



# Flight report

Research Flight 3 (RF03)

ATR-2024-0801a

SAFIRE flight as240025

Sal (SID-SID), 14:20 - 17:37 UTC

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13 August 2024

## 1 Objectives

- Earthcare CAL/VAL.
- Cloud and oceanic boundary layer sampling with remote sensing and in-situ instrumentation.

## 2 Cal/Val activity

Coordination was put in place between the ATR from the MAESTRO team and HALO plane from the PERCUSSION team to meet with EARTHCARE track at 15:42 UTC at waypoint 16.85°N 22.40°W. The ATR arrived at the waypoint at 15:42:09 and met HALO at 15:42:45 as it was reaching the waypoint.

### 3 Crew

SAFIRE	Name	Lab
Pilot (CDB)	JF Bourdinot	SAFIRE
Pilot (OPL)	G Seurat	SAFIRE
Mechanics	T André	SAFIRE
Expé Principal	G Ehses	SAFIRE
Expé	T. Jiang	SAFIRE
SCIENTISTS		
PI seat	L Jaffeux	LAERO
LNG seat	S Bounissou	SAFIRE
aWALI seat	J Lagarrigue	LAERO
Microphys seat 1	Pierre Coutris	LAMP
Microphys seat 2	A Baudoux	LAMP
RASTA seat	E François	LAERO
BASTA seat	K Huet	SAFIRE

## 4 Synoptic situation

The flight happened in a relatively wet period that followed the passing of an African Easterly wave, with daily column integrated precipitable water (PW) between 40 and 50 mm, unsufficient to trigger precipitation. The wind was weak (3-6 m/s) and blowing from the East at 920 hPa. At 700 hPa, it was blowing stronger (9-12 m/s) from the South-East. Shallow scattered clouds were present in the vicinity of Sal, in particular along the flight trajectory, and some deeper clouds were mostly found above the Cape Verde islands as can be seen in Figure 1.

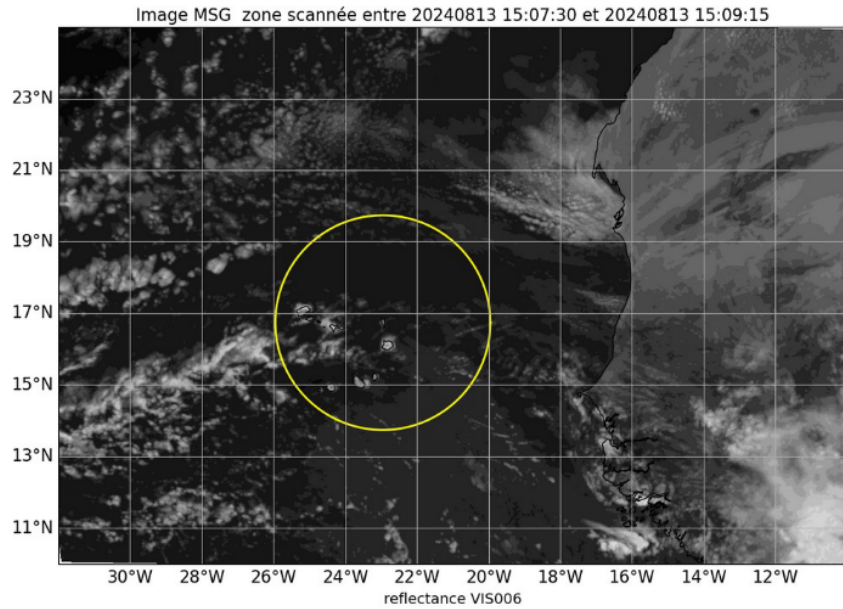


Figure 1: MSG image taken on 13/08/2024 at 15:07 UTC, during RF03.

