Flight report

Research Flight RF07
ATR-2024-0816b
SAFIRE flight as240029
Sal (SID-SID), 16:00 - 19:30 UTC

PI: **Sandrine Bony**

16 August 2024 b

1 Objectives

- Typical MAESTRO flight pattern, North-West of Sal
- Broken an ddrizzling layer of stratocumulus (cloud top around 1500 m)
- Coordination with HALO at the end of the flight (12 sondes, 70 km radius, FL350)

2 Cal/Val activity: No

3 Crew

SAFIRE	Name	Lab
Pilot (CDB)	Jean-François Bourdinot	SAFIRE
Pilot (OPL)	Guillaume Seurat	SAFIRE
Mechanics	Thierry André	SAFIRE
Expé Principal	Gilles Vergez	SAFIRE
Expé	Tania Jiang	SAFIRE
SCIENTISTS		
PI seat	Sandrine Bony	LMD
LNG seat	Kevin Huet	LATMOS
aWALI seat	Hélène Cassan	LAERO
Microphys seat 1	Pierre Coutris	LAMP
Microphys seat 2	Thierry Latchimy	LAMP
RASTA seat	Julien Delanoë	LATMOS
BASTA seat	Sophie Bounissou	LATMOS

4 Synoptic situation

- Just behind the through of an African Easterly Wave
- Temperature inversion and hydrolapse around 1600 m; At the edge of a moist regime (PRW close to 50 mm).

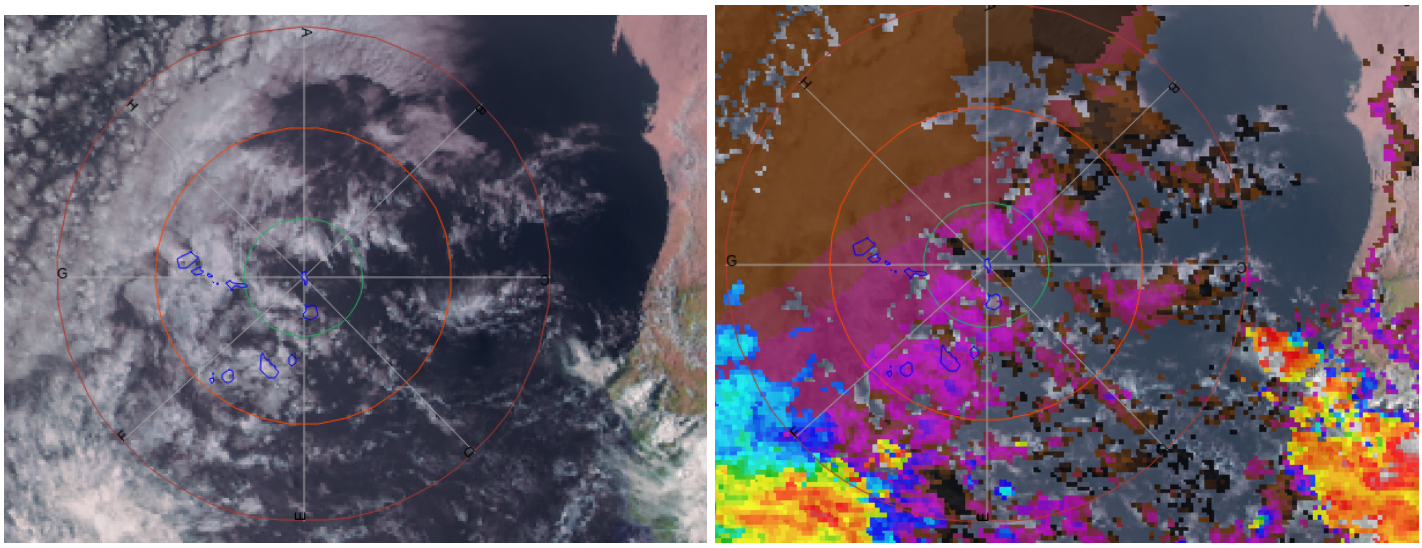


Figure 1: MSG imagery (left: RGB, right: cloud top height) on 16 Aug 2024, 16:45 UTC (from AERIS op center).

