ORACLES P3 Flight Scientist Post-Flight Status

Date: ___12 August 2017_____

Flight number: _____PRF01Y17_____

Routine flight or target of opportunity? _____Routine_____

If target of opportunity, what is the goal? _____

Flight scientist: _____Jens Redemann_____

Assistant flight scientist: _____n/a_____

Ground scientist: _____Paquita Zuidema_____

Take-off: _____08:16UT_____

Landing: _____16:33UT_____

Quick summary:

Representative ACAOD or ACAOD range for flight: _____0.3-0.45; 0.55 full column_____

Do the models predict crossing a gradient in aerosol age? YES (older in boundary layer, younger above)
Yes/No/Unclear
Notes: May have sampled age gradient in the MBL ~7-8 S, but was not a target at the time of planning.

Did the flight cross a gradient in macroscopic cloud properties, like cloud fraction?
Yes/No/Unclear YES
Notes: W-E cloud boundaries at 12 S and 2 S on NS-leg

Did the flight cross a gradient in aerosol loading? YES
Yes/No/Unclear
Notes: More AOD to North

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

How many of the following maneuvers took place?

Ramps _2(?)_____

Square spirals ___3_____

MBL legs __3x10mins_____

Cloud legs _only sawtooth_____

Above cloud legs __2-3 per profile_____

Sawtooth legs __3_____

Plume legs __>5_____

Above plume legs __all South-bound_____

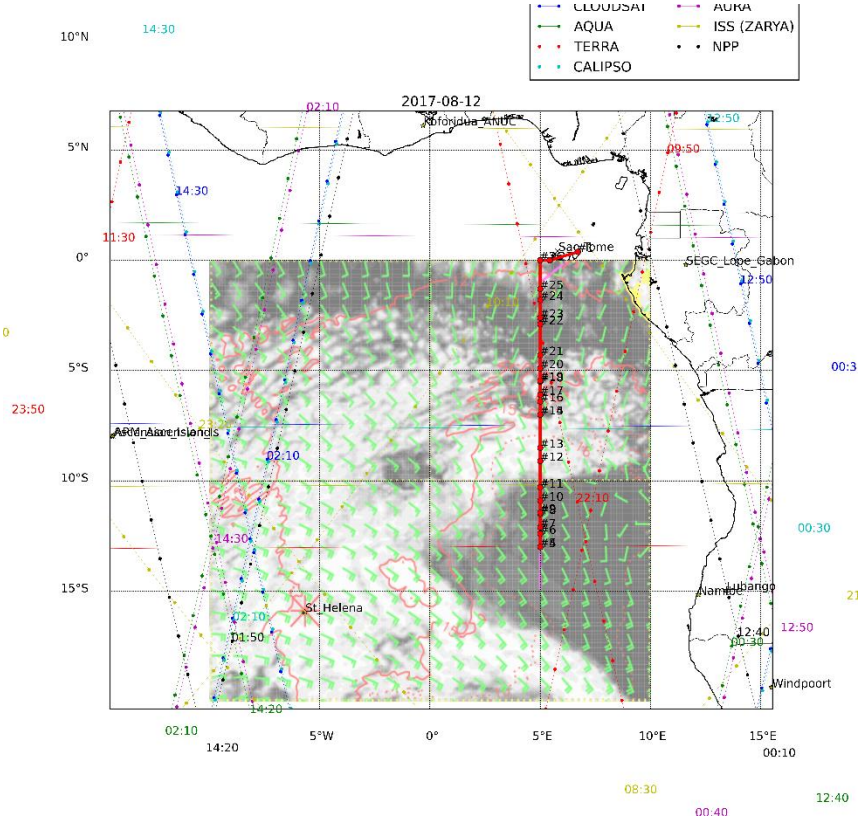
Instrument status:

