Flight report

Research Flight 16 (RF16)
ATR-2024-0829
SAFIRE flight as240038
Sal (SID-SID), 19:00 - 22:30 UTC

PI: **Marie Lothon**

29 August 2024

1 Objectives

- Earthcare CAL/VAL.
- Shallow convection, aerosols and marine boundary layer sampling with remote sensing and in-situ instrumentation.
- Coordination with King Air

2 Cal/Val activity

Yes, coordinated with King Air.

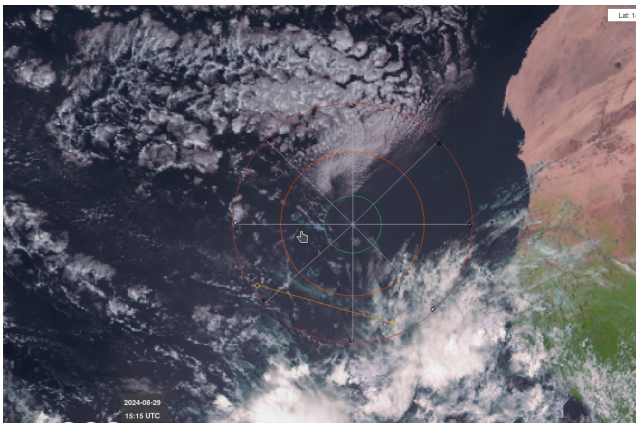
3 Crew

SAFIRE	Name	Lab
Pilot (CDB)	Dominique Duchanoy	SAFIRE
Pilot (OPL)	Guillaume Seurat	SAFIRE
Mechanics	Thierry André	SAFIRE
Expé Principal	Benoît Celou	SAFIRE
Expé	Hubert Bellec	SAFIRE
SCIENTISTS		
PI seat	Marie Lothon	LAERO
LNG seat	Sophie Bounissou	LATMOS
aWALI seat	Valentin Guillet	LSCE
Microphys seat 1	Alfons Schwarzenboeck	LAMP
Microphys seat 2	Guy Lefebvre	LAMP
RASTA seat	Julien Delanoë	LATMOS
BASTA seat	Christophe Legac	LATMOS

4 Synoptic situation

We are in the margin of a negative phase of AEWs and slightly positive phase of Rossby Waves. That also corresponds to a slightly positive anomaly of PW. The AEJ is moderate (15 m s^{-1}) in mid-troposphere, and wind is also moderate in the low layers (7 m s^{-1}).

Cabo Verde island are once again located at the northern loose frontier of the ITCZ. The ITCZ core is very active to the south, with a huge system that was sampled by HALO on the same day, that can be seen on the satellite image Fig. 1.

(a) 

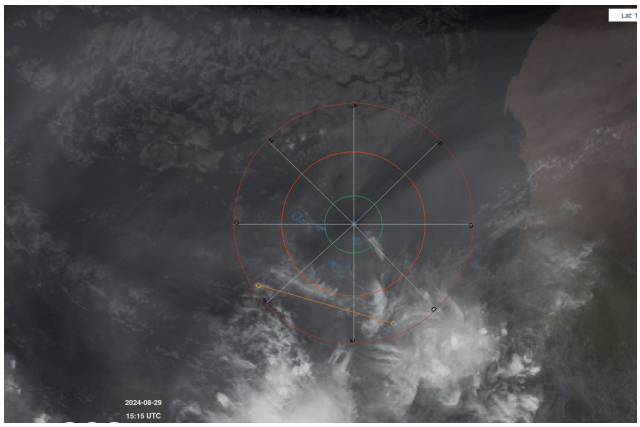
(b) 

