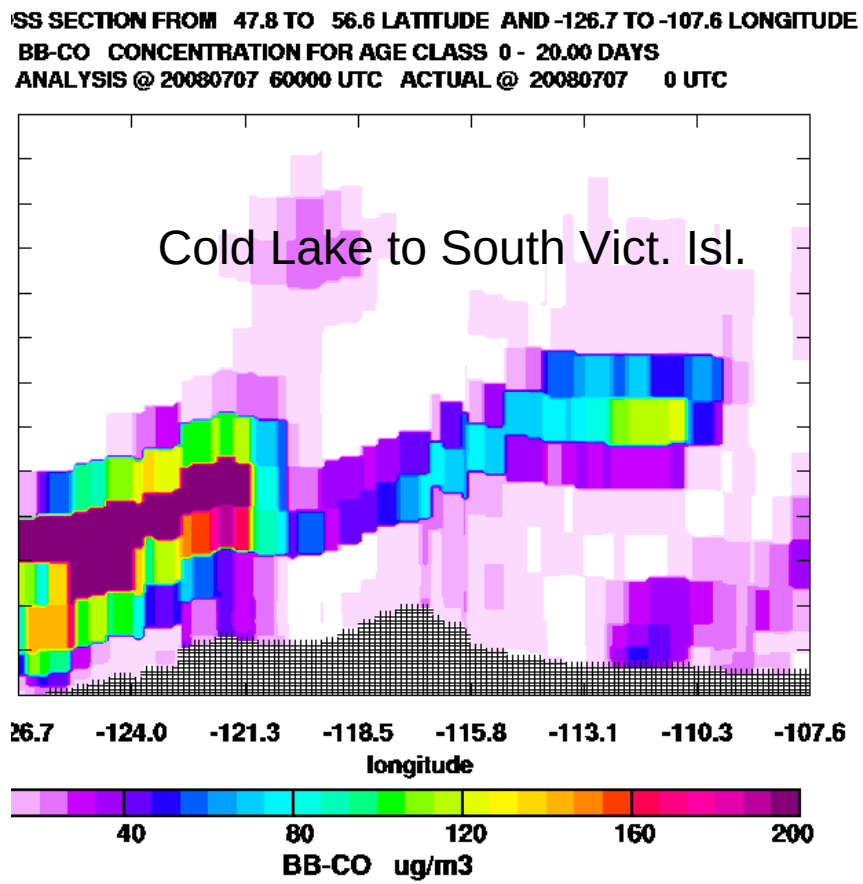


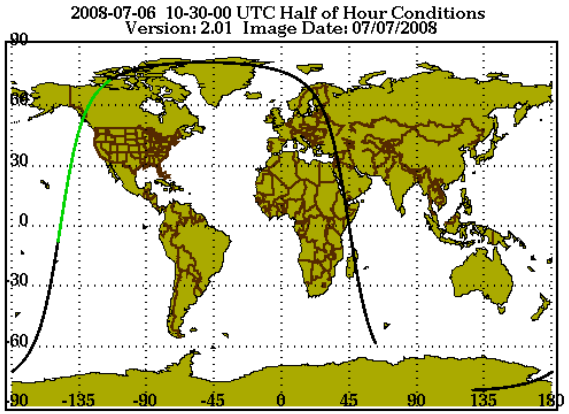
P3 Tracers: CO (purely passive)



P3 Tracers : CO (purely passive)



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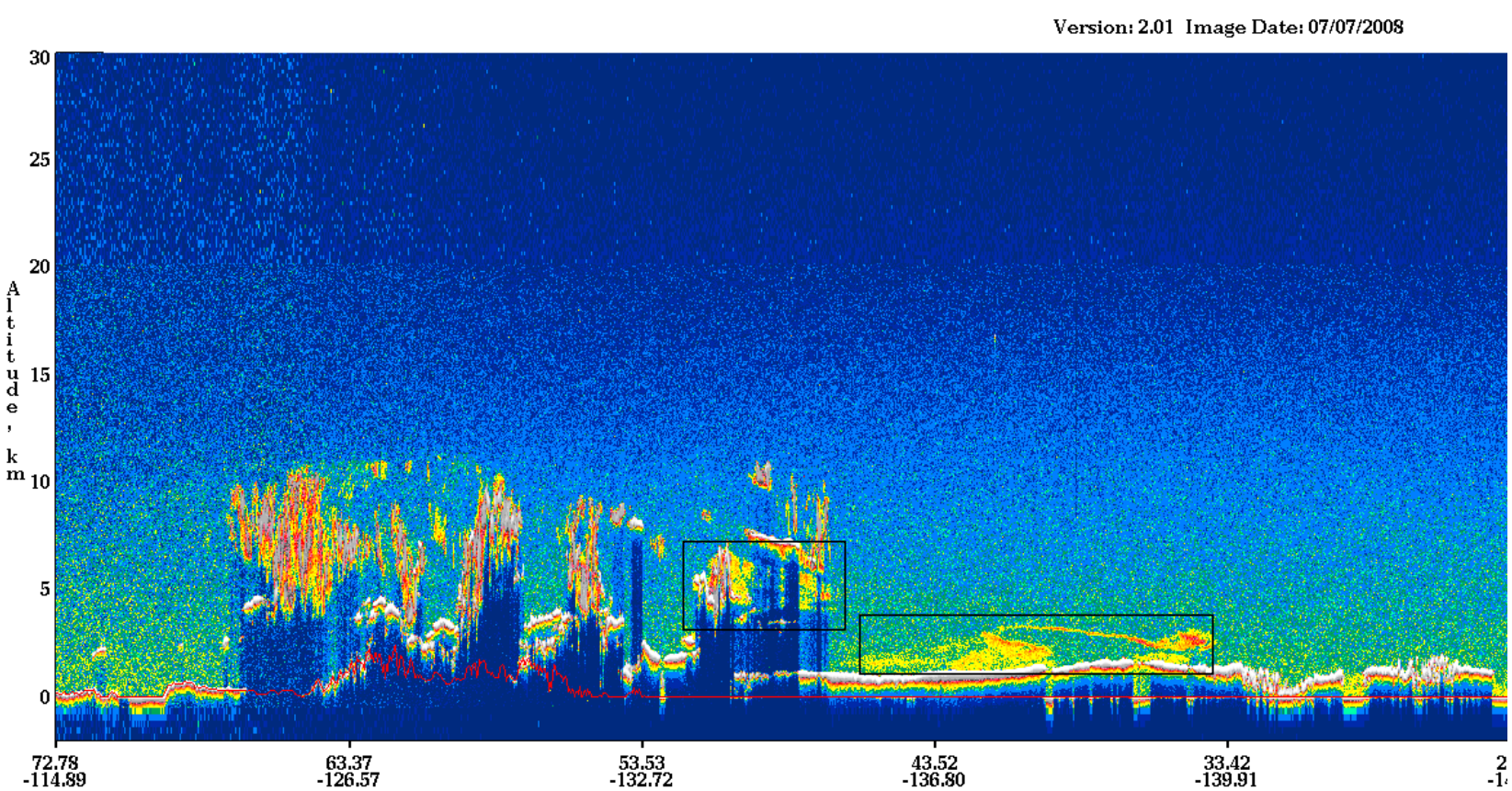
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Version: 2.01 Image Date: 07/07/2008