Instrument	Comments
P3	When pilots communicate with the control tower, they do not hear anything else, and didn't know the 4STAR monitor issue until within taxi. Otherwise the In-flight communication went well. Late going out leading to late coming back can run into crew rest issues, and pilots left quickly after flight to avoid crew rest delaying the next flight. Need to revisit protocol for communicating with pilots on next-day flight of a back-to-back sequence, as the presence of 3 pilots on the plane doesn't necessarily mean one is free to focus.
4STAR	Monitor display problem fixed 3 min into flight
HiGEAR	UHSAS non-operational (?); raw data IS RECOVERABLE; TSI neph and ultrafine CNC down.
HiGEAR-AMS	Green – all good
HSRL-2	Good, 2 calibrations, one at beginning another within initial ferry leg; Worked very well, will work on ground for direct downlink of data.
RSP	Perfect. Two switches per person perfect ratio. Decided to purge overnight post-flight. Left ~1400 PSI.
APR3	Worked AMAZING. Saw drizzle. Nothing went wrong.
Cloud probes	Worked pretty well, CDP and CIP images had an issue (?). CIP images not recorded, connection issue (in pylon?). UND CDP has low voltage in receiver, something loose.
CCN	Worked great
PDI	Worked well
Vertical winds	Lee didn't say anything negative
WISPR/CVI	Had a great science day, great cloud measurements, all green
COMA	Possible water intrusion in instrument early in flight (first 30-60 min). Good after that
SSFR	All good
data	All good, (LARC imagery site delayed images by 1.5 hours or more)

PRF01 12 August 2017 Saturday **Mission Report**

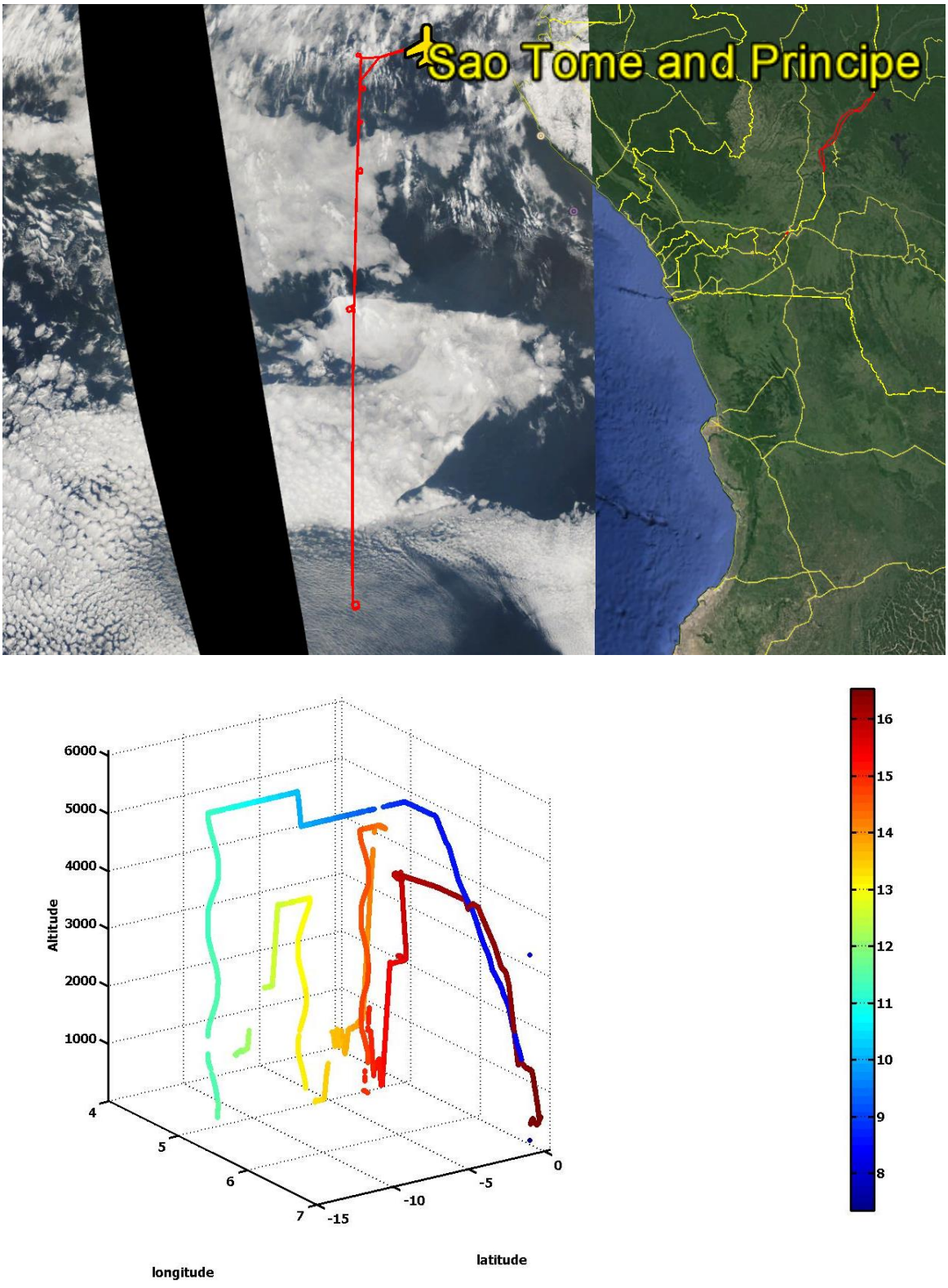
flight scientist: Jens Redemann
ground scientist: Paquita Zuidema

