ORACLES P3 Flight Scientist Post-Flight Status

Date: _____15 August 2017_____

Flight number: __PRF03_____

Routine flight or target of opportunity? routine (sampled beginning points of trajectories as part of routine flight along 5E)

If target of opportunity, what is the goal? _____

Flight scientist: _____Paquita Zuidema (Michael Diamond Ground Scientist)___

Assistant flight scientist: _____none_____

Take-off: ____07:56_____

Landing: _____17:05_____

Quick summary:

Representative ACAOD or ACAOD range for flight: ___max of 0.65___

Do the models predict crossing a gradient in aerosol age?
Yes/No/Unclear YES
Notes: Very weak gradient, from ~3 to ~6 day old smoke at 2-3 km, with younger smoke to the south of the flight track.
Did the flight cross a gradient in macroscopic cloud properties, like cloud fraction?
Yes/No/Unclear YES. Significant clearing at northern end

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

At any point during the flight, was there a clear separation between the smoke plume(s) and cloud tops? YES down at 15S
Yes/No/Unclear

How many of the following maneuvers took place?

Ramps _____6___

Square spirals __3_____

MBL legs _____3_____

Cloud legs 2 sawtooth, 1level

Above cloud legs ____0_____

Sawtooth legs ____2_____

Plume legs ____6_____

Above plume legs _2 (inc. transit)___

Instrument status:

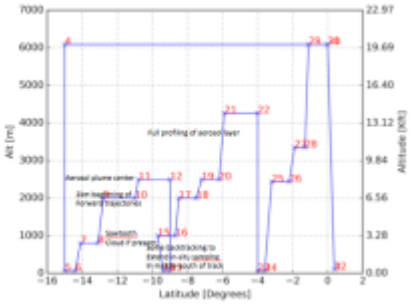
Instrument	Comments
P3	Good. Take-off and landing as planned, no issues during flight

4STAR	good
HiGEAR	Some issues, esp. at beginning. UHSAS did not appear to agree with the CN counters, corrected later in flight.
HiGEAR-AMS	Great flight, measured highest concentrations to date, coordination with CVI worked well
HSRL-2	good
RSP	good
APR3	Good flight. Few clouds, turned off early when encountered 'severe clear'
Cloud probes	Possible interference between the PDI and CAS that may have been there in the previous flights as well. The 2nd cloud leg was extended by 5 minutes to test for this; conclusion that there is no interference.
CCN	good
PDI	good
Vertical winds	good
WISPR/CVI	good
data	Issues with some macs on board accessing xchat at beginning of flight. Resolved for all computers but one.

PRF03 15 August 2017 day-of-week Mission Report

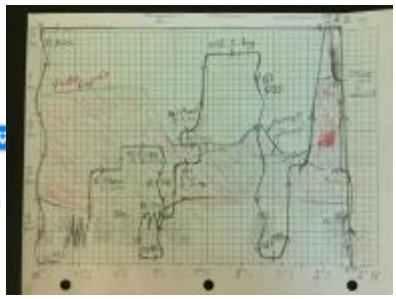
flight scientist: Paquita Zuidema
ground scientist: Michael Diamond

flight plan and objective: 9-hour routine flight down to 15S. high-altitude transit down to 15S, square spiral down, then 2 cloud layer legs and sampling at 2 and 2.5km level legs of the beginning of the forward trajectories that will be sampled on 17August. High altitude leg at end followed by in-plume sampling at two levels. Original flight plan below+sketch of more final plan

