

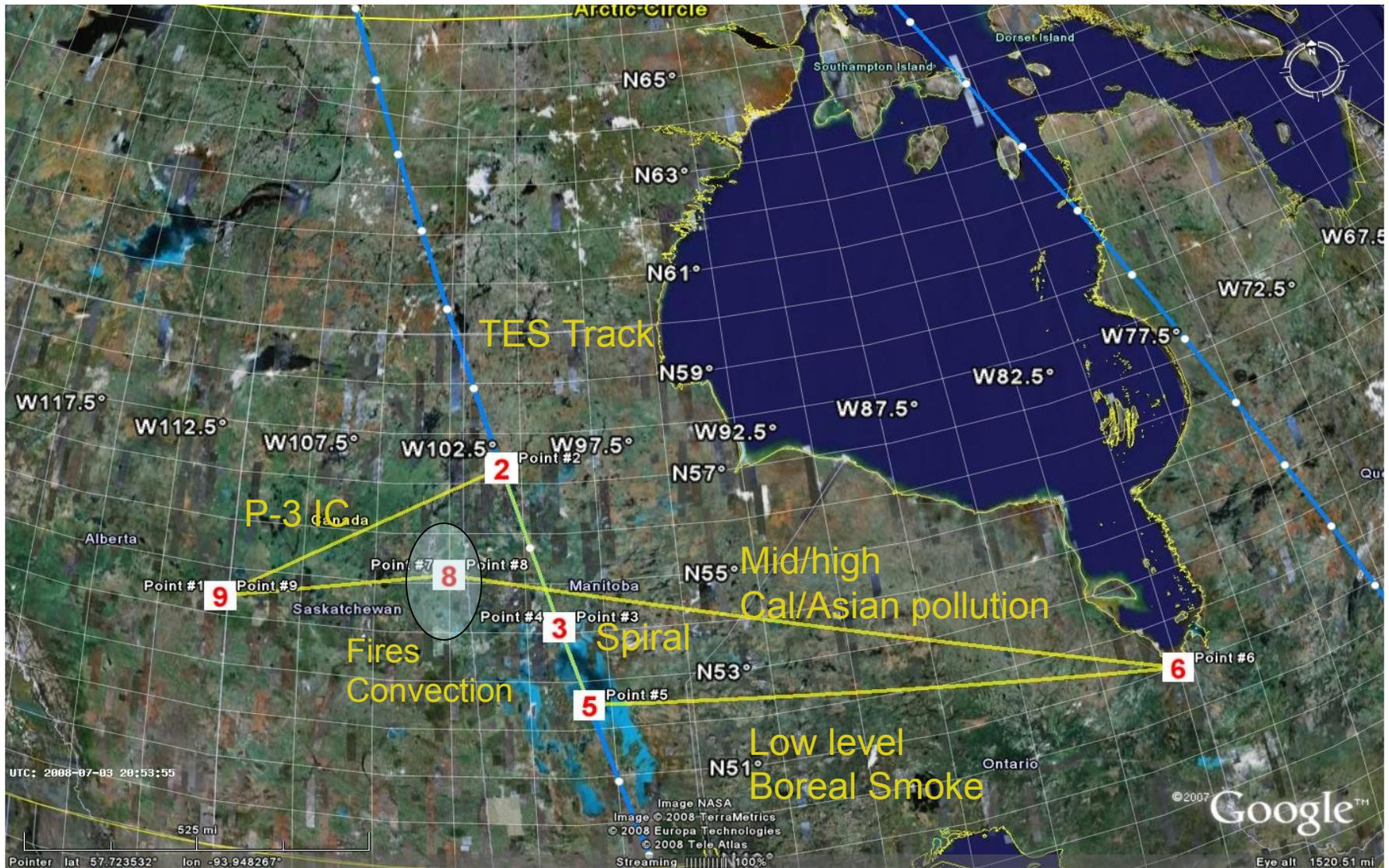
ARCTAS DC-8 Science Flight 19- (July 4, 2008; Friday)

This ARCTAS science flight was the third DC-8 sortie from Cold Lake. The main objectives were to inter-compare with the P-3, under fly the TES satellite track, and investigate Canadian (boreal) fire emissions, pyro-convection, and smoke transport. The flight plan (side 2) had to be modified some (slide 3) due to extensive cloud cover at designated locations. Take off time was 1139 UT and the flight duration was 9.7 hours.

