Cluster Science Archive:

Interface Control Document for STAFF

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PURPOSE

The purpose of this document is to provide a broad outline of the archiving of the data from the STAFF instrument on Cluster in the ESA Cluster Science Archive (CSA) and to define the agreement of the CSA and PI of STAFF on this broad outline.

The scientific rationale underpinning the CSA activities is as follows:

- Maximise the scientific return from the mission by making all Cluster data available to the worldwide scientific community.

- Ensure that the unique data set returned by the Cluster mission is preserved in a stable, long-term archive for scientific analysis beyond the end of the mission.

- Provide this archive as a major contribution by ESA and the Cluster science community to the International Living With a Star programme.

In the case of STAFF, the main responsibilities will be:

- Deliver to CSA high resolution STAFF data in an agreed format at the best possible quality level, as far as possible in physical units (Level 2 data). When not in physical units (possible case of the waveform data) the calibration files and the relevant software to calibrate the data will be delivered with the adequate documentation. Additional value added products will be delivered too, on the best effort basis, as well as graphical displays. All needed caveat regarding data quality and necessary documentation will be delivered.

POINTS OF CONTACT

For the operation of archiving the high-resolution data from STAFF the following contacts have been agreed:

- as scientific correspondents, C. P. Escoubet for the CSA and P. Canu and O. LeContel for STAFF-SC/ O. Alexandrova for STAFF-SA.

- as technical correspondents, C. Perry for the CSA and R. Piberne for STAFF-SC/ Q. N. Nguyen for STAFF-SA.

- as managerial correspondents, P. Escoubet for the CSA and P. Canu for STAFF.

1 INSTRUMENT DESCRIPTION

1.1 Science Objectives

The Cluster mission has been designed to study the thin layers of the interaction regions between the solar wind and the Earth's magnetosphere. The very existence of these regions, with their different plasma bulk properties, is largely due to wave-particle interactions which, in a collisionless plasma, provide the only means of modifying the bulk properties of plasma crossing the frontier. Within these regions, waves again provide the only effective coupling between particles of the same and of different species, and give rise to anomalous transport effects; the basic physics of these regions requires an understanding of the wave-particle interactions present.

Thus, it is important to characterise the waves and turbulence: this is the objective of the Cluster STAFF measurements. Four-point measurements will allow, for the first time, a clear separation of spatial and temporal effects. A major consideration for wave observations in a fast-flowing medium is the Doppler effect. Waveform data from four spacecraft in a tetrahedral configuration allow correction for this effect when the wavelength is comparable with the inter-spacecraft separation. On the other hand, when the wavelength is small compared to the inter-spacecraft separation, the determination of the wave normal on the four separate spacecraft may yield information about the source location. To understand turbulence, it is important to measure over a frequency range wide enough to determine any cut-off frequency; instrumentation has sometimes been inadequate for this purpose on earlier missions. Earlier missions have been even less adapted to investigate spatial wavenumber spectra. Furthermore, some geophysically important regions have been rather neglected: for example, the high-altitude cusp has been visited only by the HEOS spacecraft.

1.2 Hardware Overview

The STAFF experiment comprises a boom-mounted three-axis search coil magnetometer to measure magnetic fluctuations in the frequency range 0.1 Hz - 4 kHz, a preamplifier and an electronics box that houses the two complementary data-analysis packages: a digital Spectrum Analyser, and an on-board waveform unit.

STAFF is one of the five experiments of the Wave Experiment Consortium (WEC). The STAFF team includes scientific and hardware contributions from a number of institutes, as shown in Table 1.

LPP (previously CETP)	STAFF co-ordination (PI + technical manager) manufacturing and testing of: search coil, magnetic waveform unit, calibration check-out software support to integration and testing data analysis
LIRA (previously LESIA) Paris-Meudon Observatory	manufacturing and testing of the spectrum analyser check-out software support to integration and testing data analysis
LPCEE-Orléans	design, calibration and tests of the filters data analysis, development of dedicated scientific tools
SSD-ESTEC	manufacturing of the filters
Charles University, Prague, Czech Republic	Development of dedicated scientific tools (PRASSADCO), data analysis
LPG-Grenoble	theoretical support for data analysis relationship with ground-based measurements
Co-Is from other institutes: LPCEE, Orléans, France Sussex University, UK University of Iowa, USA IRF, Uppsala, Sweden Sheffield University, UK	link between STAFF and the other WEC experiments P.M.E. Décréau M.P. Gough D.A. Gurnett, J. Pickett G. Gustafsson, M. André H.St.C. Alleyne

Table 1: Share of tasks

1.2.1 The search coil sensors and the preamplifier

Three orthogonal sensors are mounted on a rigid boom away from the spacecraft body. Two sensors, By and Bz, are in the spin plane, while the third one, Bx, is parallel to the spacecraft spin axis (note that the science data products have different definition for axes). Each sensor consists of a high permeability core embedded inside two solenoids. The main winding has a very large number of turns, its resonant frequency is within the expected 3 dB bandwidth. The frequency response of the main winding is flattened by a secondary winding through a flux feedback effect, in the frequency range 40-4000 Hz. Furthermore, the secondary winding is used as a calibration loop on which an external AC signal is applied through a calibration network included in the pre-amplifiers. Example of the transfer function and the experiment sensitivity are given in Figure 1 below.

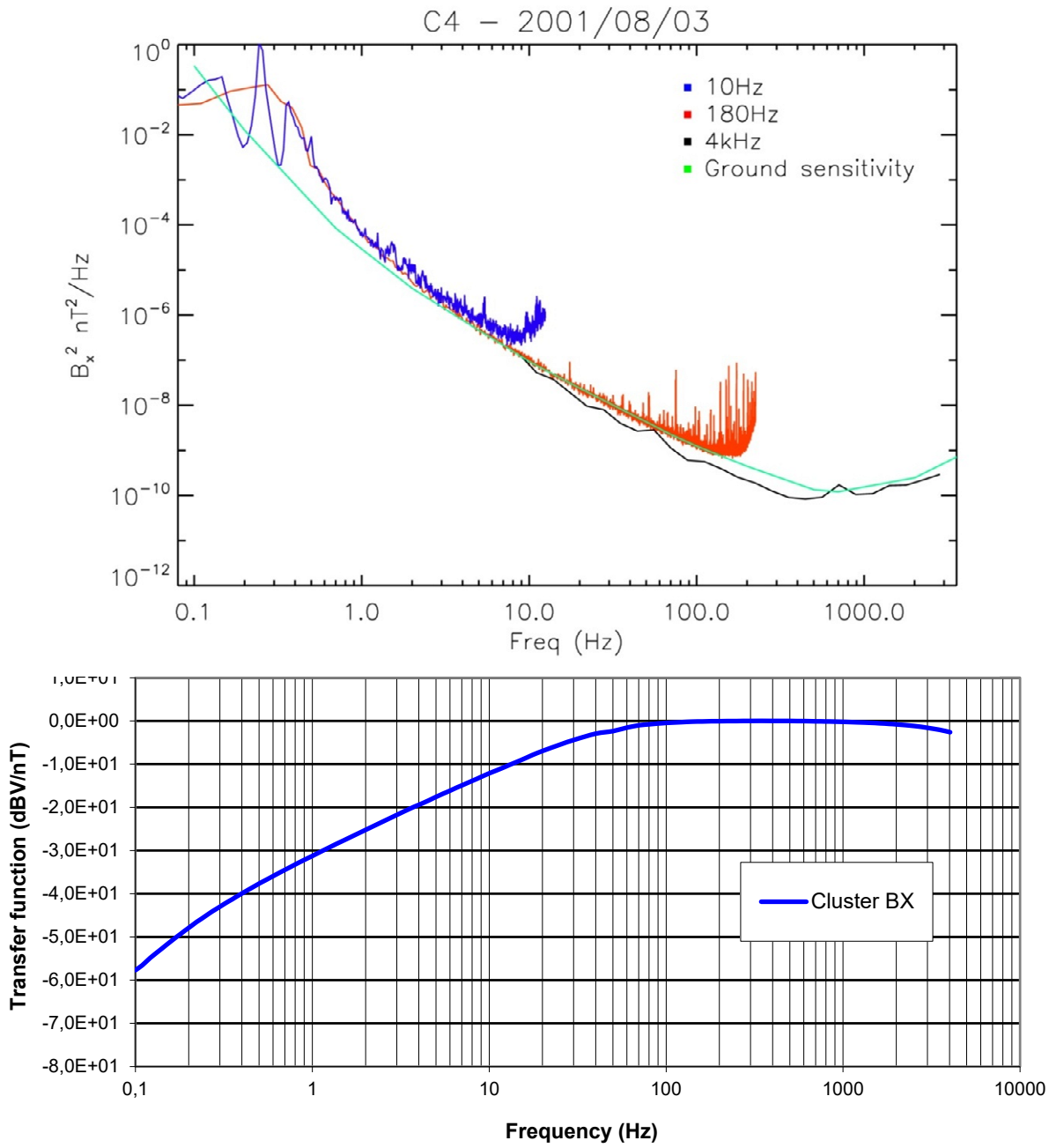


Figure 1: Top: STAFF sensitivity : comparison between ground measurements in a quiet site (green) and in flight measurements (blue/red), when no natural signal was detected Bottom: STAFF transfer function for one component.

The 3 channels pre-amplifier unit is located on the spacecraft deck. The low-power-consumption pre-amplifiers have a low-noise input stage and high input impedance since they are connected to the magnetic sensors which are characterised by a low DC resistance and a very high impedance in the vicinity of the resonant frequency. The

dynamic range of the pre-amplifiers is about 100 dB, which allows to withstand the large voltage signals induced by the rotation of the spacecraft in the DC magnetic field, as well as the weak signals to be measured. A new pre-amplifier using hybrid technology has been developed that has been flown successfully for the first time on CASSINI (first launched on Cluster I). This technique has the advantages to include protection against radiation, together with the possibility of a thermal control of the pre-amplifier (when located outside the spacecraft body, which is not the case of Cluster II). Moreover, these pre-amplifiers are lighter than the traditional ones.

The output signals of the magnetic preamplifiers are sent to:

(i) the magnetic waveform unit for analysis up to either 10 or 180 Hz,
(ii) the spectrum analyser up to 4 kHz,
(iii) the Wide Band Data unit, also up to 4 kHz,
(iv) the EFW experiment for use in one of the EFW internal burst memory modes,
(v) the Electron Drift Experiment (EDI).

1.2.2 The magnetic waveform unit

The magnetic waveform unit consists of three sections to fulfil different filtering and wave form digitalisation, data output interface and on-board calibration.

The three magnetic components Bx, By, Bz, at the output of the search coil pre-amplifier are filtered simultaneously either in 0-10 Hz or in 0-180 Hz bandwidth.

The low-pass filters are seventh order. They are specified with an accuracy of 1% in amplitude and 1° in absolute phase. The sampling frequency is 2.5 times the 3dB point frequency of the filters. So, the rejection of the aliasing components is at least 40 dB. The filters are the same as those used in the E-field experiment to optimise the E/B waveforms correlation.

The filtered signals are applied, after the selection of the bandwidth, to three sampling and hold devices synchronised by DWP, then digitized and sent to the DWP experiment. The same synchronisation signal is sent to EFW. The selection between the two bandwidths is made by the DWP DPU according to the telemetry rate. The filtered signals are simultaneously sampled in a large dynamic range within a very short sampling time of about 10 μs in order to guarantee a relative error of less than one degree at 180 Hz between the three components. The sampling signal, provided by DWP, is common between STAFF and EFW experiments to allow the best simultaneous analysis of the five available components of the electromagnetic waves.

Then the samples are digitized by a real 16-bit analogue-to-digital converter and transmitted to the DWP experiment through one parallel interface.

The 16-bits digitization advantage is a simultaneous analysis of natural waves of a few $pT.Hz^{-1/2}$and the large signal induced by the rotation of the spacecraft in the environmental DC field, up to 100 nT at 0.25 Hz. With such a dynamic range, there is no trouble shoot to expect at the inversion of the DC magnetic field at the magnetopause.

Due to the telemetry limitation, a reduction of the dynamic data range from 16 to 12 bits is performed inside DWP (see §1.3).

1.2.3 The spectrum analyser

The spectrum analyser is designed to perform the complete auto and cross correlation matrix of 5 sensor channels over a frequency range of 8-4000 Hz at a high rate.

The "front-end" of the analyser is analogue. It consists of 15 variable-gain amplifiers and 15 anti-aliasing filters. The analysis band of 8-4000 Hz is divided into three logarithmically distributed frequency sub-bands, each with a maximum frequency eight times the minimum frequency. Distinct band pass filters are applied to each 3 sub-bands and each 5 sensor channels. For each sub-band there are 3 controlled-gain amplifiers (AGC): one for Bx channel (parallel to the spin axis) and one for each couple of spinning components (By, Bz and Ey, Ez respectively). The AGC amplifiers normalise the output signals to an optimum level for digitization. For spin-plane sensors (Ey, Ez, By, Bz) the total power from the 2 sensors is used for the normalisation because the sensor outputs will have to be "de-spun" later (see below).

The dynamic range of the normalisation is 80 dB, which, combined with the 45-50 dB dynamic range of the digital processing, gives a total instrument dynamic range order of 120 dB. Separate high-pass and low-pass filters ensure that the gain normalisation is only performed for signal components with frequencies within the sub-band. It will be further analysed digitally, and more important, will prevent "aliasing", i.e. unwanted contribution from frequency components above the Nyquist frequency (sample frequency/2).

The 15 amplifier outputs are multiplexed together to a single 8-bit flash A/D converter. They are digitized in a rapid-fire mode by groups of 5 or 10, as needed at a 16 kHz rate. The 9 AGC gain-control signals are digitized separately to be included in the telemetry packets, as a multiplicative factor for the results of the subsequent digital filtering.

1.2.4 In flight calibration

One sequence of calibration can be commanded by the DWP to calibrate in flight the STAFF experiment (the magnetic wave sensors, the waveform unit and the spectrum analyser), either at normal bit rate or at high bit rate.

STAFF calibrations take place, once per orbit close to a so called BM3 period (dump of experiments internal burst memories).

The calibration sequence duration is about 6 minutes at normal bit rate and 2 minutes at high bit rate.

Two kinds of calibration signals are generated in the magnetic waveform unit: either two simultaneous sinusoidal signals at around 7 Hz and 100 Hz, or a pseudo-random noise signal covering 4 kHz bandwidth. Eight different steps in amplitude are available

to cover an 80-dB dynamic range. The calibration signal called REF is transmitted in the telemetry packets, together with the signals coming from the output of the STAFF analysers. It is used as a reference signal for the phase measurements between the different channels. It allows to identify the origin of an anomaly and thus to recalibrate the experiment. The Calibration mode is indicated by a status CAL ON (see 1.2.6).

1.2.5 Operational modes

Different operational modes are applied, mainly depending on the bit rate. A short description of these modes, for both the waveform and the spectrum analyser is given below. The STAFF modes are part of the WEC modes that are commanded and monitored by DWP.

Modes

The principle is to cover the full STAFF frequency range in all modes, but the methods are different depending on the bit rate. In Normal bit rate, the waveform data covers the 0.1 - 10 Hz frequency range, whereas the Spectrum Analyser covers the frequency range 8 Hz - 4 kHz, working in its 3 frequency bands. In High bit rate, the waveform data covers the 0.1 - 180 Hz frequency range, then in order to spare telemetry, the Spectrum Analyser only operates in its two upper frequency bands, from 64 Hz to 4 kHz.

For the waveform data, two combinations of commands can be sent, one is the sampling frequency rate which is a STAFF command, the other is whether a data compression is applied or not. This is an application software in the DWP experiment. The sampling frequency is either 25 Hz, with the 10 Hz low pass filter, in normal bit rate, or, 450 Hz, with the 180 Hz filter in high bit rate. One constraint is that STAFF and EFW must use the same sampling frequency as they are synchronised by DWP. The sampling rate is a sub multiple of the DWP clock the frequency of which is ~900 Hz, but slightly different. Its value is constant with time, but S/C dependant.

Cluster WEC (DWP) exact sampling frequency (Hz) derived from the DWP clock:

NBR:

(SC1)	25.0005833
(SC2)	25.0003611
(SC3)	25.0001667
(SC4)	25.0001667

HBR:

(SC1)	450.0105
(SC2)	450.0065
(SC3)	450.0030
(SC4)	450.0030

The STAFF waveform words are 16 bits (including status). Normally, due to telemetry limitations, DWP applies a compression algorithm to get 12 bits words (giving 912 bits

per second). In emergency mode the 16 bit words are telemetered (see tables above). The principle is the same in high bit rate; with compression the needed telemetry is then 16320 bps.

Mode	Bit rate	Low pass filter	Compression	b/s
NM	Normal	10 Hz	Yes (12 bits)	928
BM	High Bit Rate	180 Hz	Yes (12 bits)	16480
EM NBR	Normal	10 Hz	No (16 bits)	1216
EMHBR	High Bit Rate	180 Hz	No (16 bits)	21760

Table 2 - STAFF Wave Form data Modes

For the Spectrum Analyser, the different modes are the combination of three parameters: the time resolution, the number of frequencies computed, and the number of wave components considered. Then each mode is a combination of these different parameters. The modes are defined to fulfil different scientific objectives, in the framework of two constraints, first the telemetry limitation, second the total WEC power limitation.

The "Normal Mode 1" is the basic mode in normal bit rate. The auto-spectra are averaged over 1s and the complete matrix over 4s for five components (25 coefficients). The other modes are variations of this.

In Normal Mode 1', the calculation is performed for only three components, either 3 x B (NM1'b) or Bx and 2x E (NM1'e). Only nine elements of the spectral matrix are computed (instead of 25). The mode NM1'b is used in time-sharing with NM1, during active Whisper modes. It allows saving telemetry.

In the Normal Modes 2, three of the five wave components are selected. The time resolution is 0.5 or 1s for the auto spectra and 1s for the cross spectra. Modes NM2b and NM2e are used in time-sharing.

In the Special Mode the time resolution is improved.

In the Emergency Mode, the five components are taken into account, with a lower time resolution, 2 and 4 seconds for the auto- and cross- spectra respectively. This reduction in time resolution, and thus in telemetry is intended to compensate for the increase due to the non compression of the wave form data.

In high bit rate, only the two highest frequency bands are analysed. In the Fast Modes the time resolution is 1s for the cross spectra and either 0.125 s or 0.25s for the auto-spectra. Here again five or three components can be considered. The different constraints, telemetry, Whisper active and low power are considered in the choice of the modes.

The STAFF SA modes are given in the tables below:

NORMAL MODE 1: NM1 (3 x B + 2 x E),secondary power = 1.75 W

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
A: 8-64 Hz	1.s	360	4.s	180	1.s	24
B: 64-512 Hz	1.s	360	4.s	180	1.s	24
C: 512-4096 Hz	1.s	360	4.s	180	1.s	24

Table 3.1 ***Total: 1696 bps (including status)***

NORMAL MODES 1': NM1'b (3 x B) or NM1'e (2 x E + Bx)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
A: 8-64 Hz	1.s	216	4.s	54	1.s	16
B: 64-512 Hz	1.s	216	4.s	54	1.s	16
C: 512-4096 Hz	1.s	216	4.s	54	1.s	16

Table 3.2 ***Total: 864 bps (including status)***

NORMAL MODES 2: NM2 b (3 x B) or NM2 e (2 x E + Bx)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
A: 8-64 Hz	1.s	216	1.s	216	1.s	16
B: 64-512 Hz	0.5s	432	1.s	216	0.5s	32
C: 512-4096 Hz	0.5s	432	1.s	216	0.5s	32

Table 3.3 ***In NM1 the Total data rate is always 1840 bps (including status)***

SPECIAL MODE: SM (3 x B + 2 x E)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
A: 8-64 Hz	1.s	360	2.s	360	1.s	24
B: 64-512 Hz	0.5s	720	2.s	360	0.5s	48
C: 512-4096 Hz	0.5s	720	2.s	360	0.5s	48

Table 3.4 ***Total: 3032 bps (including status)***

EMERGENCY MODE: EM (3 x B + 2 x E)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
A: 8-64 Hz	2.s	180	4.s	180	2.s	12
B: 64-512 Hz	2.s	180	4.s	180	2.s	12
C: 512-4096 Hz	2.s	180	4.s	180	2.s	12

Table 3.5 ***Total: 1120 bps (including status)***

FAST MODE 1: FM1 (3 x B + 2 x E)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
B: 64-512 Hz	0.125s	2880	1.s	720	0.125s	192
C: 512-4096 Hz	0.125s	2880	1.s	720	0.125s	192

Table 3.6 ***Total: 7600 bps (including status)***

FAST MODE 2: FM2 (3 x B + 2 x E)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
B: 64-512 Hz	0.25s	1440	1.s	720	0.25s	96
C: 512-4096 Hz	0.25s	1440	1.s	720	0.25s	96

Table 3.7 ***Total: 4528 bps (including status)***

FAST MODES 3: FM3 b (3 x B) or FM3 e (2 x E + Bx)

Band	AUTO resolution	b/s	CROSS resolution	b/s	AGC resolution	b/s
B: 64-512 Hz	0.125s	1728	1.s	216	0.125s	128
C: 512-4096 Hz	0.125s	1728	1.s	216	0.125s	128

Table 3.8 ***Total: 4160 bps (including status)*** *- STAFF Spectrum Analyser Normal Bit Rate Operation*

In flight, the most often used modes are:

- in Normal Bit Rate, NM1 alternatively with NM'1b when Whisper is active.
- in Burst mode: FM1 or FM2, depending on the priority given to STAFF within WEC (one BM over 3 in average), again alternated with FM3b when Whisper is active.

The calibration mode calibrates both parts of the experiment. The different SA modes are tested during this sequence. The calibration mode operation is operated by remote control once per orbit and preferentially at the beginning of a data acquisition sequence, in connection with the S/C Burst Mode 3.

WHISPER MODE	STAFF-SA components	STAFF SA Mode Names
active	3 x B	NM1; FM1; FM3
passive	3 x B + 2 x E	NM1'b; FM3b

Table 4: Main STAFF SA modes as a function of Whisper experiment mode, active or passive.

