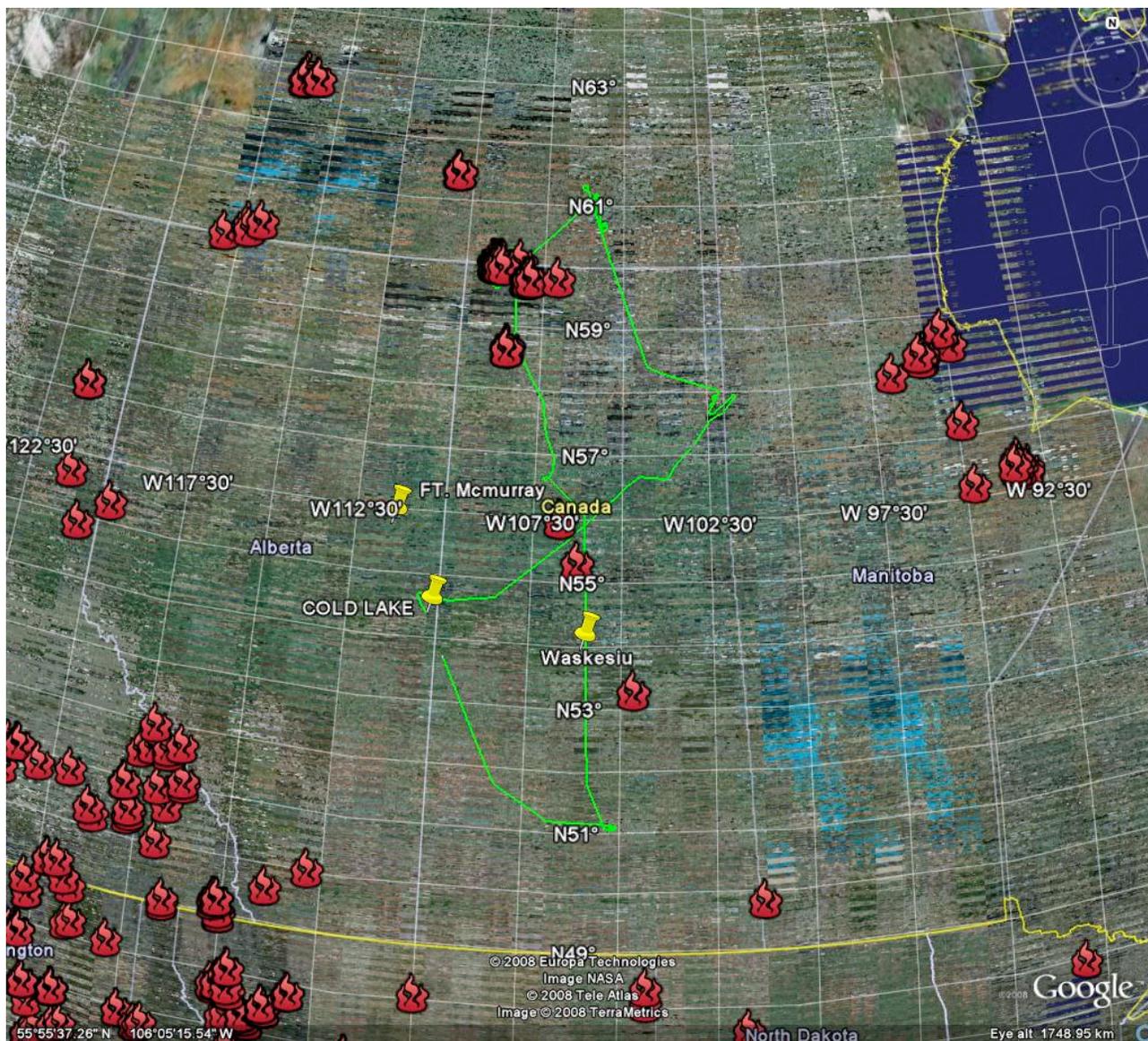


**Flight Report**  
**ARCTAS P-3B Data Flight 22, flown July 9 2008 (ARCTAS Summer)**  
Submitted by Antony Clarke

**Objectives**

- 1) **TERRA-MISR underpass (17:51 UT) over Reindeer Lake in aged plumes.**
- 2) **Coordination with B200 for CALIPSO underpass (19:38 UT) in Athabaska fire plume.**
- 3) **Stacked radiation closure in plumes along CALIPSO track**
- 4) **Validation of COAMPS predicted Athabaska plume direction and intensity**
- 5) **Validation of model predicted long range transport over southern Saskatchewan, 51N**