Figure 1: Satellite image MSG

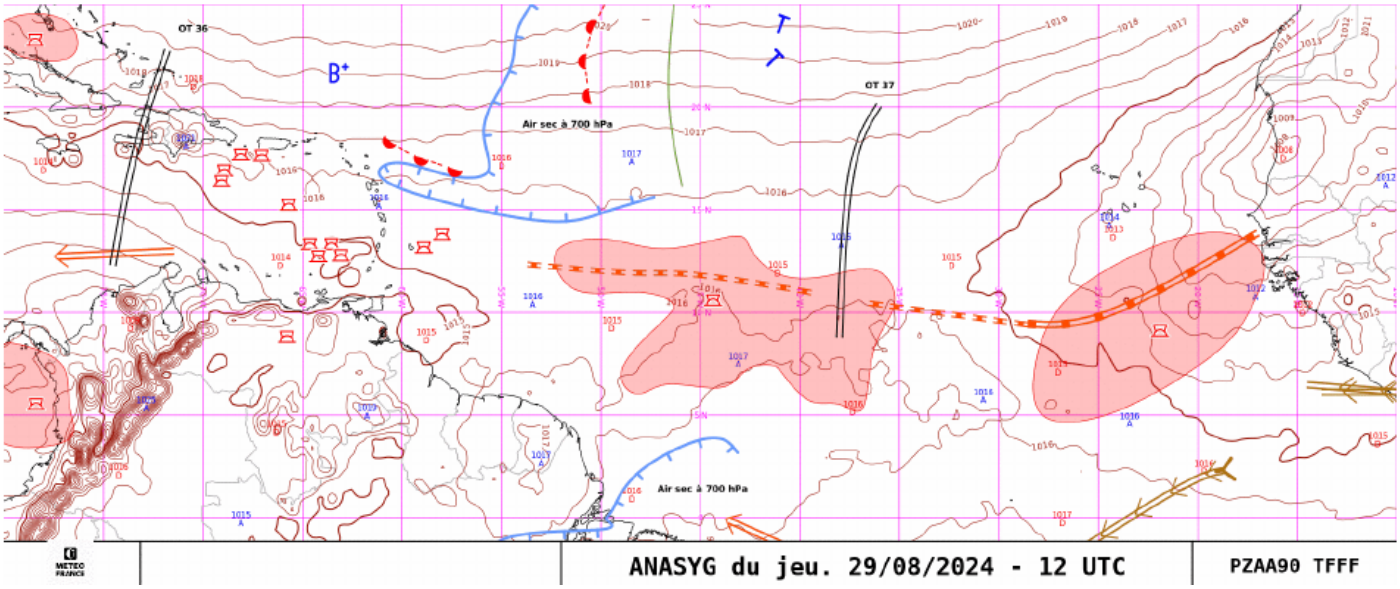


Figure 2: MISVA schematic analysis

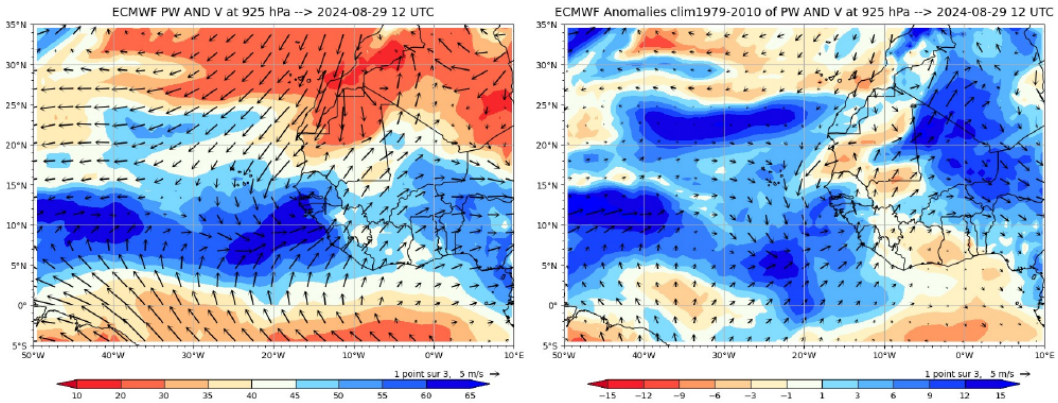


Figure 3: Precipitable water from AROME, 29 August 2024 1200 UTC.