Altitude, km
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25
20
15
10
5
0
72.78
-114.89
63.37
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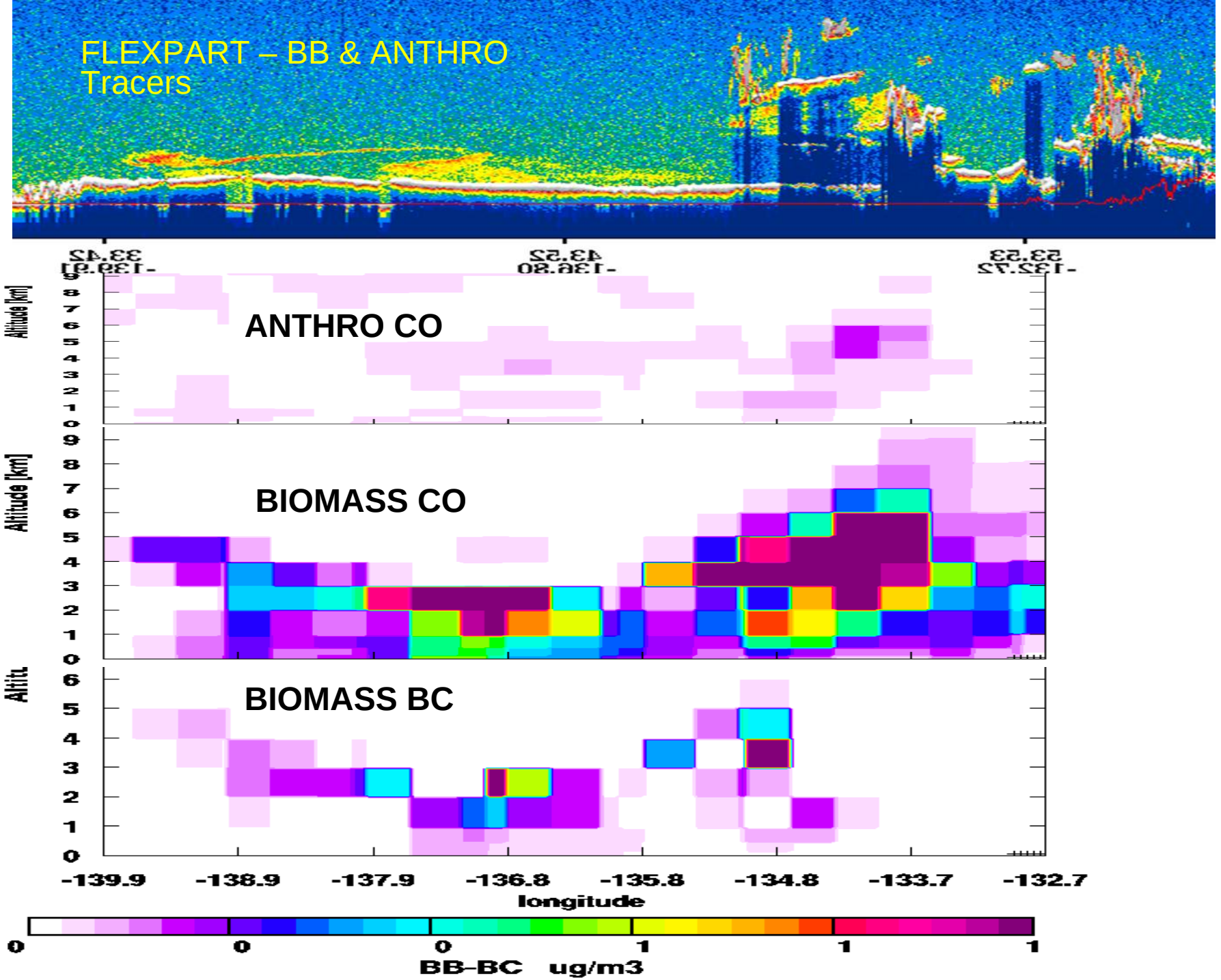
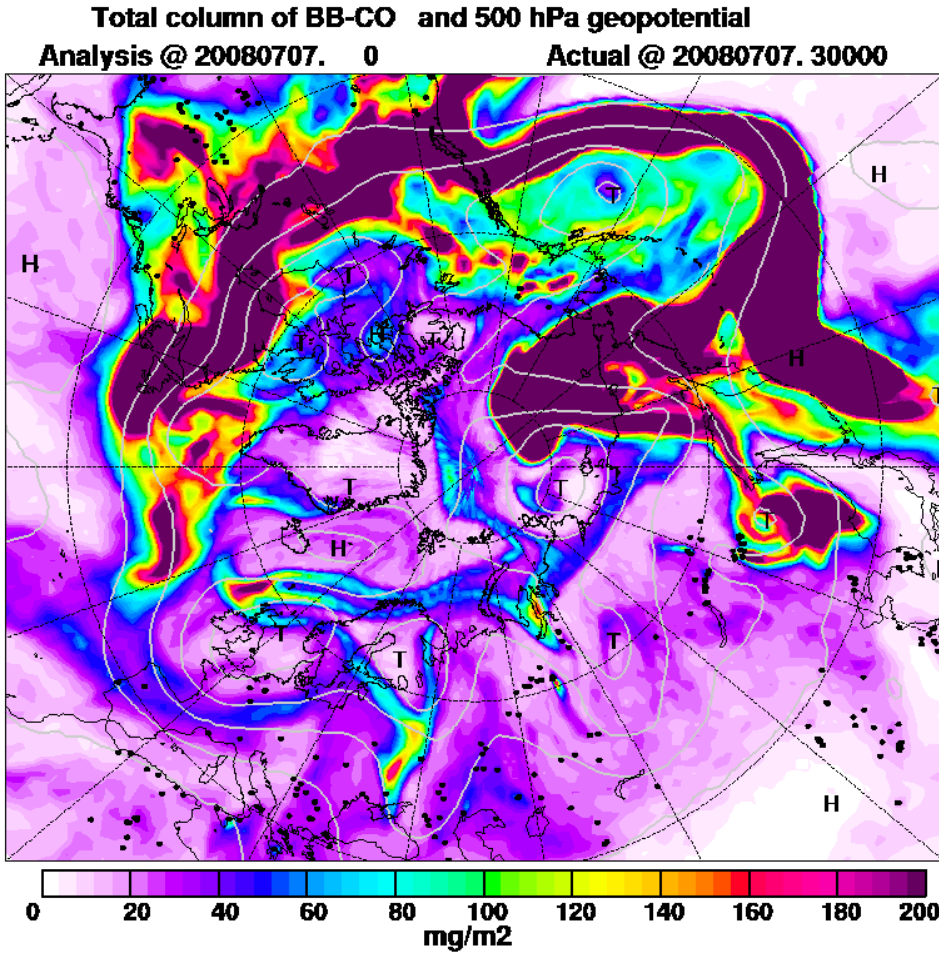
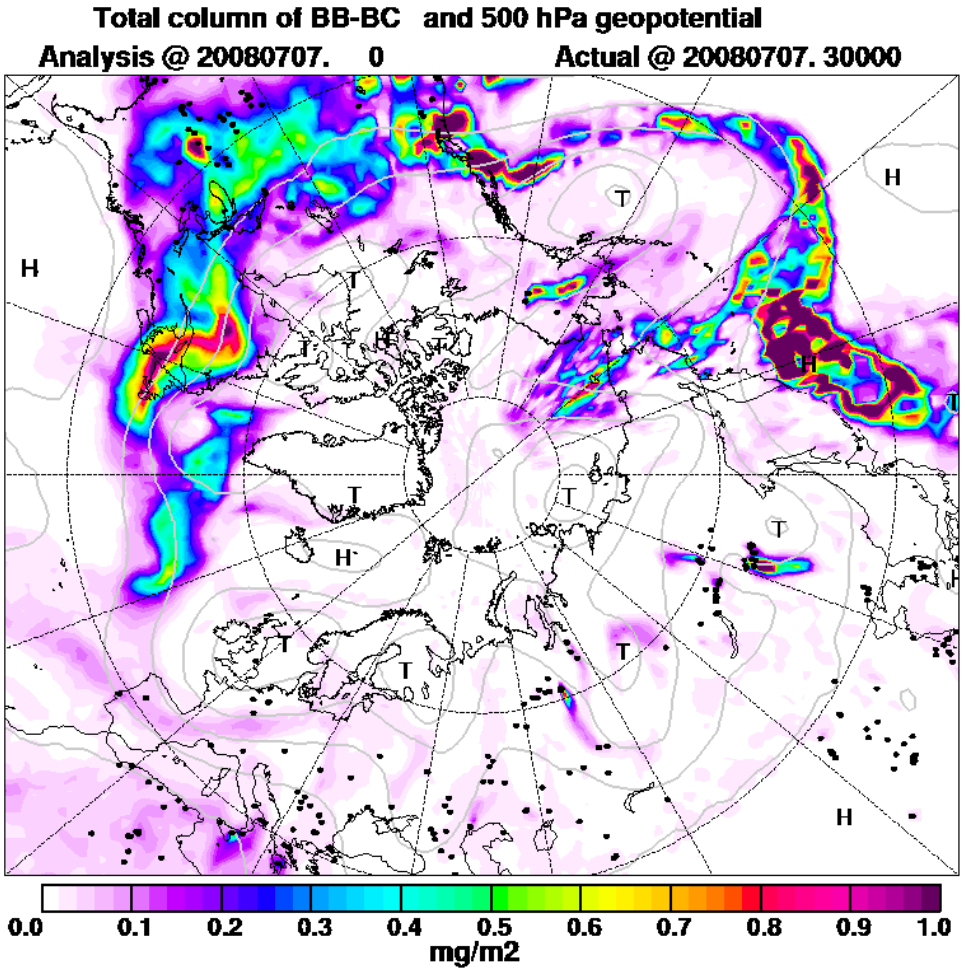
53.53
-132.72
43.52
-136.80
33.42
-139.91

