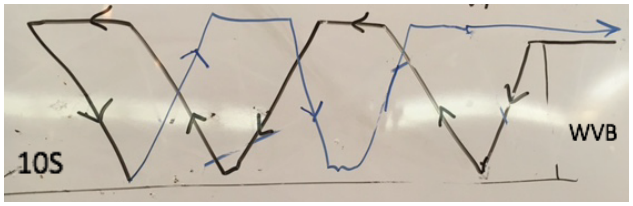
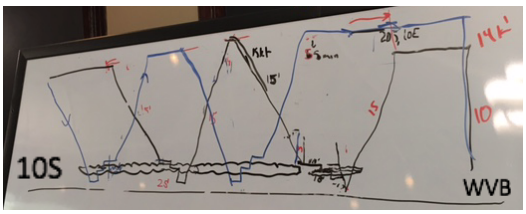
**PRF04 September 4 Sunday** **Mission Report**

**No ER2 flight**

*flight scientist: Paquita Zuidema*
*mission scientist: Jens Redemann*

flight plan and objective: reach 10S, 0E, on the second routine flight with 2 profiles outgoing and returning, offset from each other. aerosol profiling+above-cloud+in-cloud+sub-cloud

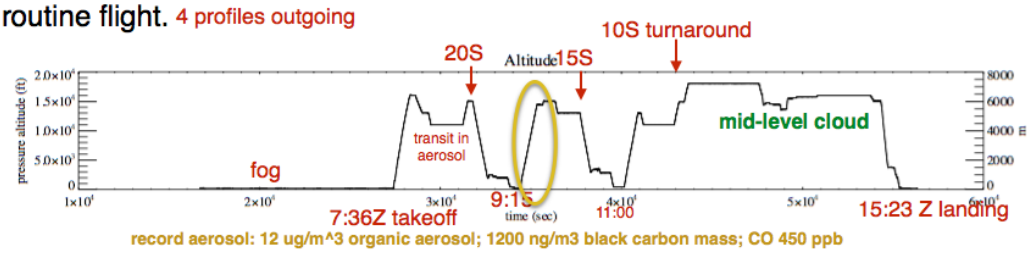


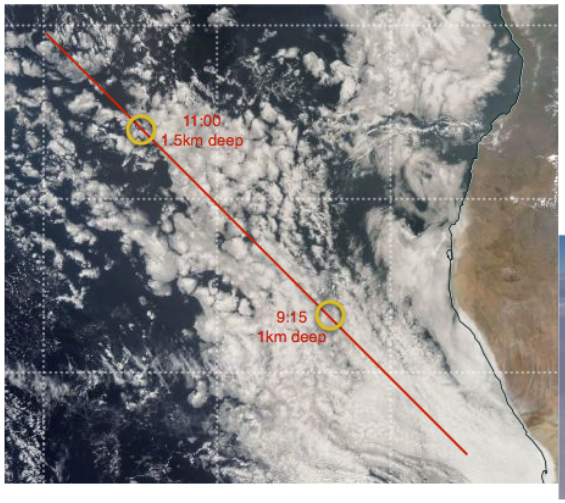

**Flight Summary: actual profile shown below. reached 10S with two boundary layer profiles along the way, transiting at 13-16kft altitude afterwards back to WVB. 2nd BL profile at 13S sampled a decoupled boundary layer reaching 1.5km with SP2 BC mass of 10 ng/m^3. The 2nd ascent sampled the highest organic aerosol/SP2 measurements to date: 12 microgram/m^3, 1200 ng/m^3 respectively. The transit back sampled a thick mid-1level cloud oriented along NW-SE transit leg [-16S, 6E -> -18.5, 7.8E] lying above the smoke layer, with similar aerosol/black carbon concentrations.**