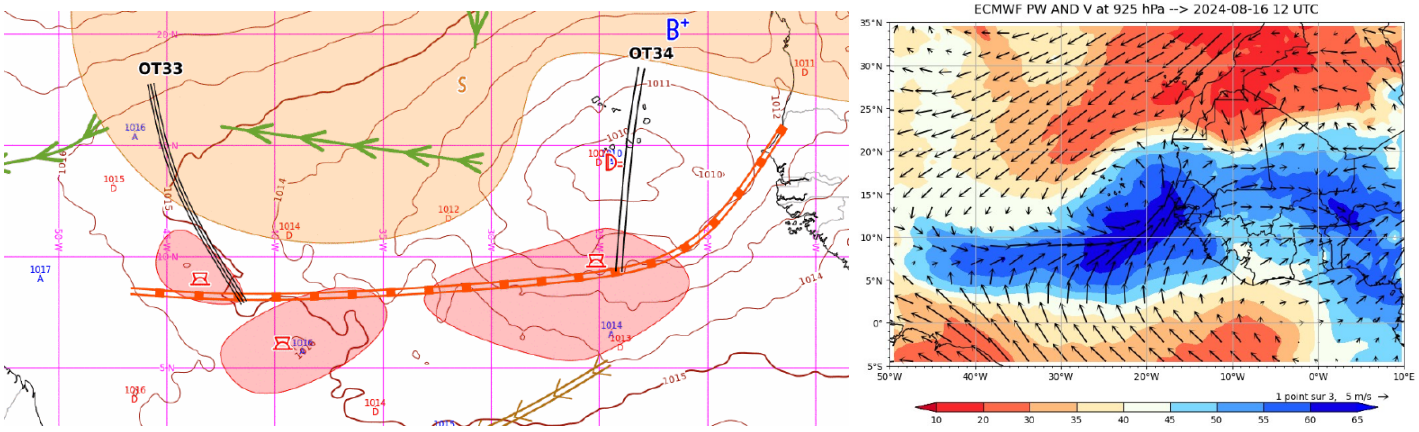


Figure 2: (Left) Anasyg analysis from MISVA and (Right) ECMWF precipitable water (kg/m^2) at 12 UTC on 2024-08-16 (courtesy Philippe Peyrillé and Florent Beucher).

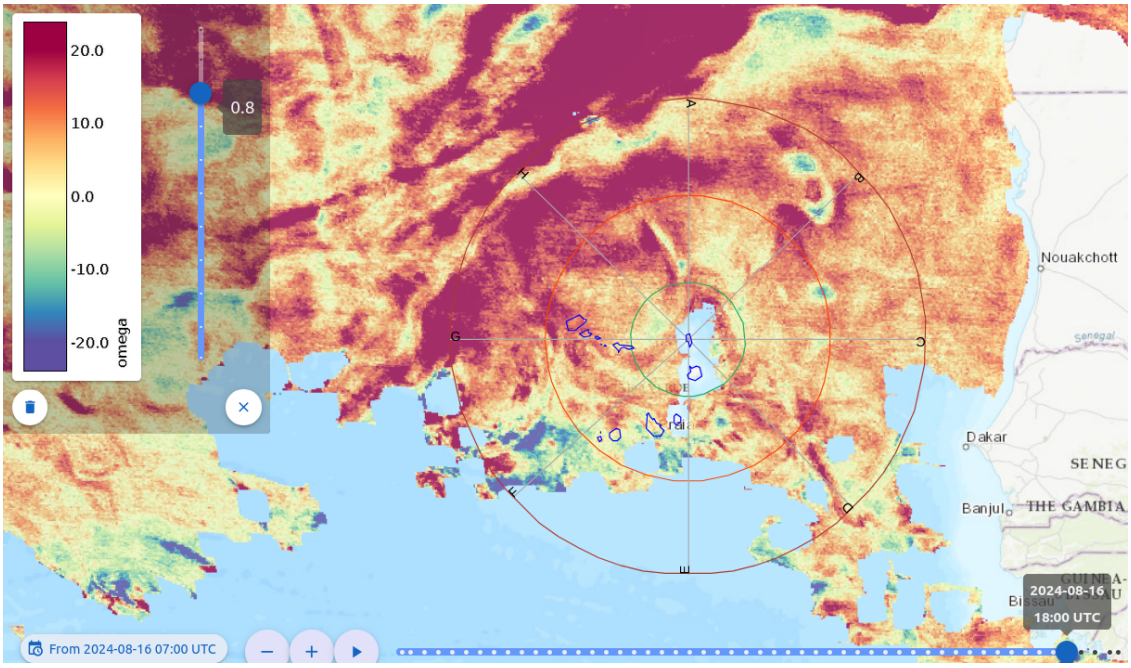
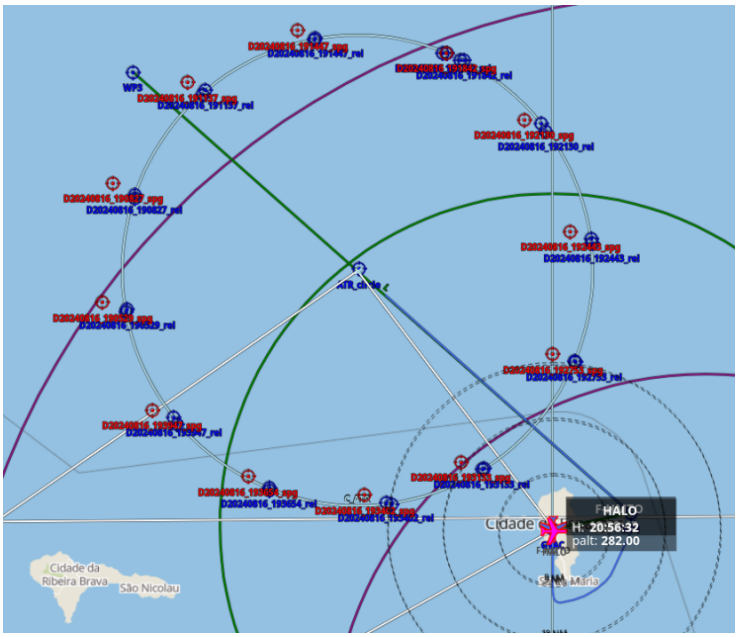


