Flight report

Research Flight 2 (RF02)
ATR-2024-0811a
SAFIRE flight as240024
Sal (SID-SID), 14:30 - 18:00 UTC

PI: **Marie Lothon**

11 August 2024

1 Objectives

- First Earth-Care flight, with track East of Mindelo
- Flying over Mindelo, near OSCM and Meteor

2 Cal/Val activity

Earth-care Cal/Val with 4 operational instruments

3 Crew

SAFIRE	Name	Lab
Pilot (CDB)	Guillaume Seurat	SAFIRE
Pilot (OPL)	Jean-François Bourdinot	SAFIRE
Mechanics	Thierry André	SAFIRE
Expé Principal	Tania Jiang	SAFIRE
Expé	Cyril de St Léger	SAFIRE
SCIENTISTS		
PI seat	Marie Lothon	LAERO
LNG seat	Sophie Bounissou	SAFIRE
aWALI seat	Patrick Chazette	LSCE
Microphys seat 1	Pierre Coutris	LAMP
Microphys seat 2	Thierry Latchimy	LAMP
RASTA seat	Julien Delanoë	LATMOS
BASTA seat	Kevin Huet	LATMOS

4 Synoptic situation

Area is influenced by an AEW, but without much cloud development nor rain, because of an interacting dry anomaly of ROSSBY wave. Significant African Easterly Jet. We are still in the large dust plume coming from West Africa.

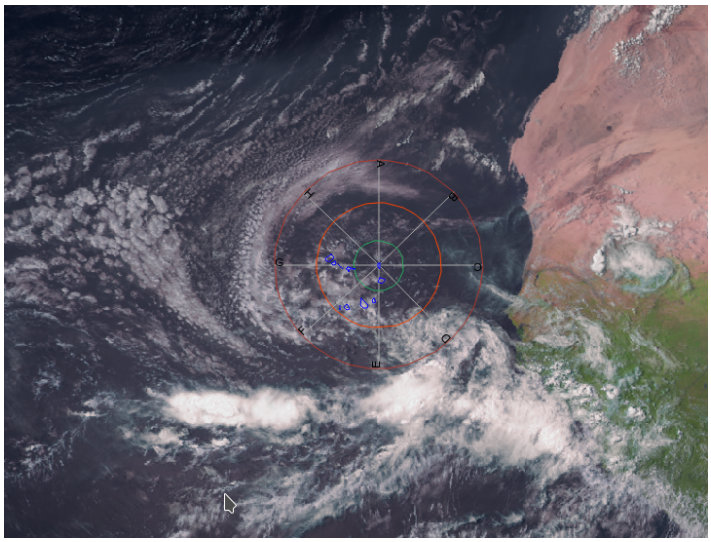


Figure 1: MSG imagery (RGB) on Aug 11 2024, 15:45 UTC (from AERIS op center)

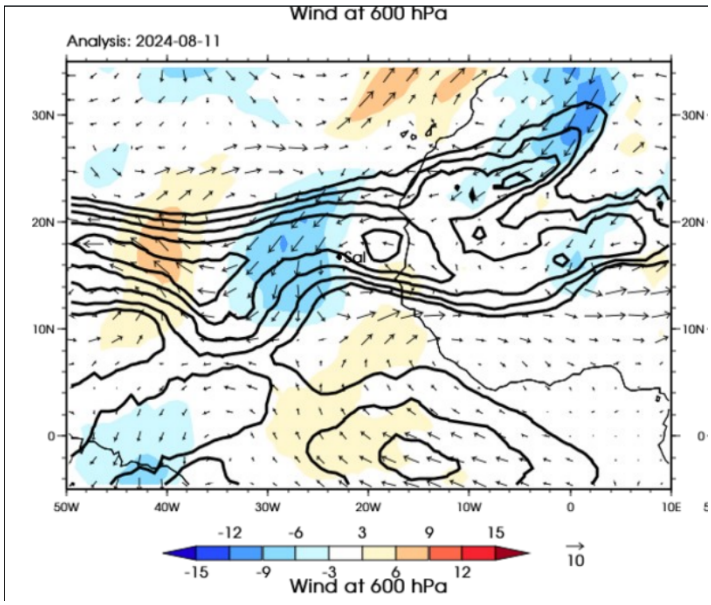


Figure 2: African Easterly Jet, at 600 hPa.

