Flight report

Research Flight 5 (RF05)
ATR-2024-0801a
SAFIRE flight as240027
Sal (SID-SID), 16:22 - 20:09 UTC

PI: **Louis Jaffeux**

15 August 2024

1 Objectives

- SAR overpass
- Cloud and oceanic boundary layer sampling with remote sensing and in-situ instrumentation.

2 Cal/Val activity

None.

3 Crew

SAFIRE	Name	Lab
Pilot (CDB)	JF Bourdinot	SAFIRE
Pilot (OPL)	G Seurat	SAFIRE
Mechanics	M André	SAFIRE
Expé Principal	C De Saint Leger	SAFIRE
Expé	T. Jiang	SAFIRE
SCIENTISTS		
PI seat	L Jaffeux	LAERO
LNG seat	E Francois	SAFIRE
aWALI seat	J Lagarrigue	LAERO
Microphys seat 1	A Baudoux	LAMP
Microphys seat 2	T Latchimy	LAMP
RASTA seat	J Delanoe	LAERO
BASTA seat	K Huet	SAFIRE

4 Synoptic situation

The flight happened in a relatively dry period in the middle of the dry phase of an African Easterly Wave, with daily column integrated precipitable water (PW) between 35 and 40 mm. At the surface, relatively strong wind was blowing from the North East between 10 and 15 m/s. Shallow non precipitating clouds were present all around Sal island. Along the flight trajectory, a hole in the cloud cover was found as can be seen in Figure 1.

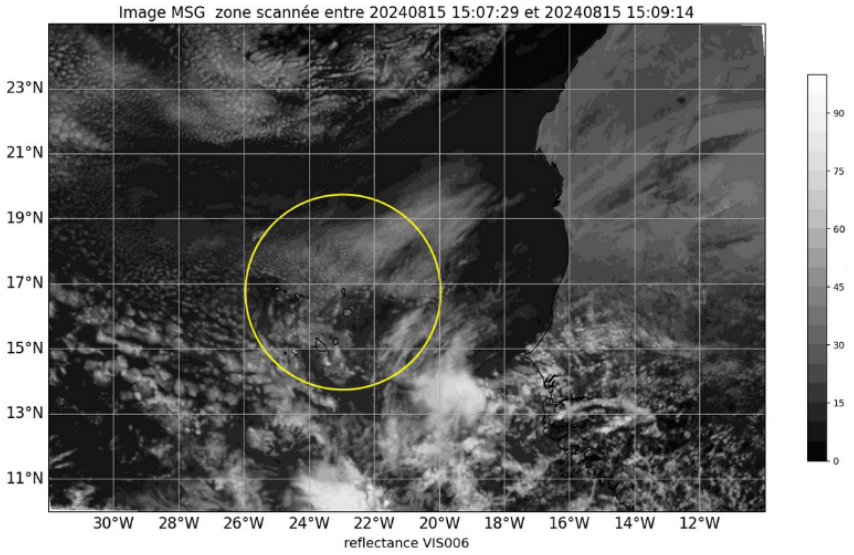

Figure 1: MSG image taken on 15/08/2024 at 15:08 UTC, during RF05.