Figure 3: Clear-sky vertical velocity in the mid-troposphere retrieved from MSG water vapor channel on 08-16 at 18:00 UTC (courtesy Basile Poujol).

5 Flight elements

- Typical MAESTRO flight pattern North-West of Sal
- WP1: N 16°46'50"; W 22°43'50"; WP2: N 17°58'06"; W 24°08'03"
- The flight pattern started with a climb to the high-level leg (FL180), then a sounding down to 500ft (150 m), then 2 legs at cloud base (around 330 m), a leg in the subcloud-layer (around 150 m) and finally a short leg near the ocean surface (60 m).
- HALO circle centered on the transect (70km radius, 12 dropsondes)

RF07 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	16:06		GVAC	
A1	16:06 – 16:45	climb to FL180	Sal → WP1	Ascent
H1	16:46 – 17:16	FL180	WP1 (S) → WP2 (N)	Mid-troposphere (5.8 km)
V1	17:16 – 17:18	FL180	WP2 (N)	VAD (roll: 26 deg)
D1	17:18 – 17:36	down to cloud base	WP2 (N)	Descent
B1	17:44 – 18:13	1200 ft	WP2 (N) → WP1 (S)	Cloud base level (330 m)
B2	18:16 – 18:48	1200 ft	WP1 (S) → WP2 (N)	Cloud base level (330 m)
L1	18:52 – 19:21	500 ft	WP2 (N) → WP1 (S)	Subcloud layer (150 m)
S1	19:22 – 19:27	200 ft	WP1 (S) to Sal	Near surface (60 m)
Landing	19:38		GVAC	
ATR circle	19:05 - 19:40	FL350 (11.5 km)	(17°26'N, 23°30'W), 70km radius	HALO: 12 dropsondes



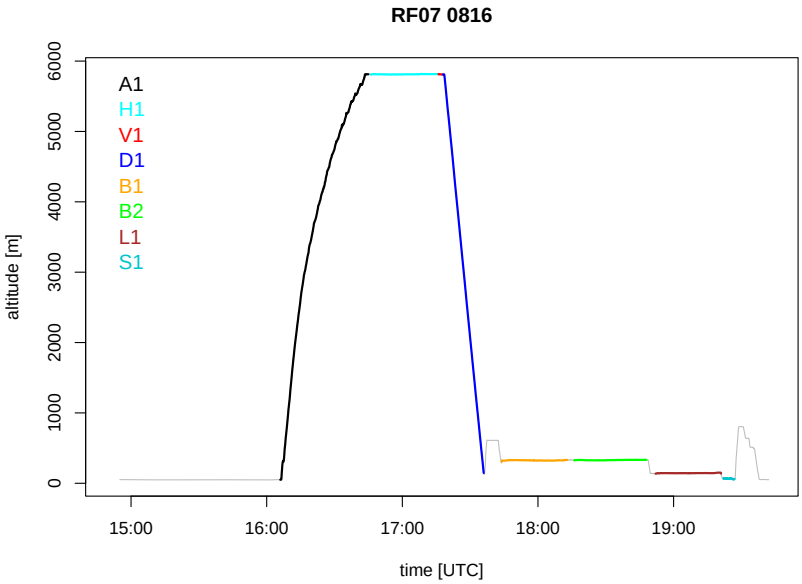


Figure 4: (Left) Screenshot of Planet showing the position of the ATR trajectory relative to the HALO/ATR circle. (Right) Flight segmentation of the ATR-20240816b flight (also named RF07 or as240029) as described in the table.