FLEXPART – BB & ANTHRO Tracers

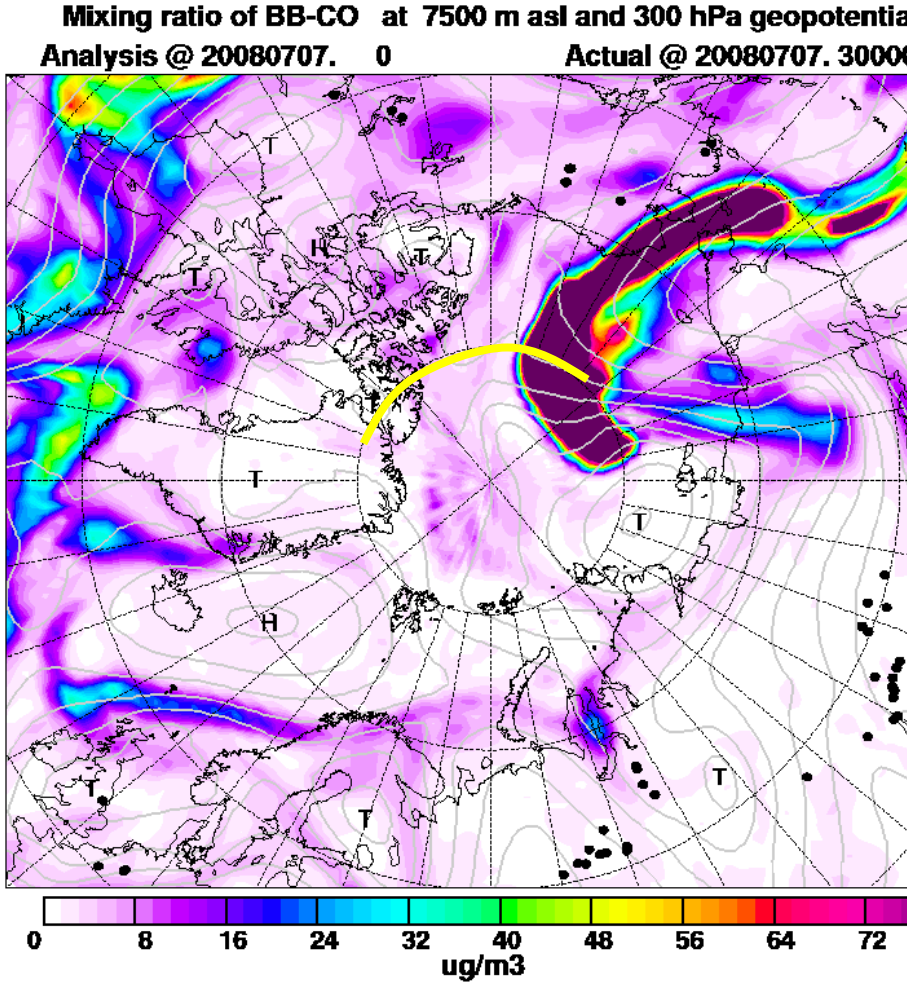


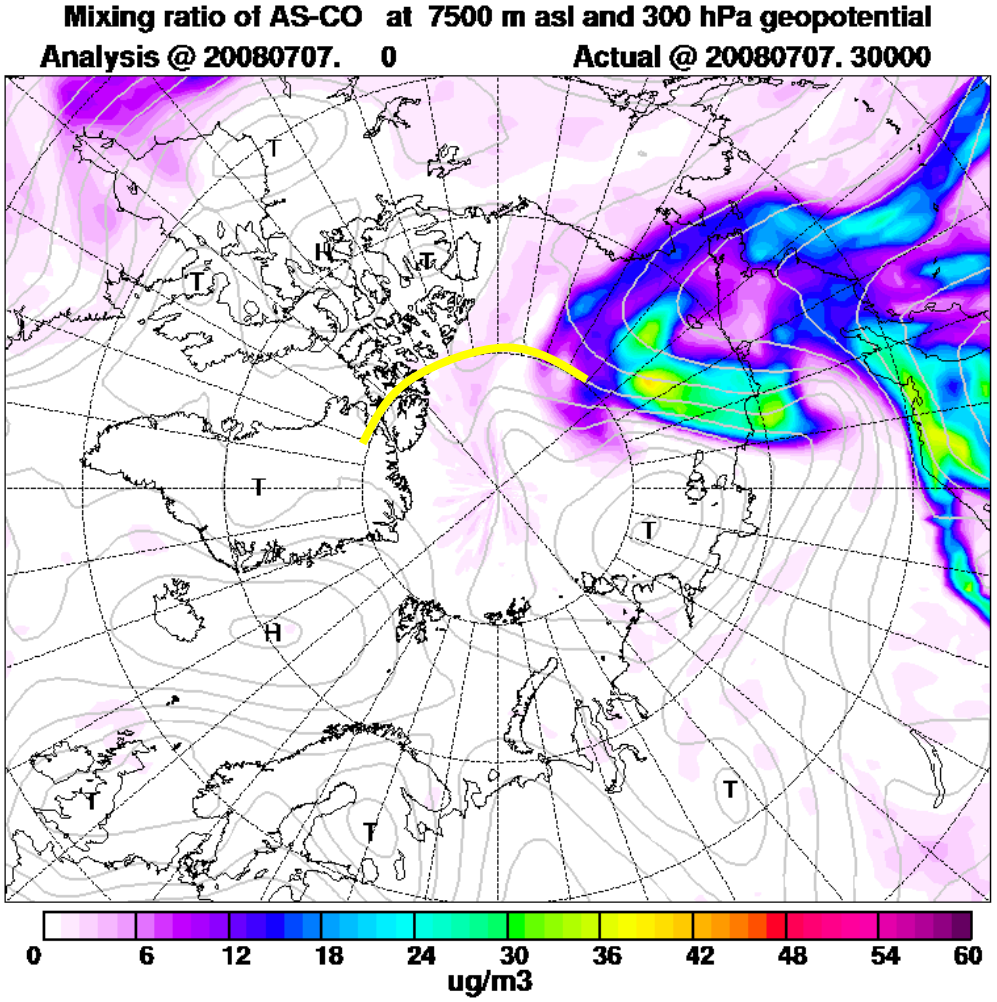
P3 Flight planning, Siberian Plume



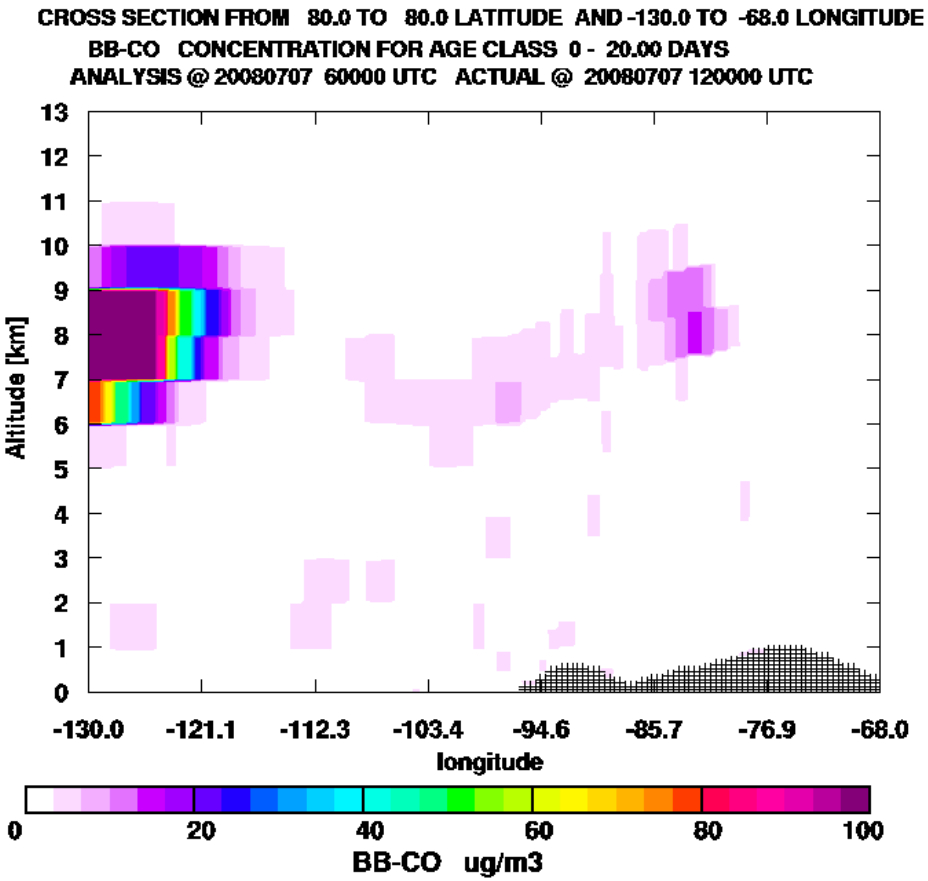


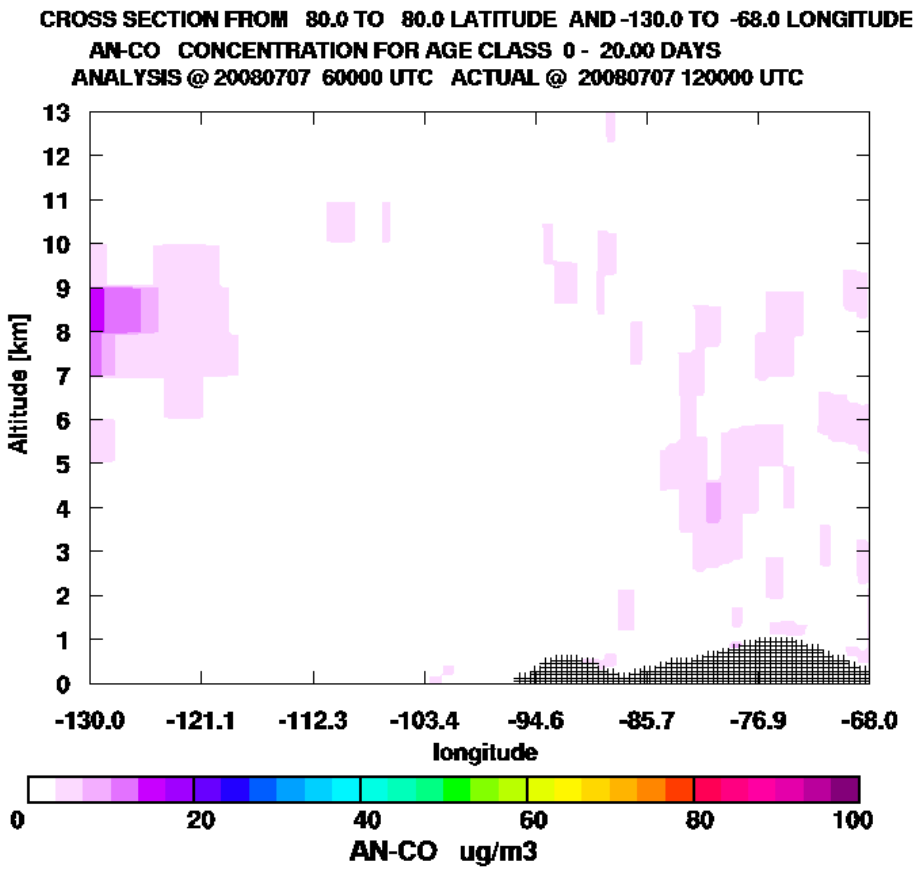
Closer examination of Siberian CO Plume





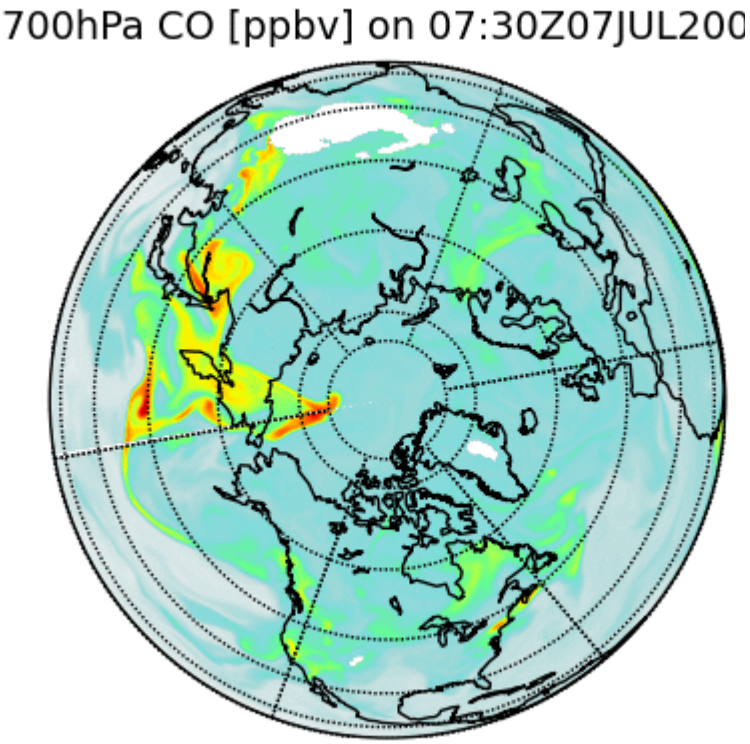
BIOMASS and ASIA CO @ 80N



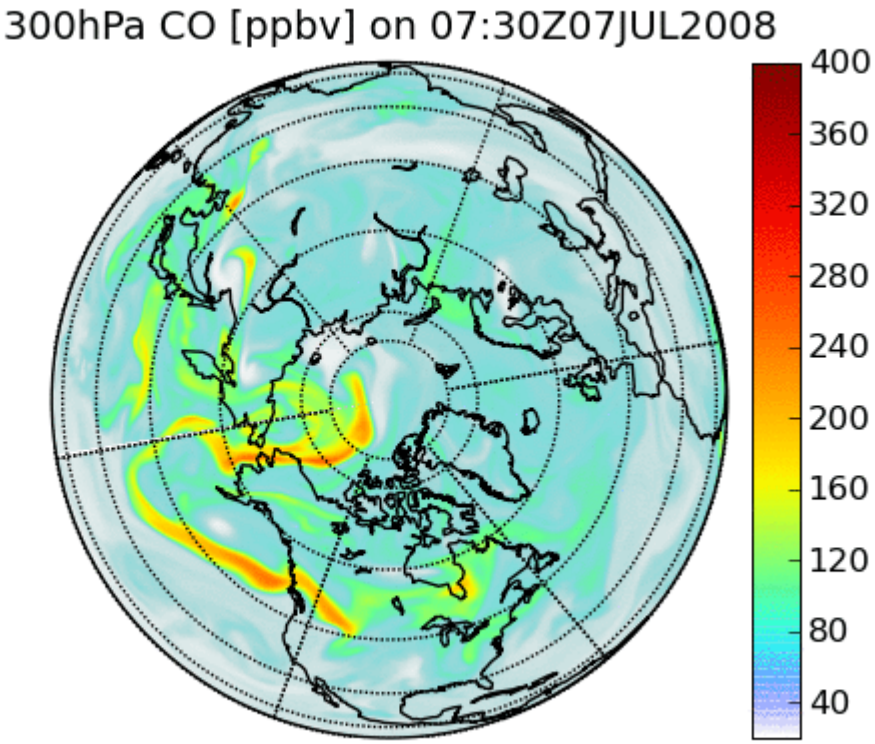


Total CO 5-day Animation: July 7th 06Z

700 mb



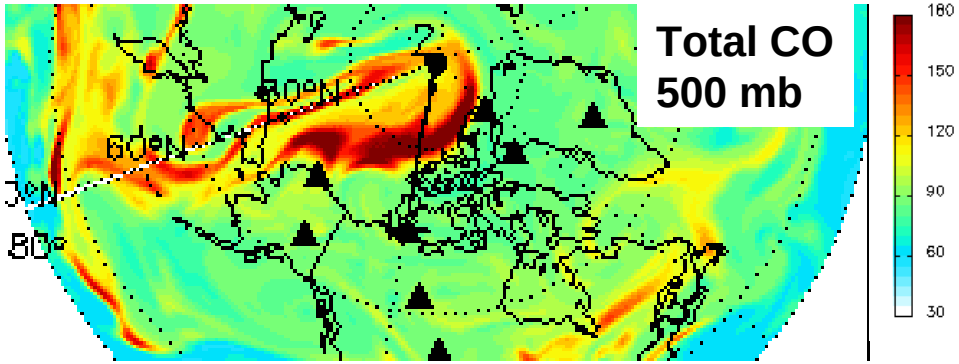
300 mb

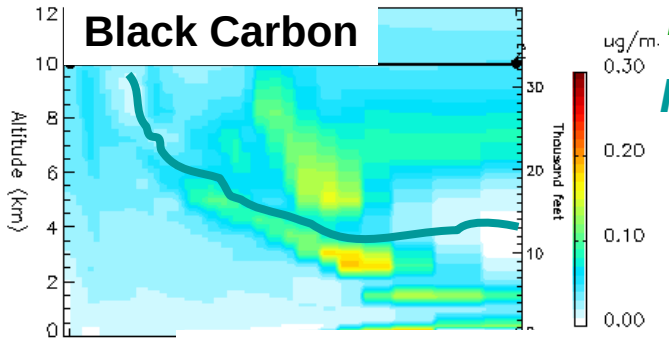


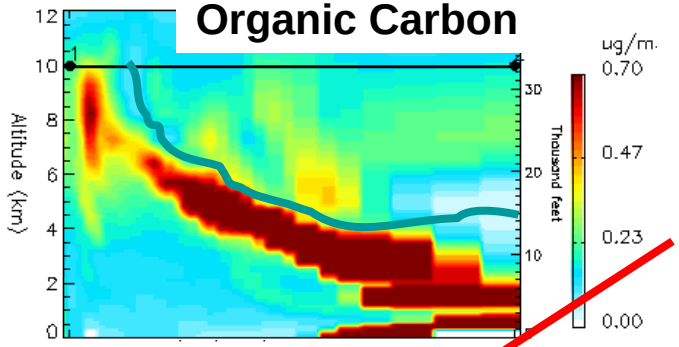
