ORACLES P3 Flight Scientist Post-Flight Status

Date: _____**2017-08-09**_____

Flight number: _____**PRF00Y17**_____

Routine flight or target of opportunity? ___**Transit + Science**_____

If target of opportunity, what is the goal? _____

Flight scientist: _____**Samuel LeBlanc**_____

Assistant flight scientist: _____NA_____

Ground scientist: _____**Rob Wood**_____

Take-off: _____**9:44:37**_____

Landing: _____**17:24:21**_____

Quick summary:

Representative ACAOD or ACAOD range for flight: _____0.15 – 0.45_____

Do the models predict crossing a gradient in aerosol age?
Yes/No/Unclear – aged near Sao Tome, and variable with height

Did the flight cross a gradient in macroscopic cloud properties, like cloud fraction?
Yes/No/Unclear – Cloudy near Ascension but no clouds observed in last spiral down near Sao Tomé

Did the flight cross a gradient in aerosol loading?
Yes/No/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 _____5_____

Square spirals ____3_____

MBL legs ____3_____

Cloud legs ____2_____

Above cloud legs _____3_____

Sawtooth legs _____2____

Plume legs _____3_____

Above plume legs ____4_____

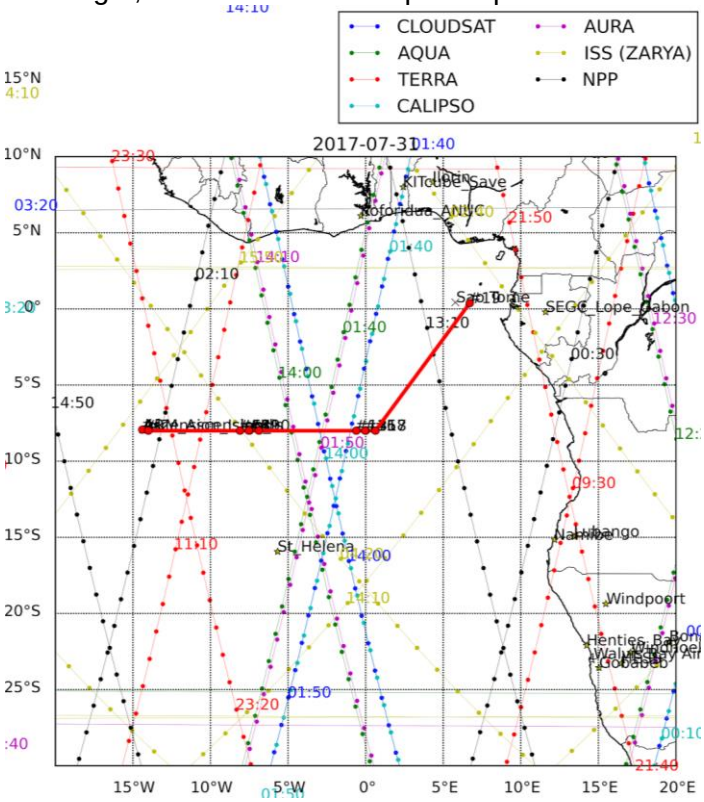
Instrument status:

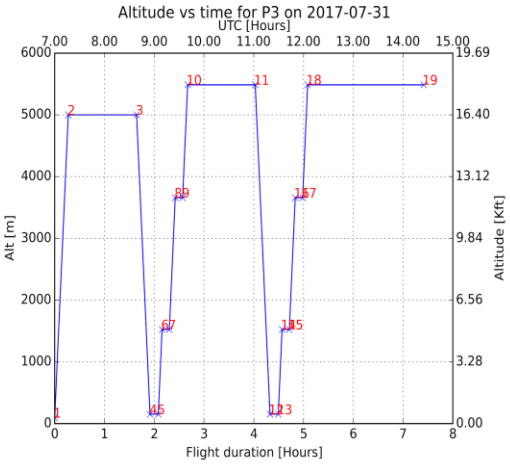
Instrument	Comments
P3	Had to replace the compressor for air conditioning on engine 2, then solenoid broke, finally fixed late the night before flight. Bird strike upon landing at TMS, but no damage noted.
4STAR	Good day. Aod up to 0.6 when measuring full column. Lots of sky scans at different altitudes, including full column directly above clouds.
HiGEAR	Pretty good flight, most things worked very well, got in cloud data, for first time. 3 outstanding issues, CN cold suspicious in beginning, no CN hot data for this flight. Neph needs calibration. LDMA showing too large concentrations in MBL. TDMA agreed with UHAS
HiGEAR-AMS	Great flight. Some issue at beginning, Ascension flyover uncertain. After fixed, concentrations seems to be trusted. Got on CVI. Overall Thrilled: that was awesome!
HSRL-2	Very good day today, except temperature issues, interferometer ran 3.5C warmer than normal. Will see in post processing how much it affects data quality.
RSP	Pretty good, door close in the first 2 spirals and clouds.
APR3	Waited in flight, was able to get W band until first spiral. Froze after first point. Got KA and KU band for rest of flight
Cloud probes	CAPS not working. No other issue. Good data collected during Sawtooth legs. Would love more. Good comparison of the 2 different CDPS. CAPS to be fixed tomorrow
CCN	It worked well, didn't suck a vacuum, also on CVI for parts
PDI	Worked during entire flight and collected data, and seemed to agree with other cloud probes.
Vertical winds	Good whole flight
WISPR/CVI	Day of science, great day of science. Everything is perfectly well. Type of sampling from today worked well and satisfied all science types of objectives.
COMA	off
SSFR	Good day. Liked the square spirals, platform worked well. Varied INS use between plane and internal. Glad for the clear air spiral
data	Good flight. Got HSRL images to the ground. Mostly loose ends to tie up. Kudos!