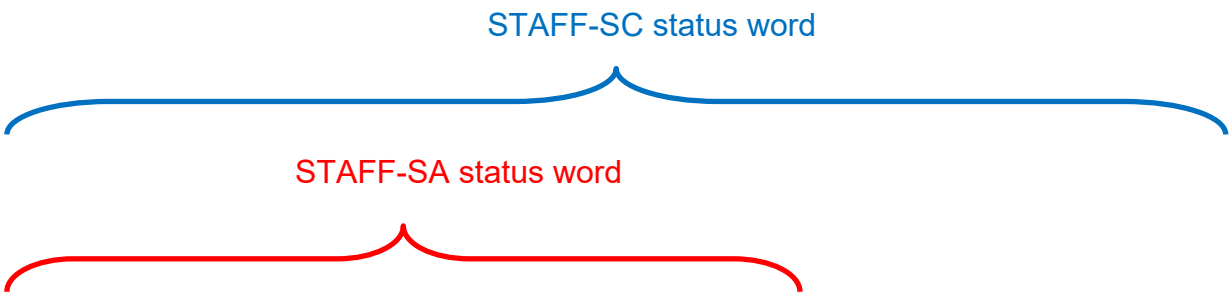
1.2.6 Status word

The Status word provides information about the onboard operations and some key parameters needed in the STAFF ground data processing. There is in fact two status word in STAFF data:

- STAFF-SA status word: 1 to 9 characters described below.
- STAFF-SC status word: 1 to 14 characters described below.

STAFF-SC status word is present in DWF and CWF data files. It is not in CS files because it can change during the spectrum integration duration.STAFF-SA status word is present in AGC, SM, PSD and PPP data.

The status word is composed as follows:



Step in cal	EFW Y	EFW Z	Mode SA	Mode SC	Despin SA	WHISPER	Calibration	EFW sweep	Compression	Phase	Tcor	Time Quality	Compression Quality

The value of each character is explained in the following table:

<table>
<tr><th>Description</th><th colspan="2">Values</th></tr>
<tr><th></th><th>Min-max</th><th>Meanings</th></tr>
<tr><td>Step in cal</td><td>0-o</td><td>0: science mode
<table>
<tr><th>Step</th><th>Mode</th><th>Attenuation (dB)</th></tr>
<tr><td>1</td><td>CAL4</td><td>0</td></tr>
<tr><td>2</td><td>CAL4</td><td>0</td></tr>
<tr><td>3</td><td>CAL4</td><td>0</td></tr>
<tr><td>4</td><td>CAL4</td><td>0</td></tr>
<tr><td>5</td><td>CAL4</td><td>-13</td></tr>
<tr><td>6</td><td>CAL4</td><td>-26</td></tr>
<tr><td>7</td><td>CAL4</td><td>-39</td></tr>
<tr><td>8</td><td>CAL4</td><td>-52</td></tr>
<tr><td>9</td><td>CAL4</td><td>-65</td></tr>
<tr><td>a</td><td>CAL4</td><td>-78</td></tr>
<tr><td>b</td><td>CAL4</td><td>Gnd</td></tr>
<tr><td>c</td><td>CAL3</td><td>0</td></tr>
<tr><td>d</td><td>CAL3</td><td>-26</td></tr>
<tr><td>e</td><td>CAL1</td><td>0</td></tr>
<tr><td>f</td><td>CAL2</td><td>0</td></tr>
<tr><td>g</td><td>CAL1</td><td>-26</td></tr>
<tr><td>h</td><td>CAL2</td><td>-26</td></tr>
<tr><td>i</td><td>CAL1</td><td>-52</td></tr>
<tr><td>j</td><td>CAL2</td><td>-52</td></tr>
<tr><td>k</td><td>CAL2</td><td>Gnd</td></tr>
<tr><td>l</td><td>CAL OFF redundant</td><td></td></tr>
<tr><td>m</td><td>CAL2</td><td>-26</td></tr>
<tr><td>n</td><td>CAL Off/On satellite</td><td></td></tr>
</table>
o: after calibration, till reset or new calibration</td></tr>
<tr><td>EFW Y boom pair</td><td>0-1</td><td>0: density mode off
1: density mode on</td></tr>
<tr><td>EFW Z boom pair</td><td>0-1</td><td>0: density mode off
1: density mode on</td></tr>
</table>

<table>
<tr><td>STAFF-SA mode description</td><td>0-f</td><td><table><tr><th>Value</th><th>Mode</th></tr><tr><td>0</td><td>NM1</td></tr><tr><td>1</td><td>NM2e</td></tr><tr><td>2</td><td>NM2b</td></tr><tr><td>3</td><td>Illegal</td></tr><tr><td>4</td><td>Emergency</td></tr><tr><td>5</td><td>Special</td></tr><tr><td>6</td><td>NM1’e</td></tr><tr><td>7</td><td>NM1’b</td></tr><tr><td>8</td><td>FM1</td></tr><tr><td>9</td><td>FM3e</td></tr><tr><td>a</td><td>FM3b</td></tr><tr><td>b</td><td>Illegal</td></tr><tr><td>c</td><td>FM2</td></tr><tr><td>d</td><td>Illegal</td></tr><tr><td>e</td><td>Illegal</td></tr><tr><td>f</td><td>Passive</td></tr></table></td></tr>
<tr><td>STAFF-SC mode</td><td>0-1</td><td>0 : SC bandwidth 10 Hz
1 : SC bandwidth 180 Hz</td></tr>
<tr><td>On-board despin (STAFF-SA)</td><td>0-1</td><td>0 : despin off
1 : despin on</td></tr>
<tr><td>WHISPER transmitter</td><td>0-1</td><td>0: off
1: active</td></tr>
<tr><td>Calibration</td><td>0-1</td><td>0: off
1: active</td></tr>
<tr><td>EFW sweep progress</td><td>0-2</td><td>0: no scanning
1: scanning
2: non synchronised block</td></tr>
<tr><td>Compression</td><td>0-2</td><td>0: nominal
1: backup
2: no compression</td></tr>
<tr><td>Phase</td><td>0-Z</td><td>0: True sun pulse used in phase calculation.
1: Interpolated sun pulse used in phase calculation.
2: Suspect sun pulse used in phase calculation.
N: Phase = -500. due to invalid sun pulse status or unable to find satisfactory sun pulse.
R: Recovered phase value (Phase with ‘N’ status in DWF but recovered by interpolation by the calibration software. Used in CWF and CS but only seen in CWF).
Z: Phase = -500. (Can’t open the interpolated sun pulses’ file).

In all cases, if the reference phase is not found in SATT, a default mean value is used.</td></tr>
<tr><td>Tcor</td><td>0-1</td><td>0:no (no Tcor correction)
1:yes (Tcor correction)</td></tr>
<tr><td>Time Quality</td><td>0-1</td><td>0:interpolated time
1:block time</td></tr>
</table>

Compression Error		0 = no compression error 1 – 7 = error on 1 to 3 components in instrument frame: 1 error on Bx 2 error on By 3 error on Bx and By 4 error on Bz 5 error on Bx and Bz 6 error on By and Bz 7 error on Bx, By and Bz

Table 5: Status word description

E.g. A status values of 000f0100020100, means: science mode, density mode off for EFW Y and Z, SA mode = Passive, SC bandwidth = 10 Hz, SA despin off, Whisper transmitter off, Cal off, EFW not scanning, Sc compression = no compression, Phase calculation done with a True Sun Pulse, TCOR is applied, the time is interpolated and no compression error.

1.2.7 Data compression

Data are sampled into 16bits for the first record of each block, but for other records only the difference is kept, coded in 12bits. If the difference between two records is too big, we may encounter compression errors. Fortunately we know on which bit the error occurs, which allows us to maximise it.

Three compression modes are available (see Status word character #10), and may lead to one or another bit to be wrong. The maximum error is then known, see the following table (where Delta is the difference between the current record and the previous one):

	Delta (16 bits)	**Maximum Compression Error (TM counts)**	**Maximum Error (mV)**
No Compression	0-65535	0	0
Normal Compression	0-2015	0	0
	2016-65535	1024	150
Backup compression	0-511	0	0
	512-1535	1	0.15
	1536-3587	2	0.3
	3588-7447	4	0.6
	7448-65535	1024	150

Table 6 : Data compression

The normal and backup compression are used respectively when we expect to measure “low” and “high” amplitude signals including large spin signals.

1.3 Data Processing Chain

1.3.1 On board data processing

1.3.1.1 STAFF wave form data processing (STAFF-SC)

DWP has an internal clock running at a fixed 900 Hz frequency. Pulses of this clock are counted by software which derives either a 25 Hz or a 450 Hz signal known as the WEC Sample Sync (WECSS). This controls STAFF Magnetic Waveform Analyser (SC) and EFW electric field sampling and ensures that sample taking is synchronised to this clock in order to facilitate further STAFF/EFW comparison.

DWP also performs the waveform compression for STAFF-SC from 16 bits to 12 bits words, in order to reduce the telemetry rate. The principle is to transmit at the beginning of each telemetry packet (1 packet = 1 second or 25 samples in NBR, 0.1 s or 45 samples in HBR) the full 16 bits word, and then the difference between the successive samples, coded on 12 bits in such a way that the dynamic of the experiment should be preserved even at boundary crossings. There are three possible modes selected by remote control: no compression, normal compression and backup compression. (see § 5.1.7 for modes and possible compression errors)

1.3.1.2 STAFF Spectrum Analyser data processing (STAFF-SA)

The digital processing of the sampled inputs is performed in three distinct steps:

1/ de-spin of the spin-plane sensor outputs,
2/ determination of the complex Fourier coefficients,
3/ calculation of the correlation matrices (see Fig. 6 in [1]).

Despin system:

The de-spinning operation involves processing of the two signals received by a pair of spinning dipole or search coils to make them appear as signals received by non-rotating sensors. This transformation is necessary because the spacecraft spin period is generally not long compared to the measurement times.

Each time samples are taken of the spinning sensor outputs; they will undergo the following calculations:

$$Va = Vy*Cos(m) + Vz*Sin(m)$$
$$Vb = Vz*Cos(m) - Vy*Sin(m)$$

where Vy and Vz are the spinning outputs, m the instantaneous angular position of the Vy sensor, and Va and Vb the expected outputs for non-spinning antennas at m=0°

and m=90°. It is foreseen that the reference for m will be the sun pulse and that m will be derived from the spin rate signals, both spacecraft-supplied on board.

Fourier Coefficients:

The Fourier coefficients are determined using appropriate algorithms which are extensions of the Remez exchange algorithm. Each of the three-octave bands is divided into 9 logarithmically-spaced channels. The relative (3 dB) bandwidth is 26 % of its central frequency.

The required analysis times are variable, depending on the frequency sub-bands, ranging from 0.016 to 1.0 s.

Correlation matrices:

The auto- and cross-spectra are calculated by complex multiplication of the complex Fourier coefficients and accumulation of the products. The analyser stores all of the results during one measurement cycle of 4 s (in normal operating mode). 540 auto-spectral coefficients are stored. This corresponds to 5 real sensor amplitudes per frequency, 27 frequencies, and 4 sub-cycles of 1s each. The number of stored cross-spectral coefficients is 540, i.e., 20 off-diagonal matrix elements and 27 frequencies. Only one set of cross-correlation components are transmitted each 4 s in the normal mode.

All of these numbers are stored in the analyser as 40-bit numbers, representing power. Out of these 40 bits, 24 are significant in the final results of the auto-spectrum calculations. They represent a dynamic range of $10*\log_{10}(2^{24})=72$dB. To optimise use of allocated telemetry and to simplify interfaces with the DWP, the 24-bit amplitudes N are logarithmically compressed in the wave analyser before the transfer to the DWP. The result of this compression for an amplitude Nin is

$$Nin = 2^{(E-3)}(8+M)$$

where 5 bits are used to represent the exponent E and 3 bits for the mantissa M. The total possible dynamic range for this data presentation is 96 dB, while the average relative amplitude resolution is 0.38 dB.

The cross-spectral coefficients are sent to the DWP with the same compression technique. But only 4 bits will be put into the telemetry bit stream.

1.3.2 Ground processing

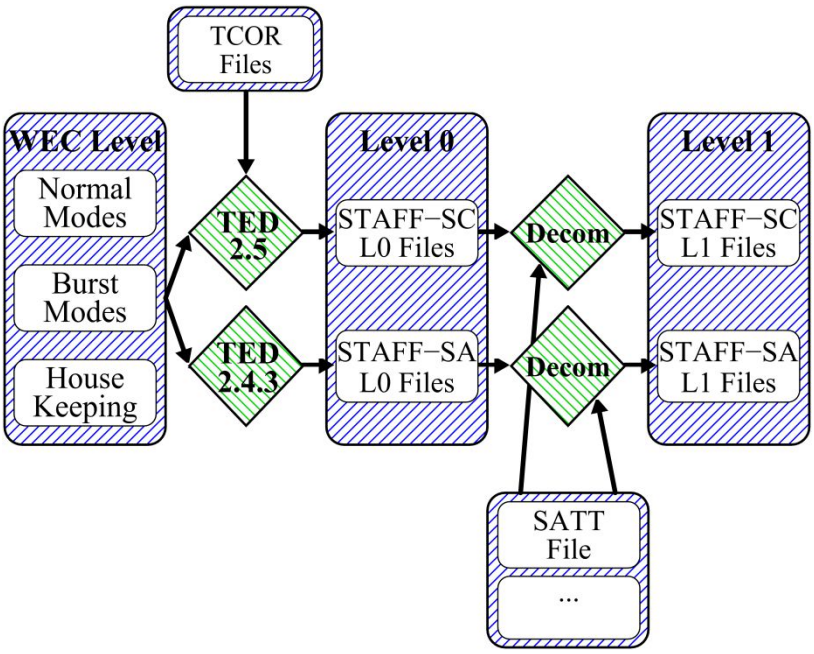
TED software produced by DWP team is applied to WEC raw data provided by ESOC in order to get level 0 files. At this level, STAFF science data are extracted in two separated datasets (STAFF-SC and STAFF-SA) and time tagged thanks to the WEC House Keeping data and TED.

The TED version 2.5 is run to extract STAFF SC data files, in order to get the best time accuracy by activating the option that uses TCOR files in order to reach a time accuracy of the order of some microseconds, which is important mainly for wave data in high bit rate for inter spacecraft comparisons.

The comments which follow only concern a future utilisation of STAFF waveform data: In the case of simultaneous utilisation of EFW waveform, the user should verify that the same option has been chosen for those concerned data set production by EFW team. As there are some gaps in TCOR files, all data are not time-corrected. The twelfth character of the STAFF status word indicates if TCOR files are applied or not.

For STAFF SA one uses TED version 2.4.3 (an accuracy of some µs is not needed as the best time resolution of STAFF SA in HBR is 125 ms).

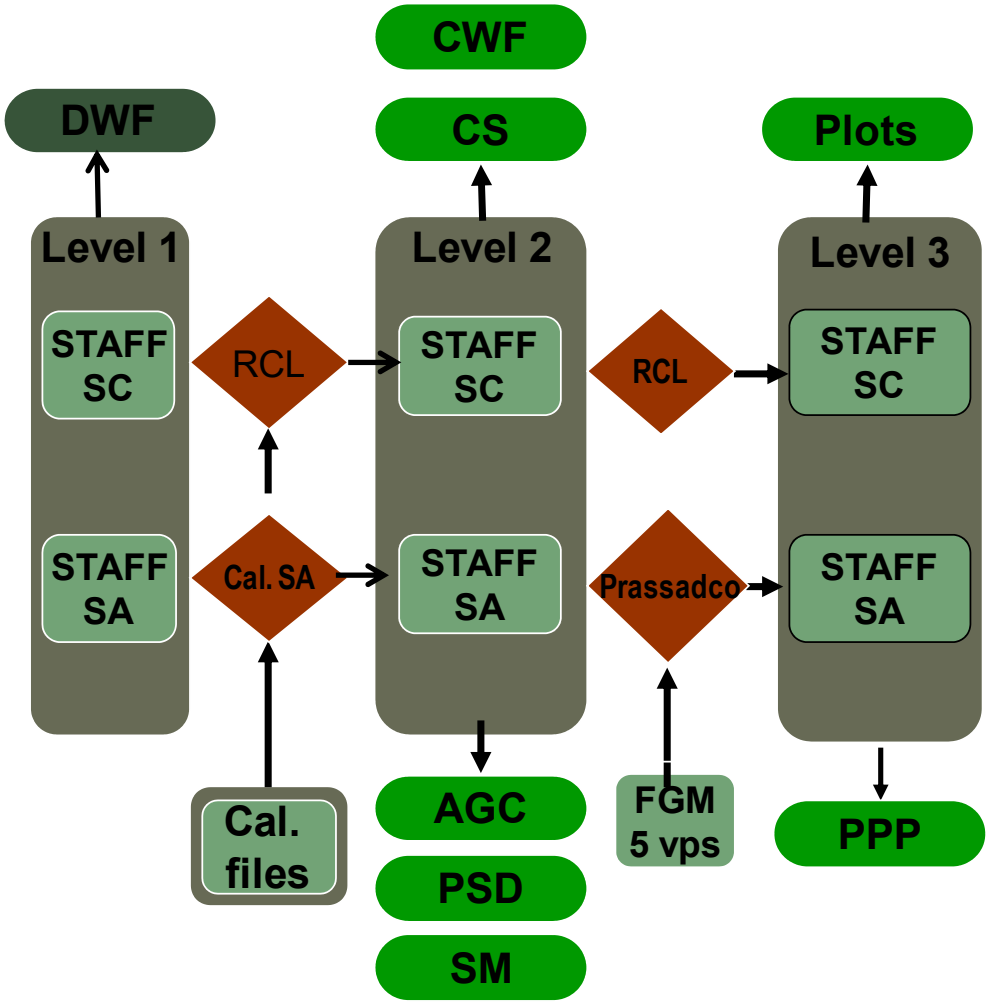
The decommutation, to go from level 0 to level 1, is done by software written in LPP, previously CETP. Data are transcribed to files of 16 bits words with regard to the compression. See documents [2] and [3] for details.



For STAFF-SC data, the spin phase is computed from the Sun Reference Pulse (see Annex 1 document [4]) and added in the Level 1 file.

The spin phase is the rotation angle of the half-plane defined by the $+Z_{SR}$ and $+X_{SR}$ Spin Reference System axes around the maximum principal axis of inertia ($+Z_{SR}$) from the time when the Sun direction was contained in this plane.

1.3.3 Science processing



The data processing routines and the related science data products (those delivered to the CSA are indicated in red).

1.3.3.1 STAFF-SC

STAFF-SC data are calibrated with the FORTRAN code developed by Patrick Robert. These routines are part of the Roproc Command Language (RCL) that calibrates, computes and plots different types of products. The output data are first formatted into

a proprietary format called Roproc File Format (RFF) and graphical products are formatted into Postscript, that can be further transformed into png format.

RCL takes L1 files and converts them into RFF files. These files are self-documented files which include metadata. These files are converts in CEF to be delivered as DWF at CSA (they only differ by the header). From this step, it is possible with RCL to perform calibration, filtering, coordinate system transformations, time checking and other processing operations whose results (L2 files) can be translated into CEF.

Value added products are computed from L2 files: spectrograms and polarisation files (L3 files) which are displayed in Postscript and PNG files and accessible via a web interface (http://cluster.lpp.polytechnique.fr/accueil/framepa.html).

1.3.3.2 STAFF-SA

The calibration procedure for the STAFF-SA is fully described in [5]. This procedure is performed by the C-code n1toN2sa, version 2002-01-25, developed by Y. de Conchy and L. Sitruk at LESIA. The calibrated STAFF-SA data are then processed by the IDL code PRASSADCO (PRopagation Analysis of STAFF-SA Data with COherency tests) developed by O.Santolik (see [6]), in order to get the polarisation parameters.

2 DATA PROVISION – GENERAL CONVENTIONS

2.1 Formats

There are two types of products:

- ASCII data files are delivered in CEF-2.0 format as described in the CEF document [8].
- Binary graphical products are delivered as PNG files.
- IFC reports files are delivered as text file

2.2 Standards

2.2.1 Time standards

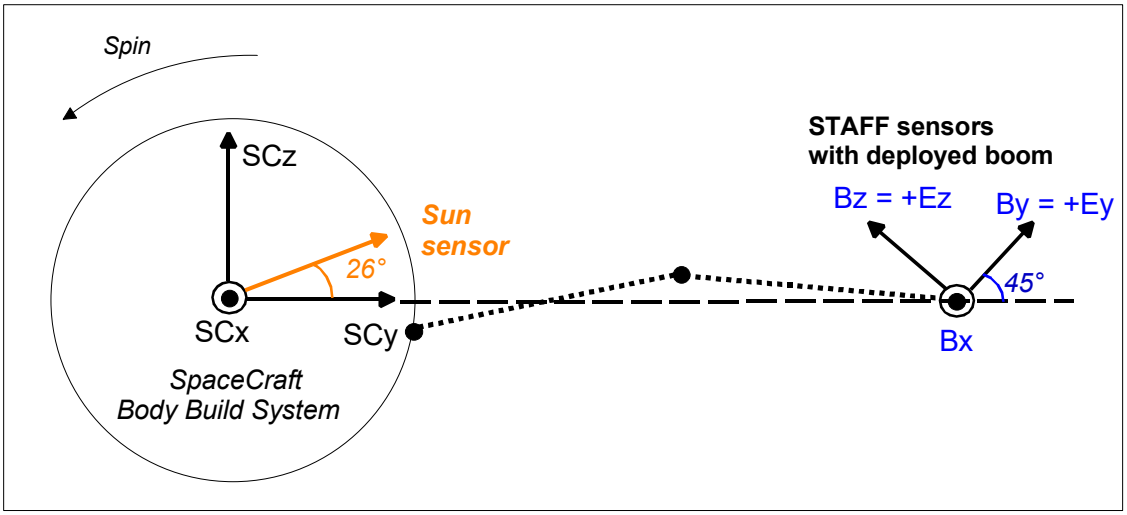
Both STAFF-SC and STAFF-SA products are time series data, every event is tagged by a time given in ISO format i.e. CCSDS ASCII time standard tag (yyyy-mm-ddThh:mm:ss.mmmZ).

