Description of the "Aztec_core_1" fileset containing measurement of SAFIRE's Piper-Aztec during BLLAST.

Météo-France CNRM/GMEI/TRAMM

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Introduction

This document is a description of the format and the parameter list of the fileset Aztec_core_1, which contains in-situ meteorological measurements made onboard SAFIRE'S Piper-Aztec, averaged to 1 Hz from various original sampling rates.

1 Descriptions

1.1 Format

The files are in netCDF format, following the "CF" (Climate and Forecast) convention[1] and the EUFAR guidelines [2].

Conformance to standards has been checked by online validators [3].

1.2 File naming convention

The naming pattern is :
`core-1Hz_safire-piper-aztec_2011`*`MMDD`*`_r0_az1100`*`nn`*`.nc`
where :
- *MM* is the month number (06 or 07)
- *DD* is the day number (see flight calendar)
- *nn* is the flight number (see flight calendar)

1.3 Flights

The table below gives the list of flights and their dates.

Date	IOP Num.	Flight Num.	Take-off	Landing
June 15	1	6	14h16m55s	15h39m10s
		7	17h51m50s	19h05m47s
June 19	2	8	13h35m26s	15h20m20s
		9	16h50m22s	18h38m45s
June 20	3	10	13h44m06s	15h37m17s
		11	17h02m33s	18h56m16s
June 25	5	12	08h05m45s	09h04m36s
		13	13h35m29s	15h27m45s
		14	16h54m26s	18h46m26s
June 26	6	15	14h10m13s	16h07m14s
		16	17h26m09s	19h19m58s

[1] http://cf-pcmdi.llnl.gov/
[2] http://eufar.net/document/CommonProtocolAnnex_NetCDFMetadata.pdf
[3] http://titania.badc.rl.ac.uk/cgi-bin/cf-checker.pl and http://puma.nerc.ac.uk/cgi-bin/cf-checker.pl

June 27	7	17	14h03m16s	14h54m21s
		18	16h36m16s	17h27m00s
June 30	8	19	14h01m53s	16h07m10s
		20	17h17m36s	19h26m23s
July 1	9	21	12h07m17s	14h13m42s
		22	16h01m53s	18h09m06s
July 2	10	23	12h37m29s	14h23m47s
		24	15h36m37s	17h10m58s
July 5	11	25	12h08m08s	14h11m23s
		26	15h06m32s	16h59m41s
		27	18h06m12s	19h33m51s

1.4 Parameter description

The files contain 11 measured parameters, described hereafter

N	Parameter	Unit	Description	**Origin** (Instrument, or computation)
1	`alt_airinspp`	*meter*	Altitude from post-processed AIRINS measurements, without outliers. Was computed at 25 Hz, and was averaged to 1 Hz by the operator MoyEch_tps_impos[4]	Measured by AIRINS Inertial Navigation System (manufacturer : IxSea, serial number PH-445) coupled to NovAtel DL-V3-L1L2 GPS receiver. Post-processing by Delphins software. Eventually, outliers were removed. Outliers are defined as samples outside a range [avg. - 7 std_dev, avg. + 7 std_dev], whose statistics are computed on a moving window of 250 samples.
2	`pos_lat_airinspp`	*degree*	Latitude from post-processed AIRINS measurements, without outliers. Was computed at 25 Hz, and was averaged to 1 Hz by the operator MoyEch_tps_impos	Measured by AIRINS Inertial Navigation System (manufacturer : IxSea, serial number PH-445) coupled to NovAtel DL-V3-L1L2 GPS receiver. Post-processing by Delphins software. Eventually, outliers were removed. Outliers are defined as samples outside a range [avg. - 7 std_dev, avg. + 7 std_dev], whose statistics are computed on a moving window of 250 samples.
3	`pos_lon_airinspp`	*degree*	Longitude from post-processed AIRINS measurements, without outliers Was computed at 25 Hz, and was averaged to 1 Hz by the operator MoyEch_tps_impos	Measured by AIRINS Inertial Navigation System (manufacturer : IxSea, serial number PH-445) coupled to NovAtel DL-V3-L1L2 GPS receiver. Post-processing by Delphins software. Eventually, outliers are removed. Outliers are defined as samples outside a range [avg. - 7 std_dev, avg. + 7 std_dev], whose statistics are computed on a moving window of 250 samples.
4	`alt_ralt_m`	*meter*	Height from aircraft radioaltimeter (range 0-2500ft), converted to meters. Was recorded at 200 Hz, and was averaged to 1 Hz by the operator MoyEch	Measured by instrument KRA10A (manufacturer : Honeywell) The recorded raw values were converted from *Volt* to *ft* by a first-order polynomial : $Y = 250X$
5	`pre_s_av_v2011`	*hPa*	Air static pressure Was computed at 25 Hz, and was averaged to 1 Hz by the operator MoyEch	$Z = X - Y$ where : X : `pre_psbav_cal` (Nose boom static pressure averaged at 25 Hz) Y : `ctl_errstat_av_v2011` (Static defect (2011 coef.))

[4]MoyEch and MoyEch_tps_impos are simple generic average-and-subsample functions. MoyEch_tps_impos takes into account the case where the orginal and destination times are not synchronous.