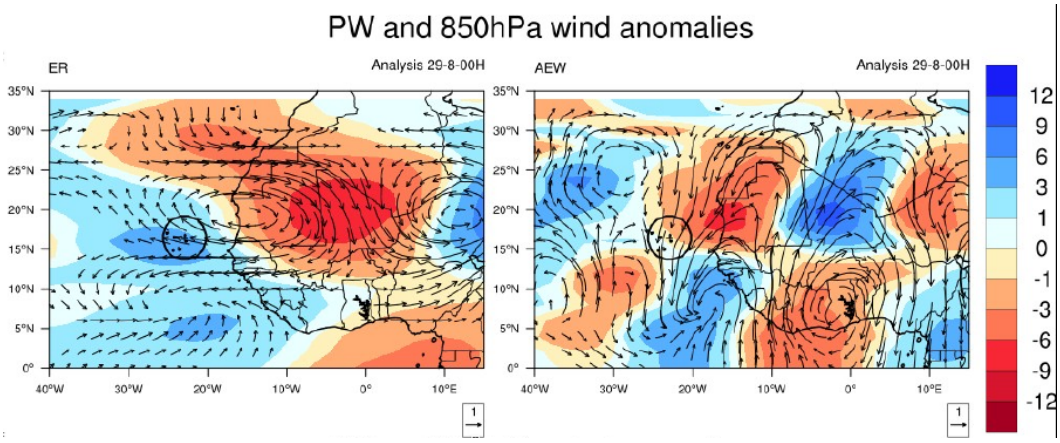


Figure 4: Precipitable water and wind anomalies, Rossby waves and African Easterly Waves, for 29 August 2024.