flight plan and objective: first routine flight, along 5E, 0S-13S, 8hours, • Southbound leg at high altitude to get an HSRL curtain out to 13S; Two sets of square spirals, plus legs at min safe alt., in cloud, just above cloud, in-plume; Possibly no return to 20kft on Northbound leg.

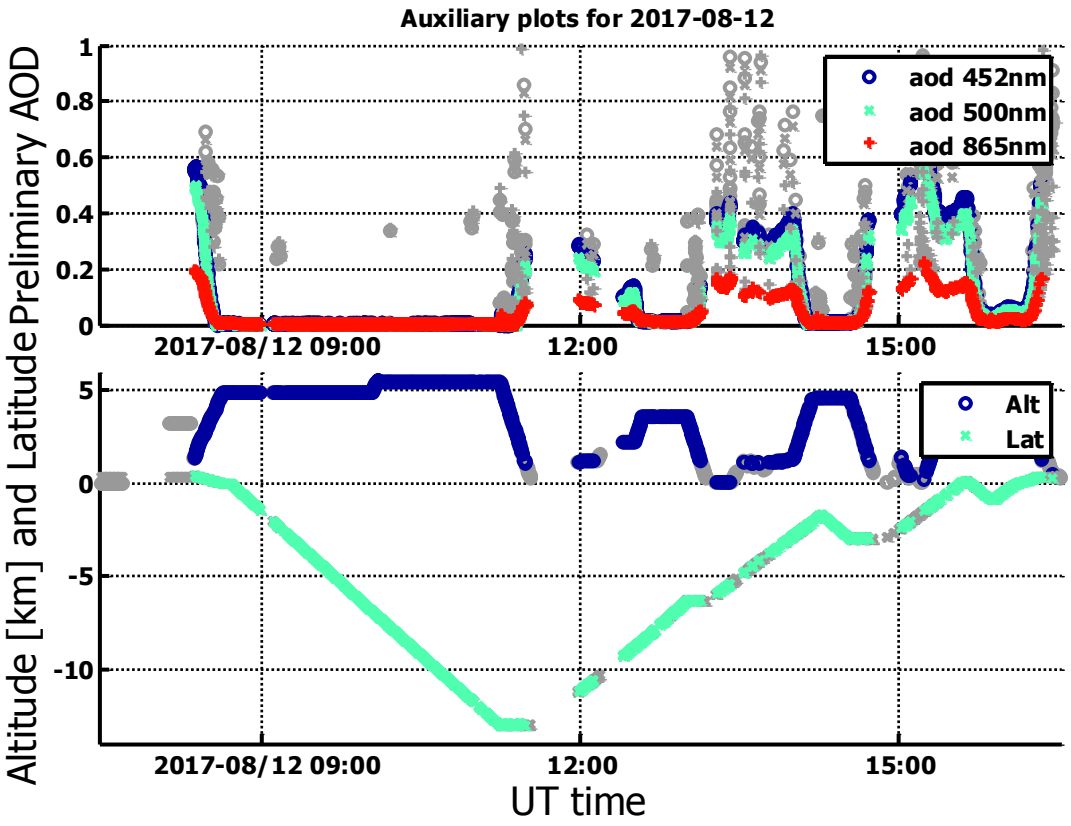


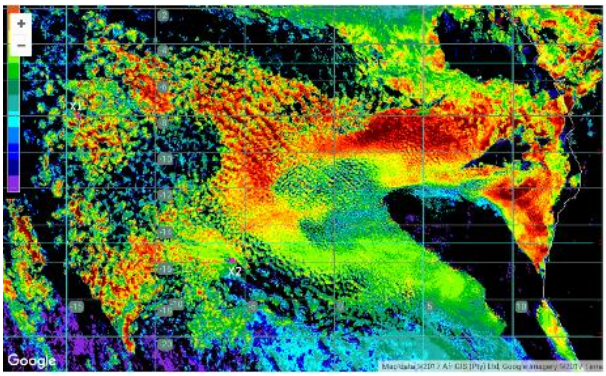
Flight Summary: Out of Sao Tome crossed into aerosol layer at ~2.6km with higher aerosol layer at 3.2 km; highest ACAOD of flight at ~0.45. flight to south over aerosol layer resting on cloud top until lowering cloud top separated from the aerosol at about 2S. at ~6S crossed over a 'soft' cloud break then over solid deck of small closed cloud cells topped by