This was a successful flight and we were able to meet our main objectives. Most instruments aboard the DC-8 performed normally and collected data. The most important meteorological feature was a weak low pressure area located over central Alberta. A cold front extended due south of the low into the northern U.S., while a warm front extended eastward of the low, through Manitoba and toward the Great Lakes. The warm sector ahead of the cold front was very unstable, and widespread intense thunderstorms began to develop in this area during the early afternoon and continued until well after midnight. Winds over the flight region were from the northwest.

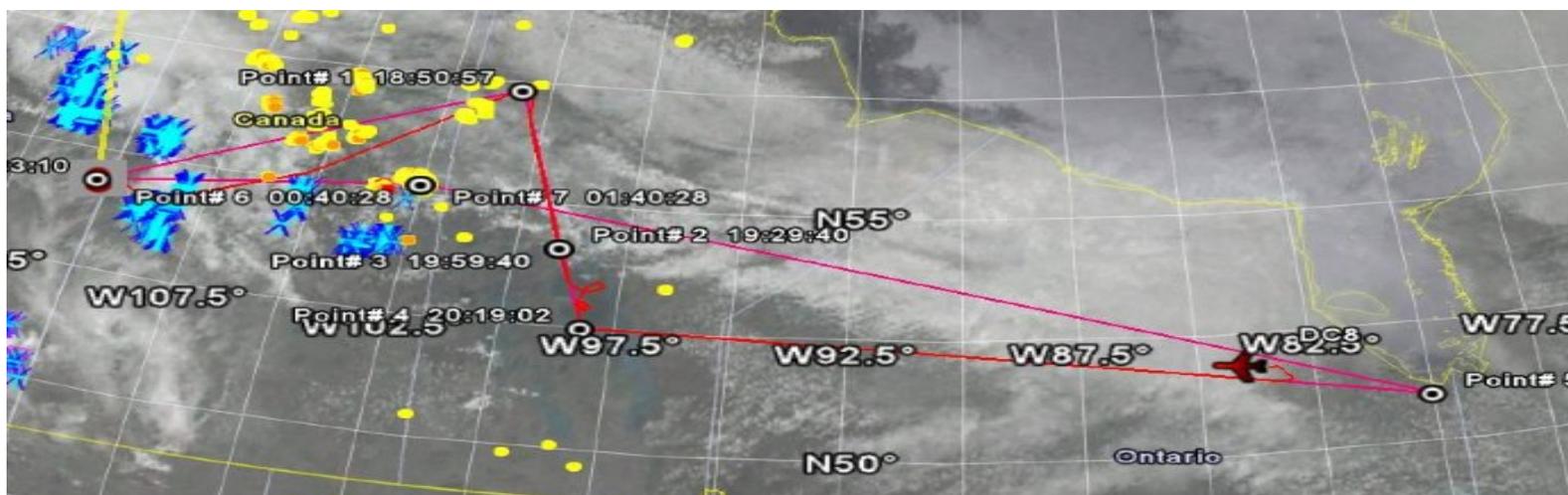
The inter-comparison with P-3 was not possible as the P-3 flight was cancelled. The DC-8 headed north-east to the TES track while profiling along the way. At the surface level (1 Kft AGL) we saw elevated CH₄ (1950 ppb) and biogenic emissions and subsequently high CO (600 ppb), elevated nitriles along with short-lived species such as xylenes indicating a mixture of fire and fresh anthropogenic pollution. We arrived at the TES track at 30 K ft sampling a number of stratified pollution layers. The elevated O₃ (90 ppb) at 21 Kft was tropospheric in character, possibly of Asian origin, and remained with us through out much of this flight (slide 4). We headed south along the TES track and climbed up to 35 Kft with the lidar observing a number of pollution layers below. We delayed the TES spiral to south of WP 3 (slide 2) where it was nearly cloud free and ATC gave permission. The DC-8 then headed south east (WP 5-6; slide 2) to sample fire pollution outflow from Canadian fires at low altitudes. The early part of this leg was moderately clean (CO <160 ppb; O₃<60 ppb) but we soon encountered BB pollution (CO - 600 ppb; CH₃CN -1 ppb and scattering- 400) at around 10 Kft. In this polluted outflow both O₃ and methane were not significantly elevated as expected from fire emissions. The return track (WP 6-8 slide 2) was modified due to excessive clouds (see slide 3) and we sampled air between 20-30 Kft encountering plumes from California fires at lower levels and Asian pollution (CO-180 ppb) at higher levels. Heading towards the Saskatchewan fires (Slide 5), we saw several convective turrets and circling one indicate little pollution outflow. A second turret was identified and pollution outflow was sampled from 37 Kft to 28 Kft in its outflow region. Modest smoke pollution (CO-270 ppb; NO_y-4 ppb) along with traces of biogenic emissions were observed. This did not appear to be a pyro-convective event but rather indicated normal convection in which surface air had been lofted up while undergoing 10-20 fold dilution. Subsequently we circled the Pelican Narrows (PN) fires at 10 K and 15 Kft encountering expected emissions (CO-3 ppm) of gases and aerosols returning to Cold Lake at 41 Kft mostly in the stratosphere. Overall this flight produced a wealth of unique data to address key ARCTAS objectives.

