ORACLES P3 Flight Scientist Post-Flight Status

Date: 30 August 2017

Flight number: PRF11

Routine flight or target of opportunity? A mixture. Routine flight along 5E, only reaching 13S to allow for a radiation wall. Also includes sampling plume at 3km with the idea of resampling it on 31 august flight.

Flight scientist: Paquita Zuidema (no AFS)

Ground Scientists: Jens Redemann/Sarah Doherty

Take-off: 0800 UTC

Landing: 1633 UTC

Quick summary:

Representative ACAOD or ACAOD range for flight: baseline 4star aod of 0.4 suggested deposition on window

Do the models predict crossing a gradient in aerosol age?
Yes/No/Unclear YES though all of it is on the young side: 3-4 days old north of 10S, 5-6 days S of 10S

Did the flight cross a gradient in macroscopic cloud properties, like cloud fraction?
Yes/No/Unclear YES

Did the flight cross a gradient in aerosol loading?
Yes/No/Unclear Unclear

At any point during the flight, was there a clear separation between the smoke plume(s) and cloud tops?
Yes/No/Unclear

How many of the following maneuvers took place?

Ramps 4 (08:00, 09:28, 12:18, 15:45)	MBL legs 1 (12:37#2)
Square spirals 3 (09:14, 10:42, 12:37#1)	Cloud legs 1 (12:37#4)

Above cloud legs 3 (09:22, 12:37#3, 14:33)

Plume legs 3 (09:31, 11:39, 12:37#5)

Sawtooth legs 0

Above plume legs 2 (08:22, last leg)

Instrument status:

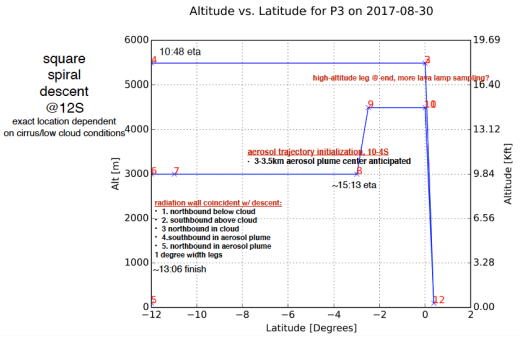
Instrument	Comments
P3	Got nitrogen for one of the tires prior
4STAR	Never read below 0.4 during flight even in ci-free conditions, Possible window deposition. Cleaning post flight saw ~23% change in signal amplitude between dirty and clean window.
HiGEAR	No issues of note
HiGEAR-AMS	No issues of note
HSRL-2	Issue with chiller @ beginning. Ultimately down for the flight, with data only available up to 0823utc. The chiller was replaced yesterday so hadn't flown before. Will work on fixing chiller #1 back on ground to use for PRF12, 31Aug flight, for which the issue is a clogged external filter. Requires communication with the company that made the part.
RSP	No issues
APR3	No issues of note
Cloud probes	Serial feed into the UND probes stopped working at TO. Data collection and saving happening but can't see it. Power cycling didn't help.
CCN	No issues of note
PDI	Did some EM interference testing prior to TO: noise popped up at use of PA system, and after engines started but before power transfer. Pilot Farley thinks it

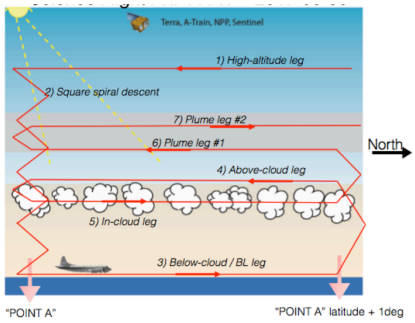
	is vibrations affecting a loose connection. Interference stopped before engine was turned off after landing however.
Vertical winds	No issues of note
WISPR/CVI	No issues of note
COMA	No issues of note
SSFR	No issues of note
data	No issues
filter	Yes, acquired.