6 Quicklooks and Comments

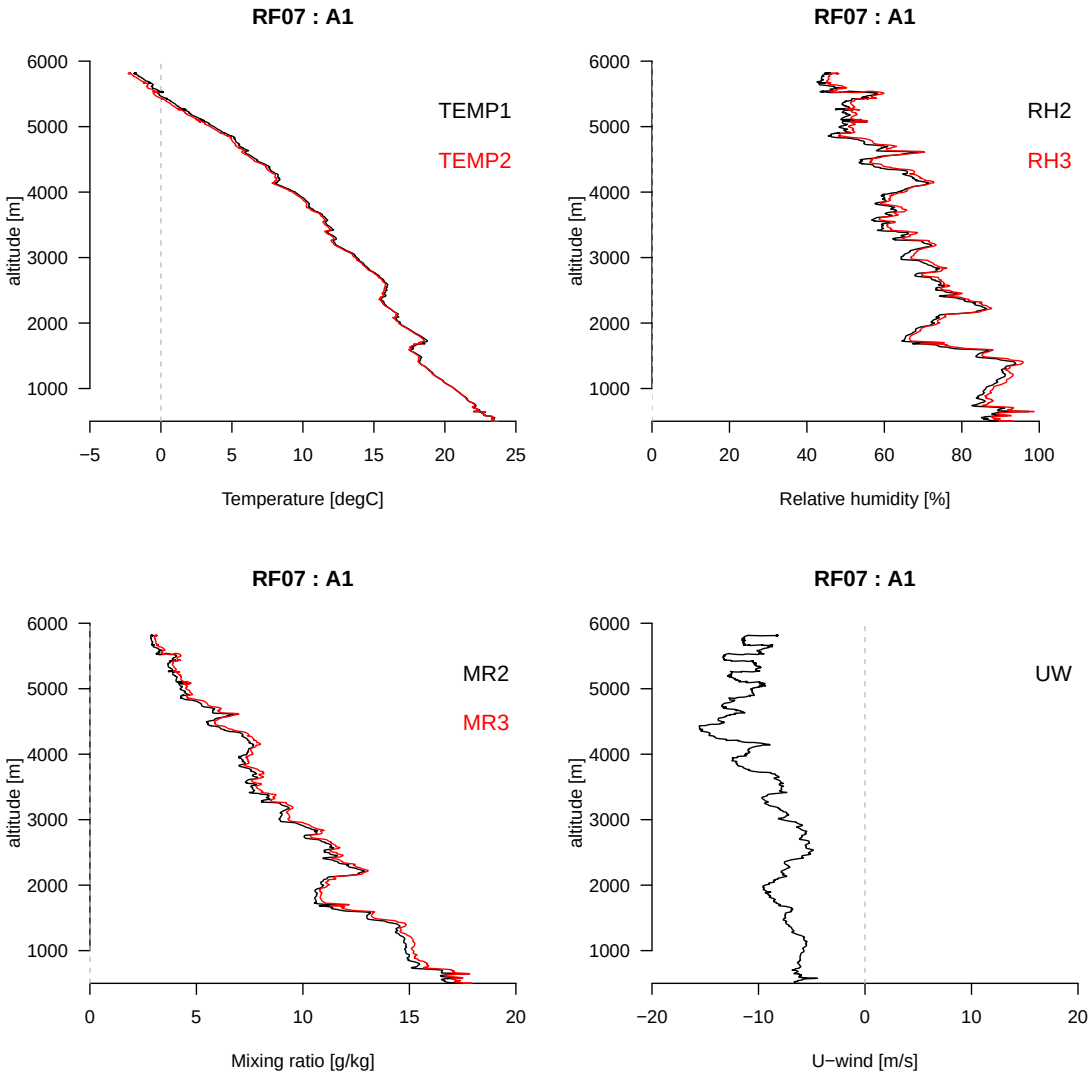


Figure 5: Vertical profiles of temperature, humidity mixing ratio, relative humidity and zonal wind measured by several in-situ sensors during the ascent of the ATR from cloud base and FL210. Note the strong inversion and hydrolapse around 1600 m.

Figure 6: [TO BE ADDED SOON] Backscatter signal measured at 532 nm by the vertically-pointing LNG HSRL lidar. (courtesy Emmeline François).

