Flight report
Research Flight 14 (RF14)
ATR-2024-0801a
SAFIRE flight as240036
Sal (SID-SID), 17:52 - 20:52 UTC

PI: **Louis Jaffeux**

26 August 2024

1 Objectives

- Cloud and oceanic boundary layer sampling with remote sensing and in-situ instrumentation.
- Short-Lived Convective cell observation

2 Cal/Val activity

None.

3   Crew

SAFIRE	Name	Lab
Pilot (CDB)	D Duchanoy	SAFIRE
Pilot (OPL)	G Seurat	SAFIRE
Mechanics	T André	SAFIRE
Expé Principal	M Cluzeau	SAFIRE
Expé	B Celou	SAFIRE
SCIENTISTS		
PI seat	L Jaffeux	LAERO
LNG seat	S Bounissou	LATMOS
aWALI seat	F Lally	LAERO
Microphys seat 1	P Coutris	LAMP
Microphys seat 2	G Fevre	LAMP
RASTA seat	J Delanoe	LATMOS
BASTA seat	B McKim	SAFIRE

4   Synoptic situation

The flight happened in a transition region between dry air to the north and humid air to the south. Over the flight track, daily integrated precipitable water values were predicted to range from 30 to 50 mm (see Figure 1). Over the Cap Verde islands, the wind was blowing from the north, reaching up to 10 m/s at the surface. At the southern edge of the islands, a convergence line was identified in the AROME model, with the surface wind nearing 0 m/s values. During the day, short-lived convective cells formed and dissipated south of the islands.
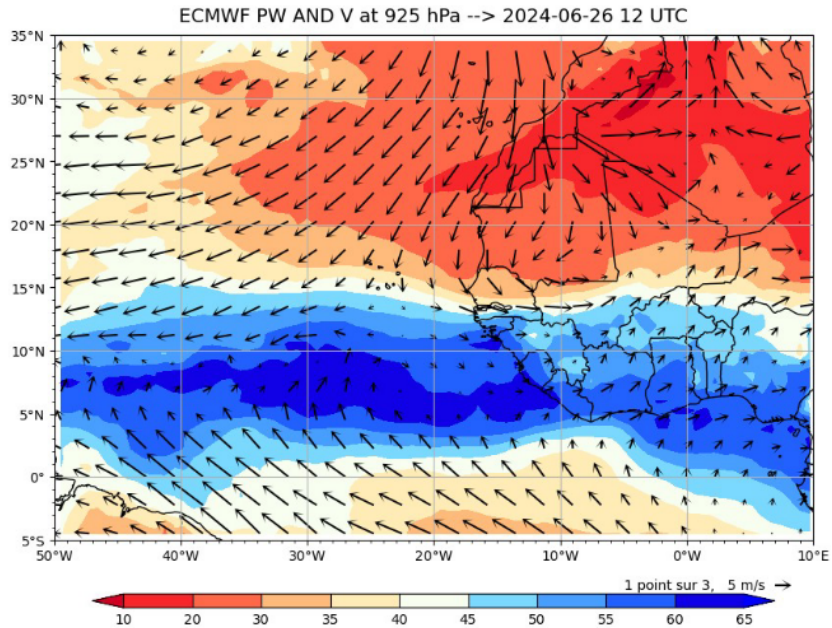