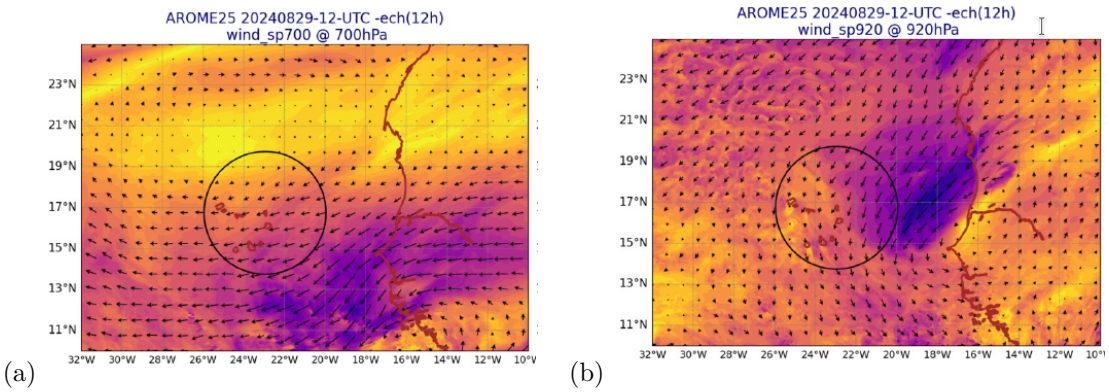


Figure 5: Forecasted wind (a) at 700 hPa (b) at 920, 29 August 2024 1200 UTC hPa

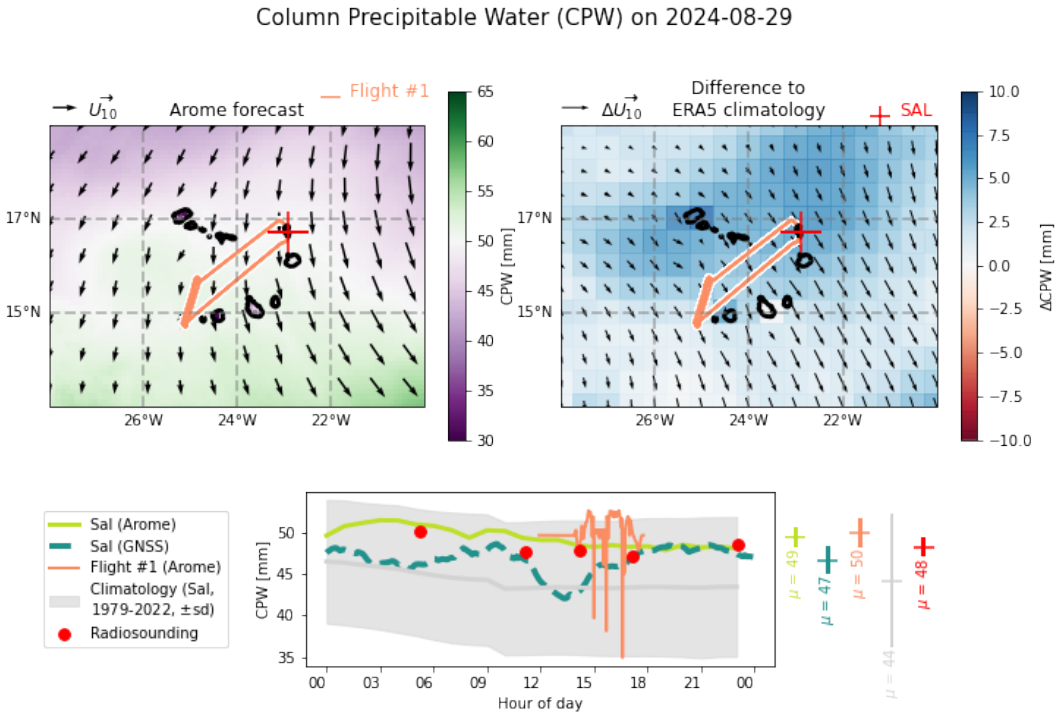


Figure 6: 24h average of Column of Precipitable Water, from ECMWF analysis and GNSS.

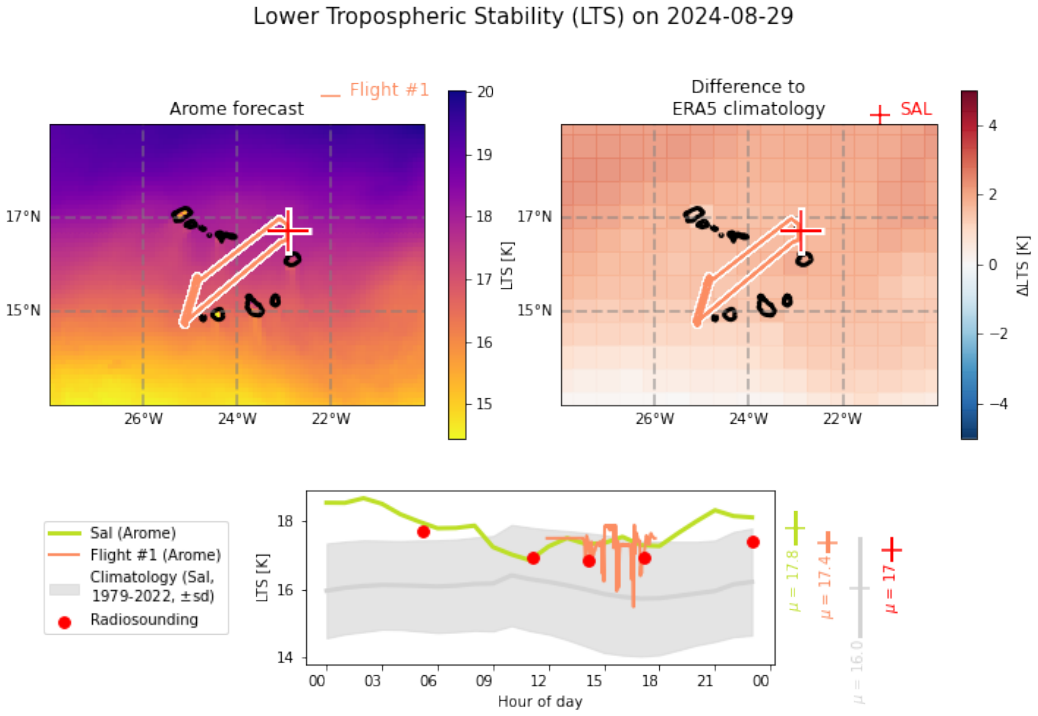


Figure 7: Lower Tropospheric Stability on 29 August 2024, from AROME, ERA5, soundings