## 5 Flight elements

Relevant positions :

1. WP1 17°31'52"N 22°05'25"W
2. WP2 16°19'51"N 22°30'14"W
3. EC meeting point 16°50'49"N 22°24'07"W
4. WP3 17°33'39"N 22°15'40"W
5. WP4 16°15'26"N 22°39'50"W
6. anticipated return point 17°12'38"N 22°26'53"W

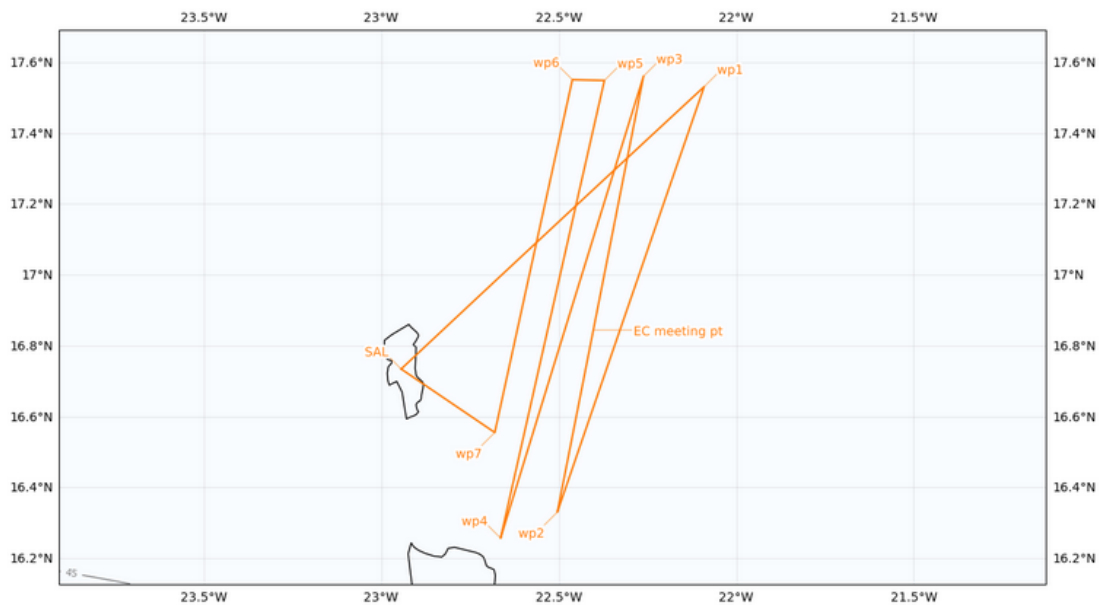


Figure 2: Initially planned path for the ATR and RF03.

A total of 5 legs were originally planned for the flight see Figure 2. After an ascent towards WP 1 at FL200, a first leg was performed, followed by a VAD, and a second leg all performed at this altitude. Earth Care was encountered at 15:42 during the second leg. Then, a spiraling descent to altitude 120 m, providing an ideal collocated sounding. A third leg was then performed at cloud base (1500 feet). During the following turn, the plane was redirected by ATC of Boa Vista towards the East, resulting in a roughly 20 minutes delay. The next cloud base leg was shortened and the next leg was aborted in order to allow for the second flight that took was scheduled later on the same day.

The flight was segmented in legs, performed with relatively stable plane heading and altitude, as shown in Figure 3.