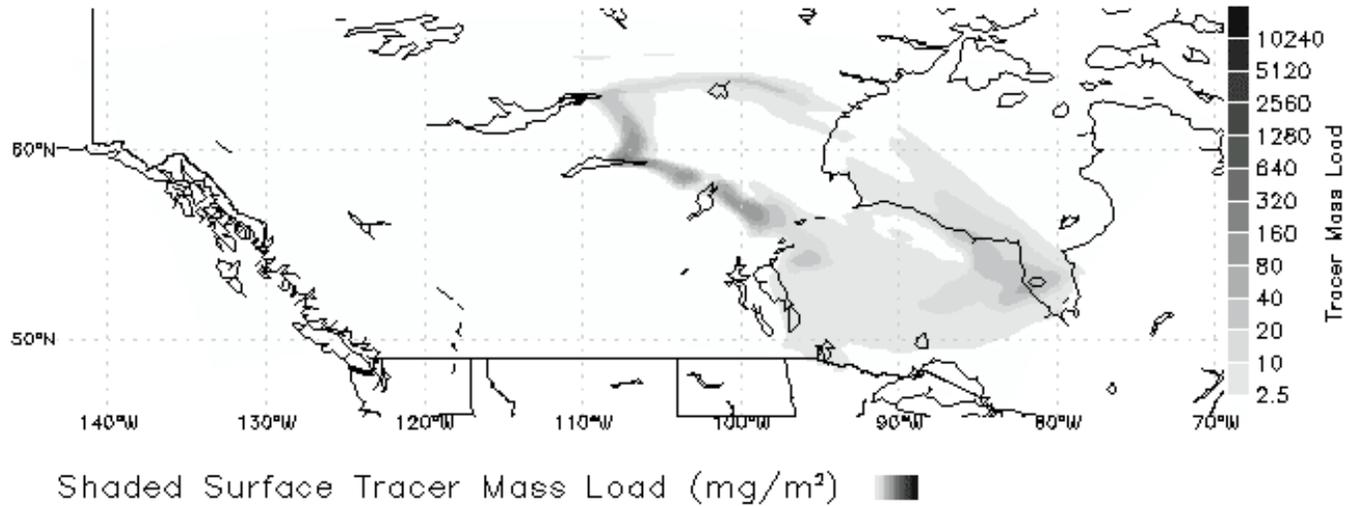


**Flight track of P3b as flown**

COAMPS PREDICTED SMOKE FROM ATHABASKA FIRES (courtesy Jeff Reid)