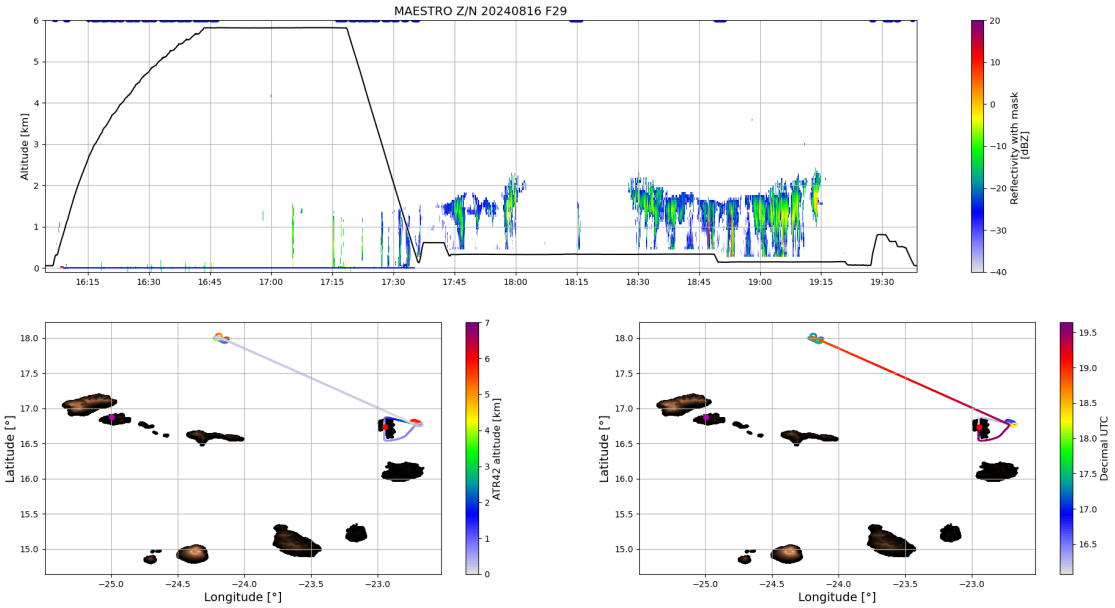


Figure 7: Radar reflectivity measured by the vertically-pointing RASTA Doppler cloud radar (courtesy Julien Delanoë).

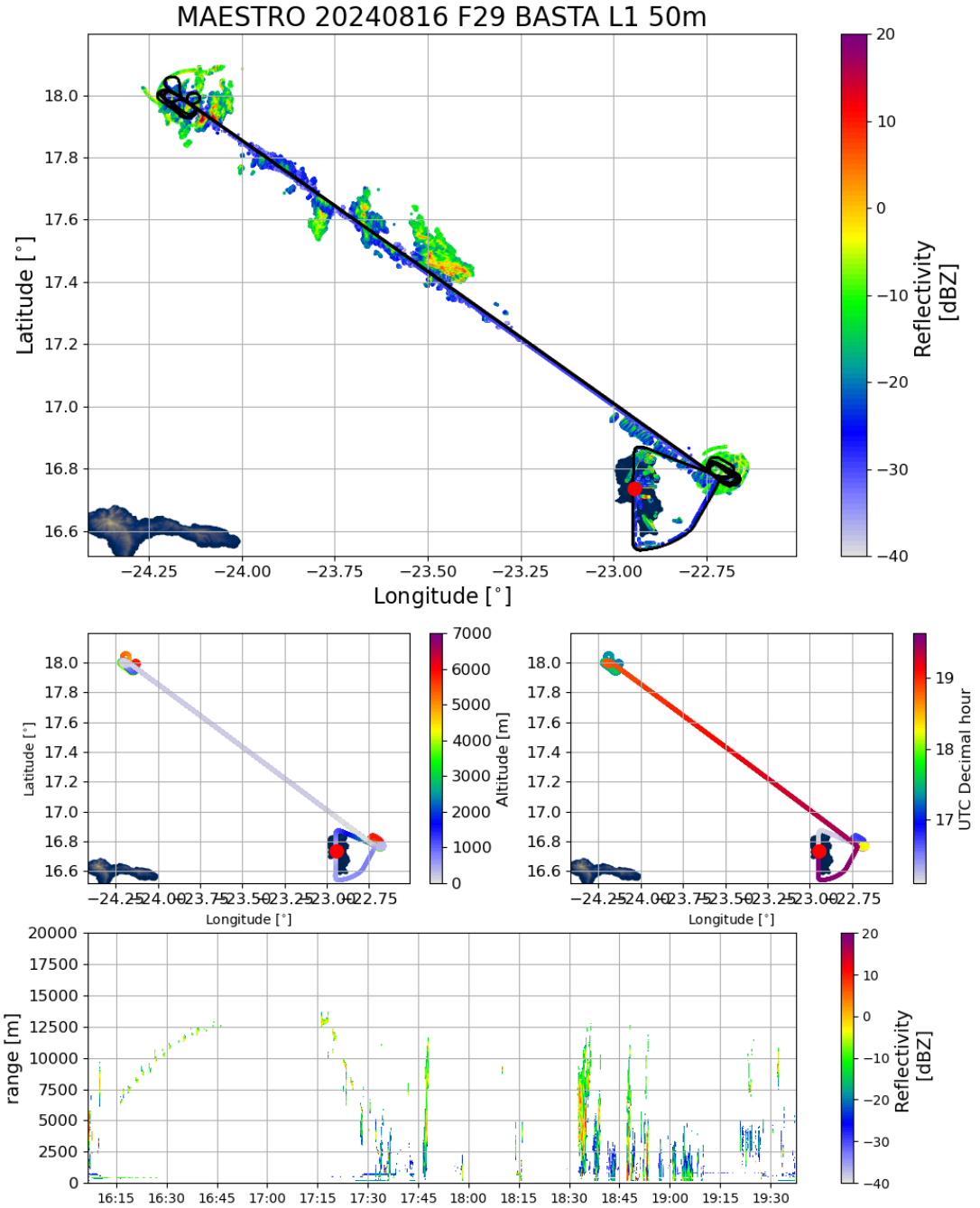


Figure 8: Radar reflectivity measured by the horizontally-pointing BASTA Doppler cloud radar (courtesy Julien Delanoë).