Figure 1: ECMWF PW forecast.
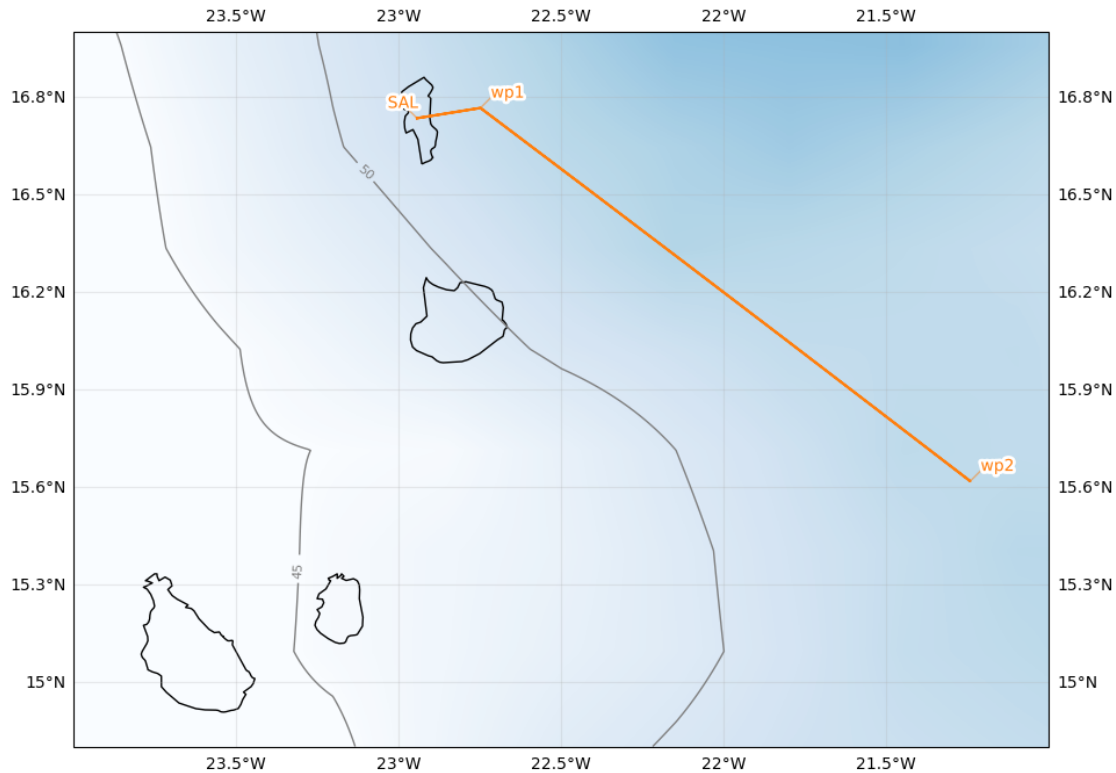
5   Flight elements

Figure 2: Initially planned Lat-Lon Path of the ATR for RF14.

Because the appearance of convective cells in the South of the Cap Verde islands was not forecast, the flight plan shown in Figure 2 was not followed beyond the first waypoint. Motivated by convective cell observations made during the flight that took place earlier that day, the exploration of cells was favoured over systematic sampling of atmospheric air layers. A convective cell was identified by ground support and the plane crew towards the SouthEast. Approached at 500 feet level, the plane then climbed to cloud base level at 1600 feet and flew at its edges, leaving the cell to the right of the airplane to allow horizontally pointing lidar (AWALI) and radar (BASTA) to sample its base from three different angles. Following this initial exploration, the plane flew further north and came back on the same path, this time crossing the cell closer to its core. Finally, clouds were chased at the pilot discretion during the ascent before returning back to Sal at FL200.

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.
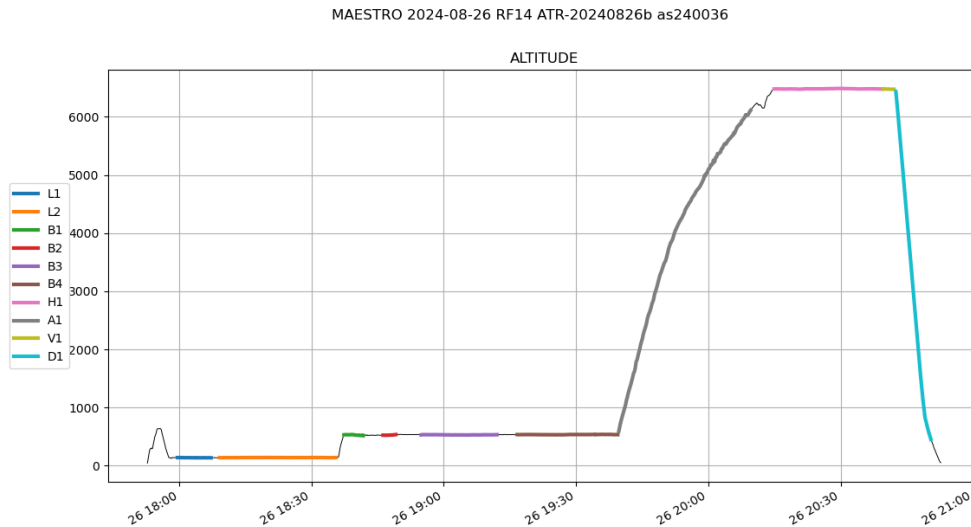
MAESTRO 2024-08-26 RF14 ATR-20240826b as240036

Figure 3: Flight segmentation as described in the table.