**UNCLASSIFIED**

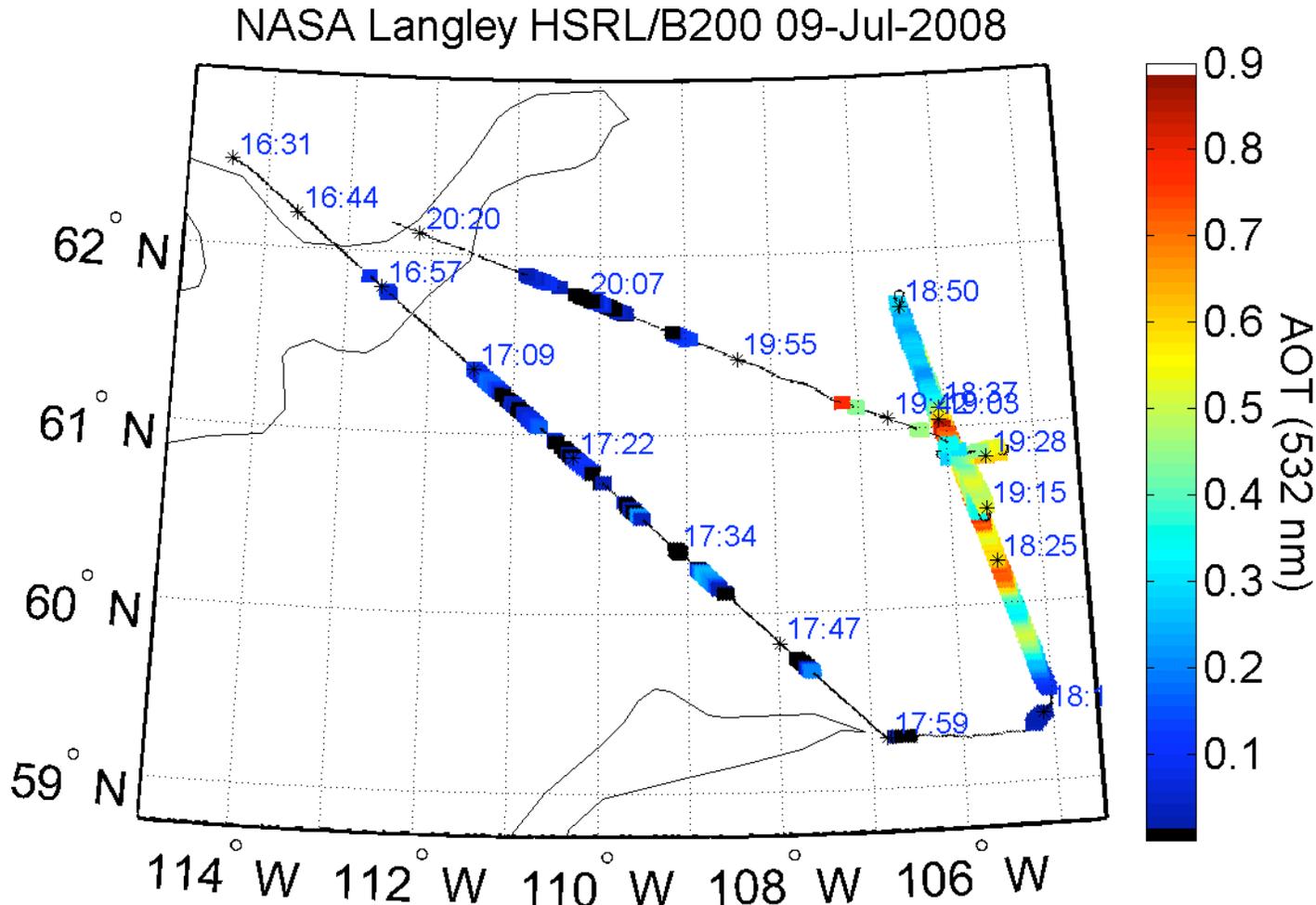
NRL COAMPS-OS® (U) ARCTAS 18.0km  
Valid Time: 18:00Z 09 JUL 2008 Forecast: 54:00  
Base Time: 12:00Z 07 JUL 2008