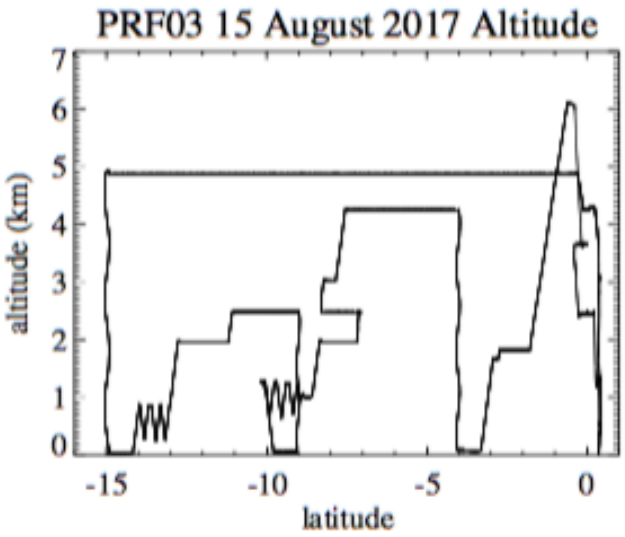


Description of Legs

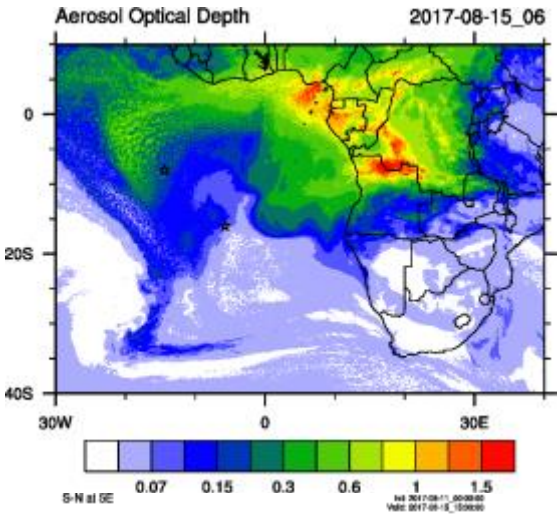
0. transit leg to 15S to get HSRL curtain (3.5 hours)
1. Square spiral descent at 15S (20 min)
2. Going back north: Sub-cloud leg (10 min)
3. Ascend to cloud and porpoise if cloud is present (20min), skip cloud leg if cloud not present
4. Ascend to 2km and level leg (30min)
5. Ascend to center of plume (~2.5km) and level leg (30min)
6. Square spiral descent at 9S, then turn south
7. near-surface leg going south (~7min)
8. Ascend to cloud, turn north, porpoise assuming cloud (20min)
9. Ascend to 2km, level leg (15 min)
10. Ascend to center of plume, level leg (15 min)
11. Ascend to above plume, level leg (25min)
12. Square spiral descent at 4S
13. 2km level leg, aerosol layer leg, ascend to 6 km

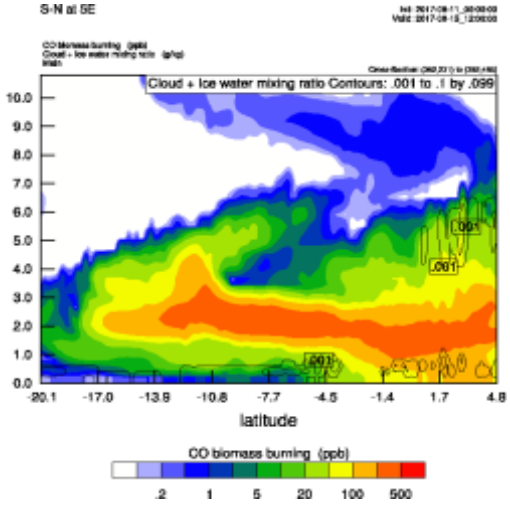


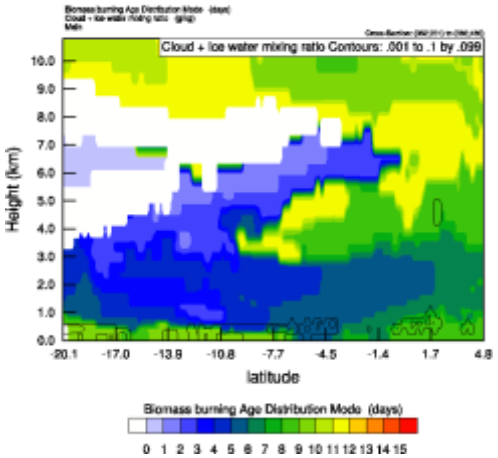
Flight Summary: flight plan diverged slightly from that filed: flight altitude first at 14kft to accommodate the heavy fuel load, rising to 16kft after first 30 minutes. On way back, after waypoint 18, the 2.5km level leg was backtracked and a 3km level leg stacked on top of that. This was done because of concern about the low-altitude level legs disappearing into the boundary layer before they could be sampled. Actual flight path below.

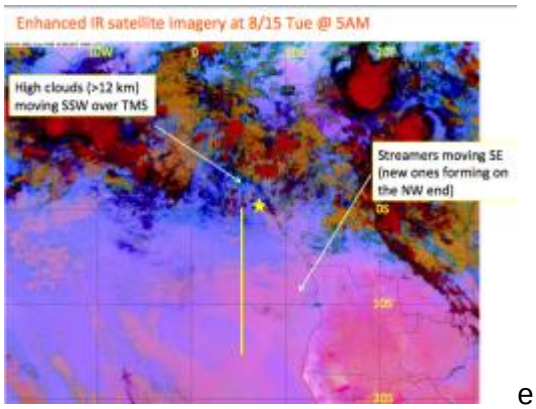


A-Priori Forecast:
High cloud north of 5S, most low clouds centered at 7-10S, may be missing at south end, fresh smoke at low levels associated with dry convection.