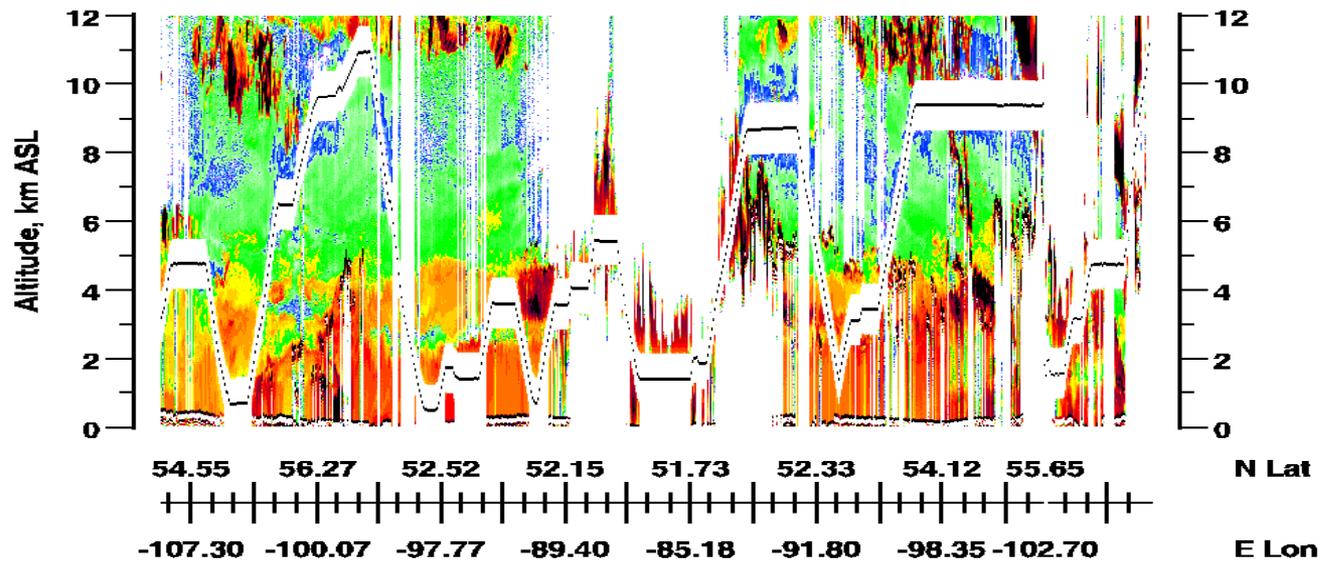
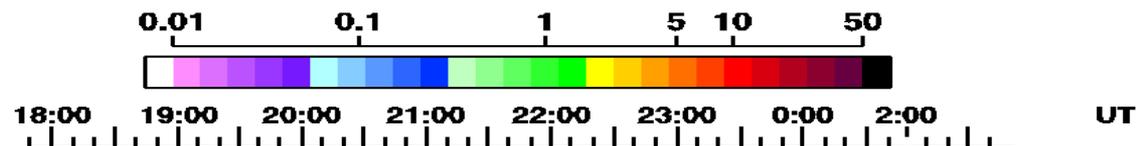