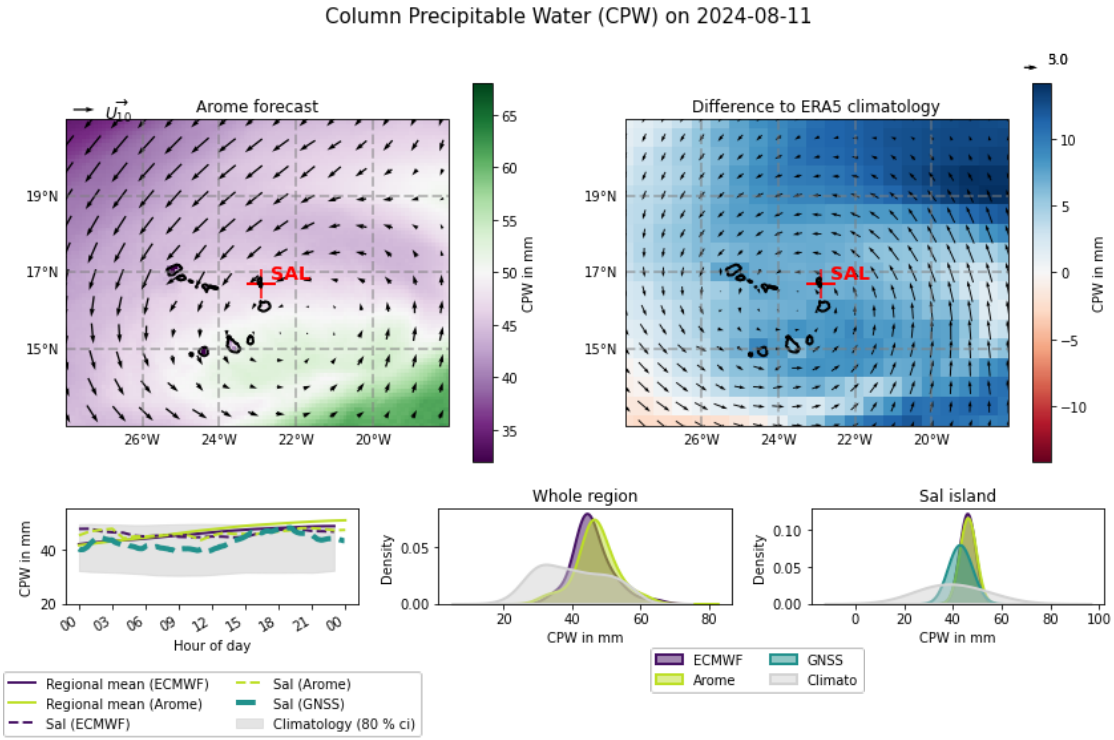


Figure 3: 24h average of Column of Precipitable Water, from ECMWF analysis and GNSS.

5 Flight elements

Description of the legs

RF02 elements	Time (UTC)	Flight Level (FL)	Position	Notes
Takeoff	14:33		SID-SID	
A	14:33 - 15:13	0 → FL200	SAL → $WP1$	Ascent from Sal to WP1
H1	15:13 - 15:28	FL200	WP1 → $WP2$	High level leg near orbit
V	15:28 - 15:41	FL200	near WP2	Two VAD and wait
H2	15:41 - 16:02	FL200	WP2 → $WP3$	High level leg with meeting point V
16:03 - 16:06	FL200		VAD	
D	16:11 - 16:32	FL200 → $1500ft$	WP3	
B	16:32 - 16:54	1500 ft	WP3 → $WP4$	Cloud base leg
A	16:55 - 17:06	1500 ft → $FL100$	WP4	Ascent South of Mindelo
H3	17:06 - 17:16	FL100	Across Mindelo	Fly over OSCM and Meteor
D	17:24 - 17:34	FL100 → $500ft$	Northwest Mindelo	Descent to subcloud layer
L1	17:34 - 17:44	500 ft	Mindelo to Sal	Subcloud layer leg
S	17:45 - 17:55	200 ft	Mindelo to Sal	Surface leg
L2	17:56 - 18:07	500 ft	Mindelo to Sal	Subcloud layer leg
Landing	18:13		SID-SID	