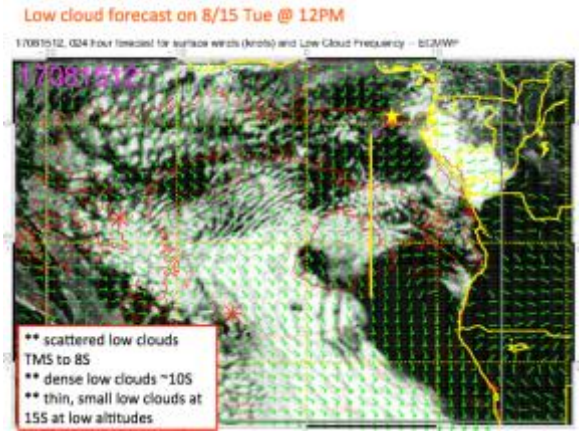

Aerosol Optical Depth
2017-08-15_06
0
20S
40S
30W
0
30E
0.07
0.15
0.3
0.6
1
1.5
S-N at 5E

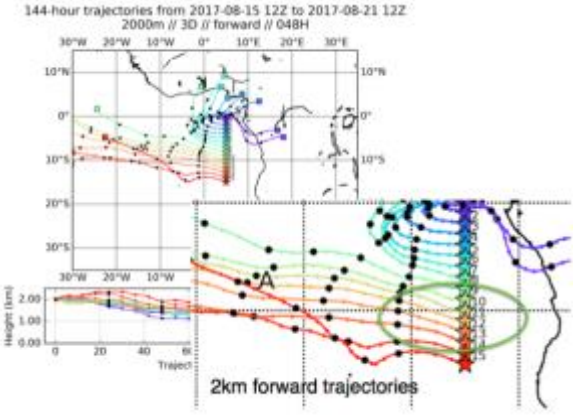

S-N at 5E
Cloud + Ice water mixing ratio Contours: .001 to .1 by .099
Height (km)
latitude
CO biomass burning (ppb)
.2
1
5
20
100
500


Cloud + Ice water mixing ratio Contours: .001 to .1 by .099
Height (km)
latitude
Biomass burning Age Distribution Mode (days)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

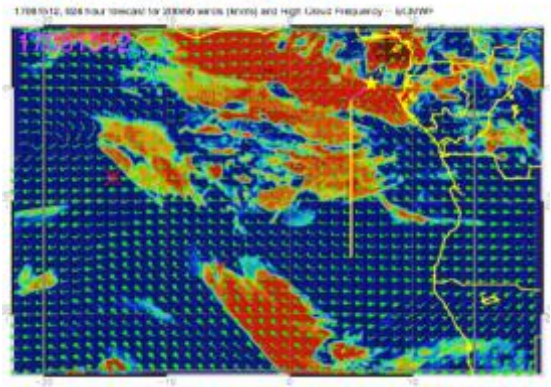

Enhanced IR satellite imagery at 8/15 Tue @ 5AM
High clouds (>12 km) moving SSW over TMS
Streamers moving SE (new ones forming on the NW end)

e


Low cloud forecast on 8/15 Tue @ 12PM
** scattered low clouds TMS to 8S
** dense low clouds ~10S
** thin, small low clouds at 15S at low altitudes


144-hour trajectories from 2017-08-15 12Z to 2017-08-21 12Z
2000m // 3D // forward // 048H
2km forward trajectories

High cloud forecast on 8/15 Tue @ 12PM



Flight Instrument status: mostly good. UHSAS and CN counters did not intercompare well at beginning. A 5-minute level leg was done on 2nd cloud module to test if PDI and CAS were interfering (answer:no). all instruments worked (except CAS).