aerosol layer resting on cloud up to 2.8km. A 'harder' cloud clearing was in fact very thin cloud with lowered tops <~1km, separated from aerosol layer above. On way back, (Spiral descents+cloud porpoising+level legs)*2 followed by acknowledgment of additional time by through backtracking and additional low-level sampling.

additional sampling added at end as flight progressed 20 minutes faster than what was in flight planner, with pilots thinking even more.
Actual flight path:



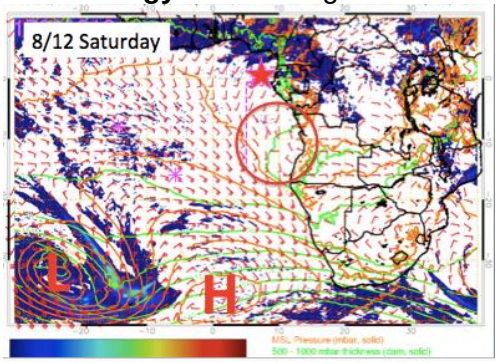
Flight track as flown – PRF01Y17 Top: overlaid on MODIS-Aqua RGB; Bottom: 3-D with color indicating UT time.





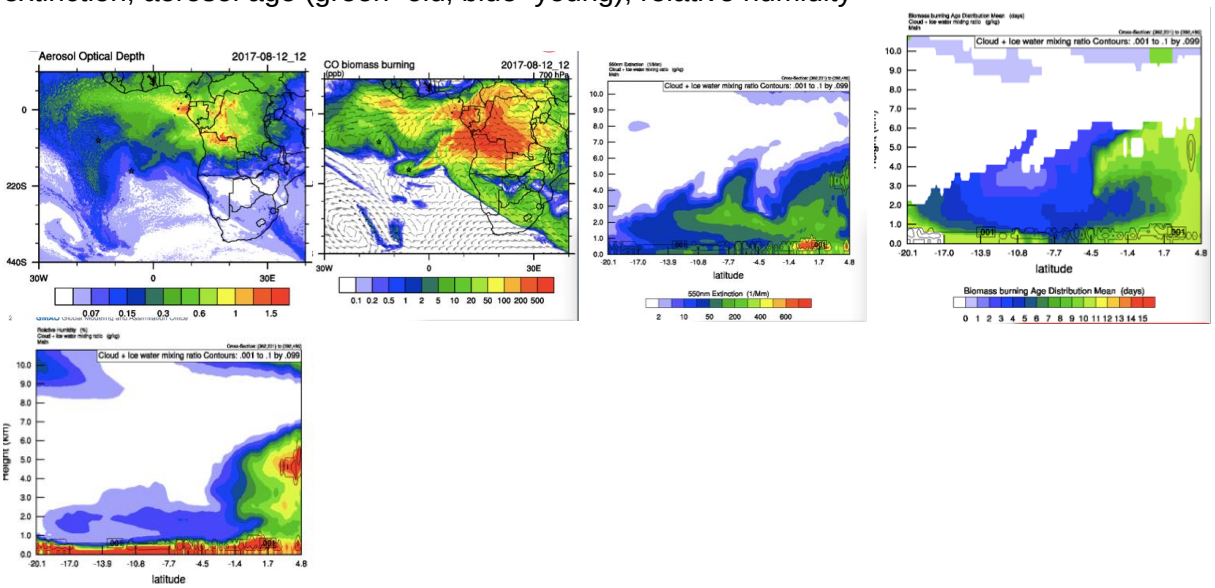
Minnis cloud Nd suggests polluted clouds north of 12S.