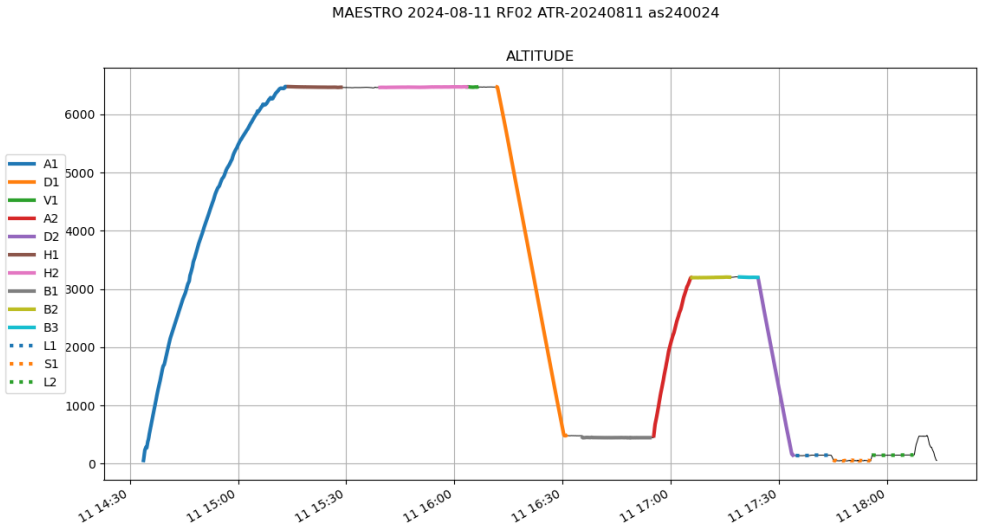
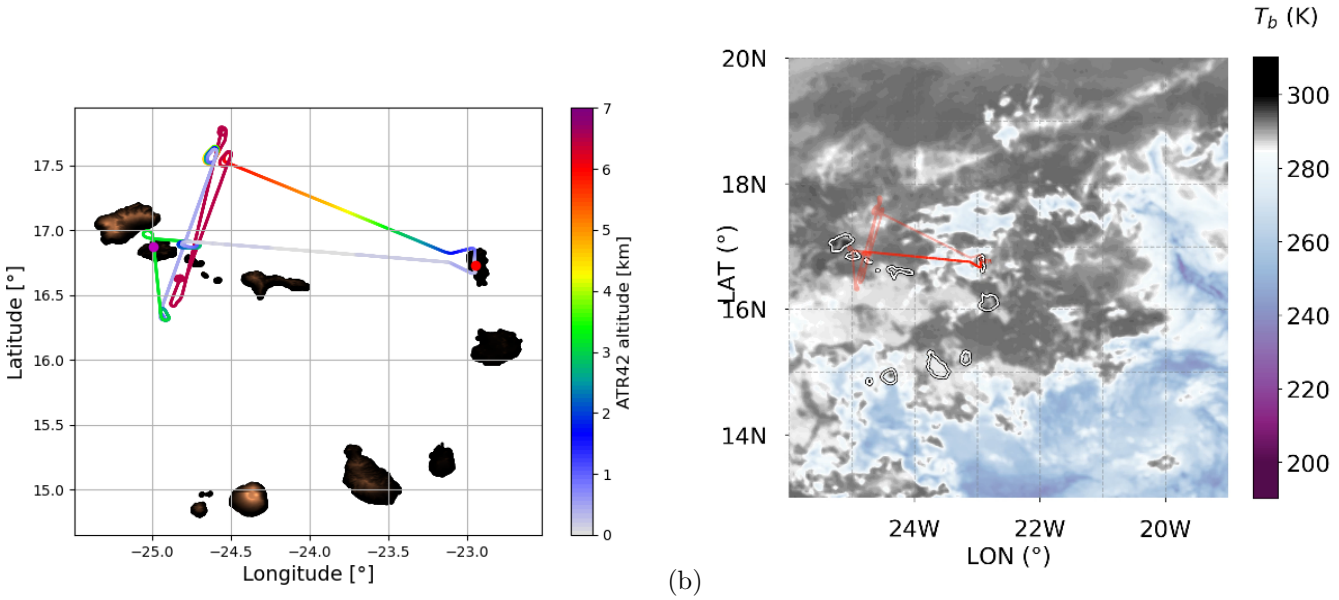