Flight Instrument/logistics notes: flight planner put flight 20 minutes ahead of schedule allowing for extra sampling in the stacked legs at ~9S on return leg

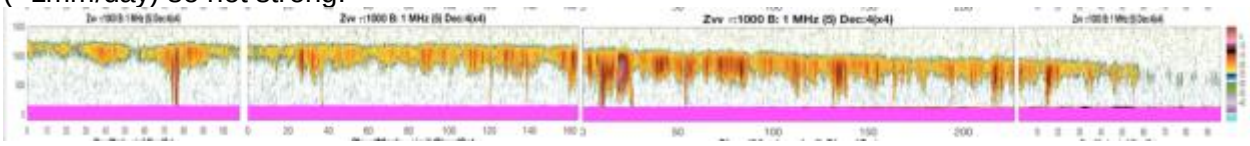
Run Table [UTC; approximate times okay, lack of detail okay. Just note major transitions, such as takeoff, time at point of furthest extent, time at beginning and end of major profiles with their detail relegated to the notes, such as spirals,level legs,straight profiling, and landing time]

description	beginning time	end time	altitude	notes
Takeoff, ascent to altitude	07:56	8:25	14kft, ascending to 16kft	Still some aerosol at 14kft
Ferry leg to 15S	08:25	~11:11	16kft	Thin strips of cirrus in northern half. Boundary layer growth between 4S-5S. aerosol separated from cloud 1-7S, aerosol layer clearly placed w/ top at 2.5km (bump up to 3km at 4S). low clouds reappear at 7S, ~9:45am, aerosol layer base has descended and is touching. Aerosol Top still at 2.5km. drizzle cell at 10:05, but overall low cloud deck anemic. Ci stopped at 10S. 10:18:33 hsrl image shows what may be a low-aerosol cloud-scavenged layer to north of the cloud deck. Satellite imagery suggests that edge is already dissipating so consistent. At 7.4S. aerosol touching cloud to ~10.8S then separating to south. Aerosol layer rises to 4.25km, consistent with WRF-AAM forecast. 1100: scale change on hsrl images

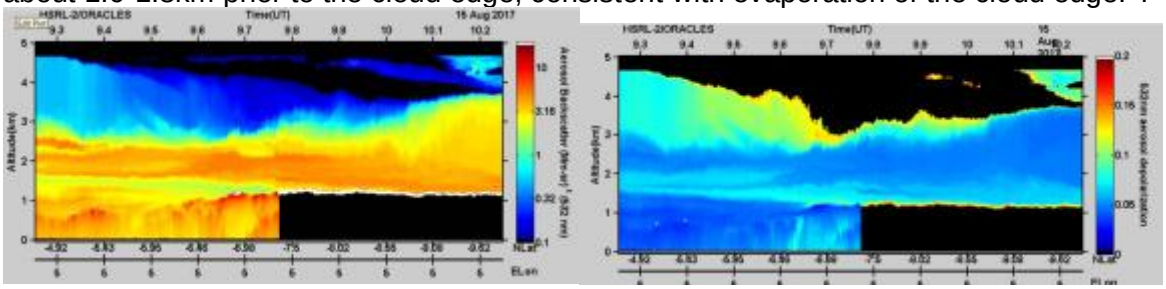
Square spiral Descent at 15S	11:11	~11:33		Surface winds 15 knots, above cloud AOD of 0.45
Level leg to north near surface	11:30	11:40		Clean boundary layer
Cloud level	11:42	11:57		Mostly sawtooth, Includes a 1minute abovecloud level leg
2km forward trajectory origin	12:00	12:20		Ramp ascent from 11:57-12:00
2.5km level leg to 9S	12:24	12:50		Preceeded by a ramp ascent to 2.5km. CO levels not so different from 2km but nitrate levels doubled
square spiral descent @9S	12:50	12:59		Calmer surface winds no white caps
Near surface leg	13:00	13:10		Backtracked, went south
Cloud leg	13:19	13:39		Ascended going south, turned around above cloud top, 'dull' sawtooths followed by 5-minute level leg to test PDI/CAS. Polluted right above cloud, aod~0.7
Ascent to 2km+ inplume 2km leg	13:42	13:57		Origin for the forward trajectories
Ascent to 2.5km+inplume 2.5km	14:00	14:15		Southbound or backtracking, 'stacked' leg w/ the 2km leg. Cleaner air layer here.
Ascent to 3km, then to 4.2 km (14kft) To 4S	14:15 14:27	14:23 15:09		Northbound @ 3km (14:15-14:23) Then northbound @4.2km to4S
Square spiral descent at 4S,BL leg,ascent, 15 minutes at 2km, ascent to 20kft, then 5 min sampling at 12kft and	15:09 15:25 15:33 15:43 15:55 16:12 16:26 16:46	15:24 15:33 15:43 15:55 16:12 16:24 16:44 16:51		Square spiral Descent Near-surface Ascent Plume heart leg @2km Ascent Plume leg 3900m Plume leg 2600m Plume leg 1300 m