A-Priori Forecast:
Meteorology: surface high/low at 30-35S



ECMWF Precip (color), surface winds, sea level pressure (orange)

WRF-AAM 12Z forecasts, left to right, of a) AOD, b)CO, c), d), e) 5E cross sections of extinction, aerosol age (green=old, blue=young), relative humidity



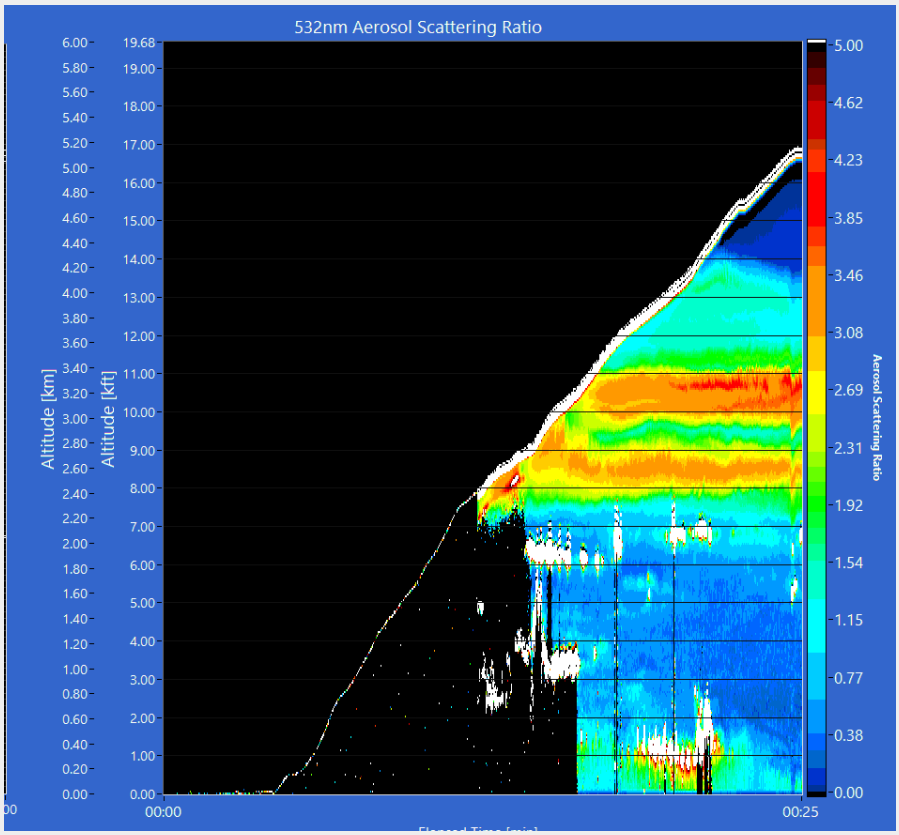
- Takeoff temperatures similar to 08/11/17 (25-26C) based on winds and mid-high cloud cover
- Low clouds expected 5-10S with most dense clouds 8-10S; need to make note of Northern edge of low cloud deck during S-bound leg
- High and middle clouds will likely NOT be a problem (mostly to the north)
- Mid levels are dry; don't expect much plume transport from dry convection reaching our flight track
- ~10-20 knot crosswinds in the 5-15 kft layer along the N-S leg

