Flight report

Research Flight 8 (RF08)
ATR-2024-0801a
SAFIRE flight as240030
Sal (SID-SID), 16:22 - 20:09 UTC

PI: **Louis Jaffeux**

19 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 very humid troposphere, with integrated precipitable water column close to 60 mm. Precipitations were experienced on Sal island. These very humid conditions were experienced as a result of an extension of the ITCZ towards the north and covering the Cap Verde islands (see Figure 1). The satellite image from MSG, taken near the start of the flight is presented in Figure 2. It shows a cloud system at the southern edge of the 3 degree diameter circle around Sal, which corresponds to the reachable domain for the ATR, with relatively high clouds at its core around 15 °N 20 °W.

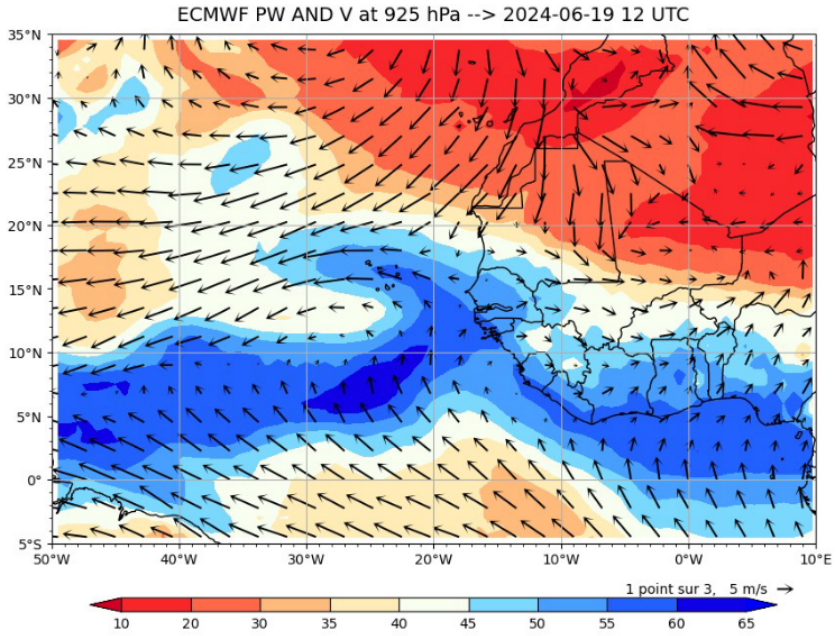

Figure 1: ECMWF PW forecast.

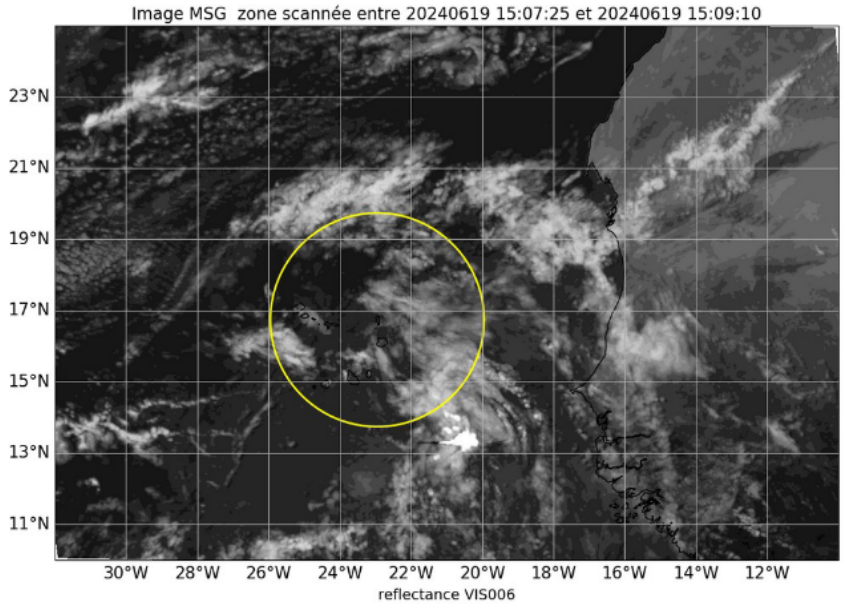

Figure 2: MSG image taken on 19/08/2024 at 15:08 UTC, during RF08.