North & South Asian Plumes

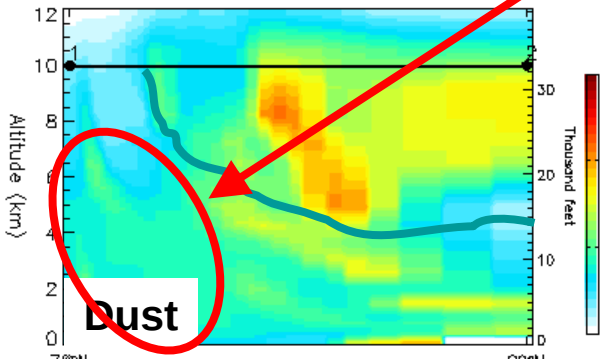
A) North Plume in Arctic – "*spaghetti*"

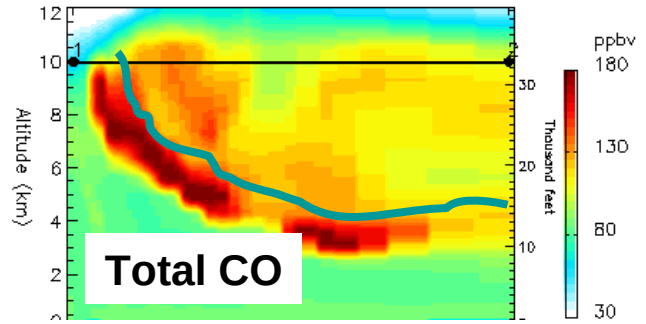
B) South Plume in southern Canada –
more "typical" Asian plume

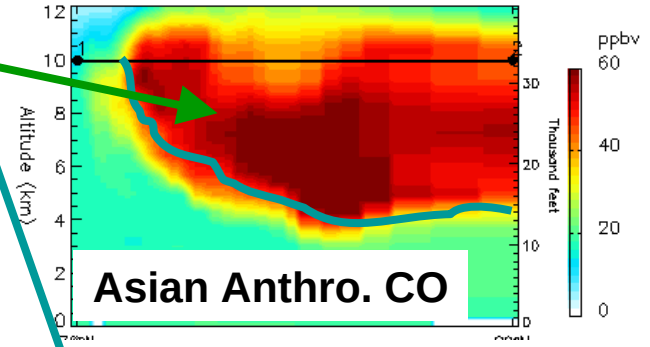


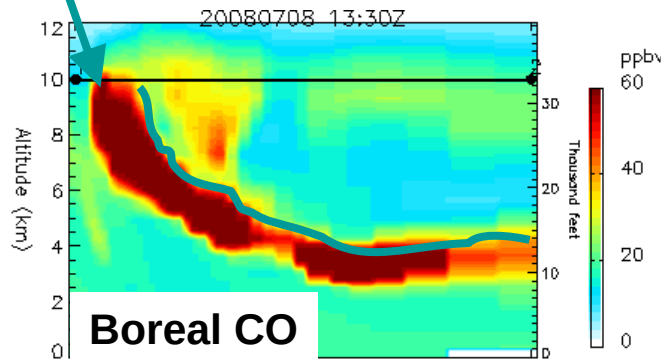










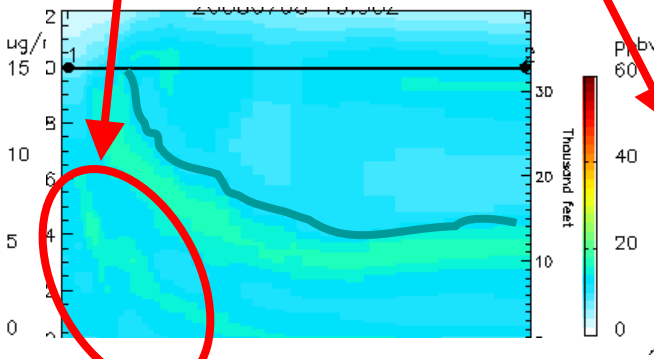


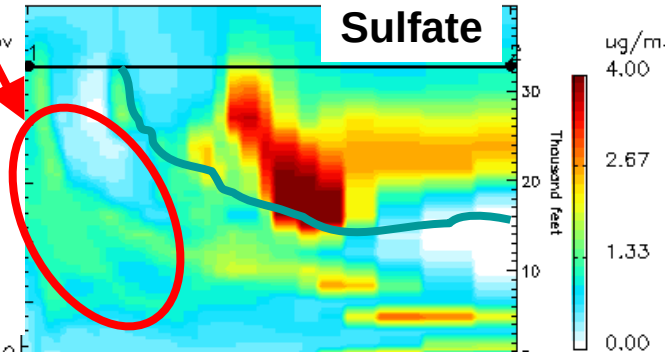
Plume#1: Asian Anthro.

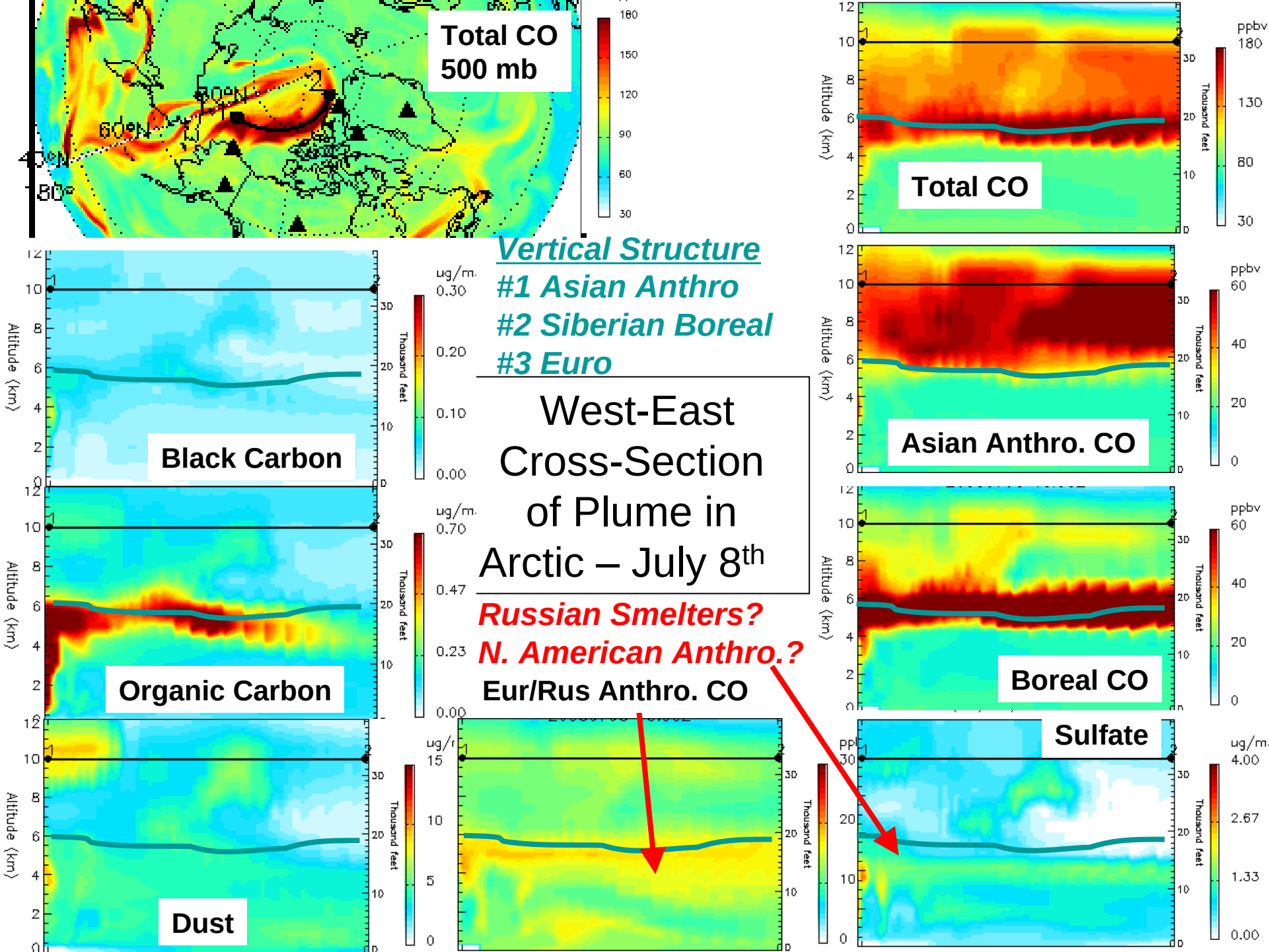
Plume#2: Siberian Boreal

South-North Cross-Section of Plume in Arctic – July 8th

Plume #3: Dust, Russian & Euro. Anthro.