8kft (some backtracking) before landing in STP				
landing	17:05			

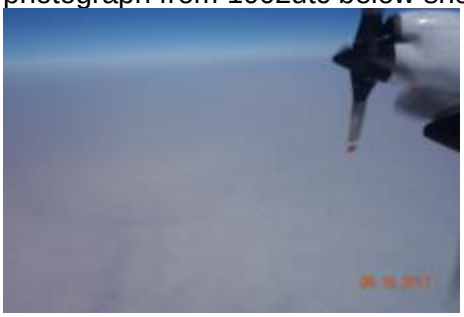
visual notes:
the southward leg of cloud radar imagery from 1000utc to 1100utc. First drizzle cell was at 9.02S at far left, last one at 13.29S (km 15 on right hand image). All had precip < 0dBZ (<1mm/day) so not strong.



the northern cloud boundary for these clouds, at about 7.4S (9.8utc), is interestingly depicted in the hsrl imagery. note the layer of decreased backscatter and increased depolarization ratio at about 1.6-1.8km prior to the cloud edge, consistent with evaporation of the cloud edge. T



photograph from 1002utc below shows a mild cellular organization.

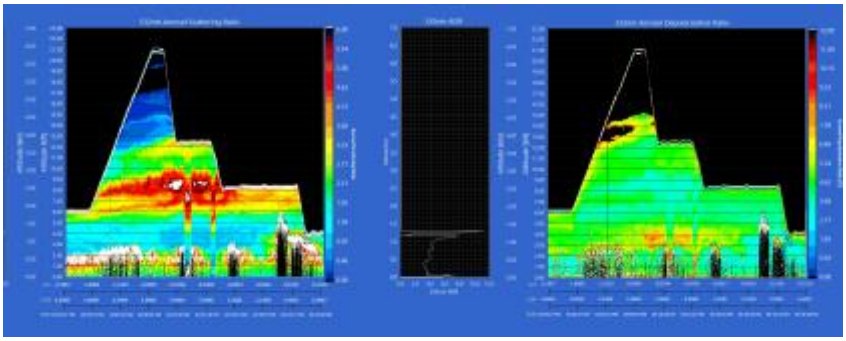


photograph of aerosol layer cleanly overlying low cloud taken at 1115utc along square spiral at 15S

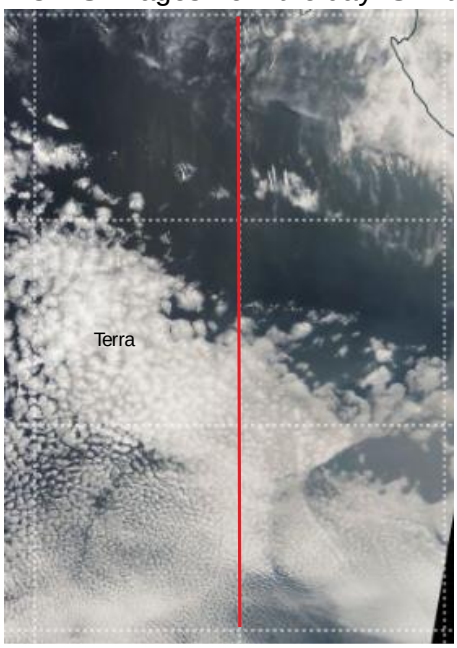
photograph of clean boundary leg at end of 15S at 1122utc and 1125utc

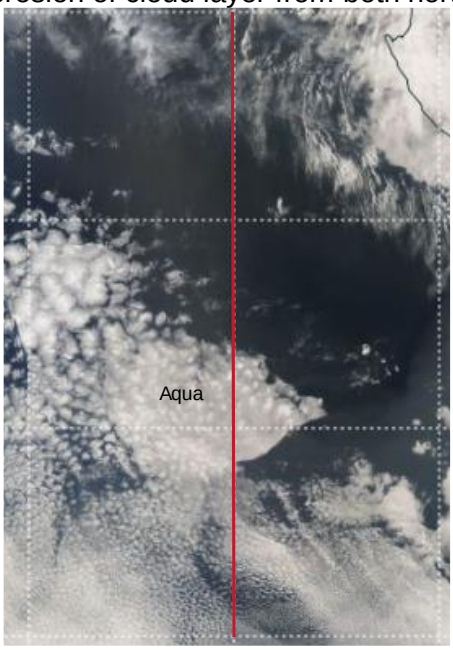
contrast with photograph of aerosol resting on cloud layer at 1326utc.

Ascent at the equator to 20kft followed by level leg in-situ characterization of the two aerosol plumes near Sao Tome on the return leg



MODIS images from the day. Swift erosion of cloud layer from both north and south.





SEVIRI showing small droplet numbers