2.2.2 Coordinate systems

Level 1 STAFF-SC products are delivered in the STAFF Data Sensor system (DSS)
Level 2 STAFF-SC products are delivered in GSE and ISR2 coordinate system.

Level 2 STAFF-SA products are delivered in SR2 system.
Level 3 STAFF-SA PPP products are delivered in the MFA reference frame.

STAFF antenna reference frame are represented on figure below.



2.2.3 Units

Level 1 STAFF-SC DWF waveform is given in telemetry counts.

STAFF-SC CWF (calibrated waveform) are given in nT.

STAFF-SC CS (calibrated complex spectra) are given in nT.

STAFF-SA PSD (Power Spectral Density) parameters are given in nT^2Hz^{-1} for the magnetic components (B_x^2,B_y^2 and B_z^2) and in $mV^2m^{-2}Hz^{-1}$ for the electric components (E_x^2 and E_y^2).

STAFF-SA SM (Spectral Matrix) parameters are given in $mV^2m^{-2}Hz^{-1}$ units.
Users have to use the SI conversion factor to get B components in nT^2

STAFF-SA AGC (Automatic Gain Control) parameters are given in nT^2Hz^{-1} for the magnetic AGC (B_z, B_{xy}) and in $mV^2m^{-2}Hz^{-1}$ the Electric AGC (E_{xy}).

In addition, the factor of conversion for all components in SI units is given.
7 parameters are given for STAFF-SA PPP (Polarization and Propagation Parameters). Polar and azimuthal angles of the direction of propagation are given in degrees. Ellipticity of the polarization and the degree of polarization in the polarization plane are unitless. The sum of the three magnetic auto-power spectra is given in $nT^2.Hz^{-1}$. The parallel component of the Poynting vector normalized by its standard deviation is unitless. Finally, the sum of the two electric auto-power spectra is given in $mV^2m^{-2}Hz^{-1}$.

2.3 Production Procedures

2.3.1 STAFF-SC

The STAFF-SC products (waveform, calibrated complex spectra and plots) are created from the L1 database (see 3.3) which is updated every time WEC data are provided by ESA. A filter is applied that converts level 1 and level 2 products to CEF.

2.3.2 STAFF-SA

SM and PSD data are extracted from the L2 database which is updated every time WEC data are provided by ESA. These data are calibrated into physical units once by our calibration software and stored in an IDL database by PRASSADCO.

IDL stored data are then formatted into CEF.

PRASSADCO transfers the SM data into MFA coordinate system with help of attitude and FGM 5VPS data extracted from CSA database. Then PRASSADCO calculates

the polarization and propagation parameters and stores them in an IDL database. IDL stored data are then formatted into CEF.

2.4 Quality Control Procedures

Every CEF file produced is checked by the CSA tool CEF MDD (Cluster Exchange Format Meta Data Dictionary, CEFpass before 2020) to satisfy the CEF requirements. The filters to generate products in CEF include the check by CEFMDD.

The procedure to generate CEF produces a matrix that indicates, for a month of processed data, the number of files generated. It is compared with the input data files. In case of problem, a visual investigation is performed.

The procedure permits also to create empty files.

Before any version update, the amount of data produced by the new version is compared to the latest version. It should correspond at last to the same set of data.

2.4.1 STAFF-SC and Staff-SA

With regard to the quality of data calibration, the Staff-SC and Staff-SA data have been carefully analysed and the results discussed during the 24 CrossCalibration Workshops held between 2006 and 2019. The most significant results are included in Staff User's Guide [7] and Staff Calibration Report [8].

2.5 Delivery Procedures

For both STAFF-SC and STAFF-SA products, a dedicated Linux PC has been installed (the last one is *Staff.lpp.polytechnique.fr*). This machine had run routinely the described processing chain and opened a secured connection to ESTEC each time a set of products is ready. Data are transferred to ESTEC via secured FTP (SFTP) to the dedicated machine (*caa.estec.esa.int*).

3 DATA PROVISION – SPECIFIC DESCRIPTIONS

3.1 Level 1 Data – SC - Decommutated Wave Form (DWF)

3.1.1 Format: CEF

3.1.2 Standard: cf 2.2.

3.1.3 Production Procedure: cf 2.3.1.

3.1.4 Quality Control Procedure: cf 2.4.1

3.1.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.1.6 Product Specification

One CEF file per day, per satellite and per mode (NBR or HBR) is produced. This CEF file contains the Decommutated Wave Form of the Magnetic Field (level 1) and other variables or constant data (constant for one given file) described below. Data are given in the instrument coordinate system '*SSW6RF',* standing for *"STAFF Sensor WEC6 Reference Frame"*.

3.1.7 Dataset metadata description

3.1.7.1 NBR mode

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_DWF_NBR.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_DWF_NBR are:

- DATASET_ID= C1_CP_STA_DWF_NBR
- DATA_TYPE= "CP"
- DATASET_TITLE = "Magnetic Field Waveform – uncalibrated (25 Hz sampling)"
- CONTACT_COORDINATES =
  "Patrick CANU>PI>Patrick.Canu@lpp.polytechnique.fr"
  "Nicole CORNILLEAU-WEHRLIN>Deputy-PI>
  nicole.cornilleau@lpp.polytechnique.fr"

- "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"DATASET_DESCRIPTION = "This dataset contains 3.99990667E-02s resolution measurements of the magnetic field Decommutated WaveForm (DWF) from the STAFF-SC instrument in NBR mode on the Cluster C1 spacecraft. This product is given in the STAFF Sensor WEC6 Reference Frame (SSW6RF).”
- PROCESSING_LEVEL = "Uncalibrated"
- TIME_RESOLUTION = "3.99990667E-02"
- MIN_TIME_RESOLUTION, same as TIME RESOLUTION.
- MAX_TIME_RESOLUTION, same as TIME RESOLUTION.

Note: The time resolution values given in the headers are more precise and satellite dependent.

- DATASET_ CAVEATS = "*C1_CQ_STA_DWF_NBR_CAVEATS. DATASET VERSION HISTORY. All versions: Use the TED software, provided by the Sheffield DWP group, with TCOR option used for a maximum UT time precision every second. S/C HK used to calculate the phase are not corrected by TCOR. The maximum error induced is 0.2 degree, including time around the leap second. Version 03 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). For each data point time inside a on-second data block, each sample has been interpolated to insure a continuous sampling rate. The phase has been re-calculated for each point inside each one-second block. Version 04 : Addition of data necessary for CWF data. Correction of the time interpolation and of the backward time problem. The Maximum Compression Error information has been removed from the variables (MaxCompError_xyz_Instrument__C[n]_CP_STA_DWF_NBR) and added to the status (cf. User Guide). Version 05 : Some support data fields were moved to the FILE_CAVEATS section."

Then, the metadata for the **Support variables** are

&Time which is the time index. Its properties are:

- CATDESC = "Interval centred time tag"
- DELTA_MINUS = "1.9999533E-02"
- DELTA_PLUS = "1.9999533E-02"
- FIELDNAM = "UT Time"
- FILLVAL = 9999-12-31T23:59:59.999999Z
- LABLAXIS = "UT"
- PARAMETER_TYPE = "Support Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 27
- SIZES = "1"
- UNITS = "s"
- VALUE_TYPE = ISO_TIME

Originally, the Waveform data are separated in blocks or windows. Each block composed of several measurements (25 in Normal Bit Rate) covers 1s of

measurement. The block is time tagged by TED and then split into individual measurements.

&Status which is a word of ASCII characters, each depending on one different factor

- CATDESC = "STAFF-SC Status"
- DEPEND_0 = Time__C1_CP_STA_DWF_NBR
- FIELDNAM = "STAFF-SC Status"
- FILLVAL = ZZZZZZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS ="We cannot certify the 9th character (EFW)"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 14
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Phase_Angle_SC__C1_STA_DWF_NBR:

- CATDESC = "Phase Angle"
- COORDINATE_SYSTEM = "SC"
- DEPEND_0 = Time__C1_CP_STA_DWF_NBR
- FIELDNAM = "Phase Angle"
- FILLVAL = -500.00
- LABEL_1 = "Phase Angle"
- LABLAXIS = "Phase Angle"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS = "Phase derived from Sun Pulse measurement: can be interpolated, see STATUS"
- QUALITY = 3
- SI_CONVERSION = "1.0>degree"
- SIGNIFICANT_DIGITS = 6
- SIZES = 1
- UNITS = "degree"
- VALUE_TYPE = FLOAT
-

&Misalignment_Matrix__C1_CP_STA_DWF_NBR

- CATDESC = "C1 transformation from STAFF real instrument frame to the theoric orthogonal frame linked to the instrument."
- COORDINATE_SYSTEM = "Instrument"
- DATA = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
- ENTITY = "Transformation"
- FIELDNAM = "Misalignment_Matrix"

- FILLVAL = 1.E30
- FRAME = "Instrument"
- LABEL_1 = "L*_C1","L*_C2","L*_C3"
- PARAMETER_TYPE = "Support_Data"
- PROPERTY = "Coordinate_rotation"
- QUALITY = 0
- REPRESENTATION_1 = "x","y","z"
- REPRESENTATION_2 = "x","y","z"
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3, 3
- TENSOR_ORDER = 2
- UNITS = "unitless"
- VALUE_TYPE = FLOAT

&Minimum_volt_range__C1_CP_STA_DWF_NBR

- CATDESC = "Minimum Volt range"
- DATA = -5.00
- FIELDNAM = "Minimum_volt_range"
- FILLVAL = -9.99
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1>V"
- SIGNIFICANT_DIGITS = 3
- UNITS = "V"
- VALUE_TYPE = FLOAT

&Maximum_volt_range__C1_CP_STA_DWF_NBR

- CATDESC = "Maximum Volt range"
- DATA = 5.00
- FIELDNAM = "Maximum_volt_range"
- FILLVAL = -9.99
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1>V"
- SIGNIFICANT_DIGITS = 3
- UNITS = "V"
- VALUE_TYPE = FLOAT

&TM_range_min__C1_CP_STA_DWF_NBR

- CATDESC = "Minimum telemetry range in TM counts"
- DATA = 0
- FIELDNAM = "TM_range_min"
- FILLVAL = -1
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 1

- UNITS = "TM counts"
- VALUE_TYPE = INT

&TM_range_max__C1_CP_STA_DWF_NBR

- CATDESC = "Maximum telemetry range in TM counts"
- DATA = 65535
- FIELDNAM = "TM_range_max"
- FILLVAL = -99999
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 5
- UNITS = "TM counts"
- VALUE_TYPE = INT

Data themselves:

&The Magnetic Field Decommutated WaveForm:
B_vec_xyz_Instrument__C1_CP_STA_DWF_NBR:

- CATDESC = "Cluster C1, NBR Magnetic Field Decommutated WaveForm"
- COMPONENT_DESC = "Cartesian xyz"
- COORDINATE_SYSTEM = "Instrument"
- DEPEND_0 = Time__C1_CP_STA_DWF_NBR
- ENTITY = "Magnetic_Field"
- FIELDNAM = "Cluster C1, NBR Magnetic Field Decommutated WaveForm"
- FILLVAL = -999
- FLUCTUATIONS = "Waveform"
- FRAME = "Instrument>xyz "
- LABEL_1 = "Bx","By","Bz"
- LABLAXIS = "Decommutated Magnetic Field Waveform"
- PARAMETER_TYPE = "Data"
- PARENT_DATASET_ID = C1_CP_STA_DWF_NBR
- PROPERTY = "Vector"
- QUALITY = 3
- REPRESENTATION_1 = "x","y","z"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3
- TENSOR_ORDER = "1"
- UNITS = "TM counts"
- VALUE_TYPE = INT

3.1.7.2 HBR mode

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_DWF_HBR.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_DWF_HBR are:

- DATASET_ID= C1_CP_STA_DWF_HBR
- DATA_TYPE= "CP"
- DATASET_TITLE = "Magnetic Field Waveform – uncalibrated (burst; 450 Hz sampling)"
- CONTACT_COORDINATES = "Patrick CANU>PI>patrick. canu@lpp.polytechnique.fr" "Nicole CORNILLEAU-WEHRLIN>Deputy-PI> nicole.cornilleau@lpp.polytechnique.fr" "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
- DATASET_DESCRIPTION = "This dataset contains 0.22221704E-02s resolution measurements of the magnetic field Decommutated WaveForm (DWF) from the STAFF-SC instrument in HBR mode on the Cluster C1 spacecraft. This product is given in the STAFF Sensor WEC6 Reference Frame (SSW6RF)."
- PROCESSING_LEVEL = "Uncalibrated"
- TIME_RESOLUTION = "0.22221704E-02s"
- MIN_TIME_RESOLUTION, same as TIME RESOLUTION.
- MAX_TIME_RESOLUTION, same as TIME RESOLUTION.

Note: The time resolution values given in the headers are more precise and satellite dependent.

- DATASET_ CAVEATS = "*C1_CQ_STA_DWF_HBR_CAVEATS. DATASET VERSION HISTORY. All versions: Use the TED software, provided by the Sheffield DWP group, with TCOR option used for a maximum UT time precision every second. S/C HK used to calculate the phase are not corrected by TCOR. The maximum error induced is 0.2 degree, including time around the leap second. Version 03 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). For each data point time inside a 0.1s data block, each sample has been interpolated to insure a continuous sampling rate. The phase has been re-calculated for each point inside each 0.1s block. Version 04 : Addition of data necessary for CWF data. Correction of the time interpolation and of the backward time problem. The Maximum Compression Error information has been removed from the variables (MaxCompError_xyz_Instrument__C[n]_CP_STA_DWF_HBR) and added to the status (cf. User Guide). Version 05 : Some support data fields were moved to the FILE_CAVEATS section." "

Then, the metadata for the **Support variables** are

&Time which is the time index. Its properties are:

- CATDESC = "Interval centred time tag"
- DELTA_MINUS = "0.1111085E-02"
- DELTA_PLUS = "0.1111085E-02"
- FIELDNAM = "UT Time"
- FILLVAL = 9999-12-31T23:59:59.999999Z
- LABLAXIS = "UT"
- PARAMETER_TYPE = "Support Data"

- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 27
- SIZES = 1
- UNITS = "s"
- VALUE_TYPE = ISO_TIME

Originally, the Waveform data are separated in blocks (also called windows). Each block composed of several measurements (45 in High Bit Rate) covers 100ms of measurement. The block is time tagged by TED and then split into individual measurements.

&Status which is a word of ASCII characters, each depending on one different factor

- CATDESC = "STAFF-SC Status"
- DEPEND_0 = Time__C1_CP_STA_DWF_HBR
- FIELDNAM = "STAFF-SC Status"
- FILLVAL = ZZZZZZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS ="We cannot certify the 9th character (EFW)"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 14
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Phase_Angle_SC__C1_STA_DWF_HBR:

- CATDESC = "Phase Angle"
- COORDINATE_SYSTEM = "SC"
- DEPEND_0 = Time__C1_CP_STA_DWF_HBR
- FIELDNAM = "Phase Angle"
- FILLVAL = -500.00
- LABEL_1 = "Phase Angle"
- LABLAXIS = "Phase Angle"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS = "Phase derived from Sun Pulse measurement: can be interpolated, see STATUS"
- QUALITY = 3
- SI_CONVERSION = "1.0>degree"
- SIGNIFICANT_DIGITS = 6
- SIZES = 1
- UNITS = "degree"
- VALUE_TYPE = FLOAT

&Misalignment_Matrix__C1_CP_STA_DWF_HBR

- CATDESC = "C1 transformation from STAFF real instrument frame to the theoric orthogonal frame linked to the instrument."

- COORDINATE_SYSTEM = "Instrument"
- DATA = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
- ENTITY = "Transformation"
- FIELDNAM = "Misalignment_Matrix"
- FILLVAL = 1.E30
- FRAME = "Instrument"
- LABEL_1 = "L*_C1","L*_C2","L*_C3"
- PARAMETER_TYPE = "Support_Data"
- PROPERTY = "Coordinate_rotation"
- QUALITY = 0
- REPRESENTATION_1 = "x","y","z"
- REPRESENTATION_2 = "x","y","z"
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3, 3
- TENSOR_ORDER = 2
- UNITS = "unitless"
- VALUE_TYPE = FLOAT

&Minimum_volt_range__C1_CP_STA_DWF_HBR

- CATDESC = "Minimum Volt range"
- DATA = -5.00
- FIELDNAM = "Minimum_volt_range"
- FILLVAL = -9.99
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1>V"
- SIGNIFICANT_DIGITS = 3
- UNITS = "V"
- VALUE_TYPE = FLOAT

&Maximum_volt_range__C1_CP_STA_DWF_HBR

- CATDESC = "Maximum Volt range"
- DATA = 5.00
- FIELDNAM = "Maximum_volt_range"
- FILLVAL = -9.99
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1>V"
- SIGNIFICANT_DIGITS = 3
- UNITS = "V"
- VALUE_TYPE = FLOAT

&TM_range_min__C1_CP_STA_DWF_HBR

- CATDESC = "Minimum telemetry range in TM counts"
- DATA = 0
- FIELDNAM = "TM_range_min"

- FILLVAL = -1
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 1
- UNITS = "TM counts"
- VALUE_TYPE = INT

&TM_range_max__C1_CP_STA_DWF_HBR

- CATDESC = "Maximum telemetry range in TM counts"
- DATA = 65535
- FIELDNAM = "TM_range_max"
- FILLVAL = -99999
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 5
- UNITS = "TM counts"
- VALUE_TYPE = INT

Data themselves:

&The Magnetic Field Decommutated WaveForm:
B_vec_xyz_Instrument__C1_CP_STA_DWF_HBR:

- CATDESC = "Cluster C1, HBR Magnetic Field Decommutated WaveForm"
- COMPONENT_DESC = "Cartesian xyz"
- COORDINATE_SYSTEM = "Instrument"
- DEPEND_0 = Time__C1_CP_STA_DWF_HBR
- ENTITY = "Magnetic_Field"
- FIELDNAM = "Cluster C1, HBR Magnetic Field Decommutated WaveForm"
- FILLVAL = -999
- FLUCTUATIONS = "Waveform"
- FRAME = "Instrument>xyz "
- LABEL_1 = "Bx","By","Bz"
- LABLAXIS = "Decommutated Magnetic Field Waveform"
- PARAMETER_TYPE = "Data"
- PARENT_DATASET_ID = C1_CP_STA_DWF_HBR
- PROPERTY = "Vector"
- QUALITY = 3
- REPRESENTATION_1 = "x","y","z"
- SI_CONVERSION = "1.52590218967E-4>V"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3
- TENSOR_ORDER = "1"
- UNITS = "TM counts"
- VALUE_TYPE = INT

3.1.8 File Metadata Specification

3.1.8.1 NBR Mode

Each file contains the following **file metadata** keywords (example is shown for a full day file on 1 October 2001):

- FILE_NAME = C1_CP_STA_DWF_NBR__20011001_V05.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- FILE_TYPE = "cef"
- DATASET_VERSION = “05”
- LOGICAL_FILE_ID = "C1_CP_STA_DWF_NBR__20011001_V05"
- VERSION_NUMBER = "05"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = “2001-10-01T00:00:00.000000Z/2001-10-01T23:59:59.999999Z”
- GENERATION_DATE = "2014-04-25T17:44:21.000Z"
- FILE_CAVEATS= "Produced using software RCL V2.1"
  "TED version 2.5.0.109"
  "TCOR option yes"
  "Measurement time : 2001-10-01T21:45:38Z"
  "Spin axis direction in GEI : 1.0, -67.09, 74.54"
  "Spin period : 4.0234250"
  "Mass center : 0.0001, 0.7609, -0.0001"
  "Euler angles (degree): 0.00, 0.06"

3.1.8.2 HBR mode

Each file contains the following **file metadata** keywords (example is shown for a full day file on 1 October 2001):

- FILE_NAME = C1_CP_STA_DWF_HBR__20011001_V05.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- FILE_TYPE = "cef"
- DATASET_VERSION = “05”
- LOGICAL_FILE_ID = "C1_CP_STA_DWF_HBR__20011001_V05"
- VERSION_NUMBER = "05"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = “2001-10-01T00:00:00.000000Z/2001-10-01T23:59:59.999999Z”
- GENERATION_DATE = "2014-04-25T17:59:11.000Z"
- FILE_CAVEATS = "Produced using software RCL V2.1"
  "TED version 2.5.0.109"
  "TCOR option yes"
  "Measurement time : 2001-10-01T21:45:38Z"
  "Spin axis direction in GEI : 1.0, -67.09, 74.54"
  "Spin period : 4.0234250"
  "Mass center : 0.0001, 0.7609, -0.0001"
  "Euler angles (degree): 0.00, 0.06"