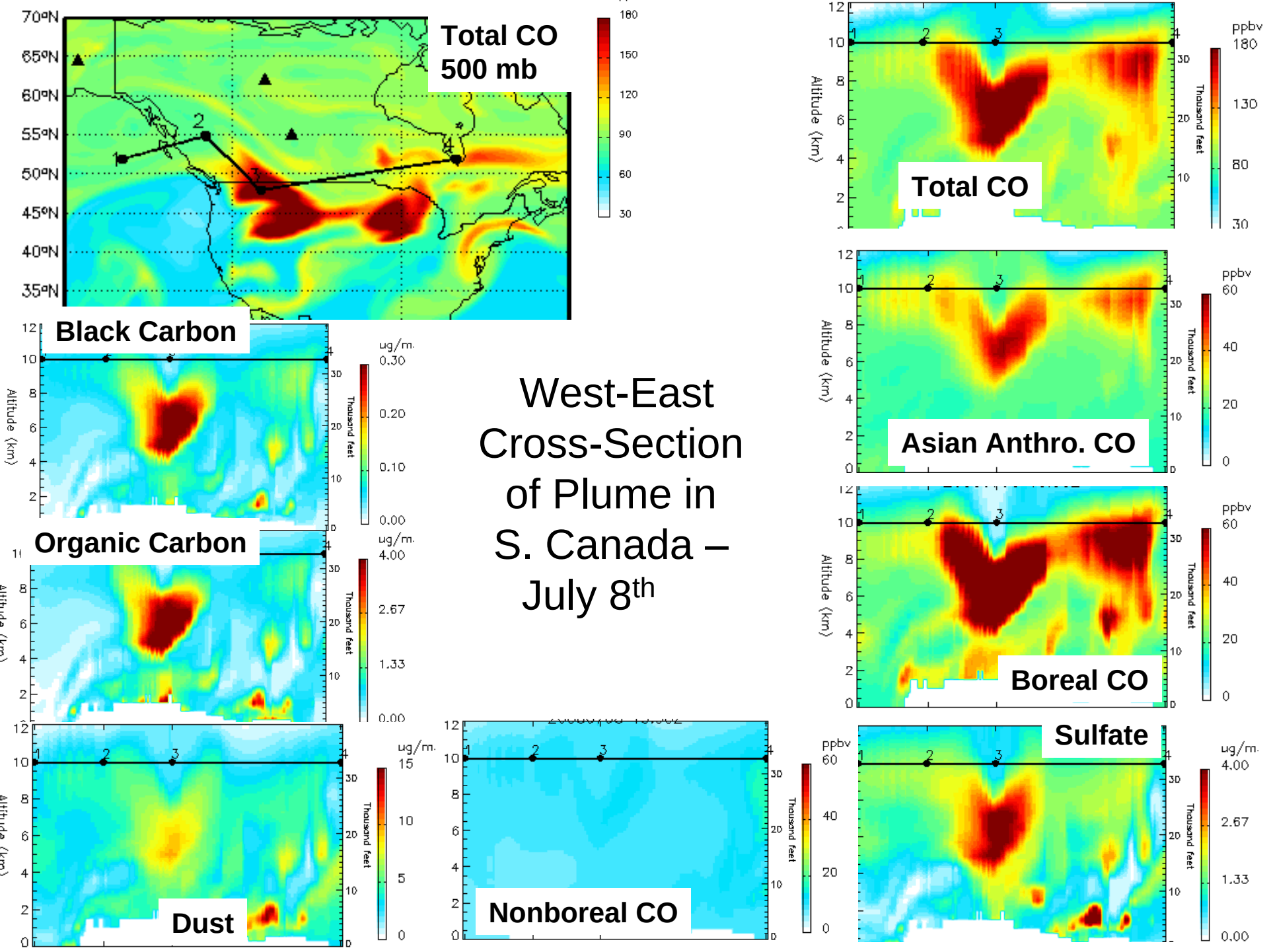



Total CO
500 mb
Total CO
Vertical Structure
#1 Asian Anthro
#2 Siberian Boreal
#3 Euro
West-East Cross-Section of Plume in Arctic – July 8th
Black Carbon
Asian Anthro. CO
Organic Carbon
Boreal CO
Russian Smelters?
N. American Anthro.?
Eur/Rus Anthro. CO
Sulfate
Dust
Altitude (km)
Thousand feet

North & South Asian Plumes

A) North Plume in Arctic – "*spaghetti*"