Flight Instrument status: see table above

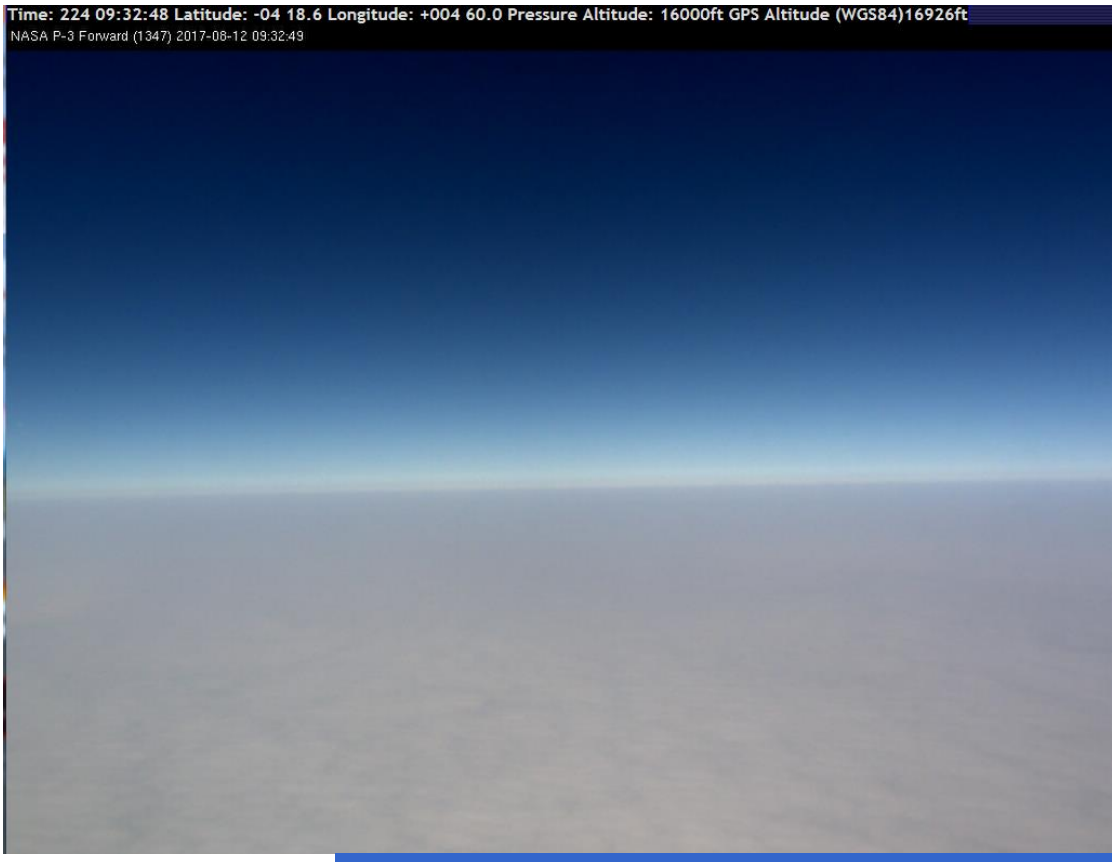
Flight Instrument/logistics notes: initial 17 minute delay as 4STAR monitor was replaced. At 1.6S on the way back, the plane was only 6 hours into the flight. The last part of the flight plan was modified to accommodate ~an hour of extra time.

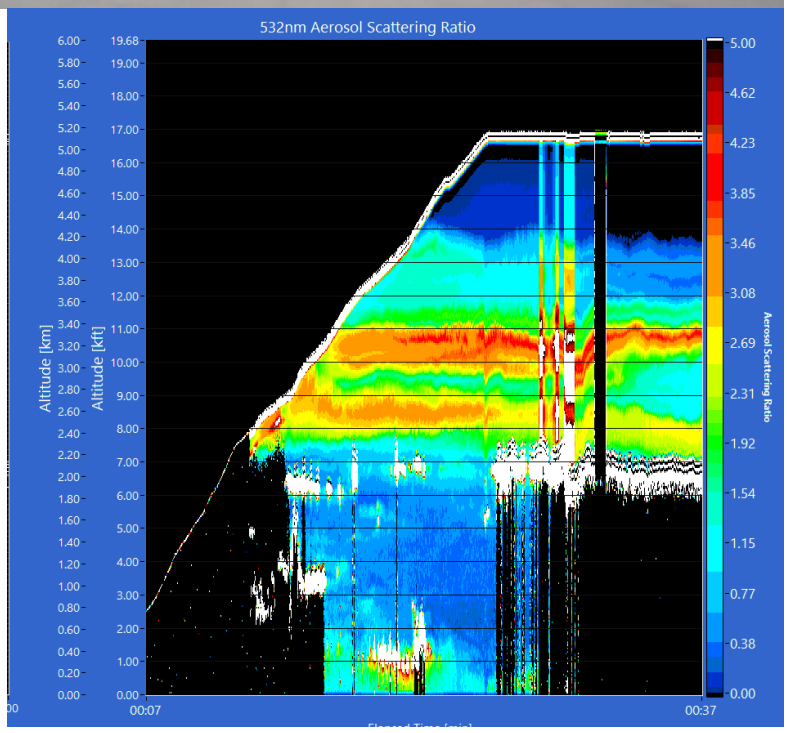
Run Table [UTC; approximate and lacking detail**]**