5 Flight elements

Description of the legs

RF16 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	13:52		SID-SID	
L1a	14:01 - 14:08	500 ft	Sal $\rightarrow WP1$	Low level leg - 1st segment
B1a	14:09 - 14:16	1800 ft	Sal $\rightarrow WP1$	Cloud base leg - 1st segment
L1b	14:17 - 14:22	800 ft	Sal $\rightarrow WP1$	Low level leg - 2nd segment
B1b	14:23 - 14:28	1800 ft	Sal $\rightarrow WP1$	Cloud base leg - 1st segment
L1c	14:29 - 14:34	800 ft	Sal $\rightarrow WP1$	Low level leg - 3rd segment
B1c	14:35 - 14:40	1800 ft	Sal $\rightarrow WP1$	Cloud base leg - 3rd segment
L2	14:46 - 15:02	500 ft	WP1 $\rightarrow EC1$	Low level leg near EC track
A	15:02 - 15:35	500 ft $\rightarrow FL200$	EC1	Ascent to FL200 at EC1
Ha	15:41 - 15:48	FL200	EC1 $\rightarrow EC2$	High level leg - Meeting point at 15:48
Hb	15:51 - 15:56	FL210	EC1 $\rightarrow EC2$	High level leg - Meeting point at 15:48
D	15:57 - 16:19	FL210 $\rightarrow 500ft$	EC2	Descent to 500 ft at EC2
B2a	16:22 - 16:37	1800 ft	WP2 $\rightarrow Sal$	Cloud base leg back - 1st segment
L2a	16:39 - 16:50	800 ft	WP2 $\rightarrow Sal$	Low level leg back - 1st segment
B2b	16:51 - 17:01	1800 ft	WP2 $\rightarrow Sal$	Cloud base leg back - 2nd segment
L2b	17:03 - 17:13	800 ft	WP2 $\rightarrow Sal$	Low level leg back - 2nd segment
B2c	17:14 - 17:24	1800 ft	WP2 $\rightarrow Sal$	Cloud base leg back - 2nd segment
L2c	17:25 - 17:32	800 ft	WP2 $\rightarrow Sal$	Low level leg back - 3rd segment
Landing	17:40		SID-SID	

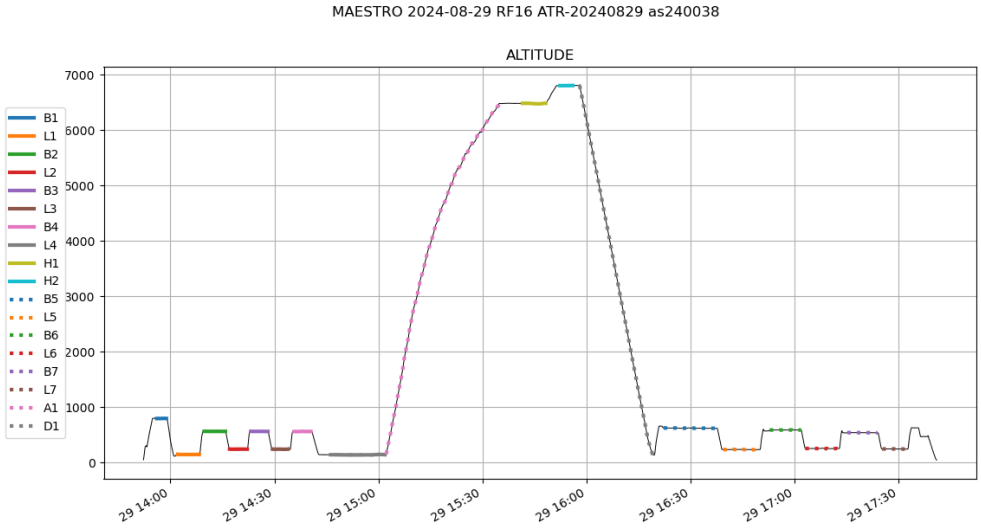


Figure 8: Flight segmentation as described in the table.