3.1.9 Dataset header example

3.1.9.1 NBR mode

Example: C1_CH_STA_DWF_NBR.ceh

```
! CEH VALIDATION 11 May 2016 by LPP, V05 (RP/PC/NC/RK)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_DWF_NBR"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Waveform - uncalibrated (25 Hz sampling)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START META = DATASET DESCRIPTION
   ENTRY = "This dataset contains 3.99990667E-02s resolution measurements"
   ENTRY = "of the magnetic field Decommutated WaveForm (DWF)"
   ENTRY = "from the STAFF-SC instrument in NBR mode on the"
   ENTRY = "Cluster C1 spacecraft. This product is given in the STAFF"
   ENTRY = "Sensor WEC6 Reference Frame (SSW6RF)."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Uncalibrated"
END_META = PROCESSING_LEVEL
!
START_META = TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 3.99990667E-02
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 3.99990667E-02
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 3.99990667E-02
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_DWF_NBR_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "All versions:"
   ENTRY = "Use the TED software, provided by the Sheffield DWP group,"
   ENTRY = "with TCOR option used for a maximum UT time precision every second."
   ENTRY = "S/C HK used to calculate the phase are not corrected by TCOR."
   ENTRY = "The maximum error induced is 0.2 degree, including time around the leap second."
   ENTRY = "Version 03 : All the headers have been updated (laboratory name"
   ENTRY = "and email). Introduction of a new header file (Dataset)."
   ENTRY = "For each data point time inside a one-second data block,"
```

```
   ENTRY = "each sample has been interpolated to insure a continuous sampling rate."
   ENTRY = "The phase has been re-calculated for each point inside each one-second block."
   ENTRY = "Version 04 : Addition of data necessary for CWF data."
   ENTRY = "Correction of the time interpolation and of the backward time problem."
   ENTRY = "The Maximum Compression Error information has been removed from the"
   ENTRY = "variables (MaxCompError_xyz_Instrument__C[n]_CP_STA_DWF_NBR) and added "
   ENTRY = "to the status (cf. User Guide)."
   ENTRY = "Version 05 : Some support data fields were moved to the FILE_CAVEATS section."
END_META = DATASET_CAVEATS
!
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                    Variables  !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_DWF_NBR
   CATDESC            = "Interval centred time tag"
   DELTA_MINUS        = 1.9999533E-02
   DELTA_PLUS         = 1.9999533E-02
   FIELDNAM           = "UT Time"
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   LABLAXIS           = "UT"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 27
   SIZES              = 1
   UNITS              = "s"
   VALUE_TYPE         = ISO_TIME
END_VARIABLE = Time__C1_CP_STA_DWF_NBR
!
START_VARIABLE = Status__C1_CP_STA_DWF_NBR
   CATDESC            = "STAFF-SC Status"
   DEPEND_0           = Time__C1_CP_STA_DWF_NBR
   FIELDNAM           = "STAFF-SC Status"
   FILLVAL            = ZZZZZZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "We cannot certify the 9th character (EFW)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 14
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_DWF_NBR
!
START_VARIABLE = Phase_Angle__C1_CP_STA_DWF_NBR
   CATDESC            = "Phase Angle"
   COORDINATE_SYSTEM  = "SC"
   DEPEND_0           = Time__C1_CP_STA_DWF_NBR
   FIELDNAM           = "Phase Angle"
   FILLVAL            = -500.00
   LABEL_1            = "Phase Angle"
   LABLAXIS           = "Phase Angle"
   PARAMETER_CAVEATS   = "Phase derived from Sun Pulse measurement: can be interpolated, see
STATUS"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 3
   SI_CONVERSION      = "3.141593/180>rad"
   SIGNIFICANT_DIGITS = 6
   SIZES              = 1
   UNITS              = "degree"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Phase_Angle__C1_CP_STA_DWF_NBR
!
START_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_DWF_NBR
   CATDESC            = "Cluster C1, NBR Magnetic Field Decommutated WaveForm"
   COORDINATE_SYSTEM  = "Instrument"
   DEPEND_0           = Time__C1_CP_STA_DWF_NBR
   ENTITY             = "Magnetic_Field"
   FIELDNAM           = "Cluster C1, NBR Magnetic Field Decommutated WaveForm"
   FILLVAL            = -999
   FLUCTUATIONS       = "Waveform"
   LABEL_1            = "Bx","By","Bz"
```

```
   LABLAXIS           = "Decommutated Magnetic Field Waveform"
   PARAMETER_TYPE     = "Data"
   PROPERTY           = "Vector"
   QUALITY            = 3
   REPRESENTATION_1   = "x","y","z"
   SI_CONVERSION      = "1.52590218967E-4>V"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3
   TENSOR_ORDER       = 1
   UNITS              = "TM counts"
   VALUE_TYPE         = INT
END_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_DWF_NBR
!
START_VARIABLE = Misalignment_Matrix__C1_CP_STA_DWF_NBR
   CATDESC             = "C1 transformation from STAFF real instrument frame to the theoric
orthogonal frame linked to the instrument."
   COORDINATE_SYSTEM  = "Instrument"
   DATA               = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
   ENTITY             = "Transformation"
   FIELDNAM           = "Misalignment_Matrix"
   FILLVAL            = 1.E30
   FRAME              = "Instrument"
   LABEL_1            = "L*_C1","L*_C2","L*_C3"
   PARAMETER_TYPE     = "Support_Data"
   PROPERTY           = "Coordinate_rotation"
   QUALITY            = 0
   REPRESENTATION_1   = "x","y","z"
   REPRESENTATION_2   = "x","y","z"
   SI_CONVERSION      = "1>unitless"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3, 3
   TENSOR_ORDER       = 2
   UNITS              = "unitless"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Misalignment_Matrix__C1_CP_STA_DWF_NBR
!
START_VARIABLE = Minimum_volt_range__C1_CP_STA_DWF_NBR
   CATDESC            = "Minimum Volt range"
   DATA               = -5.00
   FIELDNAM           = "Minimum_volt_range"
   FILLVAL            = -9.99
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1>V"
   SIGNIFICANT_DIGITS = 3
   UNITS              = "V"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Minimum_volt_range__C1_CP_STA_DWF_NBR
!
START_VARIABLE = Maximum_volt_range__C1_CP_STA_DWF_NBR
   CATDESC            = "Maximum Volt range"
   DATA               = 5.00
   FIELDNAM           = "Maximum_volt_range"
   FILLVAL            = -9.99
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1>V"
   SIGNIFICANT_DIGITS = 3
   UNITS              = "V"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Maximum_volt_range__C1_CP_STA_DWF_NBR
!
START_VARIABLE = TM_range_min__C1_CP_STA_DWF_NBR
   CATDESC            = "Minimum telemetry range in TM counts"
   DATA               = 0
   FIELDNAM           = "TM_range_min"
   FILLVAL            = -1
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.52590218967E-4>V"
   SIGNIFICANT_DIGITS = 1
   UNITS              = "TM counts"
   VALUE_TYPE         = INT
END_VARIABLE = TM_range_min__C1_CP_STA_DWF_NBR
!
START_VARIABLE = TM_range_max__C1_CP_STA_DWF_NBR
   CATDESC            = "Maximum telemetry range in TM counts"
```

```
   DATA                = 65535
   FIELDNAM            = "TM_range_max"
   FILLVAL             = -99999
   PARAMETER_TYPE      = "Support_Data"
   SI_CONVERSION       = "1.52590218967E-4>V"
   SIGNIFICANT_DIGITS = 5
   UNITS               = "TM counts"
   VALUE_TYPE          = INT
END_VARIABLE = TM_range_max__C1_CP_STA_DWF_NBR
!
```

3.1.9.2 HBR mode

Example: C1_CH_STA_DWF_HBR.ceh

```
! CEH VALIDATION 11 May 2016 by LPP, V05 (RP/PC/NC/RK)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_DWF_HBR"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Waveform - uncalibrated (burst; 450 Hz sampling)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains 0.22221704E-02s resolution measurements"
   ENTRY = "of the magnetic field Decommutated WaveForm (DWF)"
   ENTRY = "from the STAFF-SC instrument in HBR mode on the"
   ENTRY = "Cluster C1 spacecraft. This product is given in the STAFF"
   ENTRY = "Sensor WEC6 Reference Frame (SSW6RF)."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Uncalibrated"
END_META = PROCESSING_LEVEL
!
START_META = TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 0.22221704E-02
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 0.22221704E-02
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 0.22221704E-02
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_DWF_HBR_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "All versions:"
   ENTRY = "Use the TED software, provided by the Sheffield DWP group,"
   ENTRY = "with TCOR option used for a maximum UT time precision every second."
   ENTRY = "S/C HK used to calculate the phase are not corrected by TCOR."
   ENTRY = "The maximum error induced is 0.2 degree, including time around the leap second."
   ENTRY = "Version 03 : All the headers have been updated (laboratory name"
   ENTRY = "and email). Introduction of a new header file (Dataset)."
   ENTRY = "For each data point time inside a 0.1s data block,"
   ENTRY = "each sample has been interpolated to insure a continuous sampling rate."
   ENTRY = "The phase has been re-calculated for each point inside each 0.1s block."
   ENTRY = "Version 04 : Addition of data necessary for CWF data."
   ENTRY = "Correction of the time interpolation and of the backward time problem."
   ENTRY = "The Maximum Compression Error information has been removed from the"
   ENTRY = "variables (MaxCompError_xyz_Instrument__C[n]_CP_STA_DWF_HBR) and added "
   ENTRY = "to the status (cf. User Guide)."
   ENTRY = "Version 05 : Some support data fields were moved to the FILE_CAVEATS section."
```

```
END_META = DATASET_CAVEATS
!
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables  !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_DWF_HBR
   CATDESC            = "Interval centred time tag"
   DELTA_MINUS        = 0.1111085E-02
   DELTA_PLUS         = 0.1111085E-02
   FIELDNAM           = "UT Time"
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   LABLAXIS           = "UT"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 27
   SIZES              = 1
   UNITS              = "s"
   VALUE_TYPE         = ISO_TIME
END_VARIABLE = Time__C1_CP_STA_DWF_HBR
!
START_VARIABLE = Status__C1_CP_STA_DWF_HBR
   CATDESC            = "STAFF-SC Status"
   DEPEND_0           = Time__C1_CP_STA_DWF_HBR
   FIELDNAM           = "STAFF-SC Status"
   FILLVAL            = ZZZZZZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "We cannot certify the 9th character (EFW)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 14
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_DWF_HBR
!
START_VARIABLE = Phase_Angle__C1_CP_STA_DWF_HBR
   CATDESC            = "Phase Angle"
   COORDINATE_SYSTEM  = "SC"
   DEPEND_0           = Time__C1_CP_STA_DWF_HBR
   FIELDNAM           = "Phase Angle"
   FILLVAL            = -500.00
   LABEL_1            = "Phase Angle"
   LABLAXIS           = "Phase Angle"
   PARAMETER_CAVEATS   = "Phase derived from Sun Pulse measurement: can be interpolated, see
STATUS"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 3
   SI_CONVERSION      = "3.141593/180>rad"
   SIGNIFICANT_DIGITS = 6
   SIZES              = 1
   UNITS              = "degree"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Phase_Angle__C1_CP_STA_DWF_HBR
!
START_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_DWF_HBR
   CATDESC            = "Cluster C1, HBR Magnetic Field Decommutated WaveForm"
   COORDINATE_SYSTEM  = "Instrument"
   DEPEND_0           = Time__C1_CP_STA_DWF_HBR
   ENTITY             = "Magnetic_Field"
   FIELDNAM           = "Cluster C1, HBR Magnetic Field Decommutated WaveForm"
   FILLVAL            = -999
   FLUCTUATIONS       = "Waveform"
   LABEL_1            = "Bx","By","Bz"
   LABLAXIS           = "Decommutated Magnetic Field Waveform"
   PARAMETER_TYPE     = "Data"
   PROPERTY           = "Vector"
   QUALITY            = 3
   REPRESENTATION_1   = "x","y","z"
   SI_CONVERSION      = "1.525590218967E-4>V"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3
```

```
   TENSOR_ORDER       = 1
   UNITS              = "TM counts"
   VALUE_TYPE         = INT
END_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_DWF_HBR
!
START_VARIABLE = Misalignment_Matrix__C1_CP_STA_DWF_HBR
   CATDESC             = "C1 transformation from STAFF real instrument frame to the theoric
orthogonal frame linked to the instrument."
   COORDINATE_SYSTEM  = "Instrument"
   DATA               = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
   ENTITY             = "Transformation"
   FIELDNAM           = "Misalignment_Matrix"
   FILLVAL            = 1.E30
   FRAME              = "Instrument"
   LABEL_1            = "L*_C1","L*_C2","L*_C3"
   PARAMETER_TYPE     = "Support_Data"
   PROPERTY           = "Coordinate_rotation"
   QUALITY            = 0
   REPRESENTATION_1   = "x","y","z"
   REPRESENTATION_2   = "x","y","z"
   SI_CONVERSION      = "1>unitless"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3, 3
   TENSOR_ORDER       = 2
   UNITS              = "unitless"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Misalignment_Matrix__C1_CP_STA_DWF_HBR
!
START_VARIABLE = Minimum_volt_range__C1_CP_STA_DWF_HBR
   CATDESC            = "Minimum Volt range"
   DATA               = -5.00
   FIELDNAM           = "Minimum_volt_range"
   FILLVAL            = -9.99
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1>V"
   SIGNIFICANT_DIGITS = 3
   UNITS              = "V"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Minimum_volt_range__C1_CP_STA_DWF_HBR
!
START_VARIABLE = Maximum_volt_range__C1_CP_STA_DWF_HBR
   CATDESC            = "Maximum Volt range"
   DATA               = 5.00
   FIELDNAM           = "Maximum_volt_range"
   FILLVAL            = -9.99
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1>V"
   SIGNIFICANT_DIGITS = 3
   UNITS              = "V"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Maximum_volt_range__C1_CP_STA_DWF_HBR
!
START_VARIABLE = TM_range_min__C1_CP_STA_DWF_HBR
   CATDESC            = "Minimum telemetry range in TM counts"
   DATA               = 0
   FIELDNAM           = "TM_range_min"
   FILLVAL            = -1
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.52590218967E-4>V"
   SIGNIFICANT_DIGITS = 1
   UNITS              = "TM counts"
   VALUE_TYPE         = INT
END_VARIABLE = TM_range_min__C1_CP_STA_DWF_HBR
!
START_VARIABLE = TM_range_max__C1_CP_STA_DWF_HBR
   CATDESC            = "Maximum telemetry range in TM counts"
   DATA               = 65535
   FIELDNAM           = "TM_range_max"
   FILLVAL            = -99999
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.52590218967E-4>V"
   SIGNIFICANT_DIGITS = 5
   UNITS              = "TM counts"
   VALUE_TYPE         = INT
```

```
END_VARIABLE = TM_range_max__C1_CP_STA_DWF_HBR
!
```

3.1.10 Dataset file example

3.1.10.1 NBR mode

Version 05 : C1_CP_STA_DWF_HBR__20070106_V05.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_DWF_NBR__20070106_V05.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                            Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh   ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_DWF_NBR.ceh   ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = DATASET_VERSION
   ENTRY = "05"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_DWF_NBR__20070106_V05"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "05"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2007-01-06T00:00:00.000000Z/2007-01-06T23:59:59.999999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2014-04-25T21:28:29.000Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Produced using software RCL V2.1"
   ENTRY = "TED version 2.5.0.109"
   ENTRY = "TCOR option yes"
   ENTRY = "Measurement time : 2007-01-01T20:24:53Z"
   ENTRY = "Spin axis direction in GEI : 1.0, -61.27, 86.22"
```

```
   ENTRY = "Spin period : 4.1464550"
   ENTRY = "Mass center : 0.0001, 0.7535, -0.0001"
   ENTRY = "Euler angles (degree): -0.02, 0.07"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                        Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = "END_OF_FILE"
2007-01-06T00:00:00.014824Z,00100000000100, 210.00,33056,33124,32861
2007-01-06T00:00:00.054823Z,00100000000100, 213.47,33010,32959,32686
2007-01-06T00:00:00.094822Z,00100000000100, 216.94,32909,32871,32560
```

3.1.10.2 HBR mode

Version 05 : C1_CP_STA_DWF_HBR__20070106_V05.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_DWF_HBR__20070106_V05.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                               Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh   ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_DWF_HBR.ceh   ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = DATASET_VERSION
   ENTRY = "05"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_DWF_HBR__20070106_V05"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "05"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2007-01-06T00:00:00.000000Z/2007-01-06T23:59:59.999999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2014-04-25T21:59:12.000Z"
END_META = GENERATION_DATE
```

```
!
START_META = FILE_CAVEATS
   ENTRY = "Produced using software RCL V2.1"
   ENTRY = "TED version 2.5.0.109"
   ENTRY = "TCOR option yes"
   ENTRY = "Measurement time : 2007-01-01T20:24:53Z"
   ENTRY = "Spin axis direction in GEI : 1.0, -61.27, 86.22"
   ENTRY = "Spin period : 4.1464550"
   ENTRY = "Mass center : 0.0001, 0.7535, -0.0001"
   ENTRY = "Euler angles (degree): -0.02, 0.07"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                      Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = "END_OF_FILE"
2007-01-06T19:49:56.918400Z,001f1000000110, 306.30,32764,33082,32727
2007-01-06T19:49:56.920622Z,001f1000000100, 306.49,32768,33077,32721
2007-01-06T19:49:56.922844Z,001f1000000100, 306.69,32772,33079,32724
2007-01-06T19:49:56.925066Z,001f1000000100, 306.88,32769,33081,32726
2007-01-06T19:49:56.927288Z,001f1000000100, 307.07,32760,33070,32726
```

3.2 Level 2 data – SC – Calibrated WaveForm (CWF)

These data are given in two different frames: GSE and ISR2.

3.2.1 Format: CEF

3.2.2 Standard: cf 2.2.

3.2.3 Production Procedure: cf 2.3.1.

3.2.4 Quality Control Procedure: cf 2.4.1

3.2.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.2.6 Product Specification

One CEF file per day, per satellite is produced. This CEF file contains the Calibrated Wave Form of the Magnetic Field (level 2) and other variables or constant data (constant for one given file) described below. Data are given in either in GSE or in ISR2.

3.2.7 Dataset metadata description

3.2.7.1 GSE

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_CWF_GSE.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_CWF_ GSE are:

- DATASET_ID= C1_CP_STA_CWF_ GSE
- DATA_TYPE= "CP"
- DATASET_TITLE = "Magnetic Field Waveform – calibrated"
- CONTACT_COORDINATES =
  "Patrick CANU>PI>Patrick.Canu@lpp.polytechnique.fr"
  "Nicole CORNILLEAU-WEHRLIN>Deputy-PI>
  Nicole.Cornilleau@lpp.polytechnique.fr"
- DATASET_DESCRIPTION = "This dataset contains measurements of the magnetic field Calibrated WaveForm (CWF) from the STAFF-SC instrument in NBR mode (filtered from 0.6Hz to 10Hz and sampled to 12.5Hz) and in HBR mode (filtered from 0.6Hz to 180Hz and sampled to 225Hz), on the Cluster C1 spacecraft. This product is given in the GSE frame.
- PROCESSING_LEVEL = "Calibrated"
- MIN_TIME_RESOLUTION, same as TIME RESOLUTION.
- MAX_TIME_RESOLUTION, same as TIME RESOLUTION.

Note: The time resolution values given in the headers are more precise and satellite dependent.

- DATASET_ CAVEATS = "*C1_CQ_STA_CWF_CAVEATS"
  "*C1_CQ_STA_CALIBRATION_CAVEATS"
  "*C1_CQ_STA_NOTSRP_CAVEATS"

  DATASET VERSION HISTORY = Version 01: First version of dataset header.

Then, the metadata for the **Support variables** are

&Time which is the time index. Its properties are:

- CATDESC = "Time tag"
- DELTA_MINUS = "0"
- DELTA_PLUS = "Interval__C1_CP_STA_CWF_GSE"
- FIELDNAM = "UT Time"
- FILLVAL = 9999-12-31T23:59:59.999999Z
- LABLAXIS = "UT"
- PARAMETER_TYPE = "Support Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 27
- SIZES = "1"
- UNITS = "s"
- VALUE_TYPE = ISO_TIME

Originally, the Waveform data are separated in blocks or windows. Each block composed of several measurements (25 in Normal Bit Rate) covers 1s of

measurement. The block is time tagged by TED and then split into individual measurements.

&Half interval which is half time interval between two samples. Its properties are:

- CATDESC = "Sampling interval length"
- FIELDNAM = "Sampling interval length"
- FILLVAL = 9.999999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 7
- UNITS = "s"
- VALUE_TYPE = FLOAT

&Status which is a word of ASCII characters, each depending on one different factor

- CATDESC = "STAFF-SC Status"
- DEPEND_0 = Time__C1_CP_STA_CWF_GSE
- FIELDNAM = "STAFF-SC Status"
- FILLVAL = ZZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS ="See UG, Appendix C. We cannot certify the 9th character (EFW)"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 14
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Phase_Angle_SC__C1_STA_CWF_GSE:

- CATDESC = "Phase Angle"
- COORDINATE_SYSTEM = "SC"
- DEPEND_0 = Time__C1_CP_STA_CWF_GSE
- FIELDNAM = "Phase Angle"
- FILLVAL = -500
- LABEL_1 = "Phase Angle"
- LABLAXIS = "Phase Angle"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS = "Phase derivated from Sun Pulse measurement: can be interpolated, see STATUS"
- QUALITY = 3
- SI_CONVERSION = "1>degree"
- SIGNIFICANT_DIGITS = 6
- SIZES = 1
- UNITS = "degree"
- VALUE_TYPE = FLOAT

&Misalignment_Matrix__C1_CP_STA_CWF_GSE:

- CATDESC = "C1 transformation from STAFF real instrument frame to the theoric orthogonal frame linked to the instrument."
- COORDINATE_SYSTEM = "Instrument"
- DATA = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
- ENTITY = "Transformation"
- FIELDNAM = "Misalignment_Matrix"
- FILLVAL = 1e30
- LABEL_1 = "M1","M2","M3"
- PARAMETER_TYPE = "Support_Data"
- PROPERTY = “Coordinate_rotation”
- REPRESENTATION_1 = "x","y","z"
- REPRESENTATION_2 = "x","y","z"
- QUALITY = 0
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3,3
- UNITS = "unitless"
- VALUE_TYPE = FLOAT

Data themselves:

&The Magnetic Field Calibrated WaveForm:
B_vec_xyz_Instrument__C1_CP_STA_CWF_GSE:

- CATDESC = "Cluster C1, NBR Calibrated Magnetic Field WaveForm"
- COORDINATE_SYSTEM = "GSE"
- DEPEND_0 = Time__C1_CP_STA_CWF_GSE
- ENTITY = "Magnetic_Field"
- FIELDNAM = "Cluster C1, Calibrated Magnetic Field WaveForm "
- FILLVAL = 1e30
- FLUCTUATIONS = "Waveform"
- LABEL_1 = "Bx","By","Bz"
- LABLAXIS = "Decommutated Magnetic Field Waveform"
- PARAMETER_TYPE = "Data"
- PROPERTY = "Vector"
- QUALITY = 3
- REPRESENTATION_1 = "x","y","z"
- SI_CONVERSION = "1E9>T"
- SIGNIFICANT_DIGITS = 7
- SIZES = 3
- TENSOR_ORDER = "1"
- UNITS = "nT"
- VALUE_TYPE = FLOAT

3.2.7.2 ISR2:

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_CWF_ISR2.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_CWF_ ISR2 are:

- DATASET_ID= C1_CP_STA_CWF_ ISR2
- DATA_TYPE= "CP"
- DATASET_TITLE = "Magnetic Field Waveform – calibrated"
- CONTACT_COORDINATES =
  "Patrick CANU>PI>Patrick.Canu@lpp.polytechnique.fr"
  "Nicole CORNILLEAU-WEHRLIN>Deputy-PI>
  Nicole.Cornilleau@lpp.polytechnique.fr"
- DATASET_DESCRIPTION = "This dataset contains measurements of the magnetic field Calibrated WaveForm (CWF) from the STAFF-SC instrument in NBR mode (filtered from 0.1Hz to 10Hz and sampled to 12.5Hz) and in HBR mode (filtered from 0.1Hz to 180Hz and sampled to 225Hz) and DC magnetic field components in the spin plane Dx, Dy, on the Cluster C1 spacecraft. This product is given in the ISR2 frame.
- PROCESSING_LEVEL = "Calibrated"
- MIN_TIME_RESOLUTION, same as TIME RESOLUTION.
- MAX_TIME_RESOLUTION, same as TIME RESOLUTION.