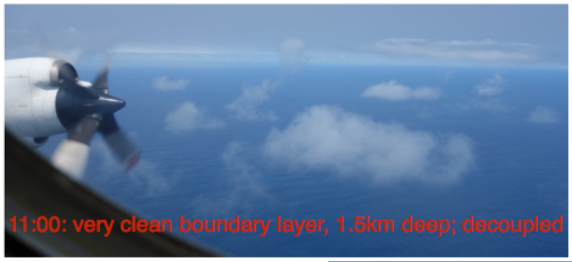
## RF 04 September 4

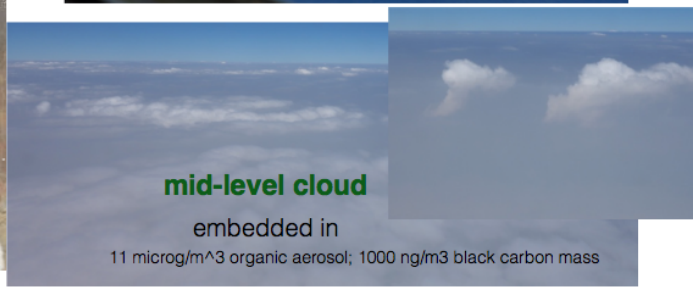
routine flight. 4 profiles outgoing



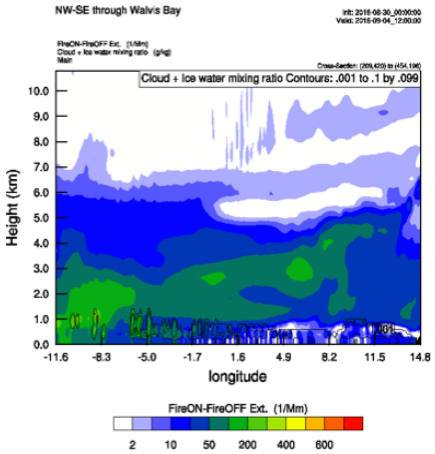

record aerosol: 12 ug/m^3 organic aerosol; 1200 ng/m3 black carbon mass; CO 450 ppb

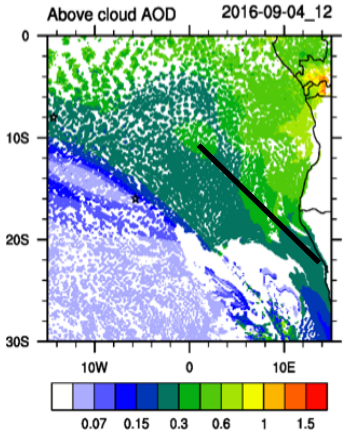


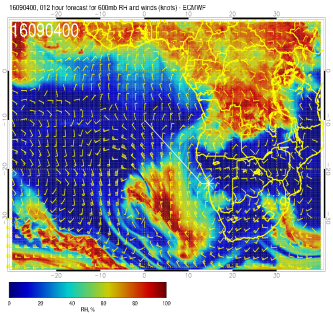



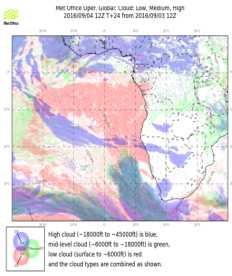



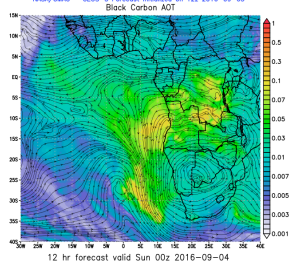
**Forecast:** WRF model routine cross-section shows max smoke at 8E reaching 5 km connected to the 600 hpa circulation confined near the coast. aerosol layer top decreasing in altitude to 4km further west, possibly associated with older aerosol. Sept 3 modis satellite image [not included] shows thin low clouds transitioning to open cells at 10S. UKMO model forecast some high cirrus near 20S, no middle cloud [note: cirrus did not verify, instead mid-level cloud at 600 hpa EC high RH].