5 Flight elements

A total of 4 collocated legs were planned initially between WP1 and WP2, begining with a 500 ft leg, two cloud base legs, and a high level leg. Upon reaching WP2 during the first leg, clear sky was mainly observed and the trajectory was readjusted in order to sample the system closer to its core (see Figure 4). A new waypoint was thereby defined and was the starting point of the second leg, performed at cloud base up to WP1. The next leg was extended to the south, 30 nm beyond the newly defined waypoint, to be able to sample the system even more closely. After this last cloud base leg, the plane ascended to altitude FL220, exceeding the planned level of 180, in order to sample, with in-situ instruments, what looked like the remain of an old anvil. Then the plane adjusted its altitude to sample the top of the clouds available, stabilizing at FL200 and FL195.

RF08 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	15:02		SID-SID	
L1-L2	15:11 - 15:46	600 ft	WP1 → WP3	Subcloud leg
B1-B2	15:48 - 16:19	1500 ft	WP3 → WP1	Cloud base leg
B3	16:23 - 17:01	1500 ft	WP1 → WP4	Cloud base leg
A1	17:01 - 17:34	1500 ft → FL220	WP5	Hippodrome ascent with sounding
H1-H2-H3	17:35 - 18:14	FL220 - FL200 - FL195	WP5 → WP1	maximum height leg
VAD	18:14 - 18:16	FL195	near WP1	Calibration maneuver
D1	18:16 - 18:28	FL195 → 800 ft	near WP1 → SID	Descent with approach and sounding
Landing	18:29		SID-SID	

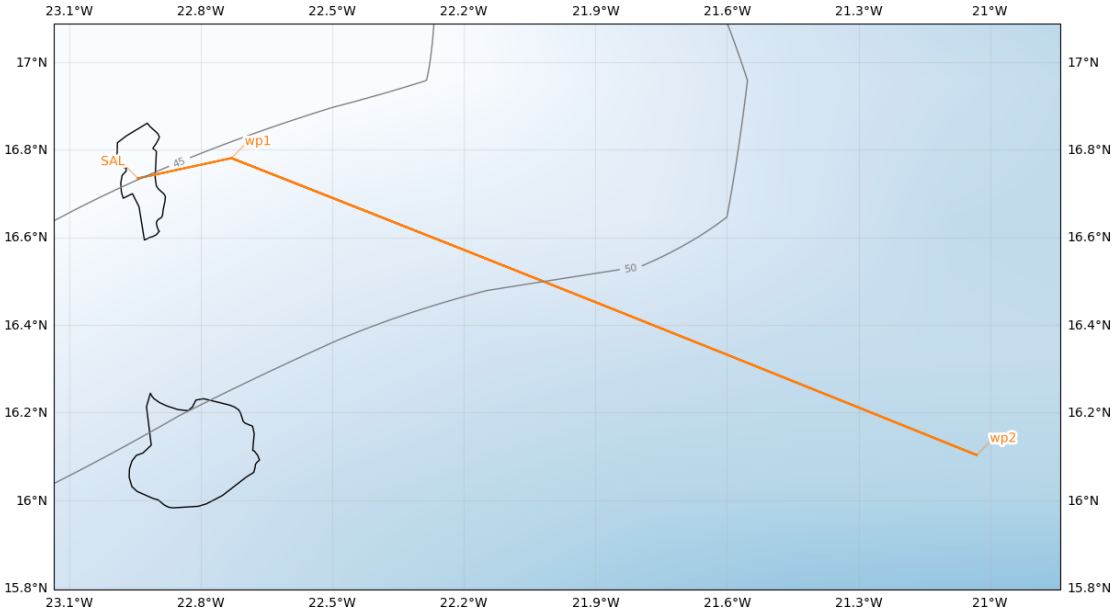

Figure 3: Initially planned Lat-Lon Path of the ATR for RF08.