  Note: The time resolution values given in the headers are more precise and satellite dependent.
- DATASET_ CAVEATS = "*C1_CQ_STA_CWF_ISR2_CAVEATS"
  "*C1_CQ_STA_CALIBRATION_CAVEATS"
  "*C1_CQ_STA_NOTSRP_CAVEATS"

  DATASET VERSION HISTORY = Version 01: First version of dataset header.

Then, the metadata for the **Support variables** are

&Time which is the time index. Its properties are:

- CATDESC = "Time tag"
- DELTA_MINUS = "0"
- DELTA_PLUS = "Interval__C1_CP_STA_CWF_ISR2"
- FIELDNAM = "UT Time"
- FILLVAL = 9999-12-31T23:59:59.999999Z
- LABLAXIS = "UT"
- PARAMETER_TYPE = "Support Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 27
- SIZES = "1"
- UNITS = "s"
- VALUE_TYPE = ISO_TIME

Originally, the Waveform data are separated in blocks or windows. Each block composed of several measurements (25 in Normal Bit Rate) covers 1s of

measurement. The block is time tagged by TED and then split into individual measurements.

&Half interval which is half time interval between two samples. Its properties are:

- CATDESC = "Sampling interval length"
- FIELDNAM = "Sampling interval length"
- FILLVAL = 9.999999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 7
- UNITS = "s"
- VALUE_TYPE = FLOAT

&Status which is a word of ASCII characters, each depending on one different factor

- CATDESC = "STAFF-SC Status"
- DEPEND_0 = Time__C1_CP_STA_CWF_ISR2
- FIELDNAM = "STAFF-SC Status"
- FILLVAL = ZZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS ="See UG, Appendix C. We cannot certify the 9th character (EFW)"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 14
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Phase_Angle_SC__C1_STA_CWF_ISR2:

- CATDESC = "Phase Angle"
- COORDINATE_SYSTEM = "SC"
- DEPEND_0 = Time__C1_CP_STA_CWF_ISR2
- FIELDNAM = "Phase Angle"
- FILLVAL = -500
- LABEL_1 = "Phase Angle"
- LABLAXIS = "Phase Angle"
- PARAMETER_TYPE = "Support_Data"
- PARAMETER_CAVEATS = "Phase derivated from Sun Pulse measurement: can be interpolated, see STATUS"
- QUALITY = 3
- SI_CONVERSION = "1>degree"
- SIGNIFICANT_DIGITS = 6
- SIZES = 1
- UNITS = "degree"
- VALUE_TYPE = FLOAT

&Misalignment_Matrix__C1_CP_STA_CWF_ISR2:

- CATDESC = "C1 transformation from STAFF real instrument frame to the theoric orthogonal frame linked to the instrument."
- COORDINATE_SYSTEM = "Instrument"
- DATA = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
- ENTITY = "Transformation"
- FIELDNAM = "Misalignment_Matrix"
- FILLVAL = 1e30
- LABEL_1 = "M1","M2","M3"
- PARAMETER_TYPE = "Support_Data"
- PROPERTY = “Coordinate_rotation”
- REPRESENTATION_1 = "x","y","z"
- REPRESENTATION_2 = "x","y","z"
- QUALITY = 0
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 5
- SIZES = 3,3
- UNITS = "unitless"
- VALUE_TYPE = FLOAT

Data themselves:

&The Magnetic Field Calibrated WaveForm:
B_vec_xyz_Instrument__C1_CP_STA_CWF_ISR2:

- CATDESC = "Cluster C1, NBR Calibrated Magnetic Field WaveForm"
- COORDINATE_SYSTEM = "ISR2"
- DEPEND_0 = Time__C1_CP_STA_CWF_ISR2
- ENTITY = "Magnetic_Field"
- FIELDNAM = "Cluster C1, Calibrated Magnetic Field WaveForm "
- FILLVAL = 1e30
- FLUCTUATIONS = "Waveform"
- LABEL_1 = "Bx","By","Bz"
- LABLAXIS = "Decommutated Magnetic Field Waveform"
- PARAMETER_TYPE = "Data"
- PROPERTY = "Vector"
- QUALITY = 3
- REPRESENTATION_1 = "x","y","z"
- SI_CONVERSION = "1E9>T"
- SIGNIFICANT_DIGITS = 7
- SIZES = 3
- TENSOR_ORDER = "1"
- UNITS = "nT"
- VALUE_TYPE = FLOAT

&BDC_vec_xy_Instrument__C1_CP_STA_CWF_ISR2:

- CATDESC = "Cluster C1, DC Magnetic Field in the spin plane"

- COORDINATE_SYSTEM = "ISR2"
- DEPEND_0 = Time__C1_CP_STA_CWF_ISR2
- ENTITY = "Magnetic_Field"
- FIELDNAM = "Cluster C1, DC Magnetic Field"
- FILLVAL = 1.e30
- FLUCTUATIONS = "Waveform"
- LABEL_1 = "Dx","Dy"
- LABLAXIS = "Calibrated Magnetic Field Waveform"
- PARAMETER_TYPE = "Data"
- PROPERTY = "Vector"
- QUALITY = 3
- REPRESENTATION_1 = "x","y"
- SI_CONVERSION = "1E9>T"
- SIGNIFICANT_DIGITS = 7
- SIZES = 2
- TENSOR_ORDER = 1
- UNITS = "nT"
- VALUE_TYPE = FLOAT

3.2.8 File Metadata Specification

Each file contains the following **file metadata** keywords (example is shown for a full day file on 1 October 2001):

3.2.8.1 GSE

- FILE_NAME = C1_CP_STA_CWF_GSE__20011001_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- FILE_TYPE = "cef"
- DATASET_VERSION = “01”
- LOGICAL_FILE_ID = "C1_CP_STA_CWF_GSE__20011001_V03"
- VERSION_NUMBER = "01"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = "2001-10-01T00:00:00.000000Z/2001-10-01T23:59:59.999999Z"
- GENERATION_DATE ="2012-05-09T11:58:02.000Z"
- FILE_CAVEATS = "Produced from DWF"
  "TED version 2.5.0.109"
  "TCOR option yes"
  "Produced using software RCL V1.8"
  "Calibration tables: feb 2013"
  "Kernel size :4096 for HBR and 1024 for NBR"
  "Shift size : 2 for HBR and 2 for NBR"
  "Cutoff frequency : 0.60"
  "Measurement time : 2001-10-01T21:45:38Z"
  "Spin axis direction in GEI : 1.0, -67.09, 74.54"
  "Spin period : 4.0234250"
  "Mass center : 0.0001, 0.7609, -0.0001"
  "Euler angles (degree): 0.00, 0.06"

3.2.8.2 ISR2

- FILE_NAME = C1_CP_STA_CWF_ISR2__20011001_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- FILE_TYPE = "cef"
- DATASET_VERSION = “01”
- LOGICAL_FILE_ID = "C1_CP_STA_CWF_ISR2__20011001_V03"
- VERSION_NUMBER = "01"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = "2001-10-01T00:00:00.000000Z/2001-10-01T23:59:59.999999Z"
- GENERATION_DATE ="2012-05-09T11:58:02.000Z"

- FILE_CAVEATS = "Produced from DWF"
  "TED version 2.5.0.109"
  "TCOR option yes"
  "Produced using software RCL V2.0"
  "Calibration tables: feb 2013"
  "Kernel size :4096 for HBR and 1024 for NBR"
  "Shift size : 2 for HBR and 2 for NBR"
  "Cutoff frequency : 0.10"
  "Measurement time : 2001-10-01T21:45:38Z"
  "Spin axis direction in GEI : 1.0, -67.09, 74.54"
  "Spin period : 4.0234250"
  "Mass center : 0.0001, 0.7609, -0.0001"
  "Euler angles (degree): 0.00, 0.06"

3.2.9 Dataset header example

3.2.9.1 GSE

Ex: C1_CP_STA_CWF_GSE.ceh

```
! CEH VALIDATION 20 April 2013 by LPP, V01 (RP/PR/NCW/PC)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_CWF_GSE"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Waveform - calibrated"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains measurements"
   ENTRY = "of the magnetic field Calibrated WaveForm (CWF)"
   ENTRY = "from the STAFF-SC instrument in NBR mode (filtered from 0.6Hz to 10Hz and sampled
to 12.5Hz)"
   ENTRY = "and in HBR mode (filtered from 0.6Hz to 180Hz and sampled to 225Hz)"
   ENTRY = "and DC magnetic field components in the spin plane Dx, Dy, on the"
   ENTRY = "Cluster C1 spacecraft. This product is given in the GSE  frame."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = MIN_TIME_RESOLUTION
   VALUE TYPE = FLOAT
   ENTRY = 3.99990667E-02
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
```

```
   ENTRY = 0.22221704E-02
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_CWF_GSE _CAVEATS"
   ENTRY = "*C1_CQ_STA_CALIBRATION_CAVEATS"
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "Version 01: First version of dataset header"
END_META = DATASET_CAVEATS
!
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                   Variables  !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_CWF_GSE
   CATDESC            = "Time tag"
   DELTA_MINUS        = half_interval__C1_CP_STA_CWF_GSE
   DELTA_PLUS         = half_interval__C1_CP_STA_CWF_GSE
   FIELDNAM           = "UT Time"
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   LABLAXIS           = "UT"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 27
   SIZES              = 1
   UNITS              = "s"
   VALUE_TYPE         = ISO_TIME
END_VARIABLE = Time__C1_CP_STA_CWF_GSE
!
START_VARIABLE = half_interval__C1_CP_STA_CWF_GSE
   CATDESC            = "Half sampling interval length"
   FIELDNAM           = "Half sampling interval length"
   FILLVAL            = 9.999999
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 7
   UNITS              = "s"
   VALUE_TYPE         = FLOAT
END_VARIABLE = half_interval__C1_CP_STA_CWF_GSE
!
START_VARIABLE = Status__C1_CP_STA_CWF_GSE
   CATDESC            = "STAFF-SC Status"
   DEPEND_0           = Time__C1_CP_STA_CWF_GSE
   FIELDNAM           = "STAFF-SC Status"
   FILLVAL            = ZZZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "See UG, Appendix C. We cannot certify the 9th character (EFW)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 14
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_CWF_GSE
!
START_VARIABLE = Phase_Angle__C1_CP_STA_CWF_GSE
   CATDESC            = "Phase Angle"
   COORDINATE_SYSTEM  = "SC"
   DEPEND_0           = Time__C1_CP_STA_CWF_GSE
   FIELDNAM           = "Phase Angle"
   FILLVAL            = -500.00
   LABEL_1            = "Phase Angle"
   LABLAXIS           = "Phase Angle"
   PARAMETER_CAVEATS   = "Phase derived from Sun Pulse measurement: can be interpolated, see
STATUS"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 3
   SI_CONVERSION      = "1>degree"
   SIGNIFICANT_DIGITS = 6
   SIZES              = 1
```

```
   UNITS              = "degree"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Phase_Angle__C1_CP_STA_CWF_GSE
!
START_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_CWF_GSE
   CATDESC            = "Cluster C1, Calibrated Magnetic Field WaveForm"
   COORDINATE_SYSTEM  = "GSE"
   DEPEND_0           = Time__C1_CP_STA_CWF_GSE
   ENTITY             = "Magnetic_Field"
   FIELDNAM           = "Cluster C1, Calibrated Magnetic Field WaveForm"
   FILLVAL            = 1.e30
   FLUCTUATIONS       = "Waveform"
   LABEL_1            = "Bx","By","Bz"
   LABLAXIS           = "Calibrated Magnetic Field Waveform"
   PARAMETER_TYPE     = "Data"
   PROPERTY           = "Vector"
   QUALITY            = 3
   REPRESENTATION_1   = "x","y","z"
   SI_CONVERSION      = "1E9>T"
   SIGNIFICANT_DIGITS = 7
   SIZES              = 3
   TENSOR_ORDER       = 1
   UNITS              = "nT"
   VALUE_TYPE         = FLOAT
END_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_CWF_GSE
!
START_VARIABLE = Misalignment_Matrix__C1_CP_STA_CWF_GSE
   CATDESC              = "C1 transformation from STAFF real instrument frame to the theoric
orthogonal frame linked to the instrument."
   COORDINATE_SYSTEM  = "Instrument"
   DATA               = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
   ENTITY             = "Transformation"
   FIELDNAM           = "Misalignment_Matrix"
   FILLVAL            = 1.E30
   FRAME              = "Instrument"
   LABEL_1            = "M1","M2","M3"
   PARAMETER_TYPE     = "Support_Data"
   PROPERTY           = "Coordinate_rotation"
   QUALITY            = 0
   REPRESENTATION_1   = "x","y","z"
   REPRESENTATION_2   = "x","y","z"
   SI_CONVERSION      = "1>unitless"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3, 3
   TENSOR_ORDER       = 2
   UNITS              = "unitless"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Misalignment_Matrix__C1_CP_STA_CWF_GSE
!
```

3.2.9.2 ISR2

Ex: C1_CP_STA_CWF_ISR2.ceh

```
! CEH VALIDATION 20 April 2014 by LPP, V01 (RP/PR/NCW/PC)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_CWF_ISR2"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Waveform - calibrated"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
```

```
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains measurements"
   ENTRY = "of the magnetic field Calibrated WaveForm (CWF)"
   ENTRY = "from the STAFF-SC instrument in NBR mode (filtered from 0.1Hz to 10Hz and sampled
to 12.5Hz)"
   ENTRY = "and in HBR mode (filtered from 0.1Hz to 180Hz and sampled to 225Hz)"
   ENTRY = "and DC magnetic field components in the spin plane Dx, Dy, on the"
   ENTRY = "Cluster C1 spacecraft. This product is given in the ISR2 frame."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = MIN_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 3.99990667E-02
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY = 0.22221704E-02
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_CWF_ISR2_CAVEATS"
   ENTRY = "*C1_CQ_STA_CALIBRATION_CAVEATS"
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "Version 01: First version of dataset header."
END_META = DATASET_CAVEATS
!
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                   Variables  !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_CWF_ISR2
   CATDESC            = "Interval centred time tag"
   DELTA_MINUS        = 0
   DELTA_PLUS         = Interval__C1_CP_STA_CWF_ISR2
   FIELDNAM           = "UT Time"
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   LABLAXIS           = "UT"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 27
   SIZES              = 1
   UNITS              = "s"
   VALUE_TYPE         = ISO_TIME
END_VARIABLE = Time__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = Interval__C1_CP_STA_CWF_ISR2
   CATDESC            = "Sampling interval length"
   FIELDNAM           = "Sampling interval length"
   FILLVAL            = 9.999999
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 7
   UNITS              = "s"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Interval__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = Status__C1_CP_STA_CWF_ISR2
   CATDESC            = "STAFF-SC Status"
   DEPEND_0           = Time__C1_CP_STA_CWF_ISR2
   FIELDNAM           = "STAFF-SC Status"
   FILLVAL            = ZZZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "See UG, Appendix C. We cannot certify the 9th character (EFW)"
```

```
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 14
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = Phase_Angle__C1_CP_STA_CWF_ISR2
   CATDESC            = "Phase Angle"
   COORDINATE_SYSTEM  = "SC"
   DEPEND_0           = Time__C1_CP_STA_CWF_ISR2
   FIELDNAM           = "Phase Angle"
   FILLVAL            = -500.00
   LABEL_1            = "Phase Angle"
   LABLAXIS           = "Phase Angle"
   PARAMETER_CAVEATS   = "Phase derived from Sun Pulse measurement: can be interpolated, see
STATUS"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 3
   SI_CONVERSION      = "1>degree"
   SIGNIFICANT_DIGITS = 6
   SIZES              = 1
   UNITS              = "degree"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Phase_Angle__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_CWF_ISR2
   CATDESC            = "Cluster C1, Calibrated Magnetic Field WaveForm"
   COORDINATE_SYSTEM  = "ISR2"
   DEPEND_0           = Time__C1_CP_STA_CWF_ISR2
   ENTITY             = "Magnetic_Field"
   FIELDNAM           = "Cluster C1, Calibrated Magnetic Field WaveForm"
   FILLVAL            = 1.e30
   FLUCTUATIONS       = "Waveform"
   LABEL_1            = "Bx","By","Bz"
   LABLAXIS           = "Calibrated Magnetic Field Waveform"
   PARAMETER_TYPE     = "Data"
   PROPERTY           = "Vector"
   QUALITY            = 3
   REPRESENTATION_1   = "x","y","z"
   SI_CONVERSION      = "1E9>T"
   SIGNIFICANT_DIGITS = 7
   SIZES              = 3
   TENSOR_ORDER       = 1
   UNITS              = "nT"
   VALUE_TYPE         = FLOAT
END_VARIABLE = B_vec_xyz_Instrument__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = BDC_vec_xy_Instrument__C1_CP_STA_CWF_ISR2
   CATDESC            = "Cluster C1, DC Magnetic Field in the spin plane"
   COORDINATE_SYSTEM  = "ISR2"
   DEPEND_0           = Time__C1_CP_STA_CWF_ISR2
   ENTITY             = "Magnetic_Field"
   FIELDNAM           = "Cluster C1, DC Magnetic Field"
   FILLVAL            = 1.e30
   FLUCTUATIONS       = "Waveform"
   LABEL_1            = "Dx","Dy"
   LABLAXIS           = "Calibrated Magnetic Field Waveform"
   PARAMETER_TYPE     = "Data"
   PROPERTY           = "Vector"
   QUALITY            = 3
   REPRESENTATION_1   = "x","y"
   SI_CONVERSION      = "1E9>T"
   SIGNIFICANT_DIGITS = 7
   SIZES              = 2
   TENSOR_ORDER       = 1
   UNITS              = "nT"
   VALUE_TYPE         = FLOAT
END_VARIABLE = BDC_vec_xy_Instrument__C1_CP_STA_CWF_ISR2
!
START_VARIABLE = Misalignment_Matrix__C1_CP_STA_CWF_ISR2
   CATDESC              = "C1 transformation from STAFF real instrument frame to the theoric
orthogonal frame linked to the instrument."
```

```
   COORDINATE_SYSTEM  = "Instrument"
   DATA               = 1.0000, 0.0000, 0.0000, 0.0000, 1.0000, 0.0000, 0.0000, 0.0000, 1.0000
   ENTITY             = "Transformation"
   FIELDNAM           = "Misalignment_Matrix"
   FILLVAL            = 1.E30
   FRAME              = "Instrument"
   LABEL_1            = "M1","M2","M3"
   PARAMETER_TYPE     = "Support_Data"
   PROPERTY           = "Coordinate_rotation"
   QUALITY            = 0
   REPRESENTATION_1   = "x","y","z"
   REPRESENTATION_2   = "x","y","z"
   SI_CONVERSION      = "1>unitless"
   SIGNIFICANT_DIGITS = 5
   SIZES              = 3, 3
   TENSOR_ORDER       = 2
   UNITS              = "unitless"
   VALUE_TYPE         = FLOAT
END_VARIABLE = Misalignment_Matrix__C1_CP_STA_CWF_ISR2
!
```

3.2.10 Dataset file example

3.2.10.1 GSE

Ex: C1_CP_STA_CWF_GSE__20010104_V01.cef"

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_CWF_GSE__20010104_V01.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                           Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL CH STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh   ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_CWF_GSE.ceh   ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = DATASET_VERSION
   ENTRY = "01"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_CWF_GSE__20010104_V01"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "01"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
```

```
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2001-01-04T00:00:00.000000Z/2001-01-04T23:59:59.999999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2013-05-21T16:14:40.000Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Produced from DWF"
   ENTRY = "TED version 2.5.0.109"
   ENTRY = "TCOR option yes"
   ENTRY = "Produced using software RCL V1.8"
   ENTRY = "Calibration tables: feb 2013"
   ENTRY = "Kernel size :4096 for HBR and 1024 for NBR"
   ENTRY = "Shift size :   2 for HBR and 2 for NBR"
   ENTRY = "Cutoff frequency : 0.60"
   ENTRY = "Measurement time : 2001-01-04T08:40:03Z"
   ENTRY = "Spin axis direction in GEI : 1.0, -60.89, 94.55"
   ENTRY = "Spin period : 4.0016010"
   ENTRY = "Mass center : 0.0001, 0.7613, -0.0001"
   ENTRY = "Euler angles (degree): 0.00, 0.03"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                        Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = "END_OF_FILE"
2001-01-04T07:20:31.193286Z,0.040000,00000000000000,   132.42,   0.427755E+00,   0.173744E+00,
0.372376E+00
2001-01-04T07:20:31.233285Z,0.040000,00000000000000,   136.02,   0.491170E+00,   0.284578E+00,
0.411116E+00
2001-01-04T07:20:31.273284Z,0.040000,00000000000000,   139.62,   0.467615E+00,   0.336600E+00,
0.483392E+00
2001-01-04T07:20:31.313283Z,0.040000,00000000000000,   143.22,   0.476545E+00,   0.403262E+00,
0.457924E+00
2001-01-04T07:20:31.353283Z,0.040000,00000000000000,   146.82,   0.487804E+00,   0.432446E+00,
0.347283E+00
```

3.2.10.2 ISR2

Ex: C1_CP_STA_CWF_ISR2__20010104_V01.cef"

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_CWF_ISR2__20010104_V01.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                               Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh   ! Instrument level metadata.
```

```
!
INCLUDE= C1_CH_STA_CWF_ISR2.ceh   ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = DATASET_VERSION
   ENTRY = "01"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_CWF_ISR2__20010104_V01"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "01"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2001-01-04T00:00:00.000000Z/2001-01-04T23:59:59.999999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2014-02-12T16:00:17.000Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Produced from DWF"
   ENTRY = "TED version 2.5.0.109"
   ENTRY = "TCOR option yes"
   ENTRY = "Produced using software RCL V2.0"
   ENTRY = "Calibration tables: feb 2013"
   ENTRY = "Kernel size :4096 for HBR and 1024 for NBR"
   ENTRY = "Shift size :   2 for HBR and 2 for NBR"
   ENTRY = "Cutoff frequency : 0.10"
   ENTRY = "Measurement time : 2001-01-04T08:40:03Z"
   ENTRY = "Spin axis direction in GEI : 1.0, -60.89, 94.55"
   ENTRY = "Spin period : 4.0016010"
   ENTRY = "Mass center : 0.0001, 0.7613, -0.0001"
   ENTRY = "Euler angles (degree): 0.00, 0.03"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                     Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = "END_OF_FILE"
2001-01-04T07:20:31.193286Z,0.040000,00000000000000,    132.42,-0.173573E+01,    0.190039E+01,
0.435648E+01,-0.348259E+01, 0.308837E+02
2001-01-04T07:20:31.233285Z,0.040000,00000000000000,    136.02,-0.169945E+01,    0.186909E+01,
0.429633E+01,-0.348259E+01, 0.308837E+02
2001-01-04T07:20:31.273284Z,0.040000,00000000000000,    139.62,-0.171817E+01,    0.175526E+01,
0.426840E+01,-0.348494E+01, 0.308941E+02
```

3.3 Level 2 data - SC - Complex Spectra (CS)

3.3.1 Format: CEF

3.3.2 Standard: cf 2.2.

3.3.3 Production Procedure: cf 2.3.1.

3.3.4 Quality Control Procedure: cf 2.4.1.

3.3.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.3.6 Product Specification

One CEF file per day, per satellite and per mode (HBR or NBR) is produced.
This CEF file contains calibrated Complex Spectra (CS) of the magnetic field measured by STAFF-SC from 0.00Hz to 12.40Hz (0.00Hz to 224.90Hz) with a frequency/time resolution of 0.097658Hz x 10.24s (0.109866Hz x 9.10s), in NBR mode (in HBR mode) and filtered at 0.6Hz for GSE data.