PRF00Y17 08/09 2017 Wednesday **Flight Science Report**

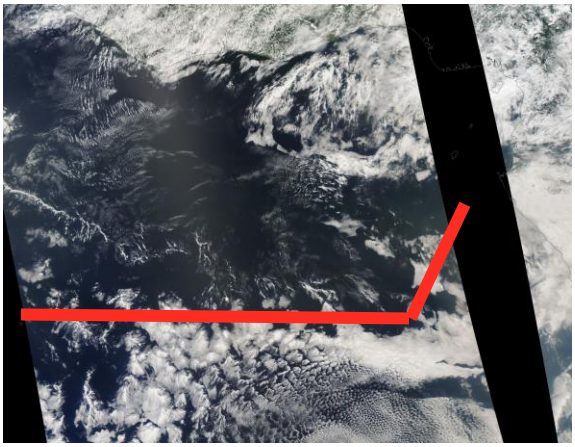
Flight Scientist: Samuel LeBlanc
Ground Scientist: Rob Wood

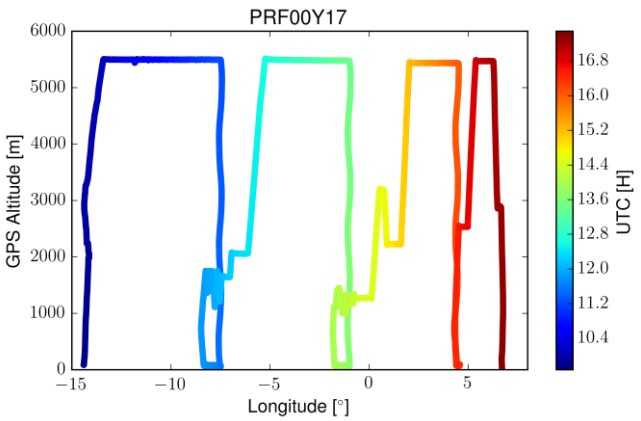
Flight plan and objective: Transit from Ascension to Sao Tomé with science enroute. Direct East flight, then North with 3 square spiral down with boundary layer sampling,

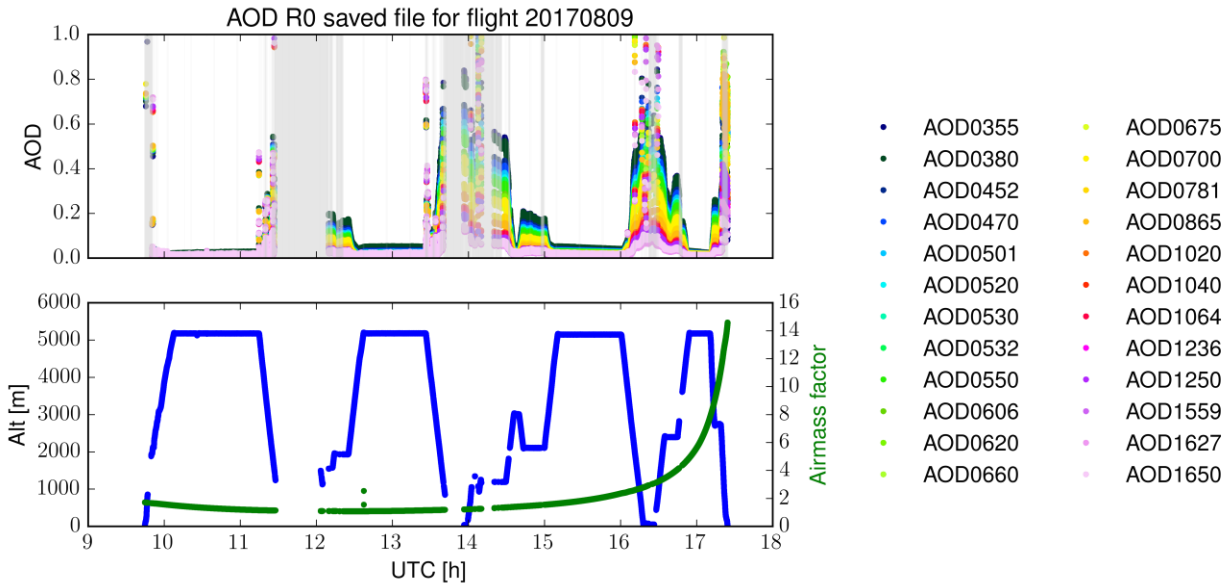




Flight Summary: Transit to Sao Tomé with in line science. First science flight successful with 3 square spirals, with backtrack under them at low altitudes. 2 of the 3 with clouds under, sampling clouds in sawtooth pattern. 1 in clear air with largest aerosol mass and concentrations measured of the flight. Most instruments worked well, highest AOD 0.6 of full column, above clouds at about 0.46. Aerosol sizes stable at ~160 nm. Sampled polluted MBL both below clouds and in free air. No aerosol above clouds at ascension. During 2nd spiral down and reverse course, measured ambient aerosol without cloud at cloud level, then transitioned to within clouds, without altitude change. Interesting gradient measurements.