Figure 4: Flight segmentation as described in the table.



(a) (b)

Figure 5: (a) Projected trajectory and altitude (color). (b) Trajectory on Brightness Temperature.

6 Quicklooks and Comments

During the first ascent, cloud base was around 550 m. A significant inversion was observed at 1700 m, top of a stratocumulus (partly broken) layer. At some places, there were two levels of Sc or St clouds, but all pretty thin. Wind was weak easterly within the Stratocumuls Topped Boundary Layer (STBL), and moderate above (15-20 m/s). Two other inversions found at 4600 m and 5600 m were found. The first may be the top of the Saharan Air Layer (SAL), more marked in humidity than temperature. The second one is more marked in dust.

The looking downward visible camera and LNG can well see the Sc layer below, with close cells. Water droplets are too small for BASTA and RASTA though.

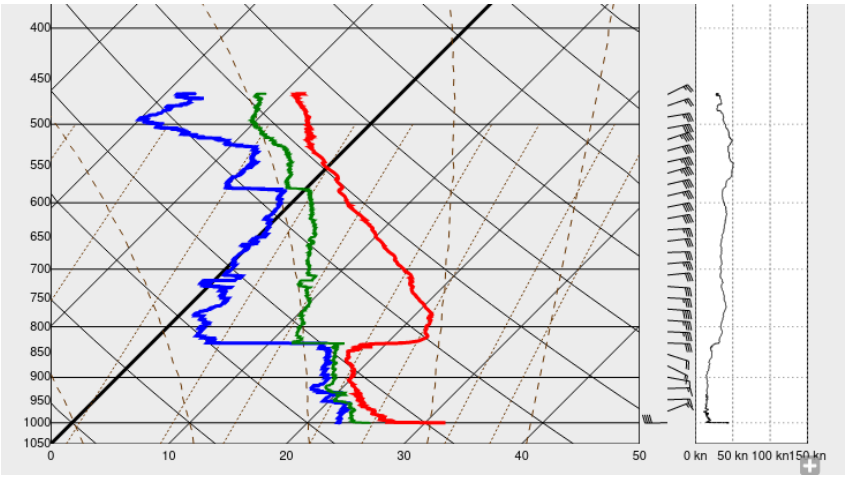


Figure 6: Skew-T diagram (T, Td) and wind profile during ascent from WP1 to WP2 (Sal to Mindelo), starting from take off to FL200.

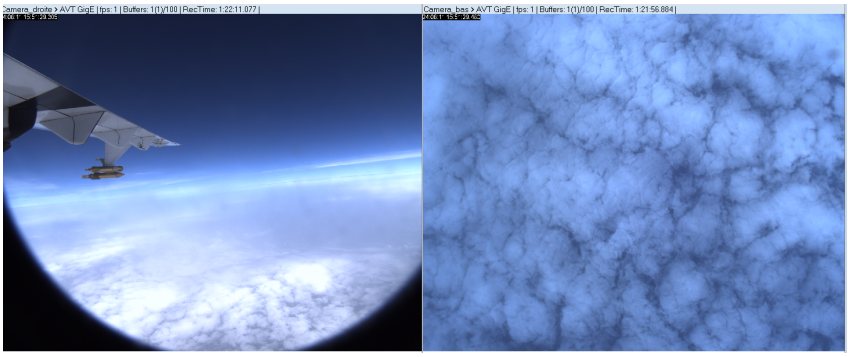


Figure 7: Visible camera image looking downard and sideward, at 15:15 UTC

During the pair of VADs made for waiting purpose at WP2, we flew over a precipitating convective cell that was well caught by RASTA.