PRF11 30 August 2017 Wednesday Mission Report

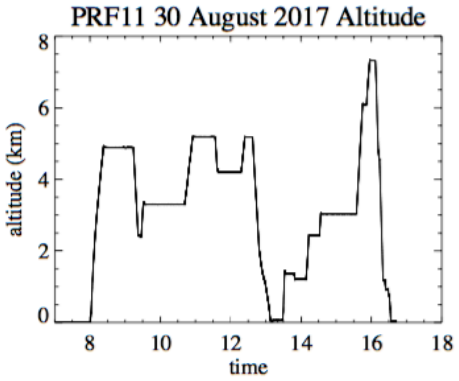
flight scientist: Paquita Zuidema
ground scientist: Jens Redemann/Sarah Doherty

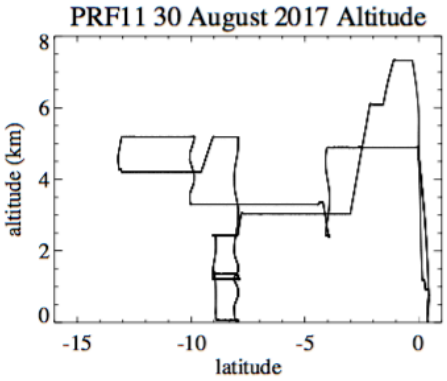
flight plan and objective: routine flight along 5E, but not reaching as far south and allowing for a full radiation wall (less cloud work and more above-cloud legs than on 28 August flight). Includes sampling of fresh aerosol and of trajectory initialization points.



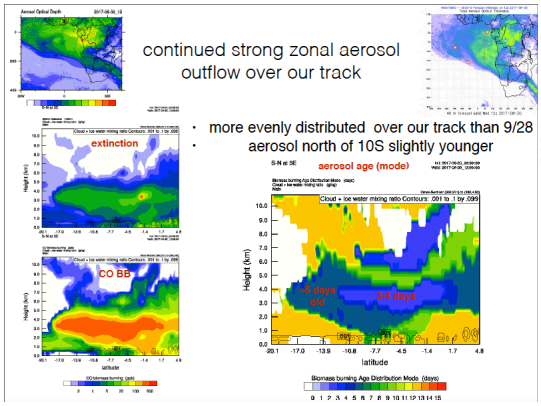


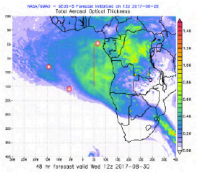
Flight Summary:



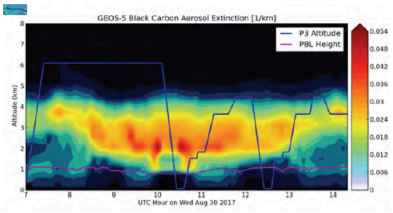


A-Priori Forecast:

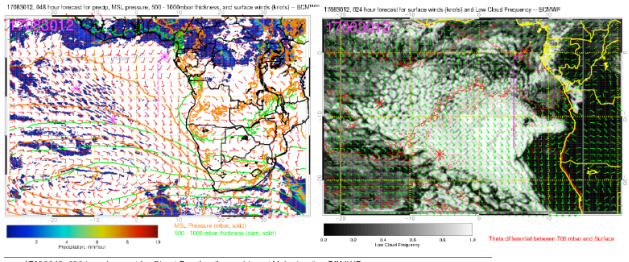


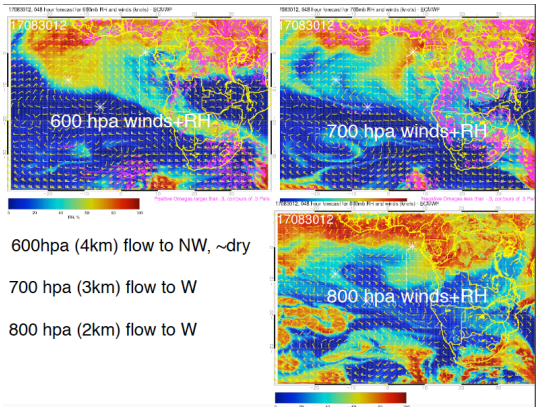


GEOS-5 model putting aerosol maximum slightly lower than WRF-AAM, @ ~3km (will pick aerosol altitude leg on way back based on HSRL)



surface winds more SWerly, & close to climatology
model low cloud edge at 5-7S

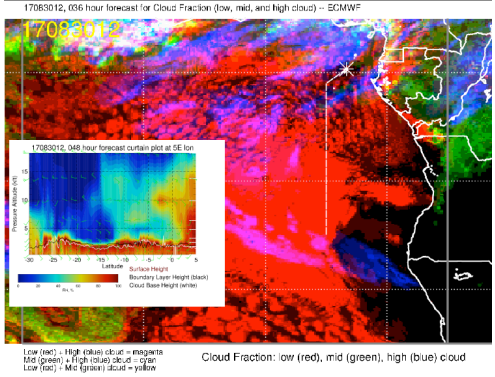




600hpa (4km) flow to NW, ~dry

700 hpa (3km) flow to W

800 hpa (2km) flow to W



Low (red) + High (blue) cloud = magenta
Mid (green) + High (blue) cloud = cyan
Low (red) + Mid (green) cloud = yellow

Cloud Fraction: low (red), mid (green), high (blue) cloud

Flight Instrument status: the HSRL failed early in the flight, the first flight to do so. Some testing occurred to search for the cause of the PDI phantom small particle sizes, and to understand why the serial data feed for the UND cloud probes was failing (a non-critical failure).