Complex_Spectrum__C1_CP_STA_CS_NBR/HBR is a complex variable defined for x, y and z components (where C1 stands for satellite 1 in this example); they are given in nT units.

This variable is sampled for 128/2048 (NBR/HBR mode) frequencies described in Frequency__C1_CP_STA_CS_NBR/HBR (given in Hz).

DATA are given in GSE coordinate system.

3.3.7 Dataset metadata description

3.3.7.1 NBR mode

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_CS_NBR.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_CS_NBR are:

- DATASET_ID="C1_CP_STA_CS_NBR"

- DATA_TYPE = "CP"
- DATASET_TITLE = "Magnetic Field Spectra in GSE (up to 12.5 Hz"
- CONTACT_COORDINATES =
  "Patrick CANU>PI>Patrick.Canu@lpp.polytechnique.fr"
  "Nicole CORNILLEAU-WEHRLIN>Deputy-PI>
  Nicole.Cornilleau@lpp.polytechnique.fr"
- DATASET_DESCRIPTION = "This dataset contains calibrated Complex Spectra (CS) of the magnetic field measured by STAFF-SC from 0.00Hz to 12.40Hz with a resolution of 0.097659Hz x 10.24s in NBR mode on the Cluster C1 spacecraft. This product is given in Geocentric Solar Ecliptic (GSE) coordinate system."
- PROCESSING_LEVEL = "Calibrated"
- TIME_RESOLUTION = 0.1024E+02
- MIN_TIME_RESOLUTION, same as time resolution
- MAX_TIME_RESOLUTION, same as time resolution
- DATASET_CAVEATS =
  ""*C1_CQ_STA_CS_NBR_CAVEATS"
  "*C1_CQ_STA_CALIBRATION_CAVEATS"
  "*C1_CQ_STA_NOTSRP_CAVEATS"
  Data are filtered at 0.6Hz. All data below this value are not relevant and must not be used.
  DATASET VERSION HISTORY
  Version 04 : The 10% error is corrected (new transfer function - Nov 2011). Onboard calibration data are removed. When there is no Sun pulse, there is now a fill value in the data.
  All versions inferior to 4: the transfer function of S/C #1 has 10% of error with all the other spacecraft up to 7Hz.
  Version 03 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). The data were time tagged using TED version 2.5.0 with option TCOR active(provided by the Sheffield DWP Group). Complex_Spectrum__C1_CP_STA_CS_NBR SI_CONVERSION has been corrected.
  Version 02 :
  Complex_Spectrum__C1_CP_STA_CS_NBR unit has been corrected. Warning: the corresponding SI_CONVERSION was set to 1.E9 instead of 1.E-9. Older versions should not be used !
  Version 01 : Obsolete. Should not be used !"

Then, the metadata for the **Support variables** are:

&Time_tags__C1_CP_STA_CS_NBR which the ISO time of data acquisition (Universal Time):

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME

- SIGNIFICANT_DIGITS = 27
- FILLVAL = 9999-12-31T23:59:59.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"

&Frequency represents the 128 frequency bin centres regularly spaces expressed in Hz. The zero frequency is not significant. The frequency resolution is 0.1024E+02:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency Bin"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 128
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -0.1000E+31
- FIELDNAM = "Frequency"
- LABLAXIS = "F"
- SCALETYP = "Linear"
- DATA = 0.0000E+00, 0.9766E-01, 0.1953E+00, 0.2930E+00,
  0.3906E+00, 0.4883E+00, 0.5860E+00, 0.6836E+00,
  0.7813E+00, 0.8789E+00, 0.9766E+00, 0.1074E+01,
  0.1172E+01, 0.1270E+01, 0.1367E+01, 0.1465E+01,
  0.1563E+01, 0.1660E+01, 0.1758E+01, 0.1856E+01,
  0.1953E+01, 0.2051E+01, 0.2148E+01, 0.2246E+01,
  0.2344E+01, 0.2441E+01, 0.2539E+01, 0.2637E+01,
  0.2734E+01, 0.2832E+01, 0.2930E+01, 0.3027E+01,
  0.3125E+01, 0.3223E+01, 0.3320E+01, 0.3418E+01,
  0.3516E+01, 0.3613E+01, 0.3711E+01, 0.3809E+01,
  0.3906E+01, 0.4004E+01, 0.4102E+01, 0.4199E+01,
  0.4297E+01, 0.4395E+01, 0.4492E+01, 0.4590E+01,
  0.4688E+01, 0.4785E+01, 0.4883E+01, 0.4981E+01,
  0.5078E+01, 0.5176E+01, 0.5274E+01, 0.5371E+01,
  0.5469E+01, 0.5567E+01, 0.5664E+01, 0.5762E+01,
  0.5860E+01, 0.5957E+01, 0.6055E+01, 0.6152E+01,
  0.6250E+01, 0.6348E+01, 0.6445E+01, 0.6543E+01,
  0.6641E+01, 0.6738E+01, 0.6836E+01, 0.6934E+01,
  0.7031E+01, 0.7129E+01, 0.7227E+01, 0.7324E+01,
  0.7422E+01, 0.7520E+01, 0.7617E+01, 0.7715E+01,
  0.7813E+01, 0.7910E+01, 0.8008E+01, 0.8106E+01,
  0.8203E+01, 0.8301E+01, 0.8399E+01, 0.8496E+01,
  0.8594E+01, 0.8692E+01, 0.8789E+01, 0.8887E+01,
  0.8985E+01, 0.9082E+01, 0.9180E+01, 0.9278E+01,
  0.9375E+01, 0.9473E+01, 0.9571E+01, 0.9668E+01,
  0.9766E+01, 0.9863E+01, 0.9961E+01, 0.1006E+02,
  0.1016E+02, 0.1025E+02, 0.1035E+02, 0.1045E+02,
  0.1055E+02, 0.1064E+02, 0.1074E+02, 0.1084E+02,
  0.1094E+02, 0.1104E+02, 0.1113E+02, 0.1123E+02,
  0.1133E+02, 0.1143E+02, 0.1152E+02, 0.1162E+02,

0.1172E+02, 0.1182E+02, 0.1191E+02, 0.1201E+02,
0.1211E+02, 0.1221E+02, 0.1230E+02, 0.1240E+02

Data themselves:

&Complex_spectrum__C1_CP_STA_CS_NBR variable stores the components of the Magnetic Field Complex Spectrum.

- PARENT_DATASET_ID = "C1_CP_STA_CS_NBR"
- PARAMETER_TYPE = "Data"
- CATDESK = “Components of the Magnetic Field Complex Spectrum”
- ENTITY = "Magnetic_Field"
- PROPERTY = "Vector"
- UNITS = "nT"
- SI_CONVERSION = "1.E-9>T"
- TENSOR_ORDER = 1
- COORDINATE_SYSTEM = "GSE"
- FRAME = "GSE>xyz"
- TENSOR_FRAME = "GSE"
- SIZES = 128,2,3 ! 128 frequency bins x 2 (Re.+Im.) parts
- DEPEND_0 = Time__C1_CP_STA_CS_NBR
- DEPEND_1 = Frequency__C1_CP_STA_CS_NBR
- LABEL_2 = "Re","Im"
- REPRESENTATION_3 = "x","y","z"
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -0.1000E+31
- QUALITY = 0
- FIELDNAM = "Magnetic Field Complex Spectrum"
- LABLAXIS = "Magnetic Field Complex Spectrum"

3.3.7.2 HBR mode

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_CS_HBR.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

Example of the **global metadata** keywords for C1_CP_STA_CS_HBR are:

- DATASET_ID="C1_CP_STA_CS_HBR"
- DATA_TYPE = "CP"
- DATASET_TITLE = "Magnetic Field Spectra in GSE (burst; up to 225 Hz)"
- CONTACT_COORDINATES =
  "Patrick CANU>PI>Patrick.Canu@lpp.polytechnique.fr"
  "Nicole CORNILLEAU-WEHRLIN>Deputy-PI>
  Nicole.Cornilleau@lpp.polytechnique.fr"
- DATASET_DESCRIPTION = " This dataset contains calibrated Complex Spectra (CS) of the magnetic field measured by STAFF-SC from 0.00Hz to 224.90Hz with a resolution of 0.109866Hz x 9.10s in HBR mode on the Cluster

C1 spacecraft. This product is given in Geocentric Solar Ecliptic (GSE) coordinate system."

- PROCESSING_LEVEL = "Calibrated"
- TIME_RESOLUTION = 0.9102E+01
- MIN_TIME_RESOLUTION, same as time resolution
- MAX_TIME_RESOLUTION, same as time resolution
- DATASET_CAVEATS = " *C1_CQ_STA_CS_HBR_CAVEATS. DATASET VERSION HISTORY. All versions: the transfer function of S/C #1 has 10% of error with all the other spacecraft up to 7Hz. Version 03: All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). The data were time tagged using TED version 2.5.0 with option TCOR active (provided by the Sheffield DWP Group). Complex_Spectrum__C1_CP_STA_CS_NBR SI_CONVERSION has been corrected. Version 02: Complex_Spectrum__C1_CP_STA_CS_NBR unit has been corrected. Warning: the corresponding SI_CONVERSION was set to 1.E9 instead of 1.E-9. Older versions should not be used ! Version 01 : Obsolete. Should not be used !"

Then, the metadata for the **Support variables** are:

&Time_tags__C1/C2/C3/C4_CP_STA_CS_HBR which the ISO time of data acquisition (Universal Time):

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME
- SIGNIFICANT_DIGITS = 27
- FILLVAL = 9999-12-31T23:59:59.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"

&Frequency represents the 128 frequency bin centres regularly spaces expressed in Hz. The zero frequency is not significant. The frequency resolution is 0.1024E+02:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency Bin"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 128
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -0.1000E+31
- FIELDNAM = "Frequency"
- LABLAXIS = "F"
- SCALETYP = "Linear"
- DATA = 0.0000E+00, 0.1099E+00, 0.2197E+00, 0.3296E+00, \
  0.4395E+00, 0.5493E+00, 0.6592E+00, 0.7691E+00, \

0.8789E+00, 0.9888E+00, 0.1099E+01, 0.1209E+01, \
0.1318E+01, 0.1428E+01, 0.1538E+01, 0.1648E+01, \
0.1758E+01, 0.1868E+01, 0.1978E+01, 0.2087E+01, \
0.2197E+01, 0.2307E+01, 0.2417E+01, 0.2527E+01, \
0.2637E+01, 0.2747E+01, 0.2857E+01, 0.2966E+01, \
0.3076E+01, 0.3186E+01, 0.3296E+01, 0.3406E+01, \
0.3516E+01, 0.3626E+01, 0.3735E+01, 0.3845E+01, \
0.3955E+01, 0.4065E+01, 0.4175E+01, 0.4285E+01, \
0.4395E+01, 0.4505E+01, 0.4614E+01, 0.4724E+01, \
0.4834E+01, 0.4944E+01, 0.5054E+01, 0.5164E+01, \
0.5274E+01, 0.5383E+01, 0.5493E+01, 0.5603E+01, \
0.5713E+01, 0.5823E+01, 0.5933E+01, 0.6043E+01, \
0.6152E+01, 0.6262E+01, 0.6372E+01, 0.6482E+01, \
0.6592E+01, 0.6702E+01, 0.6812E+01, 0.6922E+01, \
0.7031E+01, 0.7141E+01, 0.7251E+01, 0.7361E+01, \
0.7471E+01, 0.7581E+01, 0.7691E+01, 0.7800E+01, \
0.7910E+01, 0.8020E+01, 0.8130E+01, 0.8240E+01, \
0.8350E+01, 0.8460E+01, 0.8570E+01, 0.8679E+01, \
0.8789E+01, 0.8899E+01, 0.9009E+01, 0.9119E+01, \
0.9229E+01, 0.9339E+01, 0.9448E+01, 0.9558E+01, \
0.9668E+01, 0.9778E+01, 0.9888E+01, 0.9998E+01, \
0.1011E+02, 0.1022E+02, 0.1033E+02, 0.1044E+02, \
0.1055E+02, 0.1066E+02, 0.1077E+02, 0.1088E+02, \
0.1099E+02, 0.1110E+02, 0.1121E+02, 0.1132E+02, \
0.1143E+02, 0.1154E+02, 0.1165E+02, 0.1176E+02, \
0.1187E+02, 0.1198E+02, 0.1209E+02, 0.1220E+02, \
0.1230E+02, 0.1241E+02, 0.1252E+02, 0.1263E+02, \
0.1274E+02, 0.1285E+02, 0.1296E+02, 0.1307E+02, \
0.1318E+02, 0.1329E+02, 0.1340E+02, 0.1351E+02, \
0.1362E+02, 0.1373E+02, 0.1384E+02, 0.1395E+02, \
0.1406E+02, 0.1417E+02, 0.1428E+02, 0.1439E+02, \
0.1450E+02, 0.1461E+02, 0.1472E+02, 0.1483E+02, \
0.1494E+02, 0.1505E+02, 0.1516E+02, 0.1527E+02, \
0.1538E+02, 0.1549E+02, 0.1560E+02, 0.1571E+02, \
...

Data themselves:

&Complex_spectrum__C1_CP_STA_CS_HBR variable stores the components of the Magnetic Field Complex Spectrum.

- PARENT_DATASET_ID = "C1_CP_STA_CS_HBR"
- PARAMETER_TYPE = "Data"
- CATDESK = “Components of the Magnetic Field Complex Spectrum”
- ENTITY = "Magnetic_Field"
- PROPERTY = "Vector"
- UNITS = "nT"
- SI_CONVERSION = "1.E-9>T"
- TENSOR_ORDER = 1

- COORDINATE_SYSTEM = "GSE"
- FRAME = "GSE>xyz"
- TENSOR_FRAME = "GSE"
- SIZES = 2048,2,3 ! 128 frequency bins x 2 (Re.+Im.) parts
- DEPEND_0 = Time__C1_CP_STA_CS_HBR
- DEPEND_1 = Frequency__C1_CP_STA_CS_HBR
- LABEL_2 = "Re","Im"
- REPRESENTATION_3 = "x","y","z"
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -0.1000E+31
- QUALITY = 0
- FIELDNAM = "Magnetic Field Complex Spectrum"
- LABLAXIS = "Magnetic Field Complex Spectrum"

3.3.8 File Metadata Specification

3.3.8.1 NBR mode

Each file contains the following **file metadata** keywords (example is shown for a full day file on 1 October 2001):

- FILE_NAME = C1_CP_STA_CS_NBR__20011001_V03.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"
- FILE_TYPE = "cef"
- DATASET_VERSION = "03"
- LOGICAL_FILE_ID = "C1_CP_STA_CS_ NBR__20011001_V03"
- VERSION_NUMBER = "03"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- GENERATION_DATE = 2008-11-21T20:00:08.000Z
- FILE_TIME_SPAN = 2001-10-01T00:00:00.000Z/2001-04-15T23:59:59.999Z
- FILE_CAVEATS = "Produced using software version RCL 0.7.9 26/06/2009."

3.3.8.2 HBR mode

Each file contains the following **file metadata** keywords (example is shown for a full day file on 1 October 2001):

- FILE_NAME = C1_CP_STA_CS_HBR__20011001_V03.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"
- FILE_TYPE = "cef"
- DATASET_VERSION = "03"
- LOGICAL_FILE_ID = "C1_CP_STA_CS_HBR__20011001_V03"
- VERSION_NUMBER = "03"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- GENERATION_DATE = 2008-11-21T20:00:08.000Z

- FILE_TIME_SPAN = 2001-10-01T00:00:00.000Z/2001-04-15T23:59:59.999Z
- FILE_CAVEATS = "Produced using software version RCL 0.7.9 26/06/2009."