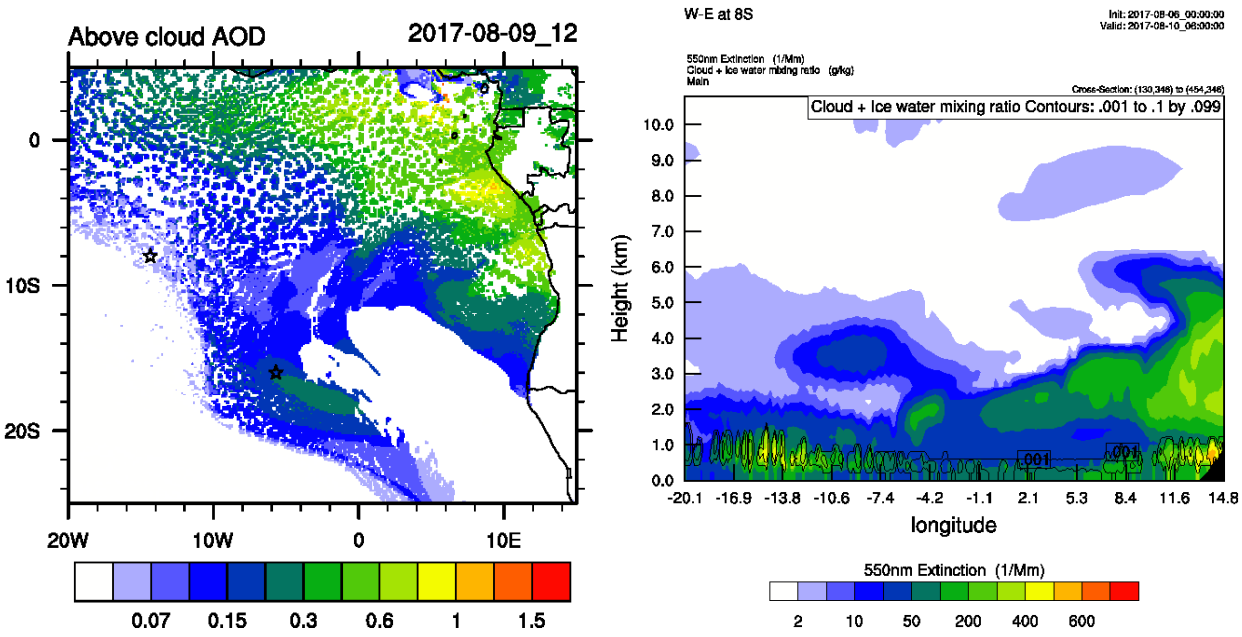




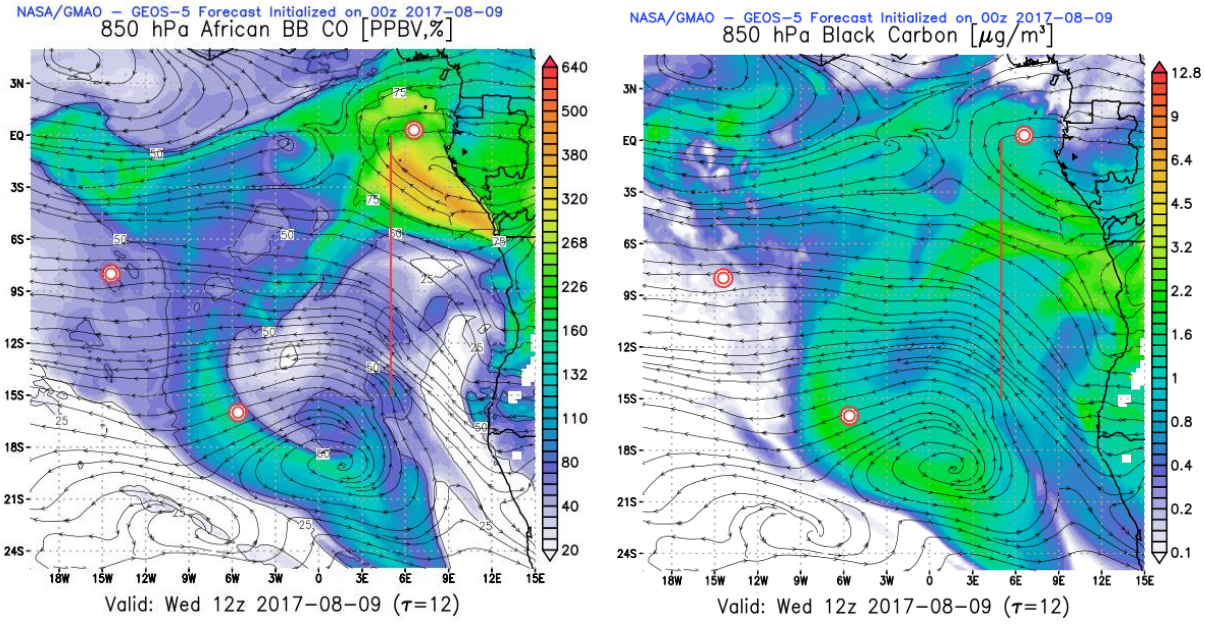


A-Priori Forecast: Forecasted low aerosol content near Ascension Island, but much more near Sao Tomé. Relatively low and sparse cloud fraction between Ascension and Sao Tomé. Highest cloud fraction about mid way through. Not much cirrus forecasted.

WRF-AAM forecast:



GEOS forecast:



Flight Instrument status: Most instruments worked well. APR3 had troubles, only got measurements until the first spiral, but afterwards less clouds regardless. A cloud probe is problematic (CAPS not working). Some issues with CN data (no hot CN, questions about CN cold) LDMA and Neph may be off. No CO measurements (COMA was not on the transit)

Flight Instrument/logistics notes: This was the first science flight, and was a transit flight. Mechanical difficulties of the P3 pushed this transit back multiple times. Limited ground support was available because of pour internet connection. Actual flight plan did not deviate much from the initial flight plan prepared months ahead of time.