Flight Instrument/logistics notes: The HSRL failure removed the motivation for the initial high-altitude remote sensing leg, and instead the flight sampled within the aerosol plume to 13S. There were also issues with where to place the radiation wall, with a cirrus shield at 10-10.5S expanding southward and enlarging ultimately leading to the decision to turn the plane back north and perform the radiation wall at 8S (which remained free of cirrus and also characterized by a lower underlying cloud albedo).

Run Table

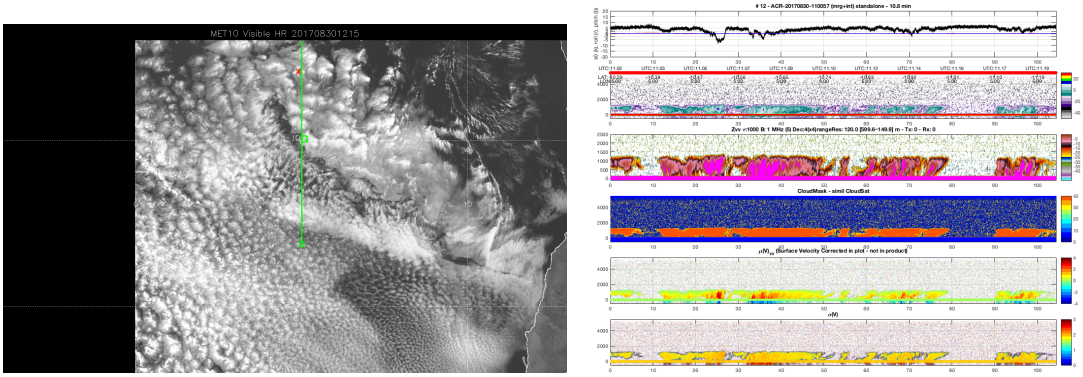
description	beginning time	end time	altitude	notes
takeoff	0800UTC	X	0km	
Ascent out of TMS	08:00 UTC	08:22 UTC	0-5km	Hit a layer up to 50 Mm-1 in blue HIGEAR scat. & 157 counts in SP2, from surface to BL (~8:00 to 8:04UTC)
Leveled leg from 0-4S	08:22 UTC	09:14 UTC	5.1-5.2km	2 green scat peaks: 12.3 Mm-1, 8:53UTC, 2.2S; 21 Mm-1, 09:05-09:09UTC, 3.2-3.7S

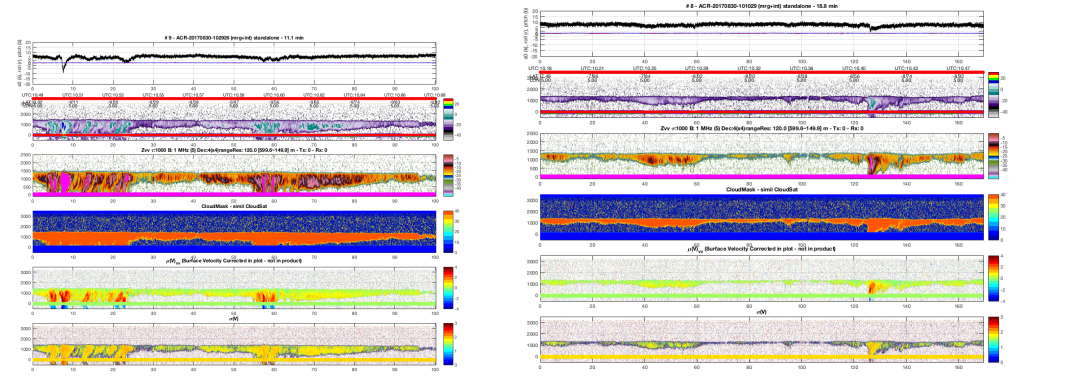
Spiral down	09:14 UTC	9:22 UTC	5.1km –2.6km	More in-situ measurements to get the vertical info because HSRL now down; layer top is about 10ft 1 green scat peaks: 200 Mm-1, 9:20UTC, 4S
Leveled leg 4S	9:22 UTC	09:28UTC	2.6km	
Small ascent 4S-4.2S	09:28UTC	09:31 UTC	2.6km – 3.5km	XX green scat peaks: 200 Mm-1, 9:29-31UTC, 4S
Leveled leg 4.2S-10S	09:31 UTC	10:42UTC	3.5km	From chat: “In the thick of the plume now/ really hazy: 09:42-47UTC CO ~500 ppbv, O3 ~100 ppbv, AOD ~0.23, BC is 1000/cc i.e. 3.5 μg/m3, green scattering 230/Mm, Bulk Aerosol ~25 ug/m3, UHSAS shows peak at about 180 nm” Value range for this leg: green scat. 230-300/Mm-1, BC 3.5μg/m3 4STAR chat: “ 10:10UTC: AOD up to 0.66 and still climbing at 11kft… That may be a record for highest AOD at high altitude” AOD 0.73, 10:19UTC 0.8 at 10:31 UTC, angstrom exponent remarkably constant around ~1.35-1.4 10:32 UTC “UHSAS mean diameter has fallen to about 170 nm”
Upward spiral 10S	10:42	10:53	3.5 km-5.2km	At 10S, 5E“we will do a square spiral to profile the aerosol above us, stop at the altitude 4STAR tells us, transit to 13S and begin the radiation module” 10:49 UTC O3 hit 120 ppbv, CO >500 ppbv; layered structure as we ascended - seeing differences in chemical composition with changes in altitude “spiral ascent took us through 2 different aerosol layers.”