B) South Plume in southern Canada – *more "typical" Asian plume*

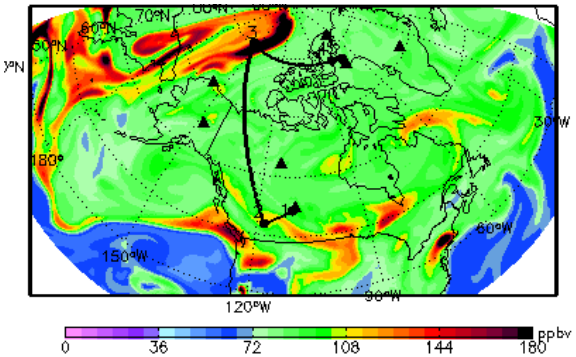


West-East Cross-Section of Plume in S. Canada – July 8th

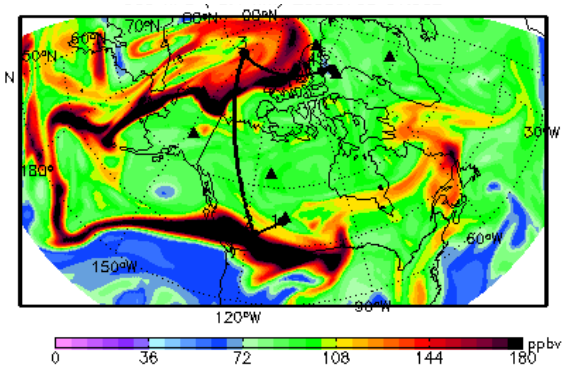
GEOS-5 7/8/08
To Thule –CO

Multi-layer CO with diff. origins at diff. altitudes with mixing

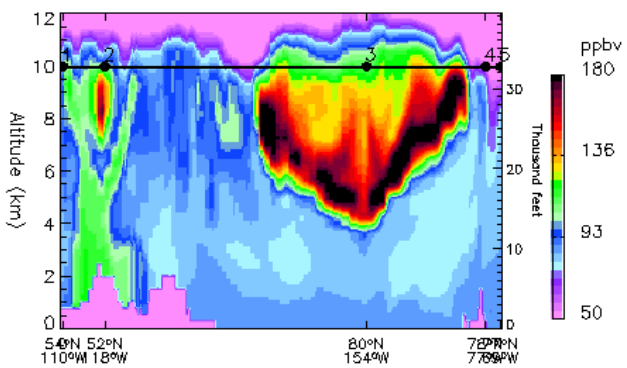
CO at 5 km



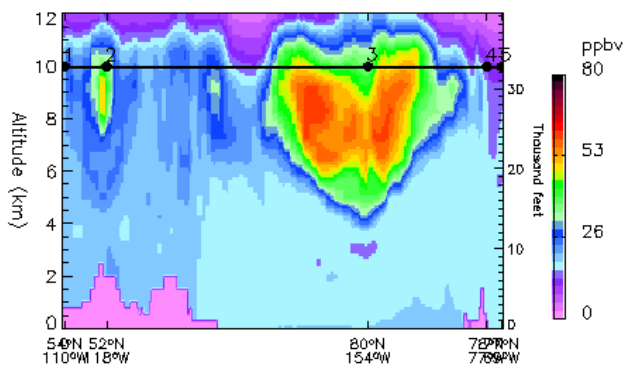
CO at 8 km



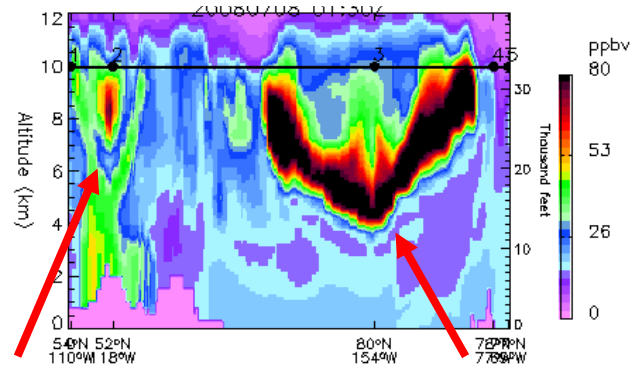
Total CO



Asian anthro CO



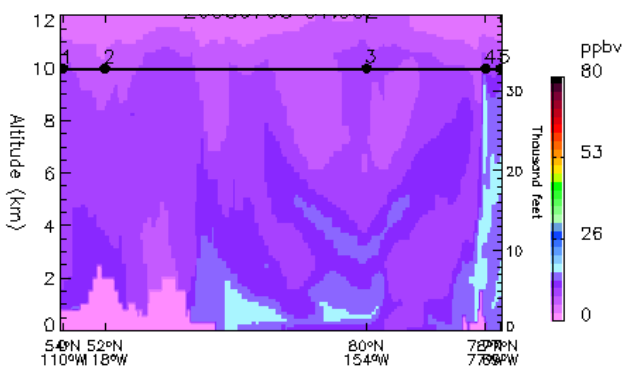
Boreal bb CO



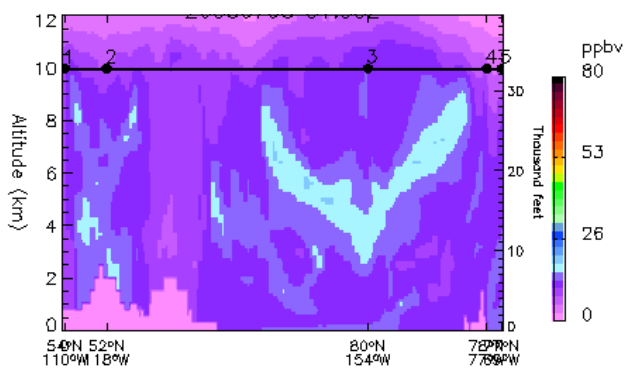
S. Plume

N. Plume

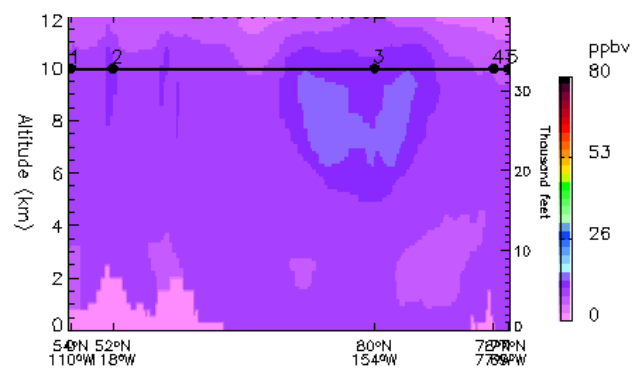
N. Amer. Anthro CO



European/Russia anthro CO

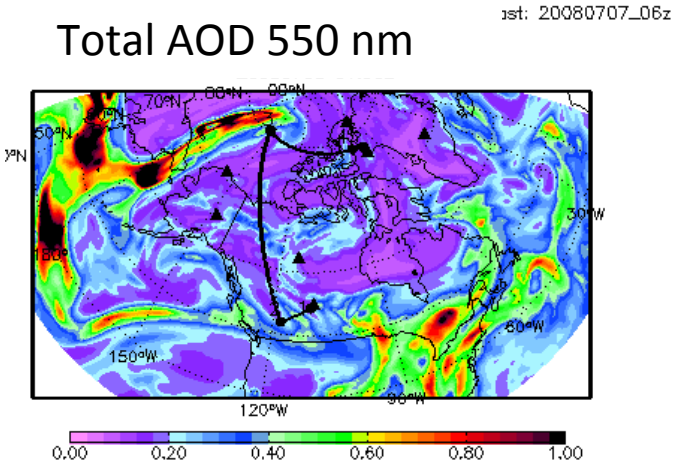


Non-boreal bb CO

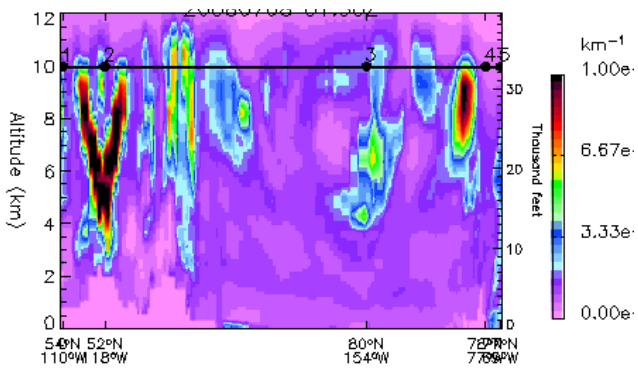


GEOS-5 7/8/08 To Thule –Aerosols

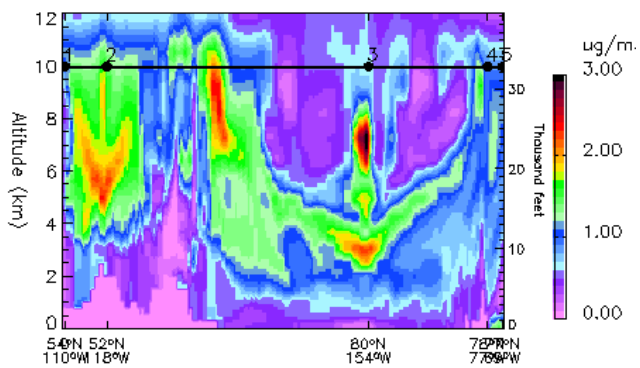
Total AOD 550 nm



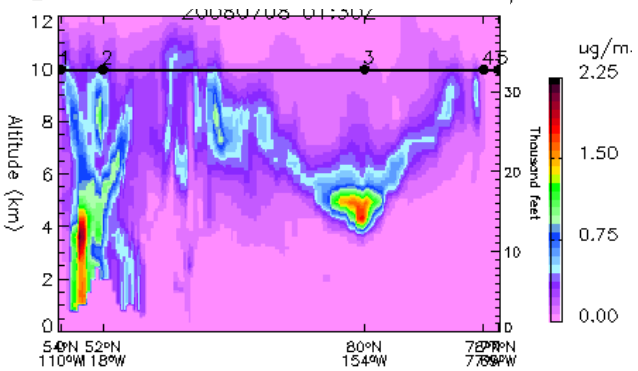
Total aerosol ext. 532



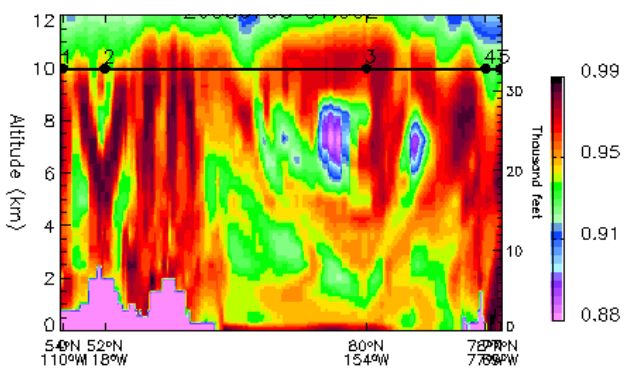
Sulfate concentration



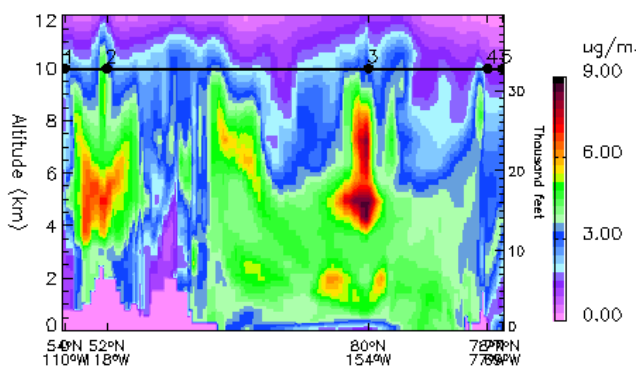
Boreal bb OC conc.