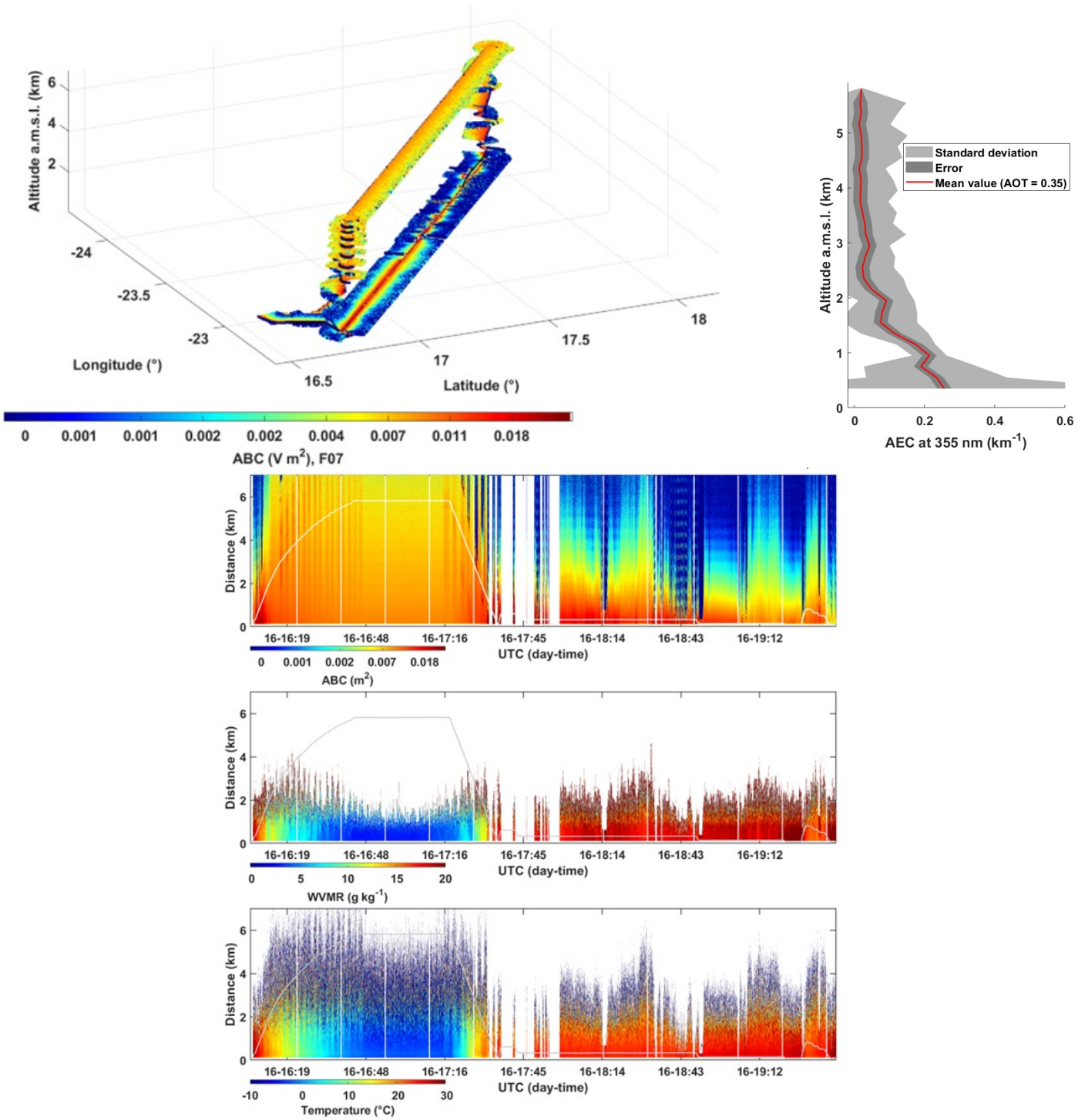


Figure 9: (Top left) Evolution of lidar backscatter ratio in the aerosol/cloud channel; (Top right) Vertical profile of the aerosol extinction, and (Bottom) 2D variation of the elastic backscatter signal, and the water vapor mixing ratio and temperature measured by the horizontally-pointing Raman lidar AWALI during RF07 (courtesy Patrick Chazette).