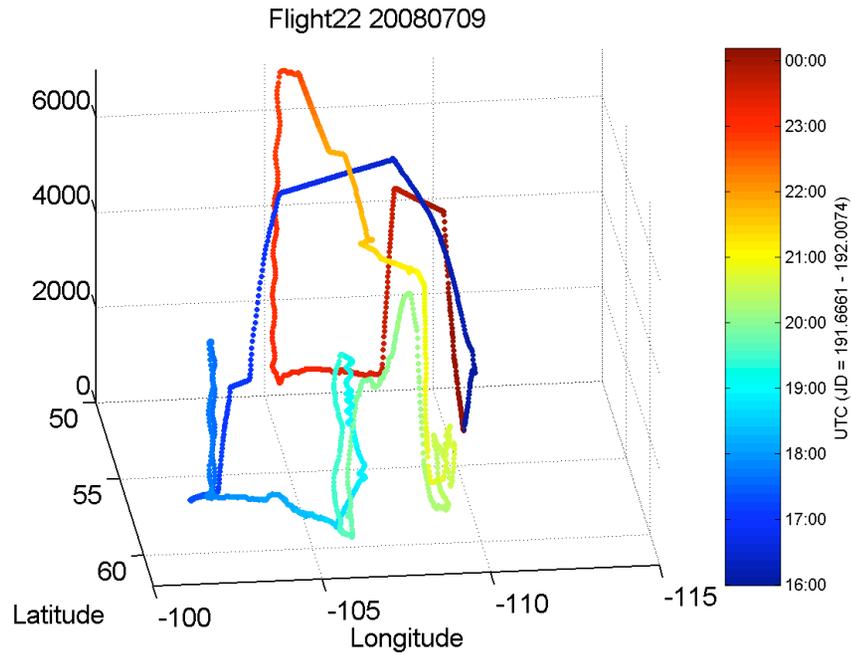


**UNCLASSIFIED**

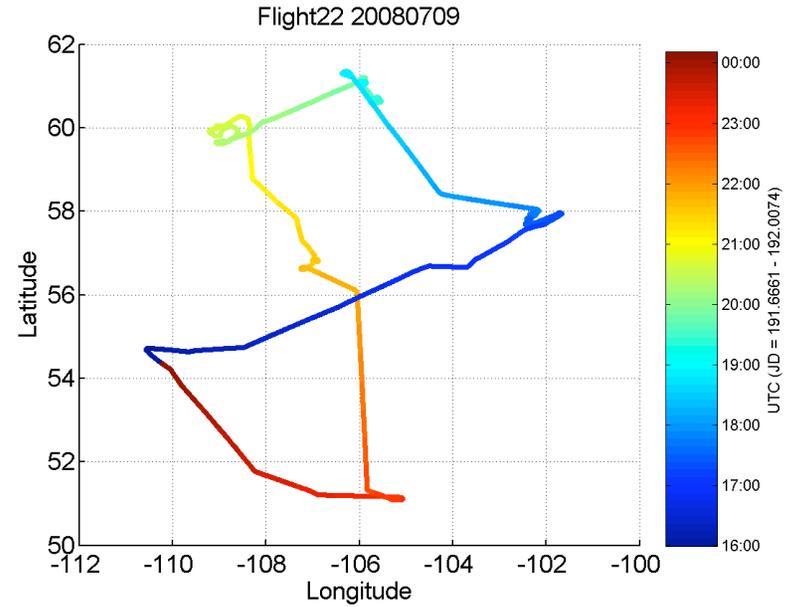
**PRELIMINARY OBSERVATIONS OF AOT FROM B200 LIDAR IN SMOKE PLUMES ALONG CALIPSO TRACK**

The region of elevated AOT from the fires was studied in coordination with the P3b using in-situ microphysics, chemistry, aerosol optics and radiation in the swath of CALIPSO. This should be an ideal satellite validation experiment and plume study.