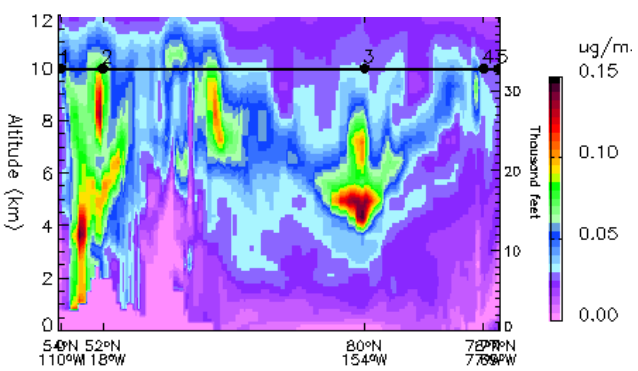
Single scat. albedo 532



Dust concentration



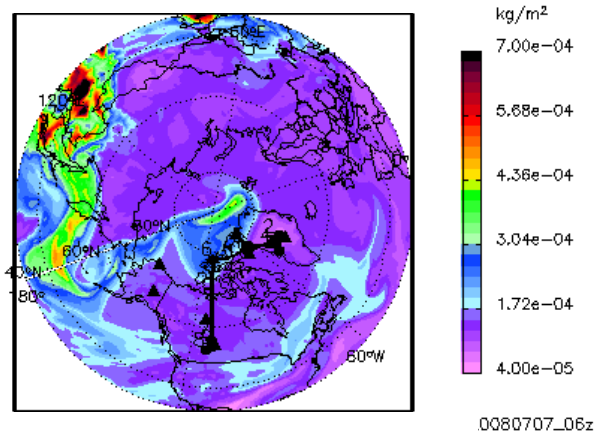
BC concentration



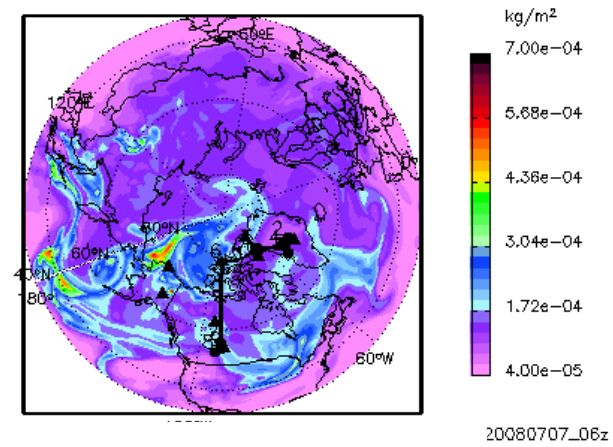
GEOS-5 7/9/08 From Thule –CO

Asian airmass over Arctic, max 6-9 km. Boreal bb at lower km with higher CO

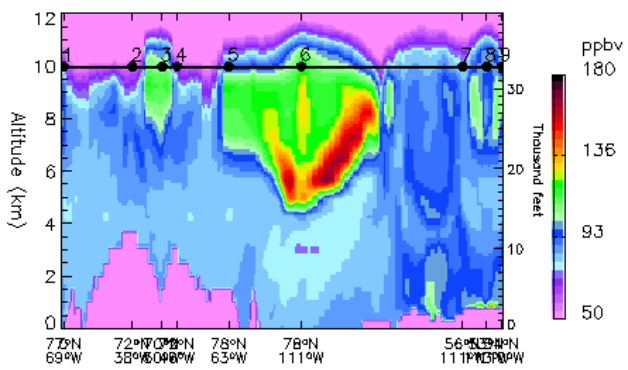
Asian anthro column



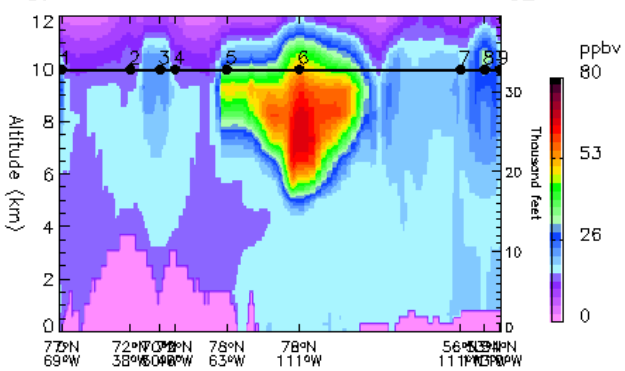
Boreal bb CO column



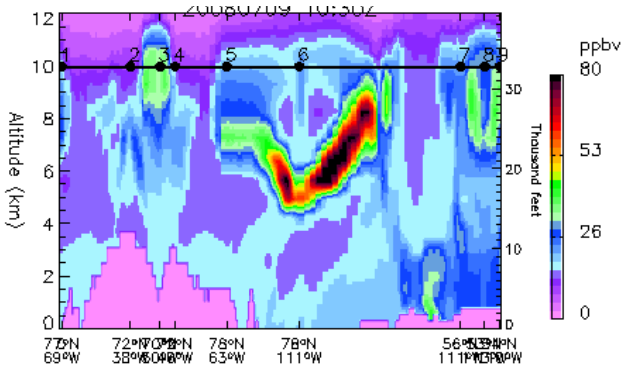
Total CO



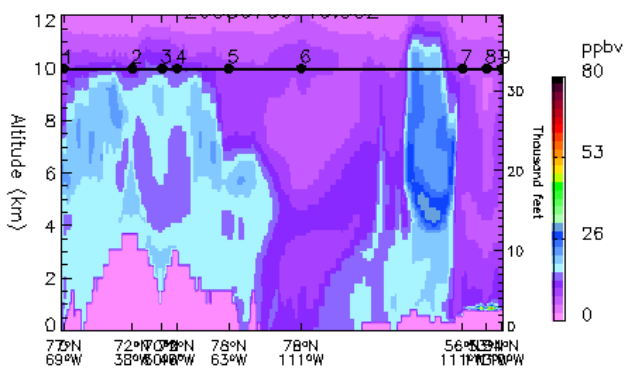
Asian anthro CO



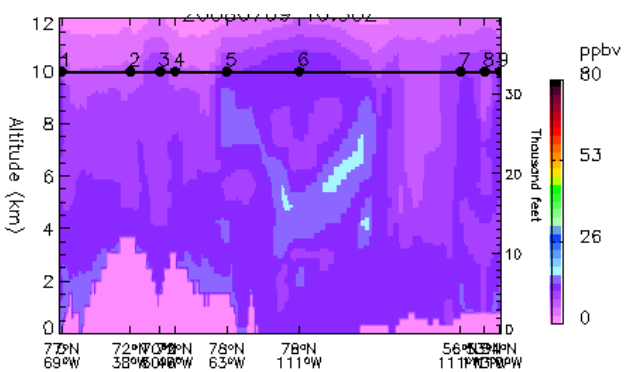
Boreal bb CO



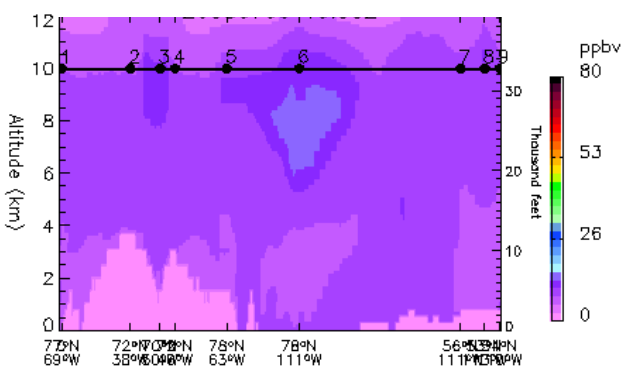
N. Amer. Anthro CO



European/Russia anthro CO

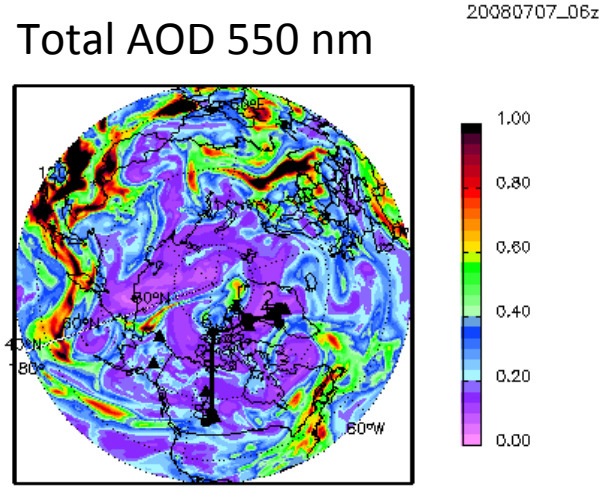


Non-boreal bb CO

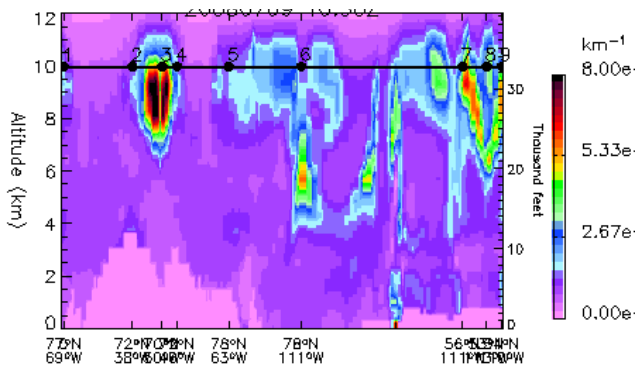


GEOS-5 7/9/08 from Thule –Aerosols

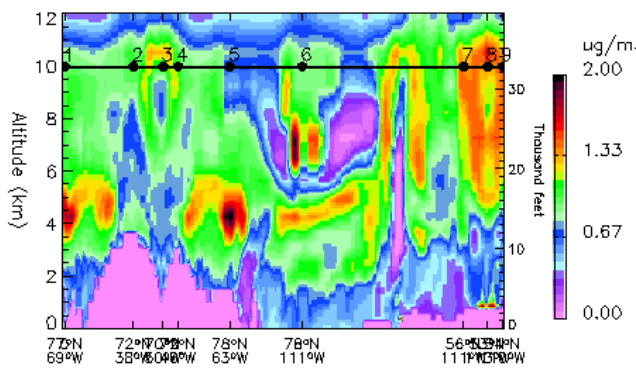
Total AOD 550 nm



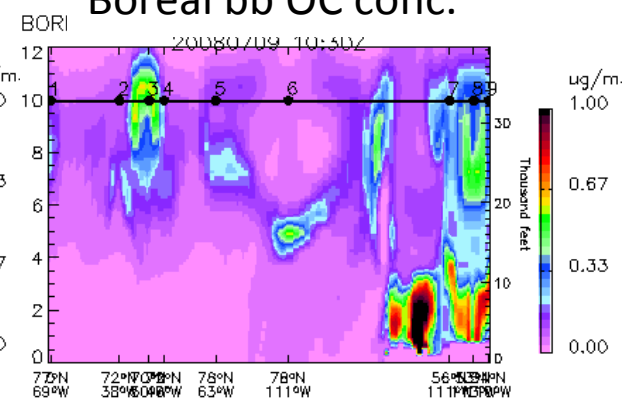
Total aerosol ext. 532



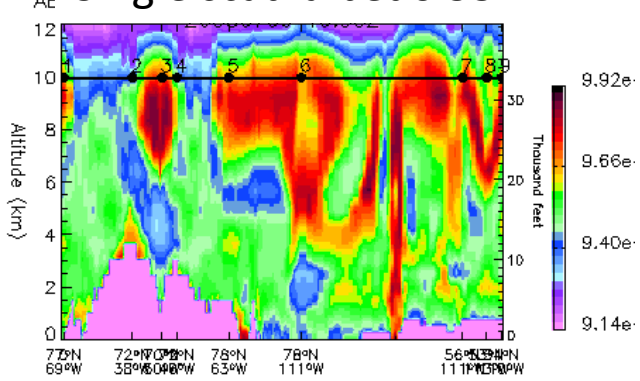
Sulfate concentration



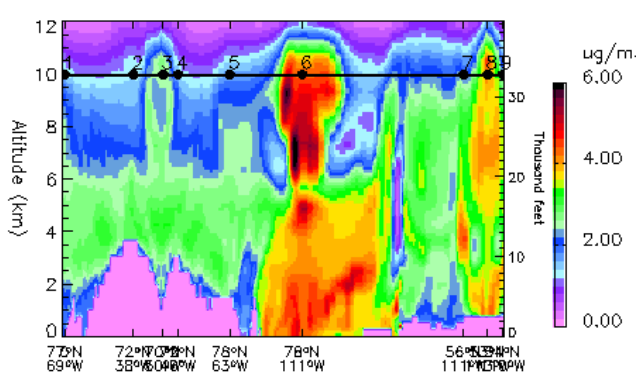
Boreal bb OC conc.