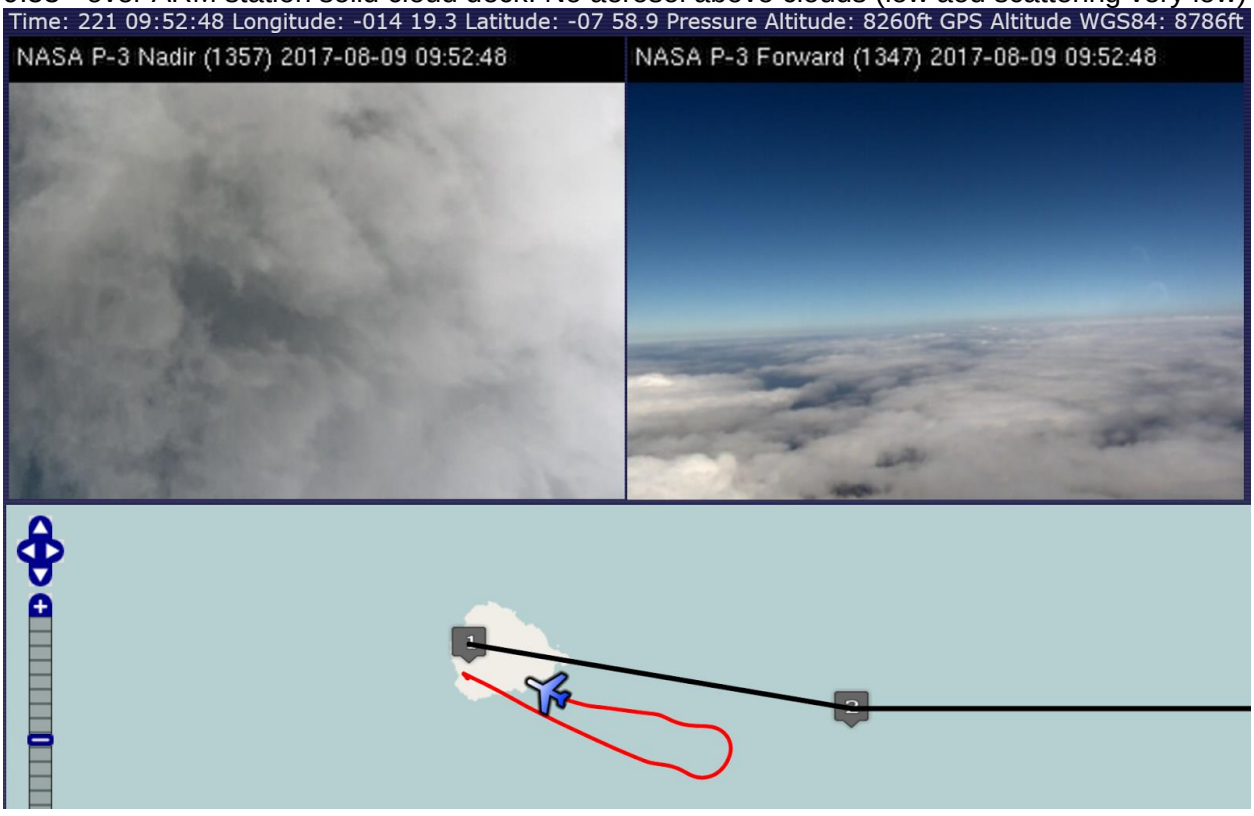
Run Table [UTC; approximate times okay, lack of detail okay]

description	beginning time	end time	altitude	notes
takeoff	9:44:37	X		
Overpass of Ascension island	9:45	9:58	0-12kft	Overfly of ARM site over Ascension, thick cloud deck, no aerosol above
Transit to first square spiral point	9:58	11:16	17kft	Low clouds clearing, some weak aerosol layer observed by HSRL
First spiral down	11:16	11:29	17kft – 200 ft	Aerosol altitude at 13 kft to 9.6 kft, weak, ~45/Mm extinction, in green. Thick and juicy clouds,
Reverse course low altitude then back for Sawtooth in cloud	11:29	12:15	200 ft, up to 6.5k ft	Well mixed boundary layer. Multiple cloud layer. nearly precipitating cloud, high LWC ~ 0.5
Ascend back to altitude, with level in aerosol layer	12:15	12:41	6.5 kft to 18 kft	
Transit East to next spiral point	12:41	13:26	18kft	No cirrus, aerosol layer starting to increase in HSRL
Second spiral down	13:26	13:49	18 kft to 200 ft	More than one aerosol layer. (top at 13.8 kft, next 10.5 kft, smaller at 8 kft), aod ~0.32. One cloud layer, LWC 0.44
Reverse course low altitude then back for Sawtooth in cloud	13:49	14:29	200ft to 4kft	Visually hazy under clouds, cloud thinning, full column AOD ~0.64. with scattering ~70/Mm in MBL, Measured transition of out of cloud to in cloud at cloud altitude during cloud hole.
Ascend back to altitude, with level in aerosol layer	14:29	15:08	4 kft to 18 kft	Multiple aerosol layers, long time in heart of main aerosol plume, aerosol plume much thicker, and more hazy than first spiral
Transit to next point, turn north East	15:08	16:00	18 kft	Clear air
Third square spiral down	16:00	16:20	18 kft to 200 ft	Multiple aerosol layer, depol ratio from HSRL is hypothesized to be aerosol of differing ages. Aerosol layers (3), with center being juiciest. No clouds underneath. Upper aerosol layers casting shadows on the lower layer.