description	beginning time	end time	altitude	notes
takeoff	08:16:40	X		Initial delay, needed replacement 4STAR monitor from shipment in hangar Initial AOD~0.47 above cloud. Hsrl shows 2 aerosol layers, separated from cloud below, loading maxima at ~2.6 and 3.4km
	08:23			During initial climb-out very thin broken cloud layer, capped at ~3500ft? (check data); CO starting to increase at ~6.5kft
				
Ferry leg @ 5E	08:43:00	11:16	16kft to 6.85S then 18kft to 13S	Aerosol plume has double-layered structure ; HSRL calibration at beginning. Aod~0.3 at beginning. Initially the aerosol layer/cloud touch, then cloud top lowers, separating itself from the aerosol, at 7S the aerosol layer also descends and aerosol/cloud touch. 'hard' cloud break at 12 S, complete cloud clearing to the south, a 'soft' cloud break at ~6.5S S on visible. Change in hsrl calibration at ~12.5S increases ASR, not physical

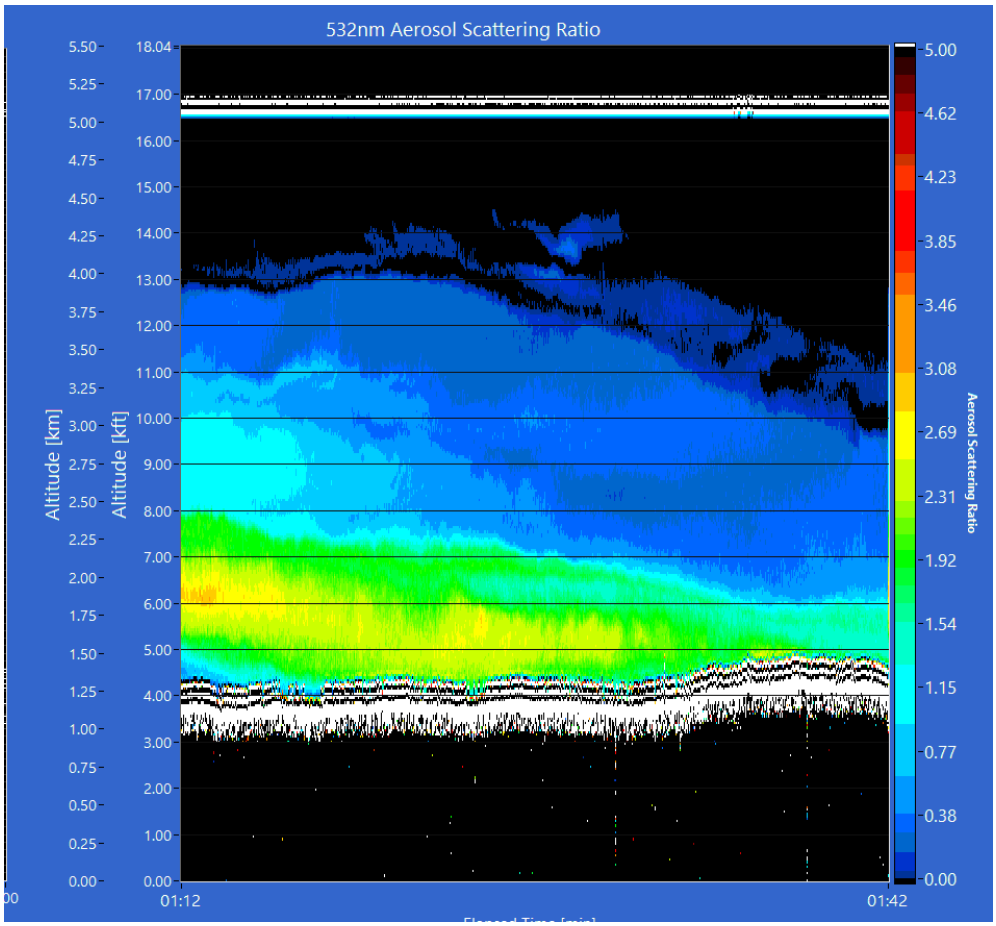


	08:50		16kft	Plume below is thick enough to where cloud structure is hard to see visibly
	08:55			Interesting feature in HSRL curtain. After low level clouds appear, aerosol layer above cloud appears to be weaker (less backscatter), near 0.8degS
	09:28			HSRL shows cloud tops decreasing from 6kft to 4kft in 30 mins; aerosol layer is decreasing in alt slightly, creating a separation


Time: 224 09:32:48 Latitude: -04 18.6 Longitude: +004 60.0 Pressure Altitude: 16000ft GPS Altitude (WGS84)16926ft
NASA P-3 Forward (1347) 2017-08-12 09:32:49


532nm Aerosol Scattering Ratio
Altitude [km]
Altitude [kft]
Aerosol Scattering Ratio
00:07
00:37

	09:53			Took picture of interesting bright spots in clouds
				
	09:55			Layer separation disappearing in lidar curtain

				
	10:02			climbing to 18kft some contrails or structure ahead of us, near 7degS
	10:09			Very broken clouds near 7.5S

				
	11:00			clouds starting to become very thin; interesting aerosol layer (different depol from farther North) right above cloud top
	11:10			cloud becoming very thin and broken

				
Descent at 13S	11:16	~11:35		Spiral descent, very thin cloud below
				