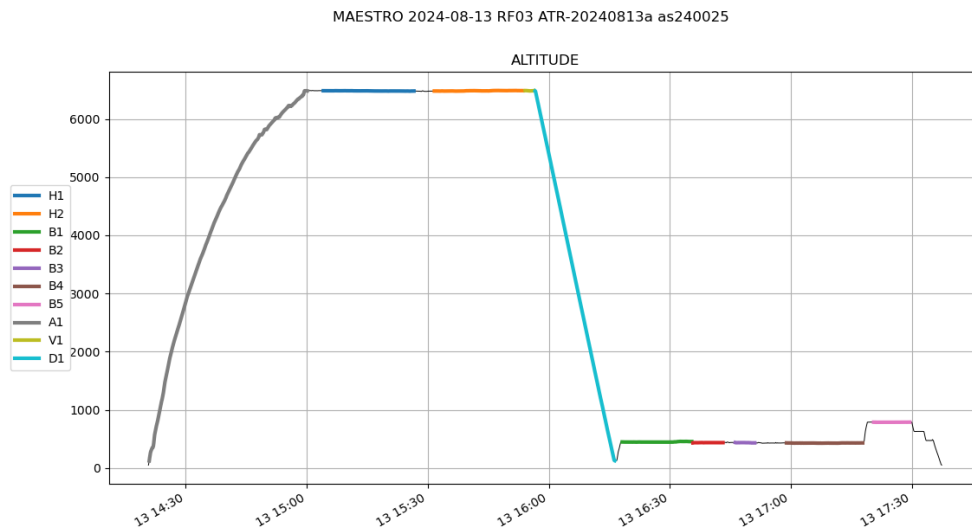


Figure 3: Flight segmentation as described in the table.

RF03 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	14:20		SID-SID	
A1	14:20 - 15:03	0 → FL200	SID → WP1	Hippodrome ascent at WP 1
H1	15:03 - 15:26	FL200	WP1 → WP2	max height leg
VAD	15:28 - 15:30	FL200	WP2	Interrupted to reach EC meeting point on time
H2	15:31 - 15:53	FL200	WP2 → WP3	EarthCare Meeting point at 15:42
VAD1	15:53 - 15:56	FL200	WP3	Calibration maneuver
D1	15:56 - 16:21	FL200 → 500 ft → 1500 ft	WP3	1000 feet per minute descent with sounding
B1-B2	16:19 - 16:43	1500 ft	WP3 → WP4	Cloud base leg
B3	16:43 - 16:57	1500 ft	WP4	ATC request to move away from Boa Vista island
B4	16:58 - 17:18	1500 ft	WP4 → WP5	shortened for 2nd flight scheduling
B5	17:18 - 17:37	2000 ft	South of Sal	approach
Landing	17:37		SID-SID	

## 6 Quicklooks and Comments

At the beginning of leg 1, a nearly occluded sky was observed from above. Towards WP 2, the cloud cover got progressively more scattered. During the descent at WP3, shallow boundary layer clouds seemed to be organized in streets near the surface. Temperature inversion was identified relatively low around 600 masl, near 900 hPa (see Figure 4). During the two cloud base legs, clouds were encountered frequently at an altitude of approximately 1500 feet with two altitude adjustments. The gradual evolution of cloud cover was similar to the one observed from the higher altitude legs, with overcast near WP4 and more scattered towards WP3 close to WP1 and WP2, respectively. This visual observation of shallow low level clouds, noted during the flight, was confirmed by the RASTA vertically pointing W-band radar (see Figure 5).