3.3.9 Dataset header example

3.3.9.1 NBR mode

Example: C1_CH_STA_CS_NBR.ceh

```
! CEH VALIDATION  26 Nov 2009 by LPP, V03 (CB/VB)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_CS_NBR"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Spectra in GSE (up to 12.5 Hz)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Nicole Cornilleau-Wehrlin>PI>Nicole.Cornilleau@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains calibrated Complex Spectra (CS)"
   ENTRY = "of the magnetic field measured by STAFF-SC"
   ENTRY = "from 0.00Hz to 12.40Hz"
   ENTRY = "with a resolution of 0.097659Hz x 10.24s,"
   ENTRY = "in NBR mode on the Cluster C1 spacecraft."
   ENTRY = "This product is given in Geocentric Solar Ecliptic (GSE)"
   ENTRY = "coordinate system."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.1024E+02
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.1024E+02
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.1024E+02
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_CS_NBR_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "All versions: the transfer function of S/C #1 has 10% of error"
   ENTRY = "with all the other spacecraft up to 7Hz."
   ENTRY = "Version 03 : All the headers have been updated (laboratory name "
   ENTRY = "and email). Introduction of a new header file (Dataset). "
   ENTRY = "The data were time tagged using TED version 2.5.0 with"
   ENTRY = "option TCOR active(provided by the Sheffield DWP Group)."
   ENTRY = "Complex_Spectrum__C1_CP_STA_CS_NBR SI_CONVERSION has been corrected."
   ENTRY = "Version 02 : "
   ENTRY = "Complex_Spectrum__C1_CP_STA_CS_NBR unit has been corrected."
   ENTRY = "Warning: the corresponding SI_CONVERSION was set to 1.E9 instead of 1.E-9."
```

```
   ENTRY=  "Older versions should not be used !"
   ENTRY = "Version 01 : Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_CS_NBR
   PARENT_DATASET_ID  = "C1_CP_STA_CS_NBR"
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Time tag"
   UNITS              = "s"
SI_CONVERSION      = "1.0>s"
   SIZES              = 1
DELTA_PLUS         = 0.1024E+02
DELTA_MINUS        = 0.0000E+00
VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 27
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
END_VARIABLE = Time__C1_CP_STA_CS_NBR
!
START_VARIABLE = Frequency__C1_CP_STA_CS_NBR
   PARENT_DATASET_ID  = "C1_CP_STA_CS_NBR"
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency Bin"
   UNITS              = "Hz"
SI_CONVERSION      = "1.0>Hz"
   SIZES              = 128
DELTA_PLUS         = 0.4883E-01
DELTA_MINUS        = 0.4883E-01
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -0.1000E+31
   FIELDNAM           = "Frequency"
LABLAXIS           = "F"
   SCALETYP           = "Linear"
   DATA               = 0.0000E+00, 0.9766E-01, 0.1953E+00, 0.2930E+00, \
                        0.3906E+00, 0.4883E+00, 0.5860E+00, 0.6836E+00, \
                        0.7813E+00, 0.8789E+00, 0.9766E+00, 0.1074E+01, \
                        0.1172E+01, 0.1270E+01, 0.1367E+01, 0.1465E+01, \
                        0.1563E+01, 0.1660E+01, 0.1758E+01, 0.1856E+01, \
                        0.1953E+01, 0.2051E+01, 0.2148E+01, 0.2246E+01, \
                        0.2344E+01, 0.2441E+01, 0.2539E+01, 0.2637E+01, \
                        0.2734E+01, 0.2832E+01, 0.2930E+01, 0.3027E+01, \
                        0.3125E+01, 0.3223E+01, 0.3320E+01, 0.3418E+01, \
                        0.3516E+01, 0.3613E+01, 0.3711E+01, 0.3809E+01, \
                        0.3906E+01, 0.4004E+01, 0.4102E+01, 0.4199E+01, \
                        0.4297E+01, 0.4395E+01, 0.4492E+01, 0.4590E+01, \
                        0.4688E+01, 0.4785E+01, 0.4883E+01, 0.4981E+01, \
                        0.5078E+01, 0.5176E+01, 0.5274E+01, 0.5371E+01, \
                        0.5469E+01, 0.5567E+01, 0.5664E+01, 0.5762E+01, \
                        0.5860E+01, 0.5957E+01, 0.6055E+01, 0.6152E+01, \
                        0.6250E+01, 0.6348E+01, 0.6445E+01, 0.6543E+01, \
                        0.6641E+01, 0.6738E+01, 0.6836E+01, 0.6934E+01, \
                        0.7031E+01, 0.7129E+01, 0.7227E+01, 0.7324E+01, \
                        0.7422E+01, 0.7520E+01, 0.7617E+01, 0.7715E+01, \
                        0.7813E+01, 0.7910E+01, 0.8008E+01, 0.8106E+01, \
                        0.8203E+01, 0.8301E+01, 0.8399E+01, 0.8496E+01, \
                        0.8594E+01, 0.8692E+01, 0.8789E+01, 0.8887E+01, \
                        0.8985E+01, 0.9082E+01, 0.9180E+01, 0.9278E+01, \
                        0.9375E+01, 0.9473E+01, 0.9571E+01, 0.9668E+01, \
                        0.9766E+01, 0.9864E+01, 0.9961E+01, 0.1006E+02, \
                        0.1016E+02, 0.1025E+02, 0.1035E+02, 0.1045E+02, \
                        0.1055E+02, 0.1064E+02, 0.1074E+02, 0.1084E+02, \
                        0.1094E+02, 0.1104E+02, 0.1113E+02, 0.1123E+02, \
                        0.1133E+02, 0.1143E+02, 0.1152E+02, 0.1162E+02, \
                        0.1172E+02, 0.1182E+02, 0.1191E+02, 0.1201E+02, \
0.1211E+02, 0.1221E+02, 0.1230E+02, 0.1240E+02
END_VARIABLE = Frequency__C1_CP_STA_CS_NBR
!
START_VARIABLE = Complex_Spectrum__C1_CP_STA_CS_NBR
```

```
   PARENT_DATASET_ID  = "C1_CP_STA_CS_NBR"
   PARAMETER_TYPE     = "Data"
   CATDESC            = "Components of the Magnetic Field Complex Spectrum"
   ENTITY             = "Magnetic_Field"
   PROPERTY           = "Vector"
UNITS              = "nT"
   SI_CONVERSION      = "1.E-9>T"
TENSOR_ORDER       = 1
   COORDINATE_SYSTEM  = "GSE"
   FRAME              = "GSE>xyz"
   TENSOR_FRAME       = "GSE"
   SIZES              = 128,2,3 ! 128 frequencies x 2 (Re.+Im.) parts vector
   DEPEND_0           = Time__C1_CP_STA_CS_NBR
   DEPEND_1           = Frequency__C1_CP_STA_CS_NBR
   LABEL_2            = "Re","Im"
   REPRESENTATION_3   = "x","y","z"
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -0.1000E+31
   QUALITY            = 0
   FIELDNAM           = "Magnetic Field Complex Spectrum"
   LABLAXIS           = "Magnetic Field Complex Spectrum"
END_VARIABLE = Complex_Spectrum__C1_CP_STA_CS_NBR
```

3.3.9.2 HBR mode

Example: C1_CH_STA_CS_HBR.ceh

```
!CEH VALIDATION 09 May 2012 by LPP, header V04, (RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_CS_HBR"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Magnetic Field Spectra in GSE (burst; up to 225 Hz)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains calibrated Complex Spectra (CS)"
   ENTRY = "of the magnetic field measured by STAFF-SC"
   ENTRY = "from 0.00Hz to 224.90Hz"
   ENTRY = "with a resolution of 0.109866Hz x 9.10s,"
   ENTRY = "in HBR mode on the Cluster C1 spacecraft."
   ENTRY = "This product is given in Geocentric Solar Ecliptic (GSE)"
   ENTRY = "coordinate system."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.9102E+01
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.9102E+01
END_META = MIN_TIME_RESOLUTION
```

```
!
START_META = MAX_TIME_RESOLUTION
   VALUE_TYPE = FLOAT
   ENTRY =  0.9102E+01
END_META = MAX_TIME_RESOLUTION
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_CS_HBR_CAVEATS"
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "DATASET VERSION HISTORY"
   ENTRY = "All versions: the transfer function of S/C #1 has 10% of error"
   ENTRY = "with all the other spacecraft up to 7Hz."
   ENTRY = "Version 03 : All the headers have been updated (laboratory name "
   ENTRY = "and email). Introduction of a new header file (Dataset). "
   ENTRY = "The data were time tagged using TED version 2.5.0 with"
   ENTRY = "option TCOR active(provided by the Sheffield DWP Group)."
   ENTRY = "Complex_Spectrum__C1_CP_STA_CS_NBR SI_CONVERSION has been corrected."
   ENTRY = "Version 02 : "
   ENTRY = "Complex_Spectrum__C1_CP_STA_CS_NBR unit has been corrected."
   ENTRY = "Warning: the corresponding SI_CONVERSION was set to 1.E9 instead of 1.E-9."
   ENTRY=  "Older versions should not be used !"
   ENTRY = "Version 01 : Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_CS_HBR
   PARENT_DATASET_ID  = "C1_CP_STA_CS_HBR"
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Time tag"
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   DELTA_PLUS         = 0.9102E+01
   DELTA_MINUS        = 0.0000E+00
   VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 27
   FILLVAL            = 9999-12-31T23:59:59.999999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
END_VARIABLE = Time__C1_CP_STA_CS_HBR
!
START_VARIABLE = Frequency__C1_CP_STA_CS_HBR
   PARENT_DATASET_ID  = "C1_CP_STA_CS_HBR"
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency Bin"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 2048
   DELTA_PLUS         = 0.5493E-01
   DELTA_MINUS        = 0.5493E-01
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -0.1000E+31
   FIELDNAM           = "Frequency"
   LABLAXIS           = "F"
   SCALETYP           = "Linear"
   DATA               = 0.0000E+00, 0.1099E+00, 0.2197E+00, 0.3296E+00, \
                        0.4395E+00, 0.5493E+00, 0.6592E+00, 0.7691E+00, \
                        0.8789E+00, 0.9888E+00, 0.1099E+01, 0.1209E+01, \
                        0.1318E+01, 0.1428E+01, 0.1538E+01, 0.1648E+01, \
                        0.1758E+01, 0.1868E+01, 0.1978E+01, 0.2087E+01, \
                        0.2197E+01, 0.2307E+01, 0.2417E+01, 0.2527E+01, \
                        0.2637E+01, 0.2747E+01, 0.2857E+01, 0.2966E+01, \
                        0.3076E+01, 0.3186E+01, 0.3296E+01, 0.3406E+01, \
                        0.3516E+01, 0.3626E+01, 0.3735E+01, 0.3845E+01, \
                        0.3955E+01, 0.4065E+01, 0.4175E+01, 0.4285E+01, \
                        0.4395E+01, 0.4505E+01, 0.4614E+01, 0.4724E+01, \
                        0.4834E+01, 0.4944E+01, 0.5054E+01, 0.5164E+01, \
                        0.5274E+01, 0.5383E+01, 0.5493E+01, 0.5603E+01, \
                        0.5713E+01, 0.5823E+01, 0.5933E+01, 0.6043E+01, \
                        0.6152E+01, 0.6262E+01, 0.6372E+01, 0.6482E+01, \
```

```
                        0.6592E+01, 0.6702E+01, 0.6812E+01, 0.6922E+01, \
                        …
                        0.2215E+03, 0.2216E+03, 0.2217E+03, 0.2218E+03, \
                        0.2219E+03, 0.2220E+03, 0.2221E+03, 0.2223E+03, \
                        0.2224E+03, 0.2225E+03, 0.2226E+03, 0.2227E+03, \
                        0.2228E+03, 0.2229E+03, 0.2230E+03, 0.2231E+03, \
                        0.2232E+03, 0.2234E+03, 0.2235E+03, 0.2236E+03, \
                        0.2237E+03, 0.2238E+03, 0.2239E+03, 0.2240E+03, \
                        0.2241E+03, 0.2242E+03, 0.2243E+03, 0.2245E+03, \
                        0.2246E+03, 0.2247E+03, 0.2248E+03, 0.2249E+03
END_VARIABLE = Frequency__C1_CP_STA_CS_HBR
!
START_VARIABLE = Complex_Spectrum__C1_CP_STA_CS_HBR
   PARENT_DATASET_ID  = "C1_CP_STA_CS_HBR"
   PARAMETER_TYPE     = "Data"
   CATDESC            = "Components of the Magnetic Field Complex Spectrum"
   ENTITY             = "Magnetic_Field"
   PROPERTY           = "Vector"
   UNITS              = "nT"
   SI_CONVERSION      = "1.E-9>T"
   TENSOR_ORDER       = 1
   COORDINATE_SYSTEM  = "GSE"
   FRAME              = "GSE>xyz"
   TENSOR_FRAME       = "GSE"
   SIZES              = 2048,2,3 ! 2048 frequencies x 2 (Re.+Im.) parts vector
   DEPEND_0           = Time__C1_CP_STA_CS_HBR
   DEPEND_1           = Frequency__C1_CP_STA_CS_HBR
   LABEL_2            = "Re","Im"
   REPRESENTATION_3   = "x","y","z"
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -0.1000E+31
   QUALITY            = 0
   FIELDNAM           = "Magnetic Field Complex Spectrum"
   LABLAXIS           = "Magnetic Field Complex Spectrum"
END_VARIABLE = Complex_Spectrum__C1_CP_STA_CS_HBR
```

3.3.10 Dataset file example

3.3.10.1 NBR mode

Version 03 : C1_CP_STA_CS_NBR__20060101_V03.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_CS_NBR__20060101_V03.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                            Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh   ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_CS_NBR.ceh   ! Dataset level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "03"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_CS_NBR__20060101_V03"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "03"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2006-01-01T00:00:00.000Z/2006-01-01T23:59:59.999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2009-11-06T13:53:04.000Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Produced using software version RCL 0.7.9 26/06/2009"
END_META = FILE_CAVEATS
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                     Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL= EOF
```

```
!
2006-01-01T00:00:00.003880Z,
 0.2063E-02,  0.0000E+00,  0.3078E-03,  0.0000E+00, -0.9845E-03,  0.0000E+00,
-0.4645E-02,  0.1486E-01, -0.6299E-03,  0.2260E-01, -0.4392E-03,  0.2697E-04,
-0.1045E-01, -0.5106E-03, -0.4664E-02,  0.1668E-01,  0.3430E-02, -0.8035E-02,
-0.4060E-02,  0.5693E-02,  0.5294E-02,  0.3914E-02,  0.2893E-02, -0.1026E-01,
-0.9962E-02, -0.2314E-02,  0.1415E-02, -0.8809E-02,  0.2561E-02,  0.1034E-01,
 0.1580E-01,  0.3381E-02,  0.3289E-02,  0.9497E-02,  0.1485E-02,  0.3441E-02,
 0.4218E-02,  0.1316E-01, -0.1189E-01,  0.2543E-02, -0.8292E-02, -0.2074E-02,
 0.9487E-02, -0.5410E-02,  0.8733E-03,  0.2584E-02, -0.3714E-02,  0.6517E-02,
-0.7152E-03, -0.2295E-02,  0.1605E-02,  0.7264E-04,  0.2318E-02, -0.6418E-02,
-0.5937E-02, -0.2451E-02,  0.3844E-02, -0.4186E-02,  0.7393E-04,  0.4084E-02,
 0.5177E-02,  0.2654E-02,  0.1776E-03,  0.3426E-02,  0.1500E-02, -0.6400E-04,
-0.1242E-03,  0.8116E-03,  0.2876E-04, -0.2541E-02, -0.8245E-03, -0.1721E-02,
 0.8735E-03, -0.1741E-02, -0.1083E-02,  0.7435E-03,  0.1785E-03,  0.1964E-02,
-0.2419E-02,  0.1714E-02, -0.3588E-03, -0.3401E-02,  0.1190E-02, -0.2958E-02,
 0.6563E-03, -0.1900E-02,  0.7925E-03,  0.1578E-02, -0.8310E-03,  0.1494E-02,
 0.9096E-03, -0.2995E-03,  0.7615E-03,  0.1731E-02, -0.5387E-04, -0.1375E-02,
-0.2291E-02,  0.3448E-03,  0.4417E-03, -0.8647E-03, -0.1218E-02, -0.1550E-03,
 0.6157E-03,  0.6974E-03,  0.4092E-03,  0.9139E-03,  0.1018E-02,  0.4613E-03,
 0.2645E-03,  0.9881E-03, -0.1862E-02, -0.1195E-04, -0.2240E-03, -0.9472E-03,
-0.8376E-03, -0.5796E-03,  0.7203E-03, -0.1603E-02, -0.6075E-03,  0.6301E-03,
 0.2533E-04,  0.2209E-04, -0.8560E-03,  0.5226E-03,  0.1081E-02, -0.2704E-03,
 0.9928E-03, -0.6617E-03,  0.2773E-04,  0.2151E-03, -0.1698E-02,  0.5259E-03,
-0.1136E-02,  0.4059E-03,  0.2979E-03, -0.5315E-03,  0.8745E-03,  0.5992E-03,
 0.4040E-03,  0.6789E-03, -0.5050E-03, -0.2757E-03,  0.4227E-03, -0.6081E-03,
 0.2924E-03, -0.3360E-03, -0.3411E-03,  0.3305E-03,  0.1548E-03,  0.1164E-05,
 0.6834E-03, -0.6305E-03,  0.7404E-03,  0.1394E-02,  0.3542E-03, -0.1622E-03,
 0.6417E-03,  0.2637E-03,  0.8060E-03, -0.1788E-03, -0.1327E-03,  0.3543E-03,
 0.9107E-03,  0.1592E-03, -0.8197E-03, -0.2991E-03,  0.3341E-03, -0.1105E-03,
 0.4229E-03,  0.4498E-03,  0.1196E-03, -0.2537E-03, -0.9413E-03, -0.4298E-03,
-0.4944E-03, -0.8967E-03,  0.1124E-03, -0.1687E-03, -0.5880E-03,  0.4774E-03,
-0.4102E-03,  0.3688E-03,  0.1560E-02,  0.1710E-03,  0.4571E-03, -0.8744E-03,
-0.2793E-03,  0.6403E-04, -0.8826E-03, -0.7828E-03, -0.4629E-03, -0.2197E-04,
 0.1097E-02, -0.6676E-04, -0.3779E-03,  0.9761E-03, -0.1184E-03, -0.4554E-03,
-0.1082E-02, -0.3064E-03, -0.1457E-04, -0.1058E-02,  0.2411E-03,  0.1836E-03,
-0.6735E-03, -0.1978E-03, -0.1012E-03, -0.1728E-03,  0.2831E-03,  0.4975E-03,
-0.4486E-03, -0.9074E-05, -0.4425E-03,  0.2059E-03,  0.2628E-03,  0.3966E-04,
 0.2107E-03, -0.6676E-04,  0.3024E-05, -0.1780E-03, -0.1394E-03,  0.4635E-03,
-0.6412E-03, -0.1887E-03, -0.2983E-03,  0.7758E-03,  0.3826E-03, -0.1083E-03,
 0.8616E-03,  0.1605E-03,  0.5191E-04,  0.7963E-04, -0.5445E-03,  0.4745E-03,
 0.2059E-03,  0.6699E-03,  0.5467E-03, -0.2810E-03,  0.4206E-03,  0.5340E-03,
-0.5783E-04,  0.1530E-03, -0.6948E-04,  0.3699E-03, -0.4570E-03, -0.1171E-02,
 0.5682E-03, -0.3468E-03, -0.3207E-03, -0.9958E-04,  0.7903E-04,  0.3005E-03,
 0.1259E-03,  0.1049E-03,  0.4388E-03, -0.9741E-04, -0.4602E-04, -0.3208E-03,
-0.2158E-04,  0.3005E-03,  0.1367E-03,  0.1710E-04, -0.1862E-03, -0.1204E-03,
-0.9058E-04, -0.7525E-03,  0.3708E-03, -0.4808E-03,  0.1455E-03, -0.3561E-04,
 0.8426E-04,  0.2580E-03, -0.6007E-04,  0.6040E-04,  0.9608E-04, -0.1891E-04,
-0.4198E-03, -0.1867E-03, -0.2447E-03, -0.1797E-03, -0.5785E-03, -0.1742E-03,
-0.4573E-04, -0.1715E-05,  0.4301E-03,  0.5469E-05,  0.5303E-03, -0.8688E-04,
 0.6497E-04,  0.8145E-04, -0.6644E-03,  0.3335E-03, -0.3215E-03,  0.3925E-04,
-0.4316E-03, -0.1609E-03,  0.9597E-04, -0.1614E-03,  0.3310E-03,  0.4649E-04,
-0.5902E-04, -0.3637E-03,  0.1192E-03,  0.4485E-03, -0.1761E-03,  0.4503E-03,
 0.3779E-03,  0.1801E-03, -0.7963E-04, -0.4135E-04,  0.5599E-04,  0.1072E-03,
-0.1089E-03,  0.2441E-03, -0.5840E-04, -0.3566E-03,  0.1185E-03, -0.3952E-03,
 0.5763E-03, -0.1873E-03,  0.2648E-03,  0.8662E-04, -0.2169E-03,  0.1035E-03,
-0.4632E-04,  0.1678E-03, -0.7276E-04,  0.1013E-03,  0.2871E-03, -0.8757E-04,
-0.3204E-04, -0.2325E-04,  0.2912E-03, -0.3689E-04,  0.1388E-03, -0.1793E-03,
-0.8953E-04,  0.7987E-04, -0.2097E-03,  0.4127E-04, -0.1025E-03,  0.2197E-03,
 0.4810E-04,  0.3039E-03, -0.4189E-04, -0.8668E-04, -0.4738E-03,  0.3471E-03,
-0.1388E-03, -0.9822E-04, -0.8902E-04,  0.1216E-03, -0.7893E-05, -0.1586E-03,
-0.1885E-03, -0.5073E-04, -0.4087E-05, -0.5800E-03, -0.4751E-04,  0.1268E-03,
 0.3338E-03, -0.3226E-03,  0.1040E-03,  0.7668E-04,  0.4456E-04, -0.2045E-03,
 0.1788E-03,  0.6261E-05,  0.1635E-03,  0.2492E-03,  0.1706E-03,  0.3011E-04,
-0.1566E-04,  0.1096E-03, -0.2337E-04,  0.2443E-03, -0.2189E-03,  0.3849E-04,
-0.9956E-04,  0.2014E-04,  0.2098E-03, -0.9331E-04, -0.4300E-04,  0.8838E-04,
-0.3168E-03,  0.3102E-03,  0.5490E-04, -0.1804E-03,  0.2783E-03, -0.1276E-03,
-0.1384E-03, -0.1529E-03, -0.2480E-03, -0.1627E-03, -0.1780E-03,  0.1035E-05,
 0.3066E-03, -0.2918E-03,  0.2076E-03, -0.3168E-03,  0.1654E-03, -0.1983E-03,
 0.1498E-03,  0.3240E-04,  0.2298E-03,  0.2273E-03,  0.2365E-03, -0.9949E-04,
 0.8883E-04, -0.2648E-04, -0.2961E-03, -0.9546E-05, -0.7498E-04, -0.4652E-05,
-0.1309E-03, -0.9703E-04, -0.1955E-03, -0.5580E-04,  0.1161E-03,  0.1446E-03,
 0.2577E-05, -0.6841E-04,  0.1204E-03,  0.2856E-03, -0.3792E-03,  0.1240E-03,
-0.5409E-04,  0.1382E-04, -0.1508E-03, -0.1934E-03, -0.7831E-04,  0.1658E-03,
```