	11:19			some layering and separation visible to South – pix
				
	11:24			top of plume at 10kft, plume seems well mixed
				

Stepping back up	11:27 ~11:35	 ~12:57		Minimum loading at 5.5kft 1. Level leg@86m 2. 2 cloud-level porpoises, 0.6-1.4km 3. ~11:58 level leg @~1.24km 4. ~12:13 level leg @ ~2.4km 5. ~12:34 level leg @ ~3.8km
	11:46 12:12			start porpoising between 1.5 and 3.5kft; clouds thickening towards N; need to go to 4kft to be above; 0.3 AOD at cloud top climbing to 7.5kft for heart of plume run; pretty well mixed here
	12:15			quartz filter #3 start, 49l/min volumetric
	12:46			broken clouds with increasing cloud fractions further North

Beginning 2nd sprial,6S,backtracking	~12:57	13:14		
	13:08			During descent plume top at 5kft, clouds thick
				
Stepping back up to 4.8km	13:14	~14:15		1.Level leg@75m, saw drizzle. 2. 3 cloud-level porpoises, 0.8-1.2km 3. ~13:55 level leg @~1.25km 4. ~14:10 level leg @ ~4.8km
	13:18			completely cleared cloud edge, 0.33 AOD
	13:30			found thin cloud; porpoising at 500ft/min
	13:34			smoke right at the top of the cloud here
Backtracking at level altitude	14:15	14:35		4.8km, course reversal for HSRL leg

Square spiral down, porpoising across cloud edge, transit in plume	14:35			Spiral down about 3S, square spiral over most solid cloud deck to set up porpoise run; highest PCASP of the day, but relatively low BC and refractory CN, AOD 0.55 (full column)
	15:06			trying to hit pop-Cu at 1.0-1.5kft – pix
				
	15:12			Drop to 200 ft

				
	15:15 15:25 15:35			ramped ascent to 7kft 7kft level leg for in situ sampling Reverse course for ramped ascent 5min to 12kft
	15:42			clouds up to 6kft near 0S and 5E

				
	12kft			leg in plume (near top), still heavy loading relatively low BC, hypothesized to be scavenged
landing	16:33			

visual notes: any photographs, additional images

please upload to https://espo.nasa.gov/ORACLES/node/add/mission-science-report when done, if access is a problem either email to bernadette.luna-1@nasa.gov to upload or ask her to grant access permission.