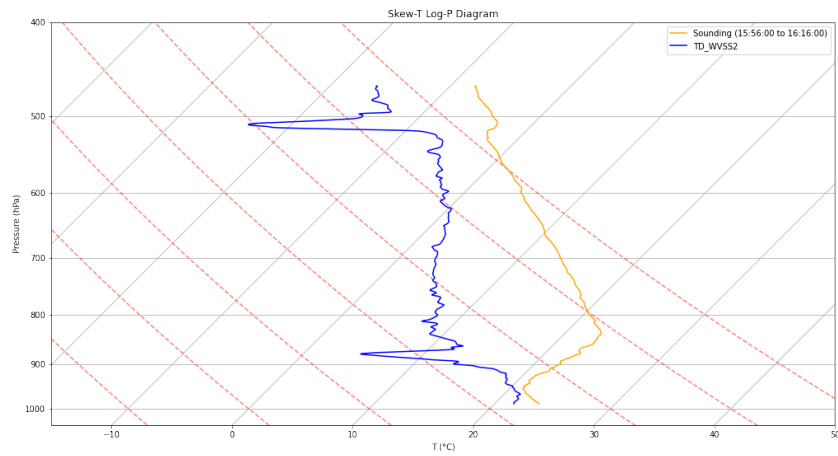


Figure 4: Quicklook Skew T diagram taken during the descent at WP2

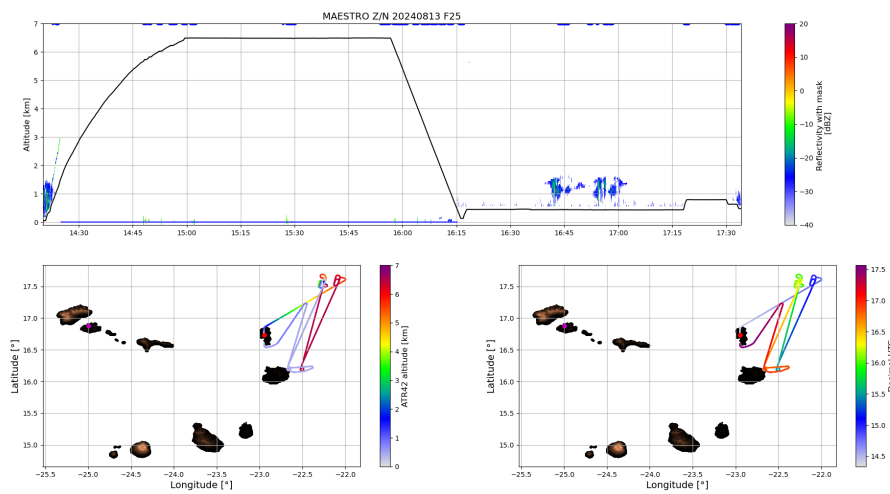


Figure 5: RASTA quicklook for RF03.

## 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 $<\pm 3^\circ$	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 $<\pm 3^\circ$	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 (8.7 $\mu$ m) ce332 radiometer	TB.C1	OK	
ray_tb_ce332_c2_1		Brightness temperature channel2 (10.6 $\mu$ m) ce332 radiometer	TB.C2	OK	
ray_tb_ce332_c3_1		Brightness temperature channel3 (12 $\mu$ m) ce332 radiometer	TB.C3	OK	
ray_lum_ce332_c1_1		Radiance, channel1 (8.7 $\mu$ m) from ce332 radiometer	RAD.C1	OK	
ray_lum_ce332_c2_1		Radiance channel2 (10.6 $\mu$ m) from ce332 radiometer	RAD.C2	OK	
ray_lum_ce332_c3_1		Radiance channel3 (12 $\mu$ m) 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	ok but 0,2 m/s offset TBC
	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	oscillation
	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	oscillation
	hum_humr_wvs_rs_1	Water Vapor Mixing ratio WVSSII	MR2	OK	reference
	hum_humr_srted_aero_1	Water Vapor Mixing ratio from humaero enviscope	MR3	OK	
	hum_huabs_rt_1011_1	Abolute Humidity from 1011C	HABS1	OK	oscillation
	hum_huabs_wvs_rs_1	Abolute Humidity from WVSSII	HABS2	OK	reference
	hum_huabs_srted_aero_1	Abolute Humidity from enviscope	HABS3	OK	
	hum_hurel_rt_1011_rs_1	Relative Humidity from 1011C	RH1	OK	oscillation
	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	:-1g/kg in lower altitude
	pre_pb_fw_100	Air Pressure measured by FastWave	FW_P	OK	
	tpr_tt_fw_100	Temperature measured by FastWave	FW_T	OK	
OZONE	chm_cc_o3_2b_ppb_RS_cal_%10	O3 2493DB OzoneMonitor mixing ratio	O3_MONITOR2	PB	incoherent value
	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	



DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	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	PB	miss value from 14:23 to 16:14
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	PB	miss value from 14:23 to 16:14
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	PB	miss value from 14:23 to 16:14
	mic_totalconc_SPP300_1	SPP300 Total particles concentration	SPP300_TCONC	PB	miss value from 14:23 to 16:14
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 (sideways)	Z, V, Doppler spectrum	OK	
	LNG	Lidar (Up or Down)	Backscatter(355nm/532/1064) - HSRand Doppler 355nm	OK	
	aWALI	Raman Lidar (sideways)	Backscatter and inelastic(RH/Temp)	PB	Trigger problem
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			NOK	