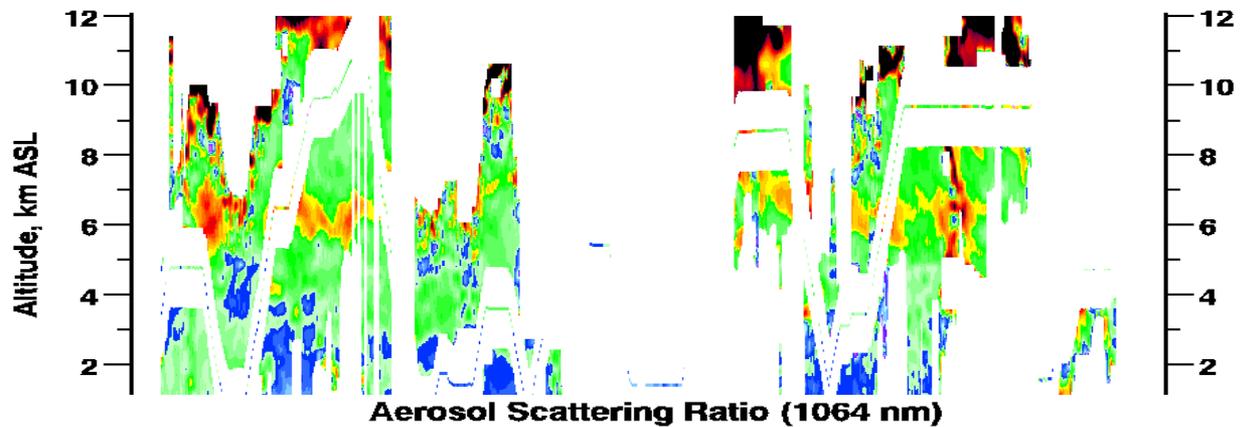
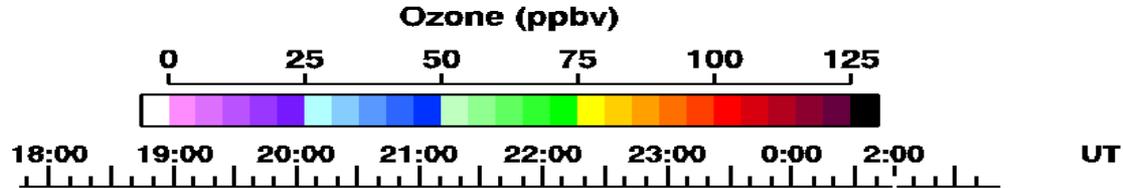
ARCTAS Flt 19-Flight Plan 070408