RF14 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	17:52		SID-SID	
L1	18:00 - 18:07	500 ft	WP1 → WP1 v4	Subcloud leg
L2	18:08 - 18:36	500 ft	WP1 v4 → WP4	Subcloud leg
B1	18:38 - 18:43	1750 ft	WP4 → WP2 v4	Cloud base leg between 2 cells
B2	18:46 - 18:50	1750 ft	WP2 v4 → WP3ter	Cloud base leg behind the cell
B3	18:52 - 19:13	1750 ft	WP3ter → WP5	Cloud base leg
B4	19:16 - 19:39	1750 ft	WP5 → WP3ter	Cloud base leg
A1	19:39 - 20:21	1750 ft → FL200	near WP3ter and towards the North-East	Ascent chasing cloud patches
H1	20:15 - 20:39	FL200	North-East → WP1	maximum altitude leg
VAD	20:39 - 20:42	FL200	WP1	Calibration maneuver
Landing	20:52		SID	

6   Quicklooks and Comments

The quicklook data from the embarked vertically pointing W band radar is shown in Figure 4.

It shows clearly that the first leg was entirely cloud free. During the ascent and descent high cirrus clouds were detected. The high leg where Earth Care was met was also cloud free. A few clouds and precipitation falling from cloud with tops near 2000 m were then sampled in two subsequent legs performed at 800 m.
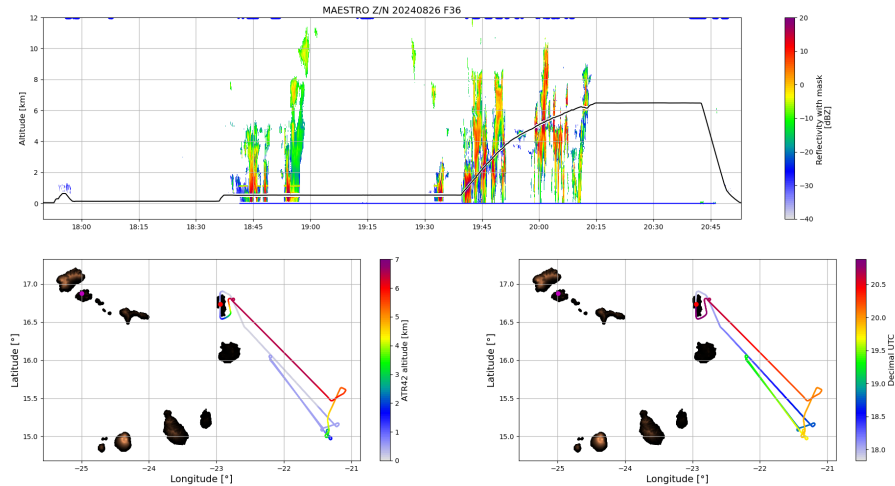
Figure 4: RASTA reflectivity, quicklook for RF14.

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	OK but Night flight don't care about negative values
	ray_rg_down_crsensor_1	Downwelling Shortwave radiation clear dome- Attitude correction for pitch/roll $<\pm3°$	SWDC	OK	Negative values filtred
	ray_pir_down_1	Downwelling Shortwave radiation red dome (no attitude correction)	SWD_RED	OK	OK but Night flight don't care about negative values
	ray_pir_down_crsensor_1	Downwelling shortwave radiation red dome-Attitude correction for pitch/roll $<\pm3°$	SWDC_RED	OK	Negative values filtred
	ray_rg_up_1	Upwelling Shortwave radiation clear dome (no attitude correction)	SWU	OK	OK but Night flight don't care about negative values

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	ray_pir_up_1	Upwelling shortwave radiation red dome (no attitude correction)	SWU_RED	OK	OK but Night flight don't care about negative values
	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	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	-
	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
	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	-
	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	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	hum_huabs_rt_1011_1	Abolute Humidity from 1011C	HABS1	OK	Reference
	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	-
	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	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	-
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	PB	
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	PB	Very noisy and stopped at 19:44
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	PB	
	mic_totalconc_SPP300_1	SPP300 Total particles concentration	SPP300_TCONC	PB	Very noisy and stopped at 19:44
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	

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	FCDP	Droplets (2?m - 50?m)	Spectrum	OK	
	NP-2			OK	