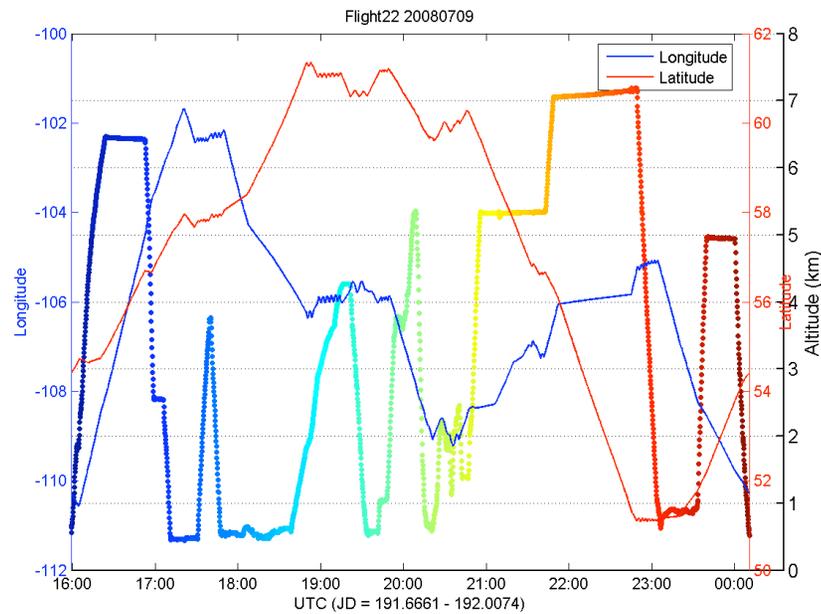




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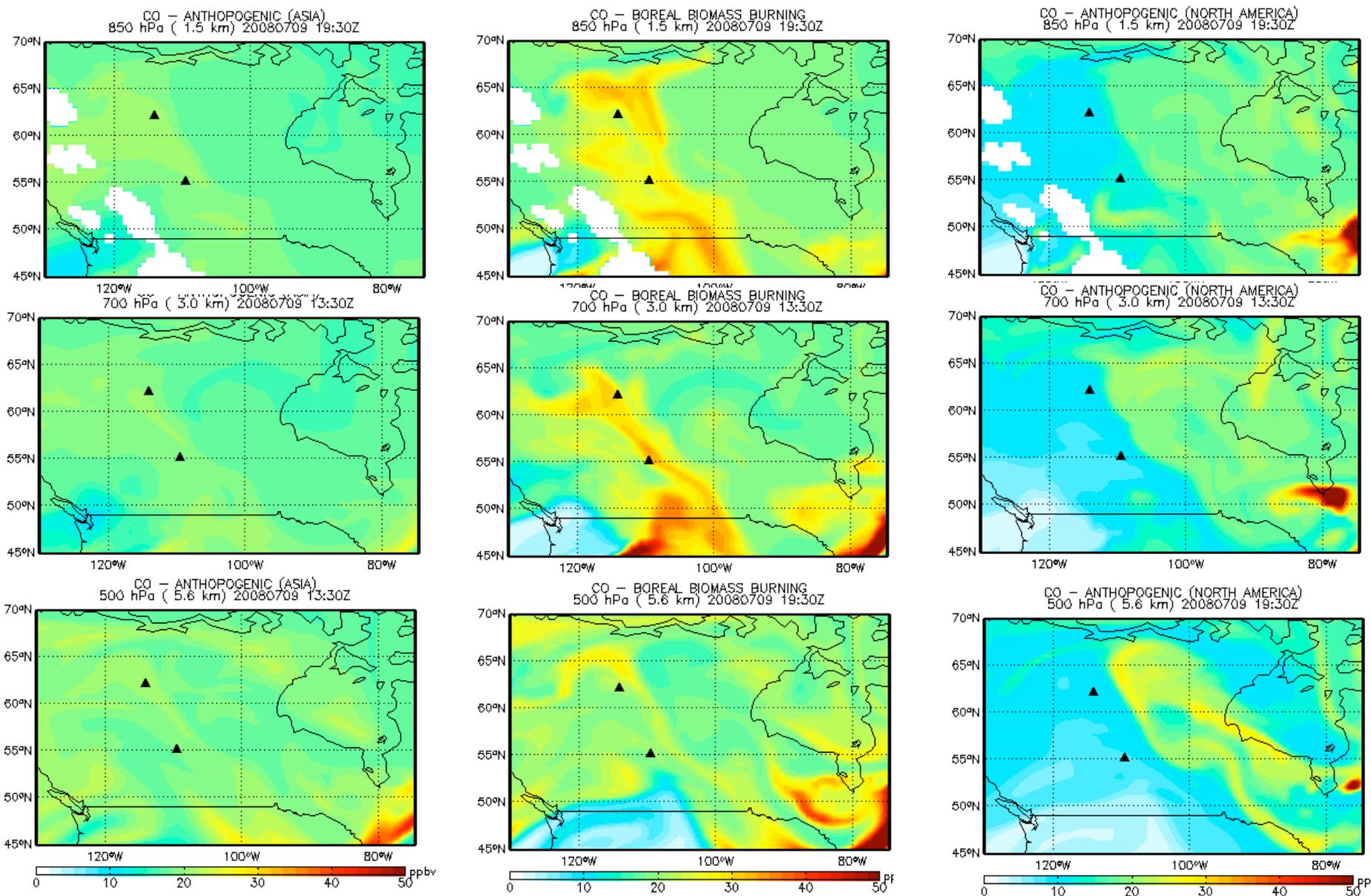
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Color coded time and location plots  
courtesy of Y. Shinozuka

GOES5 - Weak Siberia biomass burning plume between 1-6 km in central Canada,  
 Courtesy Mian Chin - Similar features also suggested in some other models.



## Time History

HHMM (UT Time- approx.)