Max Concentrations (ppb) at WP 8: CO-2500; NO_y-15, trop O₃-100

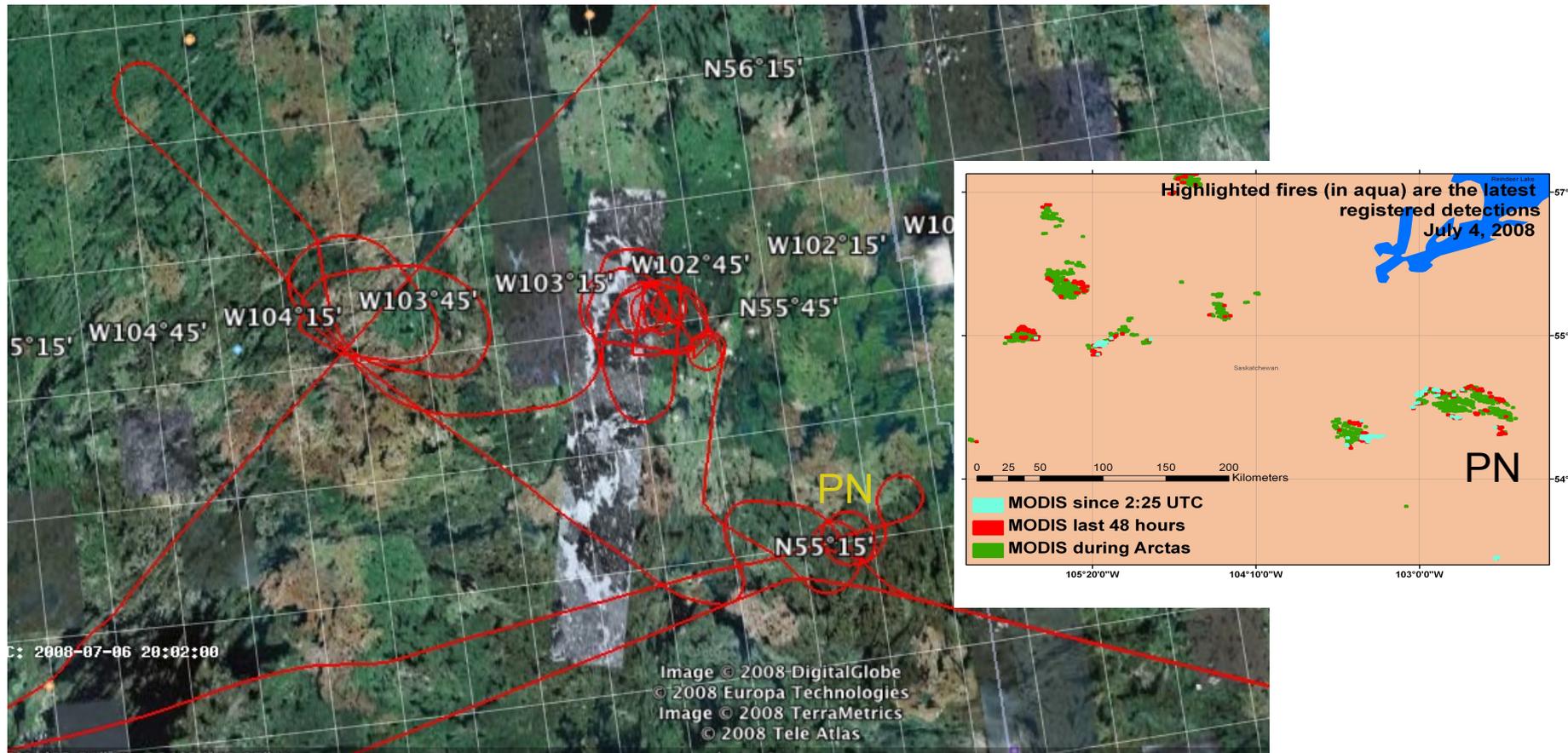
Flight 19: Actual flight track and clouds





DIAL LIDAR

Convection, Pyro-convection, and fire emissions (Saskatchewan)



Possible pyro-convection in UT (25-35 Kft): CO<300 ppb; NO_y- 4 ppb; RCN/OC elevated; biogenic source signals