When flying back up to overfly Mindelo, the strong inversion at the top of the Sc was marked again: dT=6°C and dr_v=10 g kg^{-1} across.

During the low level leg L, wind was 10 m s^{-1} at 60°, temperature 25°C and mixing ratio 18 to 19 g kg^{-1}. (It was 1.8 g kg^{-1} at FL200).

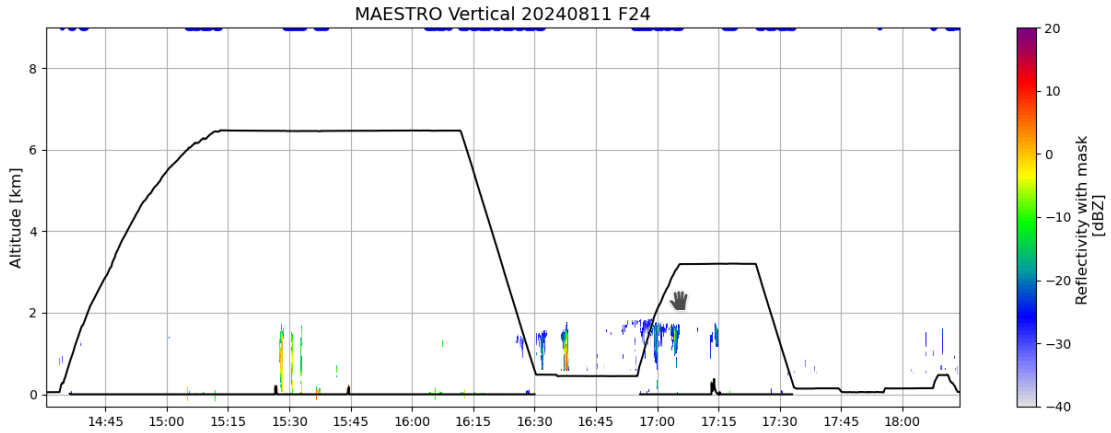


Figure 8: RASTA observations along the entire flight.

7 Instrument status

There were several acquisition issues for LNG (30 min loss) and AWALI (50% loss). But beside this, they both show very clean and interesting observations. RASTA and BASTA, Microphysics probes and Core measurements are fine. All upgrades reveal great success. FASTWAVE has shown in this flight that it is able to measure in a large spectrum of moisture from 1.8 to 19 g kg^{-1}, which was an unknown until now.

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
	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
	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
	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	-
	ven_wind_v_vp_imu_1	Upward Wind	WW	OK	ok but probably 0,2 m/s 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	oscillations in altitude
	hum_hutd_wvs_rs_1	Dew Point Temperature from WVSSII	DP2	OK	reference, even if it's a little bit lower in altitude than the others
	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	oscillations in altitude
	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	oscillations in altitude

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	oscillations in altitude
	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	- 35 hPa difference with reference raw pressure
	tpr_tt_fw_100	Temperature measured by Fast-Wave	FW_T	OK	- quite similar, 2 degree close
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	some miss values from 14:35 to 16:15
	mic_somcount_SPP300_1	SPP300 total particles count	SPP300_TCOUNT	PB	some miss values from 14:35 to 16:15
	mic_tabconc_SPP300_1	SPP300 particles concentration bin[1]...bin[30]	SPP300_CONC	PB	some miss values from 14:35 to 16:15
	mic_totalconc_SPP300_1	SPP300 Total particles concentration	SPP300_TCONC	PB	some miss values from 14:35 to 16:15
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	OK
	LNG	Lidar (Up or Down)	Backscat-ter(355nm/532/1064) – HSRand Doppler 355nm	PB	
	aWALI	Raman Lidar (sidewards)	Backscatter and inelas-tic(RH/Temp)	PB	
MICRO	CVI		TWC	OK	

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