**Notes from flight:**
manifest (full flight)
crew (5): Michael Singer [chief pilot]/Mark Russell [co-pilot]/Brian Yates/Todd Brophy/Mike Terrell
science (19): Paquita Zuidema [flight scientist]/Steffan Freitag/Nikolai Smirnow/Amie Dobracki [HiGear]/Jacek Chowdhary [RSP]/Ashley Heikkila [PDI]/Eric Stith [Data]/Jim Podolske [COMA] David Simmons [AMPR]/Art Sedlacek [PTI]/Siddhant Gupta [cloud probes]/Warren Gore/Scott Kittelman [SSFR]/Sam LeBlanc [4STAR]/Elin Mcilhatten/Ousmane Sy/Andrew Dzambo/Greg Sadowy [APR3] /Mary Kacarab [CCN]
ground mission scientist: Jens Redemann

instrument status: HiGear, RSP, PDI, COMA, AMPR, SSFR, 4STAR, APR3, CCN, cloud probe instruments worked well except the CAPS cloud probe. PTI problem with laser gasket, solved, but signal appeared to lose sensitivity over course of flight. immarsat outage for most of flight. RSP had minor issues with shutter and mirror. SSFR was able to do an inflight calibration.

instrument/logistics notes: cloud probes acquired buildup on their windows during transit back. initial takeoff delayed due to fog, from unusual on-shore winds, combined with a one-hour local hour time change from GMT+1 to GMT+2. En route, a slight deviation of planned route from actual route was traced to use of great circle route by plane, unaccounted for. maximum deviation of 0.2 degree

**Run Table [UTC; times are approximate]**
**green-success likely red-success uncertain**

| description | beginning time | end time | altitude | note | SOs attempted |
|---|---|---|---|---|---|
| takeoff | 07:36:28 | | | delayed from 0600Z due to fog | |
| transit to 20S | | 08:51 | | 13 kft dropping to 11kft @8:15 to sample aerosol. slow ascent to 15kft by 20S | SO1-1; SO1-3 |
| descent profile | 08:51:00 | | | beginning at 20S. air mass transition at ~8kft then again 6 kft | SO1-1; SO1-2; SO1-3; SO2-1; SO2-2; SO2-3; |
| BL sequence: dip into cloud+5" above cloud+10" in cloud+10" subcloud | 09:03:00 09:13:00 in-cloud leg 09:22:00 below cloud @ 1300ft | 09:35:00 | | 2800ft cloud top. aerosol-cloud separation of ~300 ft.. drizzle. patchy. 0.42 aod | SO3-1; SO3-2; SO3-3; SO2-2; SO2-3 |
| ascent to 15kft | 09:35:00 | | | AMS conc. 30 microg/m^3; SP2 >1200 ng/m^3; CO max 450; CCN 1000/cc at highest ss. mid-level cloud present at 15kft capping aod layer at ~09:57:00 | SO1-1; SO1-2; SO1-3; SO2-1; SO2-2; SO2-3; |
| transit to 15S | | | | | SO1-1; SO1-3 |
| descent | 10:30:00 | 10:38 | | | SO1-1; SO1-2; SO1-3; SO2-1; SO2-2; SO2-3; |

| description | beginning time | end time | altitude | note | SOs attempted |
|---|---|---|---|---|---|
| BL sequence: dip into cloud+5" above cloud+10" in cloud+10" subcloud | 10:38:00 | 11:11 | | 0.55 aod. -13S, 2.5E. SP2<20. 3100ft cloud top. | SO3-1; SO3-2; SO3-3; SO2-2; SO2-3 |
| ascent to 15kft | 11:11 | | | aerosol layer top at 11500ft | SO1-1; SO1-2; SO1-3; SO2-1; SO2-2; SO2-3; |
| transit to 10S | | 11:54:16 | | | SO1-1; SO1-3 |
| transit back to WVB | 11:54 | 14:48 | 15kft | 14:00 on cirrus | SO1-1; SO1-3 |
| mid-level cloud sampling: skimming cloud top+10minutes incloud+10minutes subcloud | 13:17<br>13:29 - incloud<br>13:34-below cloud | | ~13kft | cloud layer residing on top of smoke layer. thin but optically thick with cumuliform appearance. Aqua modis cloud top temperature 265-270K | ? |
| descent->landing | 14:58 | 15:23:27 | | aerosol layer top 14.4 kft | |

**Progress towards Science Objectives: expectation-based estimates need further analysis**
**green-success likely  red-success uncertain**