5 Flight elements

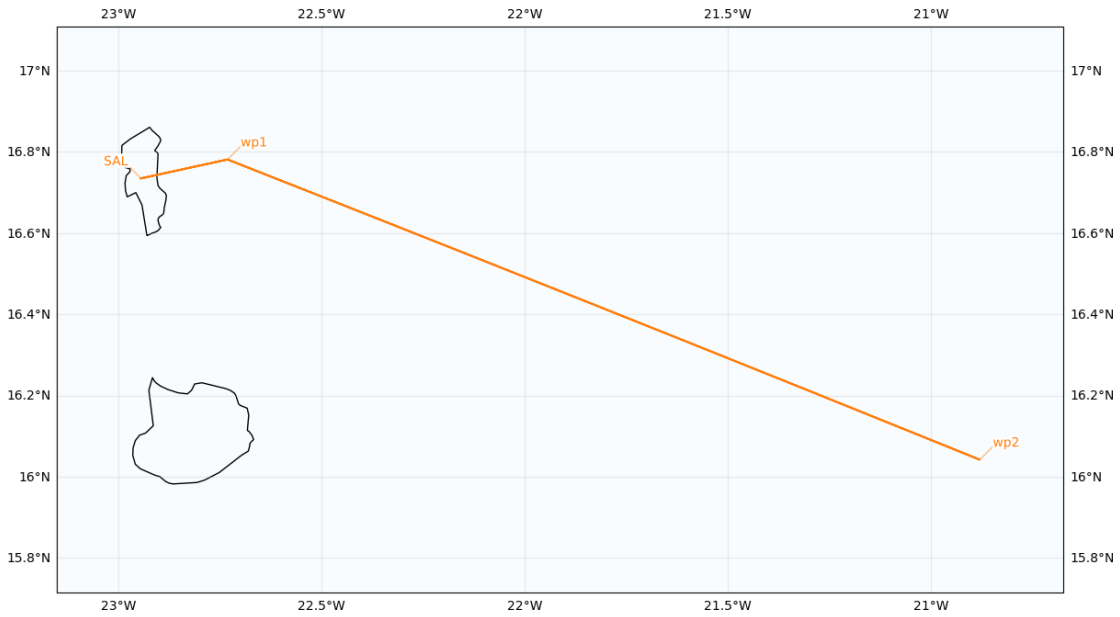

Figure 2: Initially planned Lat-Lon Path of the ATR for RF05.

A total of 4 collocated legs were planned and performed between two waypoints WP1 and WP2 for the flight see Figure 2. After takeoff and the intial ascent towards WP 1 at FL180, a first leg was performed towards WP2, followed by a VAD. This maneuver was followed by a descent to 400 feet altitude level. Then, two legs was performed at cloud base. The two legs were flown parallel to each other with a spacing of 0.5 nm. After a last turn and descent at the surface (500 feet above it), a final leg was performed to this altitude with the 5 last minutes at 150 feet, the lowest altitude that can be reached by the ATR.

The flight was segmented using an optimization function that evaluates the stabilization of the plane, which is a necessary conditions for proper wind speed retrieval. 5 minutes segments were thereby constructed (as shown in Figure 3) with associated scores. Better stabilization translates into lower score.

RF05 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	16:22		SID-SID	
A1	16:23 - 16:56	800 ft → FL180	SID → WP1	Hippodrome ascent at WP 1 with sounding
H1	16:58 - 17:34	FL180	WP1 → WP2	max height leg
VAD	17:34 - 17:37	FL180	WP2	Calibration maneuver
D1	17:37 - 17:56	FL180 → 1500 ft	WP2	Hippodrome descent at WP 2 with sounding
B1-B2-B3	17:56 - 18:37	1500 - 1650 ft	WP2 → WP3	Cloud base leg
B4	18:39 - 19:18	1650 ft	WP3 → WP4	Cloud base leg
L1	19:21 - 19:52	700 ft	near WP2 → WP1	Subcloud layer leg
S1	19:53 - 19:58	400 ft	up to WP1	Surface leg
Approach	19:58 - 20:08	800 ft	WP1 → SID	
Landing	20:08		SID-SID	

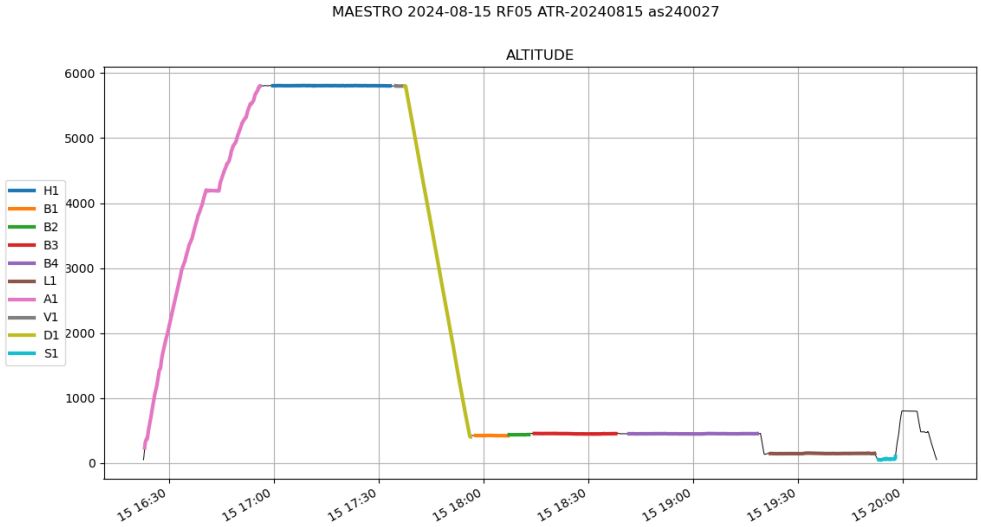

Figure 3: Flight segmentation as described in the table.

6 Quicklooks and Comments

Towards the end of the high altitude legs, ice clouds were encountered (as the embarked RASTA W-band radar clearly shows in Figure 4). The 2DS in-situ imager showed the presence of columnar ice crystals in their typical temperature growth regime (slightly below -5 °C). During the rest of the leg, precipitation was frequently observed. They originated from a cloud layer that was always found above the airplane, with consistent cloud top at 1 km above sea level.