Transit to 13S	10:53	11:33	5.2-5.5 km	Transit 10S, 5E to 13S, 5E with slow ascent 5.2-5.5km 10:53-11:04. Lots of cirrus seen along the way~
Turn	11:33	11:39	5.5km to 4.5km	At 13S, 5E, turn and head back north, descending to aerosol layer in the turn. At 4.5km at 11:39; scattering jumped from ~0 to ~250Mm-1. Newly forming cirrus is threatening this area; choose to have a cirrus-free rad. wall over thicker low clouds at 9S then a cirrus-contaminated wall over the broken cloud here at 11-13S.
Plume leg	11:39	12:18	4.5km	Transit 13S to 9S in top of plume; “plume age: Models suggest plume should be young (< 3 days old)”; ~3 μg/m3 BC, 200-250 M.m-1 in green scat.
Prepare for radiation wall	12:18	12:37	4.5 to 5.5km	Climbing to be up at 5.5km by 9S (above aerosol) from 12:18 to 12:24; go N to 8S at 5.5km from 12:24 to 12:37 UTC

Radiation wall @8S 1. spiral down 12:37-13:09 2. leg #1 near surface S from 8.1S to 8.9S 13:09-13:29 3. leg #2 above clouds 1.4-1.5km, N from 8.9S to 7.9S 13:32-13:49 4. leg #3 Within clouds 1.2km S from 7.9S to 8.9S 13:49-14:08 5. leg #4 2.5-2.6km within aerosols N from 8.9S to 7.9S 14:13 – 14:31	12:37	14:31	Between 0 and 5.5km	Plan is spiral descent down at 8S slowing down to 500ft/minute (or slower) near cloud, S to 9S below cloud, N to 8S above cloud, S within cloud to 9S, then back up to the aerosol plume heading N. 12:47 UTC green scat. is peaking at 341 Mm-1 12:56 aerosol touching cloud here, 4STAR AOD of 1.4 (is this real?!) 12:57 descending at 100ft/min 13:03 back to regular descent 13:08 near ocean surface, small whitecaps ~10 knot winds; went through 2 layers of clouds on the way down 13:11 BC 100 counts/cc, not clean; 1ug/m3 of bulk aerosols (org, no3, so4, nh4) 13:35 reported 4STAR AOD 1.5, really dirty layer according to in-situ 13:37 slight gap between aerosol/cloud 13:44 flying at about 150 ft above the cloud 13:49-51 in cloud, clean 14:31 “4STAR reporting AOD at 0.8 just before this ascent we're doing”
Leveled leg 7.9S to 3S 14:33 – 15.34	14:33	15:34	3.2 km	14:37 “seeing chemical differences in SO4 at 10kft than we saw at 8kft” BC 1200 -800 counts, green scat. 291-205 Mm-1
Climbing to high altitude	15:45		6.4km	4STAR has requested high altitude leg with no cirrus for sanity check on the AOD. AOD might be contaminated by a window deposition AOD is now 0.16 @ 15:46, down to 0.15 but doesn't seem to be declining any further; HiGEAR doesn't see anything up here so if it's real it seems to be above us @ 15:56
landing		163329 utc		

visual notes:





please upload to https://espo.nasa.gov/ORACLES/node/add/mission-science-report when done