- ~1515 Engine shutdown due to engine problem
- ~1545 engine restart
- ~1559 Takeoff - plan to cut TERRA MISR time to make up schedule and still meet B200 under CALIPSO
- ~1624 AOD 0.22
- ~1630 AOD 0.02 Some CO and O3 increases
- ~1633 o3 – 90, stratospheric?
- ~1635 AOD 0.016
- ~1650 AOD 0.011
- ~1705 B200 lidar data available
- ~1706 ramp down to 500' layer at 6000'
- ~1716 change heading to 025 to get clear air under TERRA over lake
- ~1725 AOD 0.2 Organic aerosol dominant
- ~1730 Spiral to 12500' AOD 0.15
- ~1740 Spiral down to 500' AOD 0.39, 57 55'N, 102 21' W
- ~1745 try to stay in cloud free air over lake for radiation but not easy
- ~1748 Head to CALIPSO path early at 500' , Wind SE@15-20 knts
- ~1807 Meet CALIPSO track
- ~1813 AOD - 0.09 about 35mi away form B200
- ~1819 321 deg heading, plume here, B200 about 3km away
- ~1824 AOD 0.065
- ~1826 AOD 0.14
- ~1828 Aod increasing rapidly to 0.42 in gradient.
- ~1838 Start ramp up to haze and smoke, AOD increases to 0.9
- ~1842 No change at 4000', AOD 1.0
- ~1843 AOD 1.2, continue climbing
- ~1848 5000', scattering increased to 100Mm-1, AOD 0.34
- ~1859 Strawa insruments down
- ~1851 Spiral through plume near 10000', scattering 750Mm-1, CO-600ppb, multiple layers
- ~1910 Climb out of plume and reverse for radiation leg above plume on CALIPSO track
- ~1915 Location 61 01' N, 106 00' W
- ~1920 Do square descent to surface for radiation profile from 14000'
- ~1926 Bottom of upper level
- ~1938 CALIPSO overhead, AOD 0.5, Plume peak near 11000', up and down profiles similar
- ~1942 CAR circles at 61 16'N, 106 10'W, climb to 110000', head to Athabaska fires
- ~1952 Level at 11,5000 in plume, scattering 250Mm-1 but little above as AOD 0.06

~1957 Plume looks like it is ahead, drop to 1000' to get into it but then we are out of it  
~2000 Fly below plume but over cloud, Sebastian wants aerosol forcing above cloud layer but some Ci makes it hard.  
~2013 Descending to fires near Athabaska  
~2015 PyroCu to the right  
~2017 Black smoker penetration  
~2020 Penetrate white then black then white smoke  
~2024 BIG PyroCu with lightning in it  
~2027 Sample outflow at 7000', air traffic restricts us to above 3000'  
~2029 Drop into an apparent darker layer, scattering 900 Mm<sup>-1</sup>, high OC  
~2030 Penetrate at 6200'  
~2031 Penetrate at 4000'  
~2041 Try downwind run in outflow at 4700'. CO-2000ppb  
~2042 Heading S to test model performance near 51N  
~2146 Ralph Kahn says clear at 51° 18'N, 105° 50', cleared to 23000'  
~2151 AOD 0.024 Very thin layer near our altitude  
~2208 In some glaciated cloud outflow  
~2215 Increases in nuclei, PVM LWC working  
~2223 Convection ahead of us and to the west. Fly over cloud top that had lightning 5 min ago, SP2 incandescence (soot) increase and coarse refractory (dust?) increase, CO-118, O<sub>3</sub>-50ppb, RHice 89-94%, Absorption and scattering increase some  
~2232 When scattering increases CN increases 100 to 200 and SP2 10 to 50  
~2244 AOD-0.013 at 23000', clean above us  
~2248 Start descent to surface at 1500'/min in clear, some small Cu, no high Ci, thin stratus in spots, CO<100ppb  
~2253 AOD 0.03 near cloud tops  
~2256 near cloud base, CO-130ppb  
~2257 10500', AOD 0.077  
~2300 base of low small Cu at 7500', scattering increases a bit from 5 to 15 Mm<sup>-1</sup>, CN from 500 to 3000, sulfate, nitrate and OC up  
~2303 AOD 0.09 nitrate down but others up  
~2304 at 1000'  
~2305 drop to 500'  
~2306 climb to 1000' start 20min surface run heading 260deg  
~2315 Concentrations constant on leg  
~2320 Coming out of cloudy region to broken mid-level clouds  
~2322 continue at 1000', heading 290, AOD-0.11  
~2328 AOD 0.94, CO-126ppb, O<sub>3</sub>-48ppm, scattering 12 Mm<sup>-1</sup>, Charles says BRDF is isotropic  
~2333 Climb to 18000',  
~2336 Pass cloud base and CO and AOD drop  
~2338 very clean, visually may be some haze to the west.  
~2415 Land