6 Quicklooks and Comments

First cloud bases were estimated to 500 m, with a marked inversion at top around 600 m, dT=3°C and dr_v=8 g kg^{-1}. In the sublcoud layer, we find wind 5 to 8 m s^{-1} at 15-60 deg, temperature from 26°C at 150 m to 22 °C at 250 m, mixing ration around 17-18 g kg^{-1}.

During the ascent, we found AEJ at 15 m s^{-1}. Small inversions et 5100m, 5900 m and the strongest at 6250 m (see Fig.9a). The aerosol layer was up to 4600 m (see Fig.9b).

The cumulus field was 2/8 in average, with denser areas and other clearer areas, and heterogeneous base levels (2 main levels). Note that our last cloud base leg on the way back, which had almost no clouds around, was maybe too high. Otherwise, most of the cloud base legs were fine, with actually a good number of clouds crossed and seen on the side with AWALI.

At the EC segment, we had fine cirrus above us (12 km) on the southern part. They were too thin for RASTA except at one point where it got a ground echoe band. We got even upper (FL210) to avoid it, but that was too late fror the cloud.

There were denser (and lower?) cirrus on the side, that we detected in turns with BASTA, but not AWALI (> 10 km tilted distance).

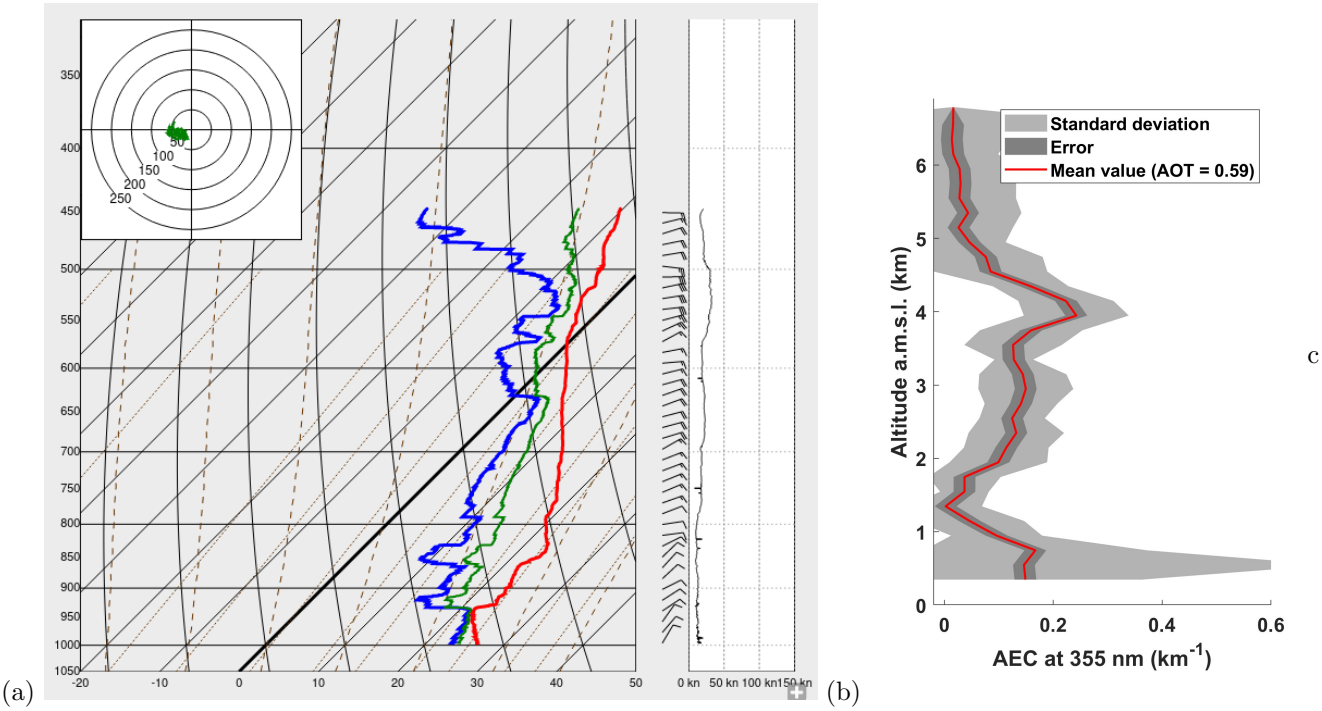


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Figure 9: (a) Skew-T diagram during descent from FL210 at EC2. (b) Observations of aerosol profile from AWALI.