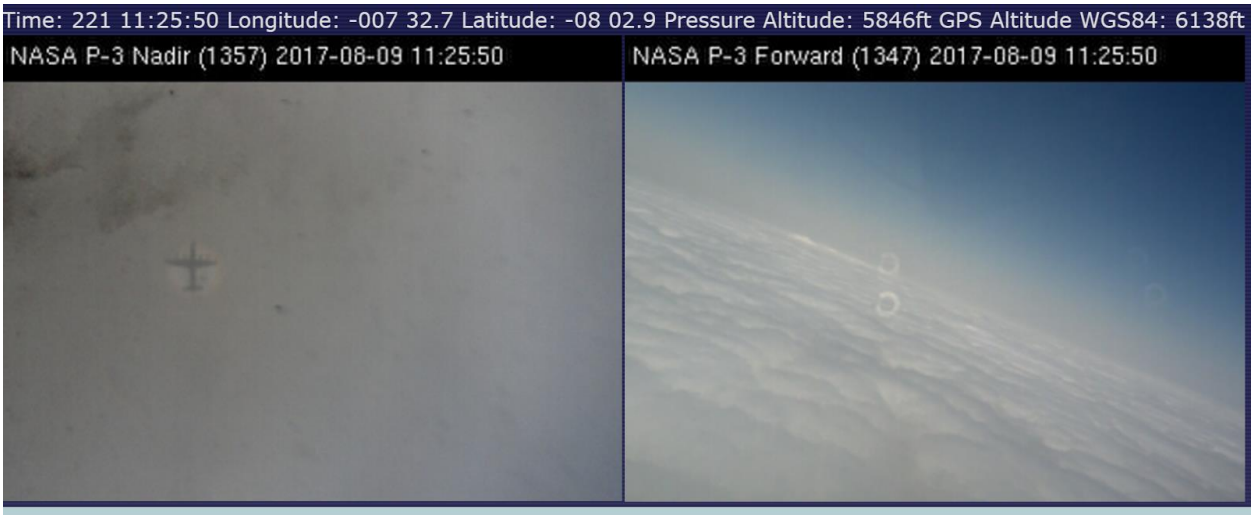
description	beginning time	end time	altitude	notes
Short low altitude reverse course in MBL	16:20	16:36	200 ft	Flew by single ship. Possibly sampled its plume.
Ascend back to transit altitude with stair steps inside aerosol plume	16:36	16:53	7 kft to 18 kft	Crossing multiple aerosol layers, some thinning. Juiciest has SP2 counts up to 1200. Slightly decreasing aerosol concentration towards North East.
Transit at altitude to Sao Tomé	16:53	17:10	18 kft	Sun setting while getting nearer to Sao Tomé, still cirrus free. Aerosol layers below showing up in HSRL that might be even thicker.
Start of descent and approach of Sao Tomé airport	17:10	17:22	18 kft to surface	Aerosol plume between 14 kft to 8 kft, sunset at 17:22, some higher clouds near horizon at sunset.
landing	17:24:21			

visual notes:

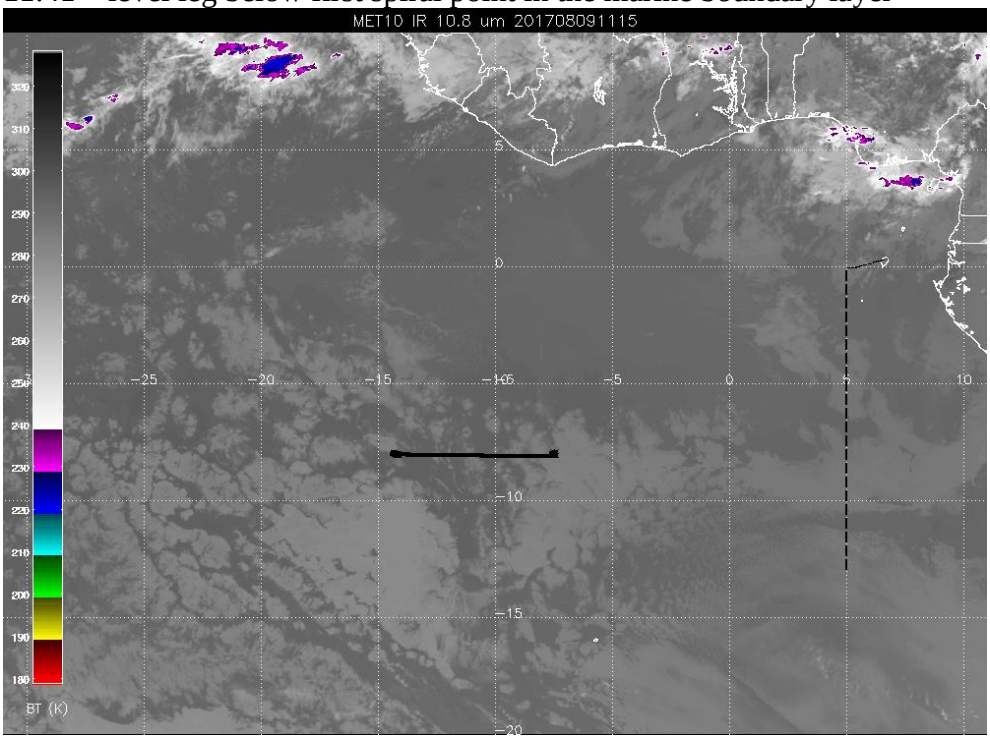
9:53 - over ARM station solid cloud deck. No aerosol above clouds (low aod scattering very low)