N	**Parameter** *(cont'd)*	**Unit**	**Description** *(continued)*	**Origin** (Instrument, or computation) *(continued)*
6	`tpr_srt`	°C	Static air temperature from non-deiced Rosemount impact temperature. Was computed at 25 Hz, and was averaged to 1 Hz by the operator MoyEch	$$T_s = \frac{T_t}{1 + r_f \times \left(\left(1 + \frac{\Delta P}{P_s}\right)^{R_a/c_{pa}} - 1 \right)}$$ where : T_t : `tpr_ttbrt_cal` (Non-deiced Rosemount impact temperature averaged at 25 Hz) ΔP : `vit_deltaP_pav` (Sum of Nose boom dynamic pressure averaged at 25 Hz and Static defect (2005 values)) P_s : `pre_s_av` (Nose boom static pressure averaged at 25 Hz minus Static defect (2005 values)) $r_f = 0.98$ $R_a/c_{pa} = 0.285725$
7	`hum_RapM_ucap1_rt_auto` or `hum_RapM_li7500_syncst` for flights 15-16.	*g/kg*	Water Vapour Mixing ratio	$$e = \frac{e_w(T_s).H_u}{100}$$ (formula used even if $T_s < 0$) $$RapM = \frac{R_a}{R_v}.\frac{e}{P_s - e}$$ where $\frac{R_a}{R_v} = 0.622$ H_u : `hum_rel_ucap1_rt_auto` (Static rel. hum. from the capacitive probe fitted to the dew-point hygrometer) T_s : `tpr_srt` (parameter 6 described on page 4) P_s : `pre_s_av` (Nose boom static pressure averaged at 25 Hz minus Static defect (2005 values) averaged at 1 Hz) For flights 15 and 16 : $$RapM = \frac{R_a \times T_s}{P_s \times 100.}.H_a$$ where $R_a = 287.05 J.kg^{-1}.K^{-1}$, and T_s is converted to K, if needed. H_a : `hum_abs_li7500_syncst` (Absolute humidity from LiCor 7500)

N	Parameter *(cont'd)*	Unit	Description *(continued)*	**Origin** (Instrument, or computation) *(continued)*

8 & 9	`ven_e_p2011_airinspp`
	&
	`ven_n_p2011_airinspp`
		m/s & *m/s*	West-East wind component &
			South-North wind component
			Both were computed at 25 Hz, and averaged to 1 Hz by the operator MoyEch
				In a first step, the wind is computed with respect to the aircraft axes. The three components are noted : U_a, V_a, and W_a.
				$U_a = V_x - V_p.D^{-1} + L_z.Vr_y - L_y.Vr_z$
				$V_a = V_y - V_p.D^{-1}.\tan\beta + L_x.Vr_z - L_z.Vr_x$
				$W_a = V_z - V_p.D^{-1}.\tan\alpha + L_y.Vr_x - L_x.Vr_y$
				where : $D = \sqrt{1 + \tan^2\alpha + \tan^2\beta}$
				Then, these values are rotated to the local earth axes :
				$U = U_a.\sin\psi.\cos\theta + V_a.(\cos\psi.\cos\phi + \sin\psi.\sin\theta.\sin\phi) + W_a.(\sin\psi.\sin\theta.\cos\phi - \cos\psi.\sin\phi)$
				$V = U_a.\cos\psi.\cos\theta - V_a.(\sin\psi.\cos\phi - \cos\psi.\sin\theta.\sin\phi) + W_a.(\cos\psi.\sin\theta.\cos\phi + \sin\psi.\sin\phi)$
				$W = U_a.\sin\theta - V_a.\cos\theta.\sin\phi - W_a.\cos\theta.\cos\phi$
				where :
				$L_x = 4.3$, $L_y = 0$, $L_z = -0.5$
				V_p : `vit_p_pav_v2011` (True air speed)
				α : `att_incid_pch` (attack angle)
				β : `att_derap_pch_v2011` (Sideslip angle (2011 estim.))
				V_x : `vit_x_calc_airinspp` (computed by Geo2mobile_3D)
				V_y : `vit_y_calc_airinspp` (computed by Geo2mobile_3D)
				V_z : `vit_z_calc_airinspp` (computed by Geo2mobile_3D)
				Vr_x : `vit_rx_datt_airinspp_rad` (computed by Vrot_repav)
				Vr_y : `vit_ry_datt_airinspp_rad` (computed by Vrot_repav)
				Vr_z : `vit_rz_datt_airinspp_rad` (computed by Vrot_repav)
				θ : `att_tang_airinspp_rad` (Post-processed AIRINS Pitch with usual orientation sampled on Time of regular samples at 25 Hz)
				ϕ : `att_roul_airinspp_rad` (Post-processed AIRINS Roll sampled on Time of regular samples at 25 Hz)
				ψ : `att_cap_airinspp_rad` (Post-processed AIRINS Heading sampled on Time of regular samples at 25 Hz)

N	**Parameter** *(cont'd)*	**Unit**	**Description** *(continued)*	**Origin** (Instrument, or computation) *(continued)*
10 & 11	`ven_DD_p2011_airinspp` `ven_FF_p2011_airinspp`	*degree* & *m/s*	Wind direction (meteorological convention) & Wind speed	$FF = \sqrt{U^2 + V^2}$ If $V = 0$ then $DD = \begin{cases} 0 & \text{if } U = 0 \\ -\pi/2 & \text{if } U < 0 \\ \pi/2 & \text{if } U > 0 \end{cases}$ else if $V > 0$ then $DD = \arctan(U/V) + \pi$ else if $V < 0$ then $DD = \arctan(U/V)$ Eventually, $DD = 180/\pi.DD$ where : U : `ven_e_p2011_airinspp` (parameter 8 described on page 5) V : `ven_n_p2011_airinspp` (parameter 9 described on page 5)