7 Instrument status

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
NAV	pos_lat_imu_1	Latitude from AIRINS	LATITUDE	OK	-
	pos_lon_imu_1	Longitude from AIRINS	LONGITUDE	OK	-
	alt_alt_imu_1	Altitude from AIRINS	ALTITUDE	OK	-
	nav_track_imu_1	Course	COURSE	OK	-
	att_thead_imu_1	True Heading	THEAD	OK	-
	att_roll_imu_1	Platform Roll angle	ROLL	OK	-
	att_pitch_imu_1	Platform Pitch angle	PITCH	OK	-
	vit_v_n_imu_1	Platform North speed	VN	OK	-
	vit_v_e_imu_1	Platform Eastward speed	VE	OK	-
	vit_v_w_imu_1	Vertical speed	VV	OK	-
	vit_v_gs_imu_1	Ground speed	GS	OK	-
RAD	ray_rg_down_1	Downwelling Shortwave radiation clear dome (no attitude correction)	SWD	OK	-
	ray_rg_down_crsensor_1	Downwelling Shortwave radiation clear dome- Attitude correction for pitch/roll $<\pm 3°$	SWDC	OK	reference
	ray_pir_down_1	Downwelling Shortwave radiation red dome (no attitude correction)	SWD_RED	OK	-
	ray_pir_down_crsensor_1	Downwelling shortwave radiation red dome-Attitude correction for pitch/roll $<\pm 3°$	SWDC_RED	OK	reference
	ray_rg_up_1	Upwelling Shortwave radiation clear dome (no attitude correction)	SWU	OK	-
	ray_pir_up_1	Upwelling shortwave radiation red dome (no attitude correction)	SWU_RED	OK	-
	ray_ir_down_1	Downwelling longwave radiation (no attitude correction)	LWD	OK	-
	ray_ir_up_1	Upwelling longwave radiation (no attitude correction)	LWU	OK	-
	ray_tb_ce332_c1_1	Brightness temperature channel1 (8.7μm) ce332 radiometer	TB_C1	OK	-
	ray_tb_ce332_c2_1	Brightness temperature channel2 (10.6μm) ce332 radiometer	TB_C2	OK	-
	ray_tb_ce332_c3_1	Brightness temperature channel3 (12μm) ce332 radiometer	TB_C3	OK	-
	ray_lum_ce332_c1_1	Radiance, channel1 (8.7μm) from ce332 radiometer	RAD_C1	OK	-
	ray_lum_ce332_c2_1	Radiance channel2 (10.6μm) from ce332 radiometer	RAD_C2	OK	-
	ray_lum_ce332_c3_1	Radiance channel3 (12μm) from ce332 radiometer	RAD_C3	OK	-
TDYN	pre_ps_av1_1	Static pressure corrected for flow distorsion	PRES	OK	-
	vit_v_dp2_crs_1	Dynamic pressure corrected for flow distorsion	DYNP	OK	-
	vit_v_p_av1_1	True Air Speed	TAS1	OK	reference
	vit_v_tas_adc_1	True Air Speed	TAS2	OK	-
	alt_ralt_15_m_1	Height	HEIGHT	OK	-
	att_aoa_radom_deg_1	Angle of Attack	AOA_RAD	OK	-
	att_aos_radom_deg_1	Angle of Sideslip	AOS_RAD	OK	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	ven_wind_v_vp_imu_1	Upward Wind	WW	OK	always +0,2 m/s offset
	ven_wind_FF_vp_imu_1	Horizontal Wind Speed	WS	OK	reference
	ven_wind_DD_vp_imu_1	Horizontal Wind Direction	WD	OK	reference
	ven_wind_FF_simp_1	Horizontal Wind Speed WITHOUT Radome angles, with non-deiced Air Static Temperature	WS_RAW	OK	-
	ven_wind_DD_simp_1	Horizontal Wind Direction WITHOUT Radome angles, with non-deiced Air Static Temperature	WD_RAW	OK	-
	tpr_ts_rt_1	Air Static Temperature, non-deiced sensor	TEMP1	OK	reference
	tpr_ts_rtd_1	Air Static Temperature, deiced sensor	TEMP2	OK	-
	tpr_tt_rt_1	Total Temperature, non-deiced sensor	TTEMP1	OK	reference
	tpr_tt_rtd_1	Total Temperature, deiced sensor	TTEMP2	OK	-
	tpr_tp_rt_1	Potential Temperature	THETA	OK	-
	hum_hutd_1011_sync_1	Dew Point Temperature 1011C	DP1	OK	reference, except 17:35 to 17:38
	hum_hutd_wvs_rs_1	Dew Point Temperature from WVSSII	DP2	OK	-
	hum_hutd_rtd_aero_1	Dew Point Temperature from humaero enviscope	DP3	OK	-
	hum_humr_1011_rs_1	Water Vapor Mixing ratio from 1011C	MR1	OK	reference, except 17:35 to 17:38
	hum_humr_wvs_rs_1	Water Vapor Mixing ratio WVSSII	MR2	OK	-
	hum_humr_srtd_aero_1	Water Vapor Mixing ratio from humaero enviscope	MR3	OK	-
	hum_huabs_rt_1011_1	Abolute Humidity from 1011C	HABS1	OK	reference, except 17:35 to 17:38
	hum_huabs_wvs_rs_1	Abolute Humidity from WVSSII	HABS2	OK	-
	hum_huabs_srtd_aero_1	Abolute Humidity from enviscope	HABS3	OK	-
	hum_hurel_rt_1011_rs_1	Relative Humidity from 1011C	RH1	OK	reference, except 17:35 to 17:38
	hum_hurel_wvs_rs_1	Relative Humidity from WVSSII	RH2	OK	-
	hum_hurel_stat_rt_aero_1	Relative Humidity from enviscope	RH3	OK	-
	ctl_CTL_P_CABINE_1	Cabin Pressure	P_CABIN	OK	-
	ctl_CTL_T_CABINE_1	Cabin Temperature	T_CABIN	OK	-
LWC	lwc_lwc300_rebase005_1	LWC calculation according to DMT PADS Hotwire LWC	LWC2	OK	-
FW	hum_humolfra_fw_crh_100	Mole fraction of water vapour in air measured by FastWave	FW_MOLFRA	NOK	datation problem, investigated
	hum_humr_fw_100	Water Vapor Mixing ratio from FastWave	MR6	NOK	datation problem, investigated
	pre_pb_fw_100	Air Pressure measured by FastWave	FW_P	NOK	datation problem, investigated