*Direct Forcing*

SO1-1 evolution of BBA properties with transport: ~ 5 **hours**
SO1-2 spectral radiative fluxes **~ 1 hours (profiles+above-BLcloud)**
SO1-3 factors that control seasonal variation of aerosol ~ **5 hours**

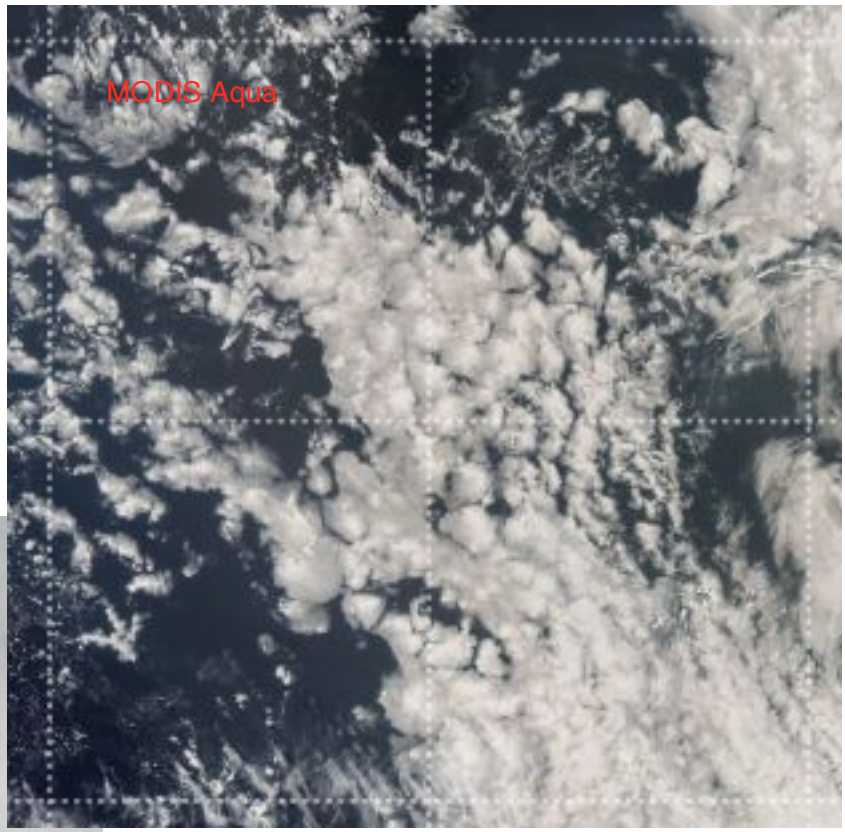
*Semi-Direct Effect*

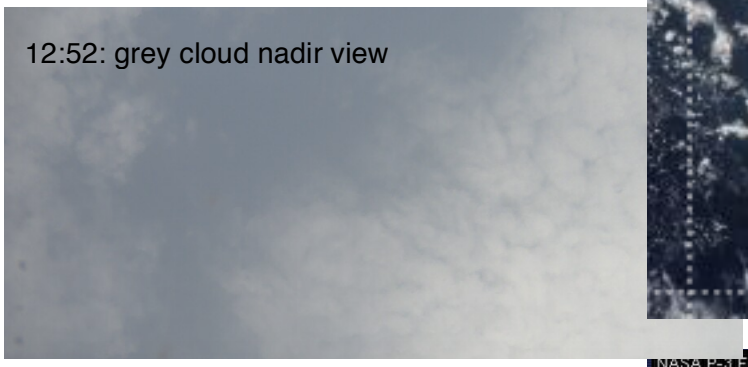
SO2-1 relative aerosol-cloud vertical structure **~2.5 hours (full profiles)**
SO2-2 constrain aerosol heating rates **~1 hour (profiles+above-BLcloud)**
SO2-3 cloud microphysics **~1.5 hours (BL sequences)**

*Indirect Effects*

SO3-1 aerosol-BL mixing **~1.5 hour**
SO3-2 aerosol-BLcloud microphysics* **~1 hour**
SO3-3 precipitation susceptibility* **~1 hour**
*does not include 0.5 hour spent in mid-level cloud

visual notes:





mid-level cloud feature had cloud top temperature at 265-270 K according to