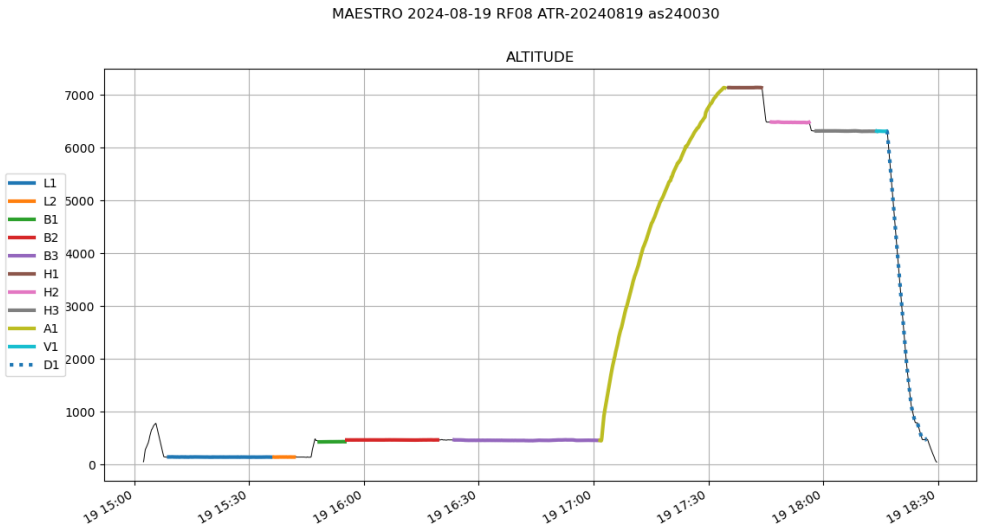

Figure 4: Flight segmentation as described in the table

6 Quicklooks and Comments

During the ascent the melting point was observed around 4.8 km. The quicklook data from the embarked W-band radar RASTA (Figure 5) shows well the multi layer structure observed during this flight. A mid-level layer of clouds was found when approaching both leg ends at an altitude of up 7000 m. When sampled on the way back (mostly at their top), they were observed to be largely composed of supercooled water droplets and sporadically of rimed ice particles, giving a plausible explanation for the fall streak patterns experienced during the lower level legs. At very high altitude, above 11 km, the radar also detected thin cirrus clouds. Further to the south, a low level layer, with cloud top near 2 km. The hypothesis that the slightly higher cloud sampled at the highest flight level was an aged anvil was confirmed by the optical array probe images showing capped columns and large dendritic crystals (larger than 1mm in size).

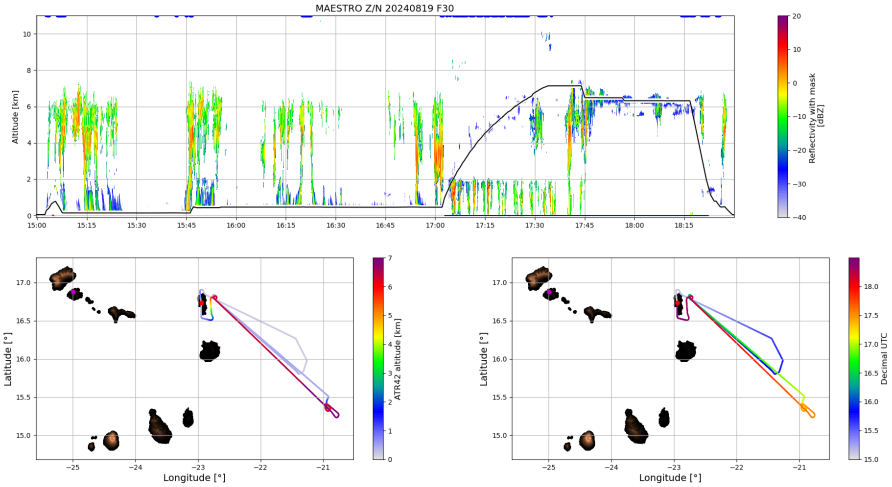

Figure 5: RASTA quicklook for RF08.

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	strange signal from 15:05 to 15:13 (attitude of the plane)
	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	strange signal from 15:05 to 15:13 (attitude of the plane)
	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	strong noisy

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	alt_ralt_15_m_1	Height	HEIGHT	OK	No signal beyond 19250 ft (normal)
	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	-
	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	rare oscillations
	hum_hutd_wvs_rs_1	Dew Point Temperature from WVSSII	DP2	OK	reference
	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	-
	hum_huabs_wvs_rs_1	Abolute Humidity from WVSSII	HABS2	OK	reference
	hum_huabs_srtd_aero_1	Abolute Humidity from enviscope	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 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	OK	-
	hum_humr_fw_100	Water Vapor Mixing ratio from FastWave	MR6	OK	-
	pre_pb_fw_100	Air Pressure measured by FastWave	FW_P	OK	-
	tpr_tt_fw_100	Temperature measured by FastWave	FW_T	OK	noisy
OZONE	chm_cc_o3_2b_ppb_RS_cal_%10	O3 2493DB OzoneMonitor mixing ratio	O3_MONITOR2	OK	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	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	
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	OK	-
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	OK	
	mic_totalconc_SPP300_1	SPP300 Total particles concentration	SPP300_TCONC	OK	-
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	
	LNG	Lidar (Up or Down)	Backscatter(355nm/532/1064) – HSRand Doppler 355nm	OK	
	aWALI	Raman Lidar (sidewards)	Backscatter and inelastic(RH/Temp)	OK	
MICRO	CVI		TWC	OK	
	HSI			OK	
	2DS		Images and Spectrum	OK	
	HVPS	Hydrometeors imagery	Images	OK	
	FCDP	Droplets (2?m - 50?m)	Spectrum	OK	
	NP-2			OK	