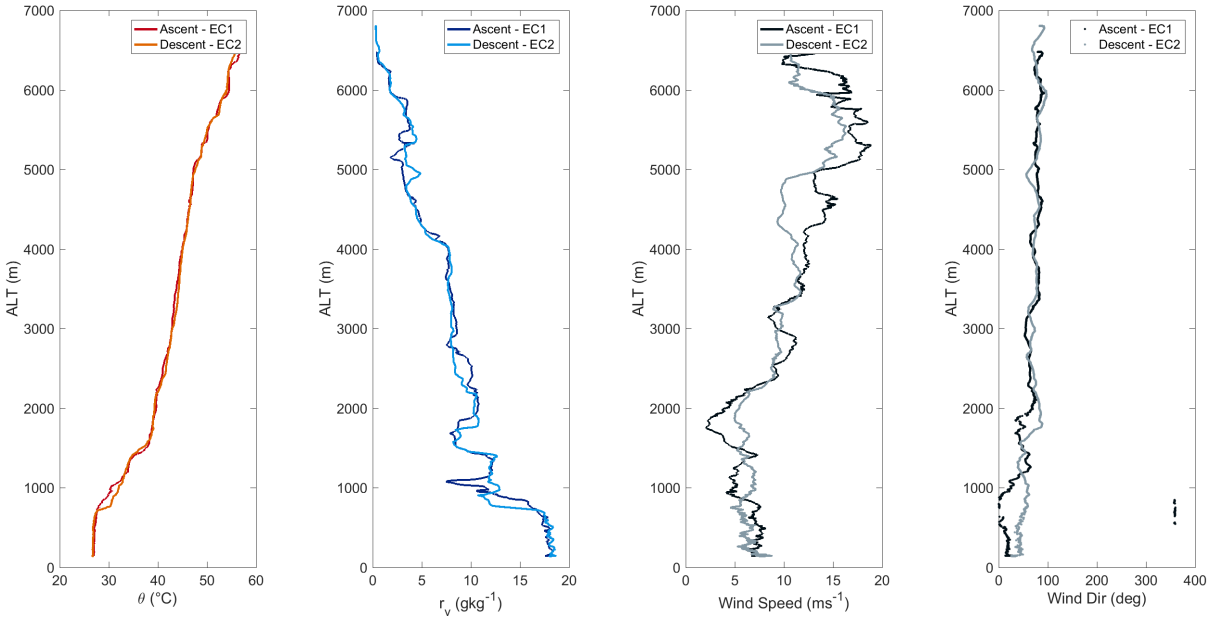

Figure 10: Profiles of potential temperature, water vapour mixing ratio, windspeed and windir during the ascent at WP2 and descent at WP1.