## Summary

**Very Good Flight:** Initial delayed start due to engine problems required some modification to TERRA-MISR underflight plan but we were still able to get to target area over Raindeer Lake on time. Cloud conditions were not ideal but we completed profiles and radiation legs in the most cloud free area possible - thanks to RTMM real time GOES imagery. Worsening conditions prompted early departure to CALIPSO track and rendezvous with B200 was rearranged in-flight. Excellent cloud conditions were present on most of CALIPSO leg and Athabaska fires were found to cross track in location predicted by COAMPS model (between Lake Athabaska and Great Slave Lake). We completed two radiation profiles that bracketed the radiation stacks along CALIPSO track in the fire plumes coordinated with the B200. Should be an ideal data set combining in-situ data, B200 lidar, in-situ radiation all with high signal to noise under CALIPSO.

This was followed by an in-situ sampling of the chemistry and optical properties of the fires responsible for the plumes under CALIPSO including a range of “black” and “white” smoke. A final leg south to 51N was intended to test model predictions of long range aerosol transport and optical properties in that area. No significant elevated plumes were encountered along this southern part of the flight path. REVEAL and RTMM worked well and some B200 lidar imagery was received in flight.

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**Flight Report** SUBMITTED BY: Colleen Kelly 09 July 2008

<b>Aircraft :</b>	NASA P-3B
<b>Operating Site(s) From / To :</b>	CYOD/CYOD
<b>Flight Date :</b>	July 9, 2008
<b>Flight Number / Data Flight # :</b>	599/ ARCTAS Science Flight # 22
<b>Time out:</b>	<b>0952 (L)</b>
<b>Time in:</b>	<b>1815 (L)</b>
<b>Flight Time :</b>	8.4
<b>Flt Request # / PI:</b>	<b>8P301/ Phil Russell</b>
<b>Purpose of Flight :</b>	<b>Data [ X ] Ferry [ ] Functional Check [ ] Other [ ]</b>
<b>Sensor Payload :</b>	ARCTAS ( flight)
<b>Comments :</b>	<p>Aircraft is in an up status and ready for the next flight. Flight #599 Data Flight #22 was 8.4 hours with a departure time of 0952 (L) and landing 1815 (L). 9 Jul 08 Flight</p> <p>REVEAL system was working well during today's flight. Data uploading for RTMM worked well. Data transfer between B200 and P3 was very successful. We were able to display B200's HSRL data in P3 using a viewer developed by RTMM team. Today, P3 spent a lot of time doing low altitude flying, CAR circles and spirals. These increased the chances of Iridium disconnection. Xchat worked well most of the time, but had more than average drop-offs. The Iridium link interruptions also affect the speed of data uploading.</p>

## Flight Hours for ARCTAS Campaign

<b>Flight</b>	<b>Date</b>	<b>Aircraft Flight #</b>	<b>Data Flight#</b>	<b>Duration (hr)</b>	<b>Remaining Hours*</b>
<i>Total Allocated</i>					<i>90.3</i>
Reveal Test /Training Flight	6/13/2008	583	PCF 1	2.0	88.3
Transit To NUQ	6/19/2008	582	Trans	7.7**	No charge
PCF/Data	6/22/08	584	#11	3.5	84.8
CARB/Data	6/24/08	585	#12	8.0	76.8
ARCTAS Transit Flt	6/26/08	587	#13/14	6.6/.9	69.3
ARCTAS Science Flt	6/28/08	591	#15	4.0	65.3
ARCTAS Science Flt	6/29/08	592	#16	7.9	57.4
ARCTAS Science Flt	6/30/08	593	#17	5.6	51.8
ARCTAS Science Flt	7/02/08	594	#18	6.5	45.3
ARCTAS Science Flt	7/3/08	595	#19	8.2	37.1
ARCTAS Science Flt	7/06/08	597	#20	7.7	29.4
ARCTAS Science Flt	7/07/08	598	#21	8.0	21.4
ARCTAS Science Flt	7/09/08	599	#22	8.4	13.0

\*Allotted flight hours include the following:

ARCTAS – 75 hours

CARB – 8 hours

Hours carried over from Spring ARCTAS – 7.3

\*\* transit flight billed as a maintenance flight

Transit flight allow approx 5.5 hours to include customs clearance at Dover