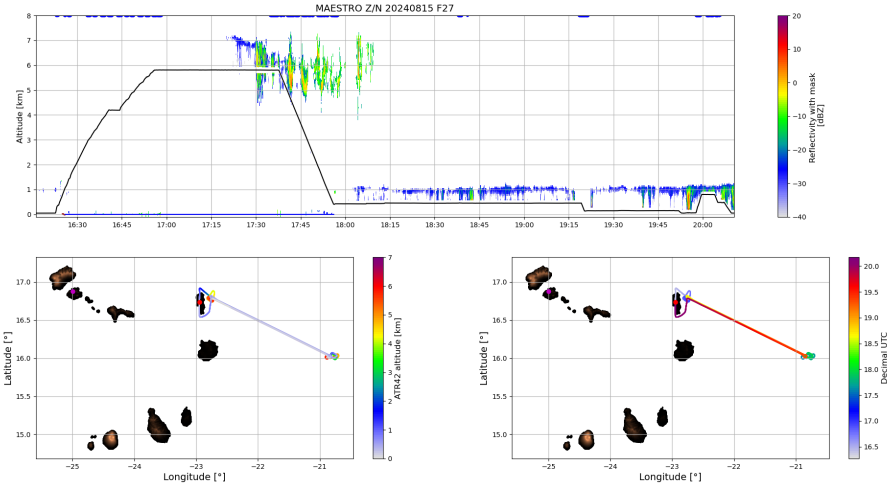

Figure 4: RASTA quicklook for RF05.

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 <±3°	SWDC	OK	reference, forget artefact at the end of flight
	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 <±3°	SWDC_RED	OK	reference, forget artefact at the end of flight
	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	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	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, forget artefact at the end of flight
	vit_v_tas_adc_1	True Air Speed	TAS2	OK	- , noisy
	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	-
	ven_wind_v_vp_imu_1	Upward Wind	WW	OK	ok but +0,2 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	some oscillations (sometimes antiphase)
	hum_hutd_wvs_rs_1	Dew Point Temperature from WVSSII	DP2	OK	reference, but sometimes slow
	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	-
	hum_humr_wvs_rs_1	Water Vapor Mixing ratio WVSSII	MR2	OK	reference
	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	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	hum_huabs_wvs_rs_1	Abolute Humidity from WVSSII	HABS2	OK	reference
	hum_huabs_srtd_aero_1	Abolute Humidity from envis-cope	HABS3	OK	-
	hum_hurel_rt_1011_rs_1	Relative Humidity from 1011C	RH1	OK	-
	hum_hurel_wvs_rs_1	Relative Humidity from WVSSII	RH2	OK	reference
	hum_hurel_stat_rt_aero_1	Relative Humidity from envis-cope	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	OK	-
	hum_humr_fw_100	Water Vapor Mixing ratio from FastWave	MR6	OK	-
	pre_pb_fw_100	Air Pressure measured by Fast-Wave	FW_P	OK	ok, 40 hPa difference with raw pressure reference
	tpr_tt_fw_100	Temperature measured by Fast-Wave	FW_T	OK	-
OZONE	chm_cc_o3_2b_ppb_RS_cal_%10	O3 2493DB OzoneMonitor mix-ing ratio	O3_MONITOR2	OK	-
	chm_cc_o3_2b_ppb_anlg_%10	O3 2493DB OzoneMonitor con-centration 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 volu-metric flow rate	VOLFLRATE_MONITOR2	OK	-
SPP300	mic_tabcount_SPP300_1	SPP300 particles count bin[1]...bin[30]	SPP300_COUNT	OK	
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	OK	ok except miss-ing in hight alti-tude
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	OK	
	mic_totalconc_SPP300_1	SPP300 Total particles concen-tration	SPP300_TCONC	OK	ok except miss-ing in hight alti-tude
UHSAS	mic_tabcount_uhsas_sync_1	UHSAS particles count	UHSAS_COUNT	OK	
	mic_somcount_uhsas_sync_1	UHSAS total particles counts	UHSAS_TCOUNT	OK	ok
	mic_tabconc_second_uhsas_sync_1	UHSAS Particles concentration	UHSAS_CONC	OK	
	mic_totalconc_uhsas_sync_1	UHSAS total particles concen-tration	UHSAS_TCONC	OK	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	
	LNG	Lidar (Up or Down)	Backscat-ter(355nm/532/1064) – HSRand Doppler 355nm	OK	
	aWALI	Raman Lidar (sidewards)	Backscatter and inelas-tic(RH/Temp)	OK	
MICRO	CVI		TWC	OK	
	HSI			OK	

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	2DS		Images and Spectrum	OK	
	HVPS	Hydrometeors imagery	Images	OK	
	FCDP	Droplets (2?m - 50?m)	Spectrum	OK	
	NP-2			OK	