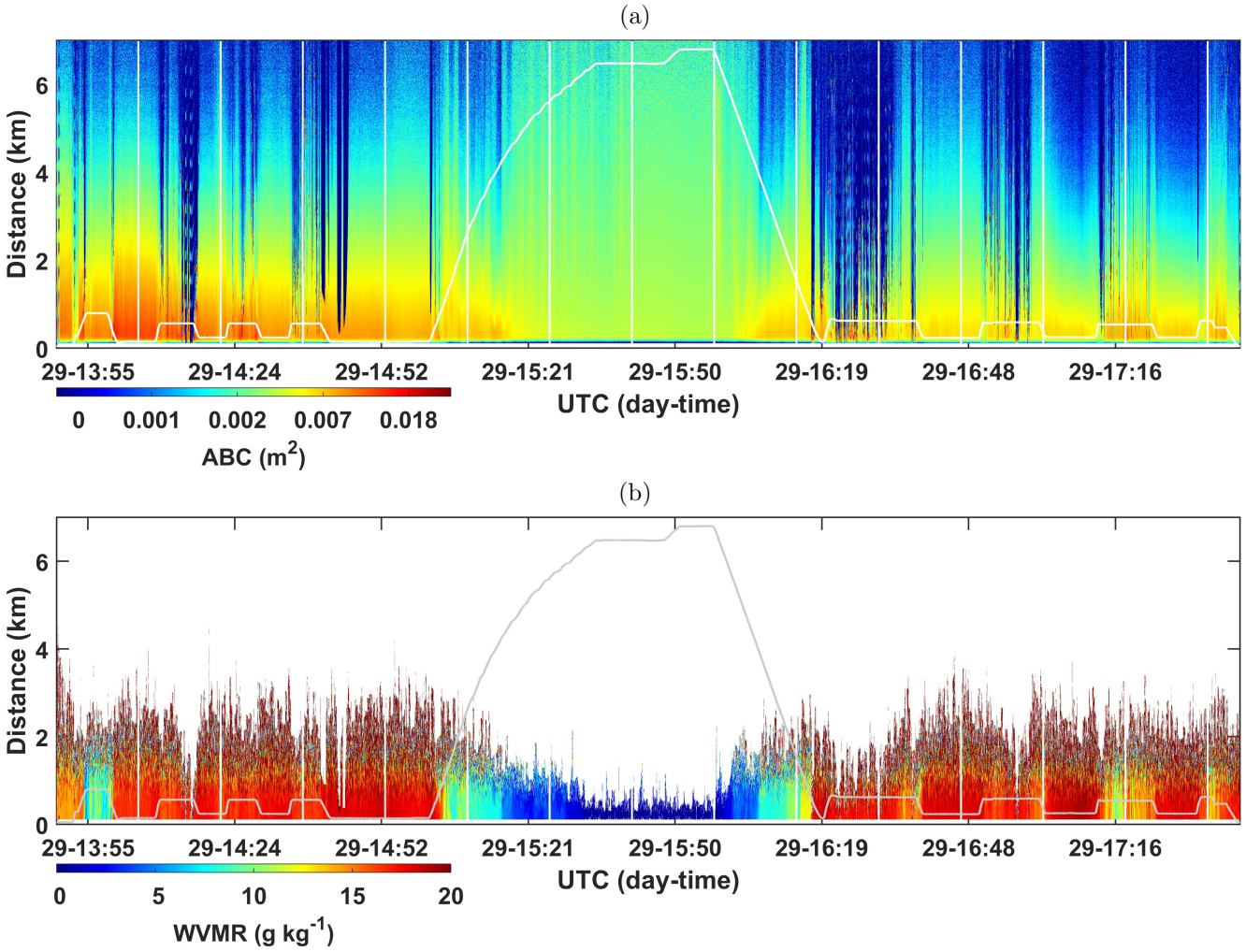

Figure 11: Observations made by AWALI during the flight (a) Apparent Backscatter Coefficient, (b) water vapour mixing ratio.

7 Instrument status

LNG had a tough problem today. No interface for vizualisation. Attempts to make acquisitions anyway. But turned out to fail. Maybe due to a disk failure or damage. No LNG data for this flight.

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	-
	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	-
	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	Noisy
	alt_ralt_15_m_1	Height	HEIGHT	OK	-
	att_aoa_radom_deg_1	Angle of Attack	AOA_RAD	OK	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	att_aos_radom_deg_1	Angle of Sideslip	AOS_RAD	OK	-
	ven_wind_v_vp_imu_1	Upward Wind	WW	OK	Ok but baseline values seems to increase slowly
	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	Oscillations
	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	Reference
	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	-
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	-

DATA	SAFIRE_name	DESCRIPTION	PARAMETER	STATUS	COMMENT
	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	Very noisy and stopped at 14:45:00
	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	Very noisy and stopped at 14:45:00
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	NOK	IHM problems, then acquisitions issues. No data.
	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	