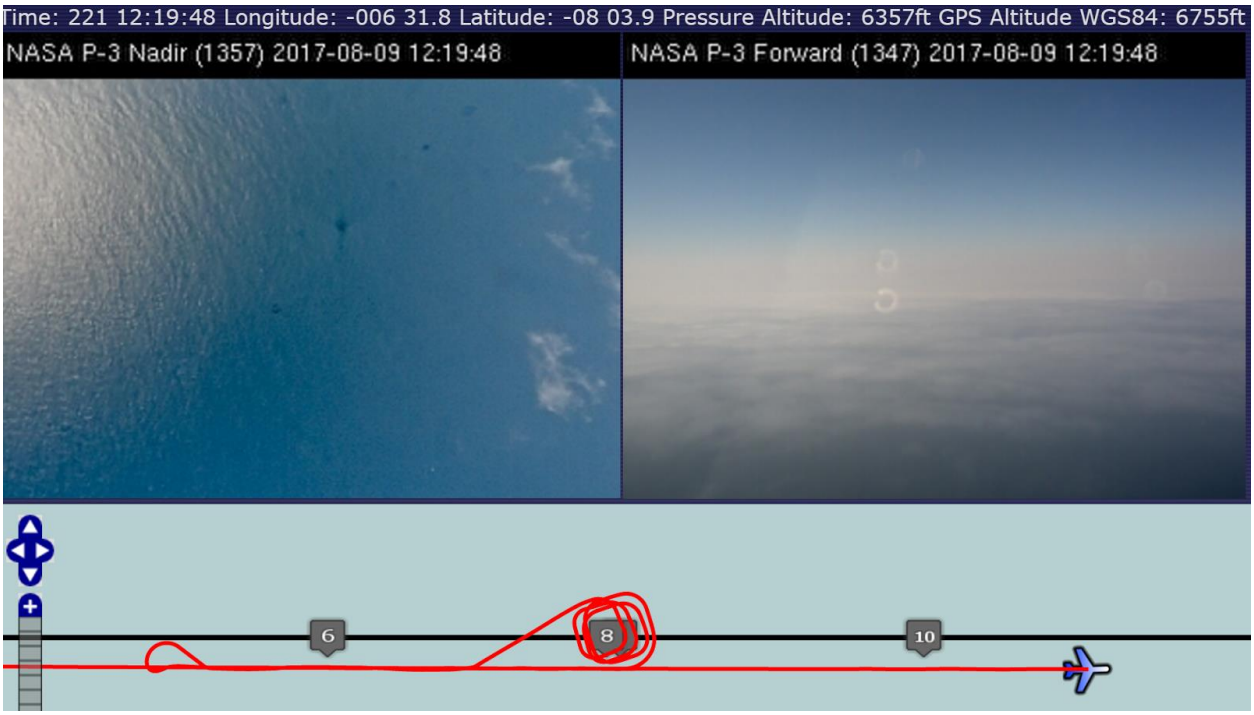
11:27 – during first spiral down, 6.5kft cloud top. Juicy clouds, out of clouds at 4.2kft, 0.18 CWC g/m3



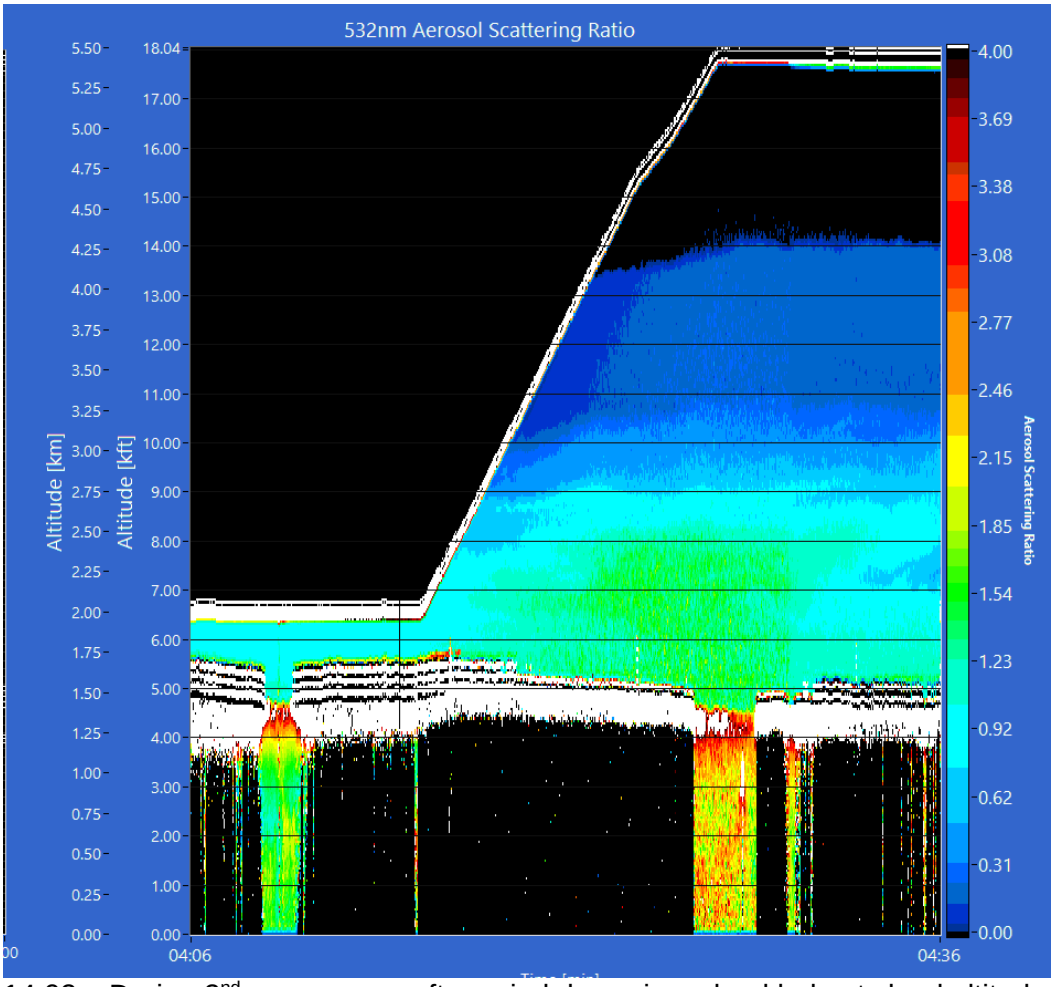
11:41 – level leg below first spiral point in the marine boundary layer