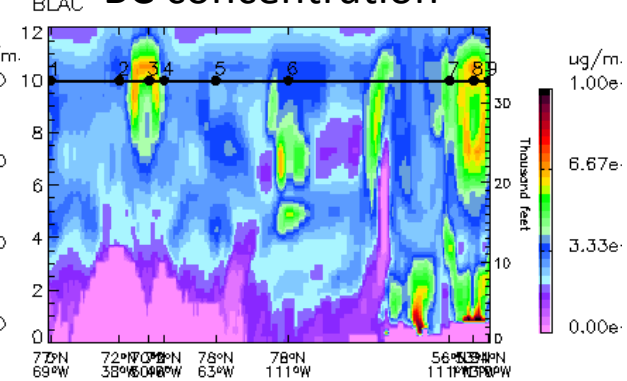
Single scat. albedo 532



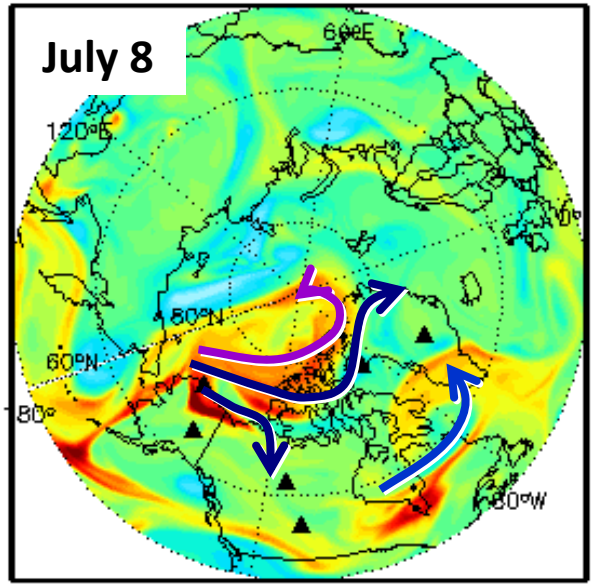
Dust concentration

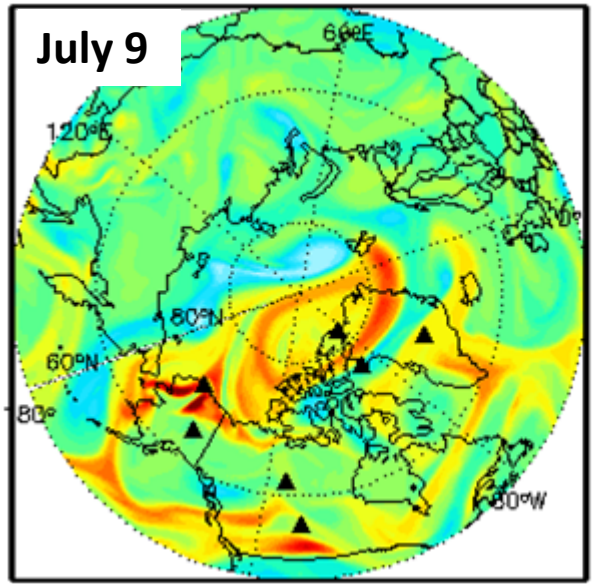


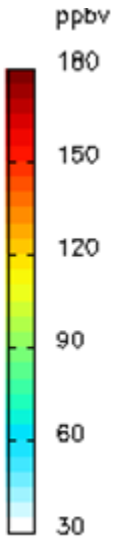
BC concentration



GEOS5 Outlook for next four days – Total CO @ 300 hPa



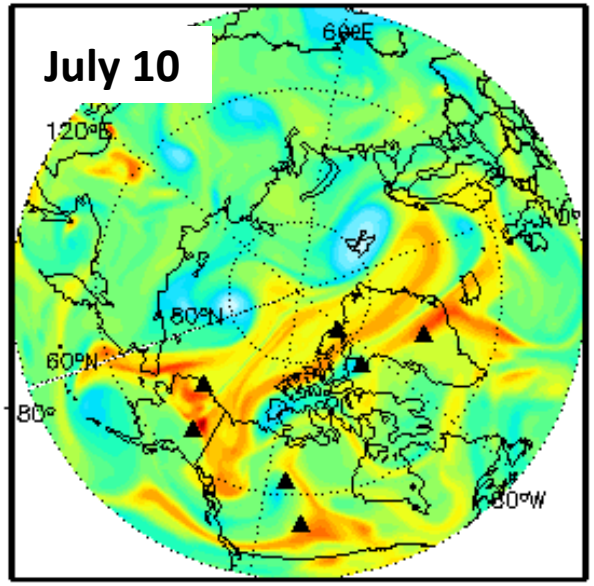


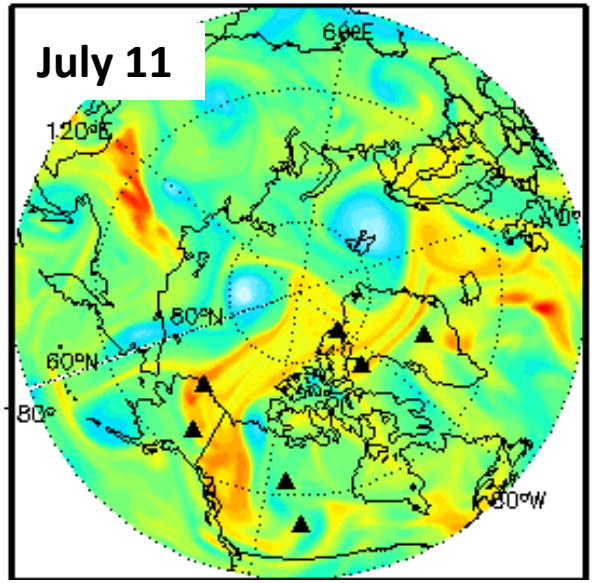


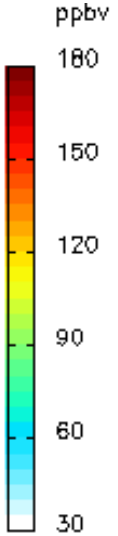
Asian plumes circulate over the Arctic for several days

Siberian biomass burning plume: N. Branch advects to Greenland, S. Branch advects south to Yukon/BC.

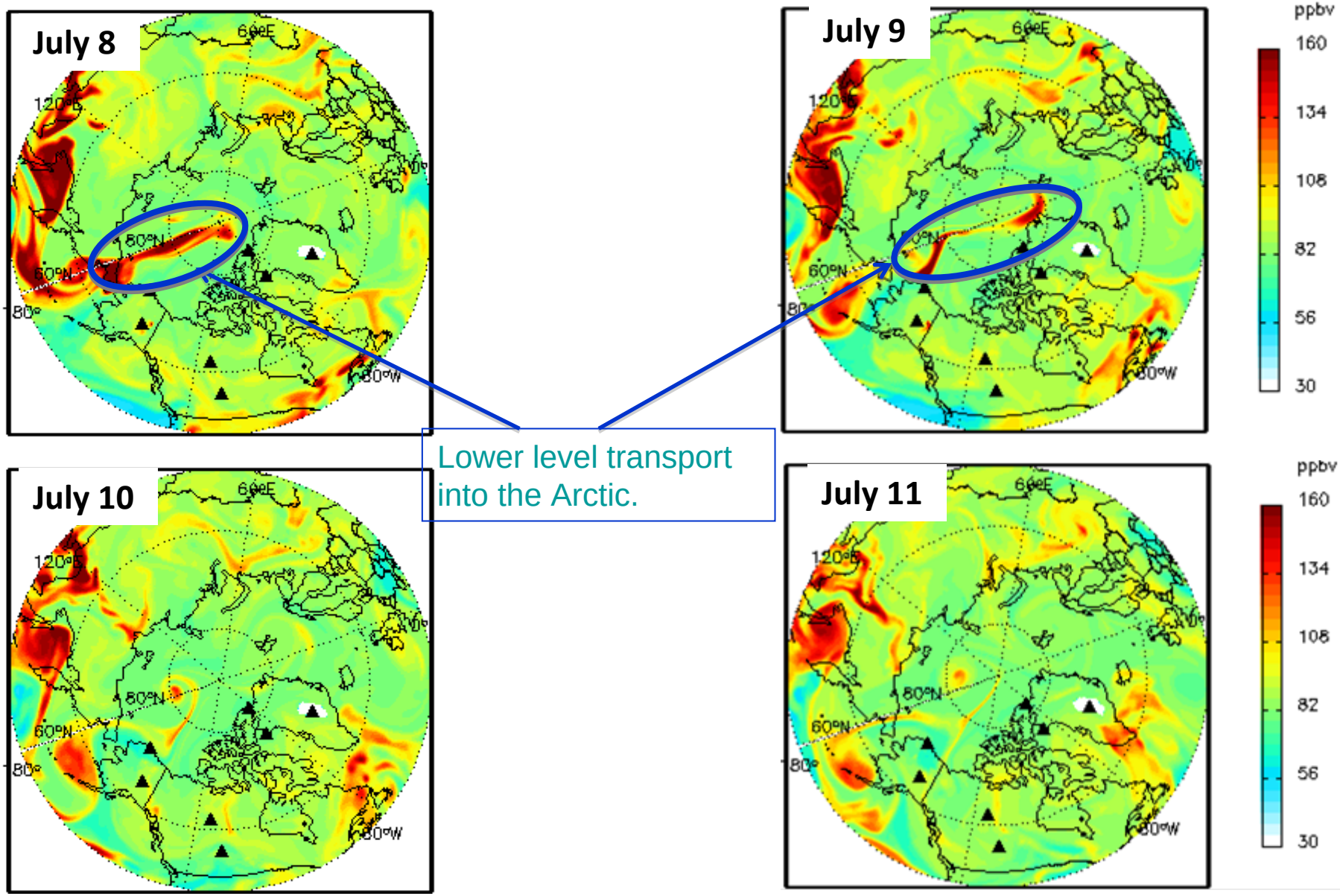
N. Am. outflow (pollution and fires) to Atlantic/S. Greenland.



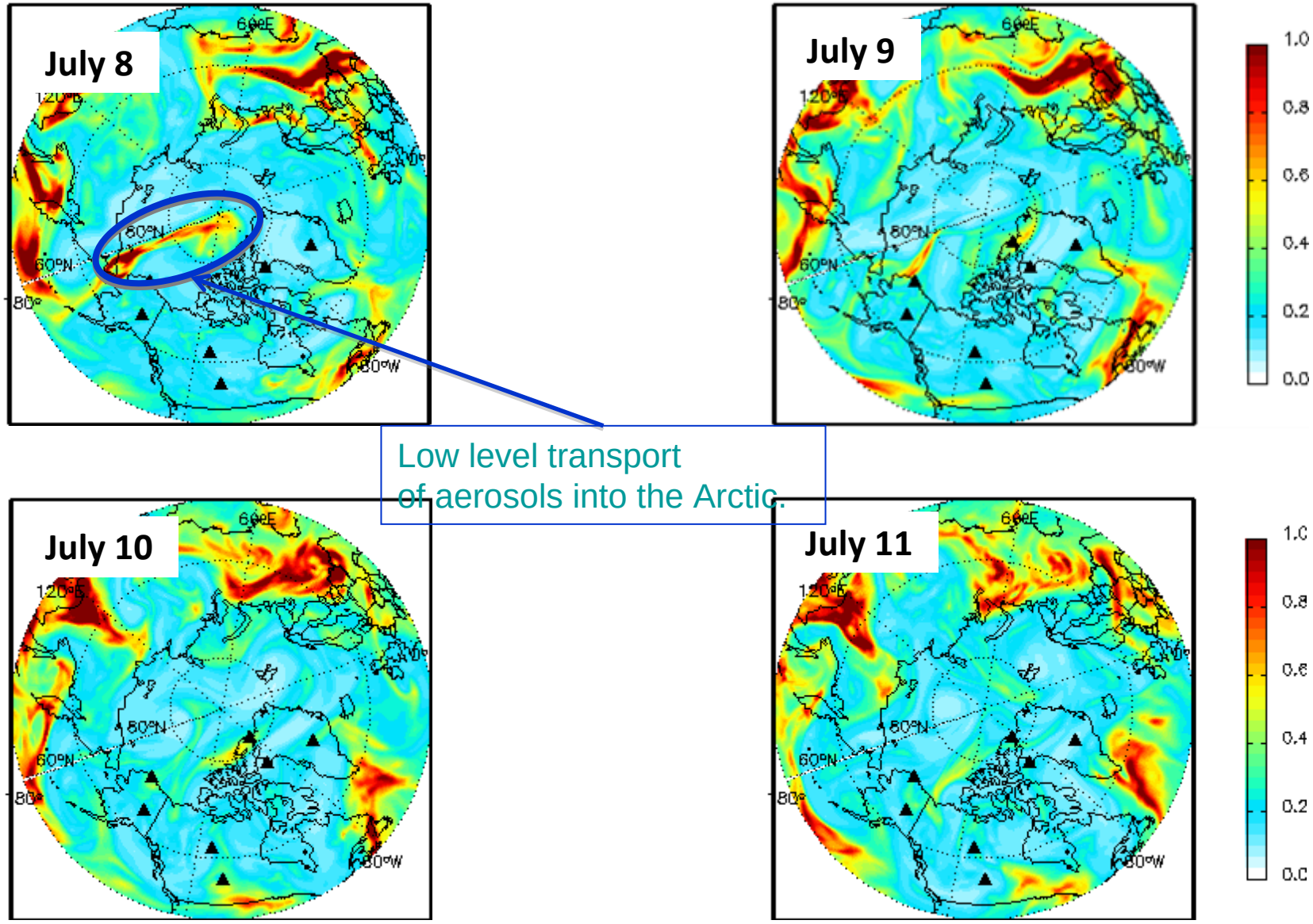




GEOS5 Outlook for next four days – Total CO @ 700 hPa



GEOS5 Outlook for next four days – AOT



Low level transport
of aerosols into the Arctic.