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	tpr_tt_fw_100	Temperature measured by FastWave	FW_T	NOK	datation problem, investigated
OZONE	chm_cc_o3_2b_ppb_RS_cal_%10	O3 2493DB OzoneMonitor mixing ratio	O3_MONITOR2	OK	-
	chm_cc_o3_2b_ppb_anlg_%10	O3 2493DB OzoneMonitor concentration analogical	O3_MONITOR2_ANALOG	OK	-
	ctl_CTL_CELL_T_2B_RS_cal_%10	O3 2493DB OzoneMonitor cell temperature	TCELL_MONITOR2	OK	-
	ctl_CTL_CELL_P_2B_RS_cal_%10	O3 2493DB OzoneMonitor cell presure	PCELL_MONITOR2	OK	-
	ctl_CTL_VOLFR_2B_RS_cal_%10	O3 2493DB OzoneMonitor volumetric flow rate	VOLFLRATE_MONITOR2	OK	-
SPP300	mic_tabcount_SPP300_1	SPP300 particles count bin[1]...bin[30]	SPP300_COUNT	OK	missing values in hight altitude
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	OK	missing values in hight altitude
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	OK	missing values in hight altitude
	mic_totalconc_SPP300_1	SPP300 Total particles concentration	SPP300_TCONC	OK	missing values in hight altitude
UHSAS	mic_tabcount_uhsas_sync_1	UHSAS particles count	UHSAS_COUNT	OK	
	mic_somcount_uhsas_sync_1	UHSAS total particles counts	UHSAS_TCOUNT	OK	-
	mic_tabconc_second_uhsas_sync_1	UHSAS Particles concentration	UHSAS_CONC	OK	
	mic_totalconc_uhsas_sync_1	UHSAS total particles concentration	UHSAS_TCONC	OK	-
	ctl_sample_flow_uhsas_sync_1	UHSAS sample flow	UHSAS_FLOW	OK	-
	ctl_sheath_flow_uhsas_sync_1	UHSAS sheath flow	UHSAS_SHEATH	OK	-
REMOTE	RASTA	Cloud radar (Up and down)	Z, V, Doppler spectrum	OK	
	BASTA	Cloud radar (sidewards)	Z, V, Doppler spectrum	OK	Clouds/drizzle detected up to 12 km; Some issues within the first few km away from the aircraft
	LNG	Lidar (Up or Down)	Backscatter(355nm/532/1064) – HSRand Doppler 355nm	OK	Some drizzle/virga detected
	aWALI	Raman Lidar (sidewards)	Backscatter and inelastic(RH/Temp)	OK	a few breaks at the beginning but otherwise ok
MICRO	CVI		TWC	OK	CVI seems to respond weakly in the drizzle
	HSI			OK	
	2DS		Images and Spectrum	OK	After cloud-base legs, was too warm -¿ switched off in clear-sky
	HVPS	Hydrometeors imagery	Images	OK	
	FCDP	Droplets (2?m - 50?m)	Spectrum	OK	
	NP-2			OK	