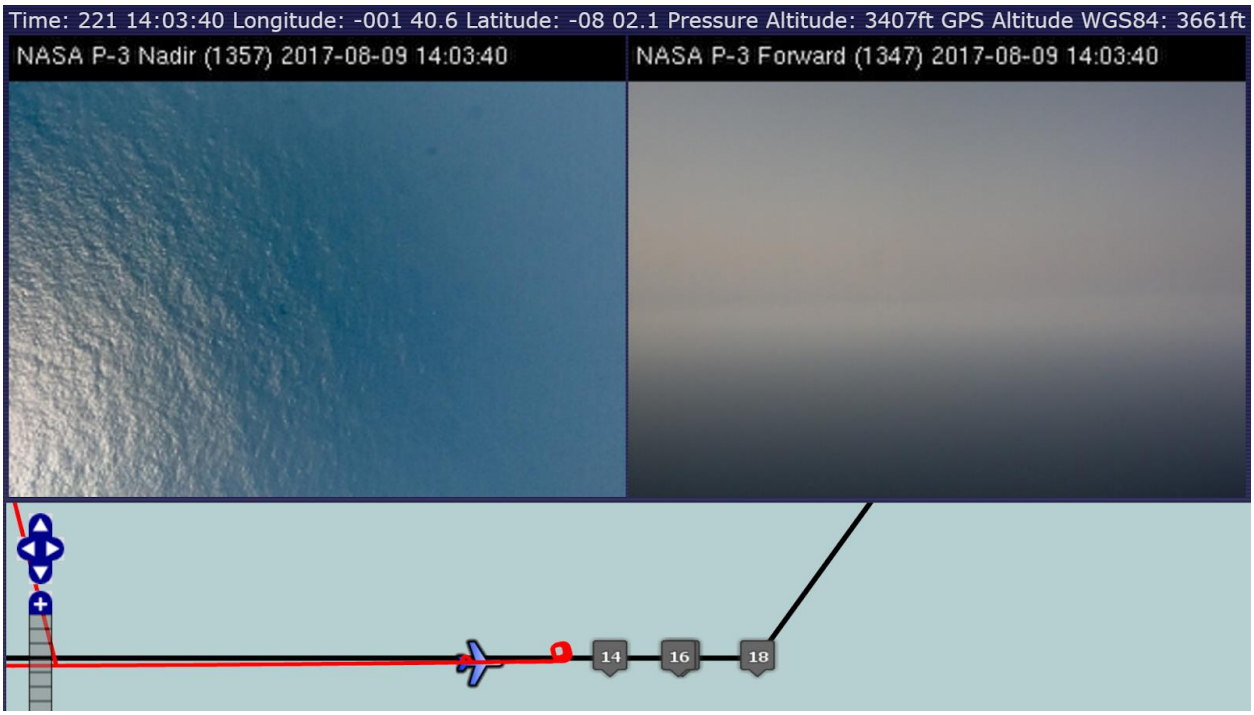
12:15 - start of 10 min, level leg of mid aerosol at 6.5kft After first spiral down. Seeing lower level of aerosol here then at right above cloud. Repeated a few skyscans, noticed some AOD increases in between scans. AOD ~0.12@ 6500ft.



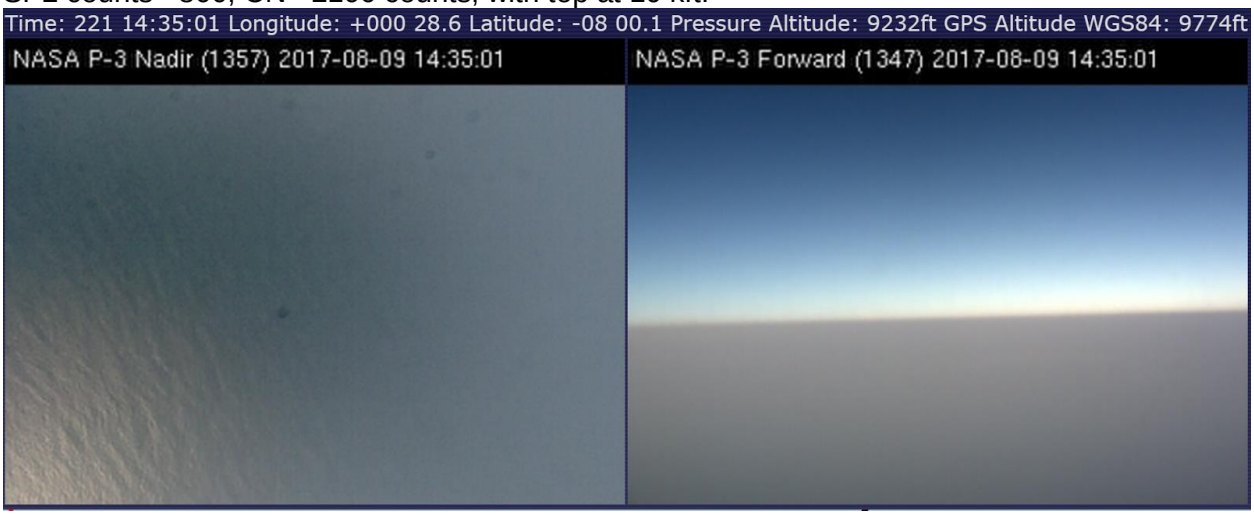
12:26 - climbing out of layer. 8500 - 9000 ft out of aerosol layer. Very similar profile than the previous descent in terms of in situ aerosol properties.



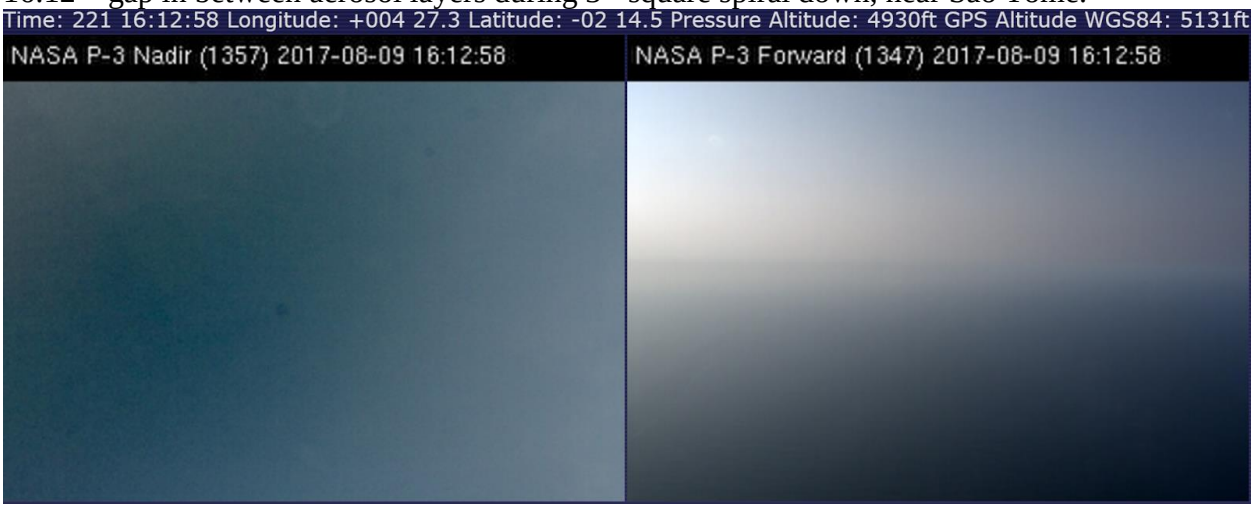
14:02 – During 2nd manoeuver, after spiral down, in a cloud hole at cloud altitudes, level at 3500ft, very hazy, aod ~0.44



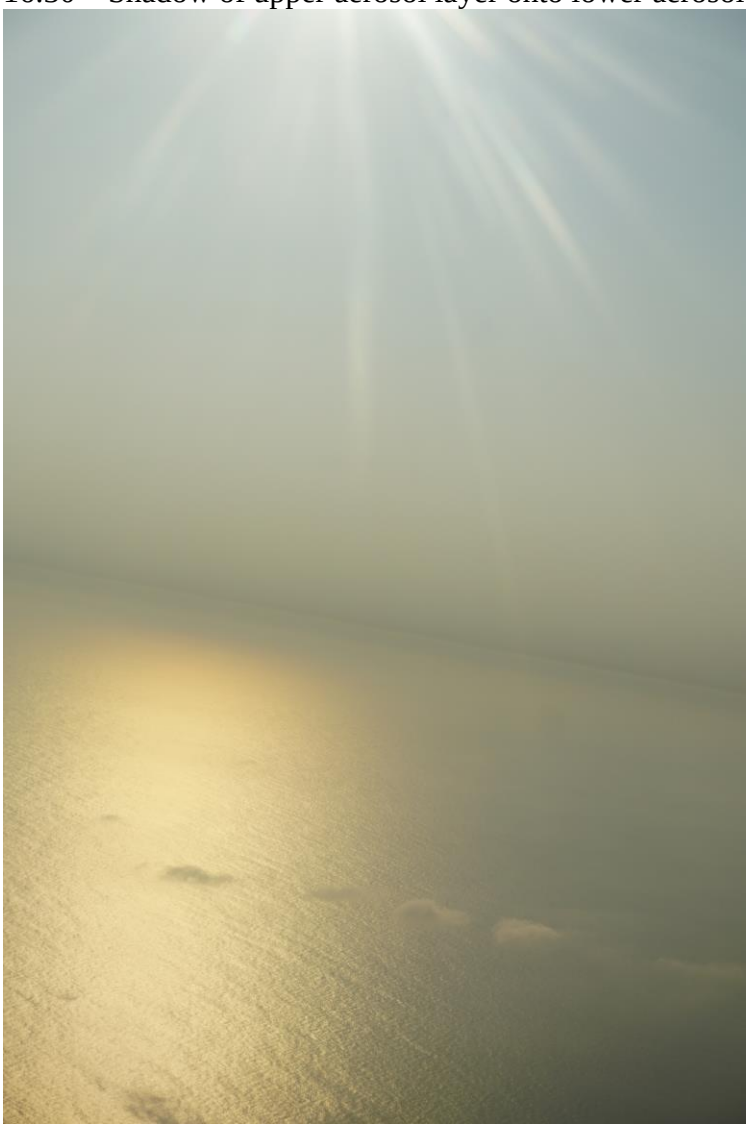
14:29 – ascend after 2nd square spiral down, with distinct aerosol layers, heart of layer at 7kft, SP2 counts ~800, CN ~2100 counts, with top at 10 kft.



16:12 – gap in between aerosol layers during 3rd square spiral down, near Sao Tomé.



16:30 – Shadow of upper aerosol layer onto lower aerosol layer



17:11 – descending into Sao Tomé over aerosol layers and scattered low clouds.