```
 0.1011E-05,  0.2686E-03,  0.6826E-04,  0.1394E-03,  0.1578E-03,  0.5290E-04,
-0.1823E-04,  0.2313E-03, -0.2024E-04, -0.1124E-03,  0.2040E-03, -0.1596E-03,
 0.2683E-03,  0.5947E-04,  0.1394E-04, -0.1106E-05,  0.2115E-04, -0.2767E-03,
-0.1568E-03, -0.1933E-03, -0.4269E-04,  0.1086E-03,  0.1859E-04, -0.1813E-03,
 0.1258E-03,  0.7223E-05, -0.1461E-03, -0.6036E-04, -0.1346E-04,  0.1136E-03,
-0.1766E-03, -0.3456E-03, -0.1113E-04,  0.1730E-03,  0.6598E-04,  0.2373E-03,
 0.1320E-04, -0.1474E-04,  0.9100E-04, -0.3979E-03, -0.1863E-03,  0.1334E-03,
-0.6894E-04,  0.1437E-03,  0.1376E-03,  0.2100E-04, -0.1820E-03,  0.6265E-04,
-0.2098E-04,  0.4103E-04,  0.2585E-03, -0.1725E-03,  0.1967E-04, -0.7575E-04,
 0.2325E-03, -0.1069E-03,  0.6733E-04,  0.1356E-03,  0.1701E-03, -0.5418E-04,
 0.1003E-03,  0.9430E-04, -0.1362E-03,  0.2972E-04,  0.7280E-04, -0.3206E-03,
-0.1307E-03,  0.1157E-03,  0.6809E-04,  0.1486E-03, -0.2310E-03,  0.8839E-04,
-0.1933E-03,  0.2942E-03, -0.1558E-03,  0.2581E-03,  0.8866E-04,  0.6660E-04,
 0.1708E-03, -0.1815E-03,  0.2186E-03,  0.4418E-03, -0.1750E-03, -0.7762E-04,
-0.4750E-04, -0.8858E-04, -0.3206E-04, -0.2968E-03,  0.1703E-03,  0.1405E-03,
 0.1123E-04, -0.2205E-03,  0.2773E-04, -0.3326E-03, -0.9895E-04, -0.1628E-03,
 0.1810E-03, -0.5270E-04, -0.2927E-03, -0.5539E-04,  0.1102E-03,  0.1822E-03,
-0.1112E-03, -0.8185E-04,  0.1746E-03,  0.8708E-04, -0.3209E-04,  0.1751E-03,
-0.2059E-03,  0.6297E-04,  0.4446E-03, -0.1632E-03, -0.2035E-03,  0.9173E-04,
 0.4237E-03,  0.1212E-03, -0.1233E-03, -0.1306E-03,  0.1538E-03,  0.3340E-05,
-0.1359E-03,  0.1030E-03, -0.1245E-03, -0.1546E-03,  0.1168E-03,  0.4285E-05,
-0.2034E-03,  0.6500E-05, -0.2829E-03,  0.1125E-03,  0.5145E-04, -0.2736E-03,
-0.3912E-04, -0.9471E-04, -0.4033E-05, -0.7558E-04, -0.1314E-04, -0.9053E-04,
 0.7422E-04, -0.1106E-03, -0.2480E-03,  0.2198E-03, -0.2592E-04,  0.1706E-03,
 0.1955E-03,  0.2283E-03, -0.7112E-04,  0.4502E-04,  0.9629E-04, -0.5046E-04,
 0.2750E-03,  0.1752E-05,  0.1100E-03, -0.1512E-03,  0.7073E-05, -0.9661E-04,
 0.2762E-03, -0.1589E-03,  0.1327E-03, -0.2366E-03,  0.7073E-04, -0.9566E-04,
-0.4363E-03,  0.1560E-03,  0.3060E-03,  0.2352E-03,  0.2095E-03, -0.6630E-04,
-0.9828E-04, -0.1945E-03,  0.1240E-04,  0.3352E-03, -0.1223E-04,  0.1165E-03,
-0.1529E-03, -0.2794E-03, -0.9257E-04,  0.1148E-04, -0.5414E-03, -0.3558E-03,
-0.5801E-04, -0.3229E-04,  0.2937E-03, -0.9774E-04, -0.2426E-04,  0.3181E-03,
 0.9628E-04,  0.2067E-04,  0.1409E-03,  0.6400E-04, -0.1653E-03,  0.5674E-04,
-0.1490E-03,  0.3405E-03, -0.1138E-03, -0.1998E-03,  0.1173E-03, -0.1428E-03,
 0.5089E-04,  0.9984E-05, -0.6944E-04,  0.9821E-04,  0.5719E-04, -0.6300E-04,
-0.1966E-04, -0.2339E-03, -0.1961E-03, -0.1911E-04,  0.9857E-04,  0.6436E-04,
-0.2430E-04,  0.1464E-03,  0.1260E-03,  0.1791E-05, -0.1041E-03,  0.6754E-04,
 0.1989E-03, -0.1372E-04,  0.2937E-04, -0.1286E-03,  0.9951E-04,  0.1980E-03,
 0.3129E-03,  0.9452E-04,  0.2856E-06, -0.2044E-03,  0.2875E-03,  0.1825E-03,
 0.2939E-04, -0.2019E-03, -0.6493E-04,  0.8343E-04, -0.2602E-03,  0.2323E-03,
-0.1683E-03,  0.6487E-04, -0.8466E-04,  0.4995E-04,  0.5275E-05,  0.2345E-03,
 0.1677E-03,  0.1317E-03,  0.8003E-04,  0.4976E-04, -0.1839E-03, -0.7435E-03,
-0.3177E-03,  0.1465E-03,  0.9977E-04, -0.8990E-04, -0.5701E-04, -0.2700E-03,
-0.1629E-03,  0.4525E-03, -0.3652E-03,  0.1912E-03,  0.9906E-04, -0.9352E-04,
 0.1124E-03, -0.1919E-03,  0.1624E-03, -0.6747E-04, -0.7105E-04,  0.1332E-03,
 0.8319E-04, -0.3543E-03, -0.9886E-04, -0.3746E-03,  0.6577E-04,  0.2173E-04,
-0.9365E-04, -0.3789E-04,  0.1742E-03, -0.1419E-03,  0.1425E-03,  0.4896E-04,
-0.3216E-03, -0.2941E-03,  0.7228E-04,  0.5850E-03,  0.2035E-03,  0.1423E-03,
-0.3671E-04, -0.2829E-03,  0.1542E-03, -0.4616E-04,  0.2047E-03,  0.1772E-03,
 0.1234E-03,  0.1814E-03,  0.5562E-04,  0.1136E-03, -0.2422E-03, -0.6151E-04,
 0.3257E-03,  0.1253E-03,  0.2220E-03, -0.4571E-04, -0.7483E-04,  0.1479E-03,
 0.2365E-03,  0.3411E-03, -0.3296E-03,  0.2428E-03,  0.1150E-03,  0.2934E-03,
 0.1235E-03,  0.4121E-03, -0.2197E-04,  0.2044E-04,  0.1358E-03, -0.8254E-04,
 0.7806E-04,  0.4068E-04, -0.3369E-03,  0.8814E-04, -0.3114E-03, -0.4759E-03,
 0.2727E-03, -0.2912E-03,  0.2716E-03, -0.2089E-03, -0.3600E-03,  0.5737E-04,
-0.2020E-03, -0.1042E-03,  0.1843E-03, -0.5684E-03, -0.1825E-03, -0.5495E-03,
-0.3257E-03, -0.2135E-03, -0.2754E-03, -0.3013E-03,  0.1114E-03,  0.2509E-03 $
!
...
-0.3797E-02,  0.2132E-02,  0.4854E-02, -0.1462E-03,  0.3765E-02,  0.4213E-02,
 0.4394E-03, -0.1436E-02, -0.5116E-02, -0.9623E-02, -0.1245E-02, -0.6084E-02,
 0.1891E-02, -0.4762E-02,  0.3460E-02,  0.5691E-02, -0.5287E-02,  0.9177E-02,
-0.2597E-02,  0.5417E-02,  0.8954E-02, -0.7220E-02,  0.5763E-02, -0.6887E-02,
 0.7509E-02, -0.2908E-02, -0.1269E-01,  0.6101E-02, -0.6627E-02,  0.4308E-02 $
!
```

3.3.10.2 HBR mode

Ex: C1_CP_STA_CS_HBR__20060103_V03.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_CS_HBR__20060103_V03.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                              Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C1 CH STA SC.ceh   ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_CS_HBR.ceh   ! Dataset level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "03"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_CS_HBR__20060103_V03"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "03"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2006-01-03T00:00:00.000Z/2006-01-03T23:59:59.999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2009-11-06T14:58:55.000Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Produced using software version RCL 0.7.9 26/06/2009"
END_META = FILE_CAVEATS
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                        Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL= EOF
!
2006-01-03T07:15:59.177646Z,
```

```
 0.2004E-02,  0.0000E+00,  0.2904E-01,  0.0000E+00, -0.4946E-02,  0.0000E+00,
-0.3398E-01,  0.2963E+00, -0.2467E+00,  0.8111E-01,  0.2498E-01, -0.1747E-02,
-0.5983E-02, -0.3333E-01,  0.9912E-01,  0.1708E-01,  0.5155E-02,  0.2111E-02,
 0.4735E-01,  0.2439E-01, -0.6446E-02,  0.2219E-01, -0.7050E-02, -0.6132E-02,
 0.5605E-02, -0.1612E-01, -0.3635E-02,  0.7257E-02, -0.2779E-02, -0.6205E-03,
-0.2159E-01, -0.1789E-01,  0.9097E-02, -0.6448E-02, -0.4090E-02,  0.8858E-03,
 0.1919E-03, -0.2898E-01,  0.3750E-01,  0.4822E-02, -0.4654E-03, -0.6417E-03,
 0.8904E-02, -0.1825E-01,  0.2937E-01,  0.3332E-02, -0.3964E-03,  0.3064E-02,
-0.8196E-03, -0.1477E-01,  0.1759E-01, -0.3178E-02, -0.3770E-02,  0.7196E-03,
-0.2254E-02, -0.1768E-01,  0.1966E-01, -0.3997E-02,  0.3407E-03,  0.3283E-02,
-0.1946E-02, -0.6022E-02,  0.9533E-02, -0.4816E-02, -0.2945E-02,  0.8654E-03,
-0.1512E-02,  0.1172E-02,  0.4945E-02, -0.6058E-02, -0.8818E-03,  0.2617E-03,
 0.1406E-02,  0.3864E-02,  0.2364E-02, -0.4831E-02, -0.1463E-02, -0.4613E-03,
 0.1596E-02,  0.4957E-02, -0.1537E-02, -0.5837E-02, -0.2920E-03, -0.1539E-02,
-0.3569E-02,  0.1346E-02, -0.1683E-02, -0.1215E-02, -0.1140E-02, -0.1463E-02,
-0.3534E-03, -0.2717E-02, -0.4249E-04,  0.1283E-02,  0.9055E-03,  0.9297E-03,
 0.1312E-02,  0.1910E-02, -0.3736E-02, -0.2075E-03, -0.1575E-04,  0.3937E-03,
 0.3123E-02,  0.1532E-02, -0.1622E-02,  0.2157E-02,  0.2963E-03,  0.5909E-04,
 0.7263E-03, -0.5004E-03,  0.7521E-03,  0.2342E-02, -0.4329E-03, -0.4055E-03,
 0.1556E-02, -0.9988E-03,  0.5689E-03,  0.2893E-04, -0.1298E-03,  0.2957E-03,
-0.6951E-03, -0.2123E-03,  0.1546E-02,  0.5908E-03,  0.1149E-03,  0.4160E-03,
-0.2763E-03, -0.1435E-02,  0.1314E-02,  0.6277E-03, -0.4432E-03, -0.1359E-04,
…
-0.1488E-04, -0.8043E-05, -0.1473E-04, -0.3554E-04,  0.3786E-05,  0.1844E-04,
-0.5390E-05, -0.1480E-04, -0.1766E-04,  0.6611E-05, -0.2056E-04, -0.1655E-04,
-0.1537E-04, -0.3180E-05,  0.6927E-05,  0.1837E-05,  0.9762E-05, -0.2585E-04,
 0.2101E-05,  0.3921E-05,  0.1032E-04,  0.1256E-04, -0.1087E-04,  0.1651E-04,
-0.2047E-04, -0.7555E-05, -0.7678E-05, -0.1169E-04, -0.1884E-05,  0.1802E-05,
 0.8244E-05, -0.7725E-06, -0.4716E-05,  0.7150E-05, -0.1421E-04,  0.5794E-05,
 0.2136E-04,  0.2774E-04, -0.1372E-04, -0.2053E-05,  0.1664E-04, -0.5379E-05,
 0.2130E-04,  0.1195E-04,  0.1360E-04, -0.1726E-04,  0.9991E-05, -0.1942E-04,
 0.2566E-05, -0.2178E-04,  0.1304E-05,  0.1866E-04,  0.1727E-05,  0.1424E-04 $
!
```

3.4 Level 2 data – SA- Automatic Gain Control (AGC)

3.4.1 Format: CEF

3.4.2 Standard: cf 2.2.

3.4.3 Production Procedure: cf 2.3.1.

3.4.4 Quality Control Procedure: cf 2.4.1.

3.4.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.4.6 Product Specification

One CEF file per day and per satellite is produced.
The CEF file contains the average power spectral density in the passband of the analogue receivers derived from the Automatic Gain Control signal. This is measured in the three large passbands with 1s time resolution, for the axial component of the

magnetic field, and the sums of the spins plane components of the magnetic and of the electric field.
Data are separated in two variables, one for the magnetic AGC, one for the electric AGC.

- B__C1/C2/C3/C4_CP_STA_AGC. They are given in nT^2 Hz^{-1}units.
- E__C1/C2/C3/C4_CP_STA_AGC. They are given in mV^2 m^{-2} Hz^{-1} units.

3.4.7 Dataset metadata description

The CEF file version 07 includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_AGC.ceh.**

The introduction of dataset header gives the possibility to upload caveat files in the future and can be easily updated.

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

First, the following **global metadata** keywords:

- DATASET_ID = "C1/C2/C3/C4_CP_STA_AGC"
- DATA_TYPE = "CP"
- DATASET_TITLE = "Automatic Gain Control"
- CONTACT_COORDINATES = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr Olga Alexandrova>Co-I >olga.alexandrova@obspm.fr Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
- DATASET_DESCRIPTION = "Average power spectral density in the passband of the analogue receivers derived from the Automatic Gain Control signal. This is measured in three large passbands for the axial component of the magnetic field, and the sums of the spin plane components of the magnetic and of the electric field. The time resolution can vary between 0.125 and 0.250s in High Bit Rate and usually 1s (exceptionally 0.5 and 2s) in Normal Bit Rate telemetry mode."
- PROCESSING_LEVEL = "Calibrated"
- TIME_RESOLUTION = 1.0
- MIN_TIME_RESOLUTION = 2.0
- MAX_TIME_RESOLUTION = 0.125
- DATASETS_CAVEATS = "*C1_CQ_STA_AGC_CAVEATS Version 07 : New calibration tables plus addition of the interval duration and status. Removal of onboard calibration data. Warning to the users of versions lower than 07: Delta_plus of Time__C1_CP_STA_AGC variables is set to a fixed value instead of a value varying with the mode. This chosen fixed value is the usual minimum time resolution (1s) which is correct in most of the time (Normal Bit Rate). The time resolution is better in High Bit Rate. Note that the data themselves are correct. Version 04 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). Version 03 : The data were time tagged using TED version 2.4.3 (TED Library

4.4.3 User Patch 1), provided by the Sheffield DWP Group. Version 02 : Obsolete. Should not be used ! Version 01 : Obsolete. Should not be used !"

- Then, the following **Support data**:

Data are indexed by the **following variables**:

&Time which is the time tag. Its properties are:
- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:59.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"
- DELTA_MINUS = 0.
- DELTA_PLUS = Duration__C1_CP_STA_SM

&Duration defining the time interval between two measurements:
- CATDESC = "Interval duration"
- FIELDNAM = "Interval duration"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_AGC
- FILLVAL = 9.999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 4
- UNITS = "s"
- VALUE_TYPE = FLOAT
- SIZES = 1

&Status defining the nine characters STAFF-SA status:
- CATDESC = "STAFF-SA Status"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_AGC
- FIELDNAM = "STAFF-SA Status"
- FILLVAL = ZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_CAVEATS = "First nine characters of STAFF Status. See UG, Appendix C. We cannot certify the 9th character (EFW Sweep)"
- PARAMETER_TYPE = "Support_Data"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 9
- SIZES = 1
- UNITS = "unitless"

- VALUE_TYPE = CHAR

&Frequency defining the centres of the 3 frequency bands:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval centred frequency tag"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 3
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin centres"
- LABLAXIS = "F"
- LABEL_1 = "A","B","C" ! 3 bands
- DELTA_PLUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_AGC
- DELTA_MINUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_AGC
- SCALETYP = Log
- DATA = 34.9226,279.3811,2235.0488

&Frequency_BHW which is the half width of the 3 frequency bands :

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency bin half widths"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 3
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin half widths"
- LABLAXIS = "F_bhw"
- LABEL_1 = "A_bhw","B_bhw","C_bhw"
- SCALETYP = Log
- DATA = 27.1618,217.2948,1738.3584

Data themselves

&The magnetic AGC **B** :

- PARAMETER_TYPE = "Data"
- ENTITY = "Magnetic_Field"
- PROPERTY = "Component"
- FLUCTUATIONS = "Mean_Square_Level"
- CATDESC = "Magnetic AGC"
- UNITS = "nT^2 Hz^-1"
- SI_CONVERSION = "1.0e-18>T^2 Hz^-1"
- TENSOR_ORDER = 0
- TENSOR_FRAME = "SR2"
- FRAME = "ISR2>xyz"
- COORDINATE_SYSTEM = "SR2"

- SIZES = 3,2 ! 3 frequency bins x 2 components
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -1.00E+31
- FIELDNAM = "Magnetic AGC"
- LABLAXIS = "Magnetic AGC"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_AGC
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_AGC
- LABEL_2 = "Bz","Bxy"
- QUALITY = 0

&The Electric AGC **E** :

- PARAMETER_TYPE = "Data"
- ENTITY = "Electric_Field"
- PROPERTY = "Component"
- FLUCTUATIONS = "Mean_Square_Level"
- CATDESC = "Electric AGC"
- UNITS = "mV^2 m^-2 Hz^-1"
- SI_CONVERSION = "1.0E-6> V^2 m^-2 Hz^-1"
- TENSOR_ORDER = 0
- TENSOR_FRAME = "SR2"
- FRAME = "SR2>xyz"
- COORDINATE_SYSTEM = "SR2"
- SIZES = 3 ! 3 frequency bins x 1 components
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -1.00E+31
- FIELDNAM = "Electric AGC"
- LABLAXIS = "Electric AGC"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_AGC
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_AGC
- LABEL_2 = "Exy"
- QUALITY = 0

3.4.8 File Metadata Specification

The version 07 CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_AGC.ceh** described above.

For the version 0, the CEF file header contains now only the static parameters (file and global metadata):

- The following **file metadata** keywords:
  - FILE_NAME = C1/C2/C3/C4_CP_STA_AGC __20070101_V04.cef
  - FILE_FORMAT_VERSION = "CEF-2.0"
  - END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
  - FILE_TYPE = "cef"
  - DATASET_VERSION = "04"
  - LOGICAL_FILE_ID = "C1/C2/C3/C4_CP_STA_AGC__20070101_V04"
  - VERSION_NUMBER = "04"
  - METADATA_TYPE = "CAA"
  - METADATA_VERSION = "2.0"
  - FILE_TIME_SPAN = 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
  - GENERATION_DATE = ex. 2009-09-13T09:52:11.000Z
  - FILE_CAVEATS = "Release V04 of STAFF-SA CAA Data. Ted version 2.4.3 with lib 4.4.3 User patch 1. STAFF-SA Processing software with C1_CT_STASA_20010110_V003.cal. Prassadco software: Module Read_N2SA (2002Dec16). Caa software version 2.0 of July 2009"

3.4.9 Dataset header example

Example: C1_CH_STA_AGC.ceh

```
!CEH VALIDATION 12 Jan 2015 by LPP, header V08, (PC, NCW, RP, RK)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_AGC"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Automatic Gain Control"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "Average power spectral density in the passband of the analogue"
   ENTRY = "receivers derived from the Automatic Gain Control signal."
   ENTRY = "This is measured in three large passbands"
   ENTRY = "for the axial component of the magnetic field, and the sums"
   ENTRY = "of the spin plane components of the magnetic and of the electric field."
   ENTRY = "The time resolution"
   ENTRY = "can vary between 0.125 and 0.250s in"
   ENTRY = "High Bit Rate and usually 1s (exceptionally"
   ENTRY = "0.5 and 2s) in Normal Bit Rate telemetry mode."
END_META = DATASET_DESCRIPTION
!
START_META = TIME_RESOLUTION
   ENTRY = 1.0
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   ENTRY = 2.0
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   ENTRY = 0.125
END_META = MAX_TIME_RESOLUTION
!
START_META = PROCESSING_LEVEL
```

```
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_AGC_CAVEATS"
   ENTRY = "Version 07 : New calibration tables plus addition of the interval "
   ENTRY = "duration and status. Removal of onboard calibration data."
   ENTRY = "Warning to the users of versions lower than 07:"
   ENTRY = "Delta_plus of Time__C1_CP_STA_AGC variables is set to a fixed value"
   ENTRY = "instead of a value varying with the mode."
   ENTRY = "This chosen fixed value is the usual minimum time resolution (1s)"
   ENTRY = "which is correct in most of the time (Normal Bit Rate)."
   ENTRY = "The  time resolution is better in High Bit Rate."
   ENTRY = "Note that the data themselves are correct."
   ENTRY = "Version 04 : All the headers have been updated (laboratory name "
   ENTRY = "and email). Introduction of a new header file (Dataset). "
   ENTRY = "Version 03 : The data were time tagged using TED version 2.4.3"
   ENTRY = "(TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group."
   ENTRY = "Version 02 : Obsolete. Should not be used !"
   ENTRY = "Version 01 : Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_AGC
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval Start time tag"
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
   DELTA_MINUS        = 0.0
   DELTA_PLUS         = Duration__C1_CP_STA_AGC
END_VARIABLE = Time__C1_CP_STA_AGC
!
START_VARIABLE = Duration__C1_CP_STA_AGC
   CATDESC            = "Interval duration"
   FIELDNAM           = "Interval duration"
   DEPEND_0           = Time__C1_CP_STA_AGC
   FILLVAL            = 9.999
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 4
   UNITS              = "s"
   VALUE_TYPE         = FLOAT
   SIZES              = 1
END_VARIABLE = Duration__C1_CP_STA_AGC
!
START_VARIABLE = Status__C1_CP_STA_AGC
   CATDESC            = "STAFF-SA Status"
   DEPEND_0           = Time__C1_CP_STA_AGC
   FIELDNAM           = "STAFF-SA Status"
   FILLVAL            = ZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "First nine characters of STAFF Status. See UG, Appendix C. \
                         We cannot certify the 9th character (EFW Sweep)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 9
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_AGC
!
START_VARIABLE = Frequency__C1_CP_STA_AGC
   PARAMETER_TYPE     = "Support_Data"
```

```
   CATDESC            = "Interval centred frequency tag"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 3
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin centres"
   LABLAXIS           = "F"
   LABEL_1            = "A","B","C"
   DELTA_PLUS         = Frequency_BHW__C1_CP_STA_AGC
   DELTA_MINUS        = Frequency_BHW__C1_CP_STA_AGC
   SCALETYP           = Log
   DATA               = 34.9226,279.3811,2235.0488
END_VARIABLE = Frequency__C1_CP_STA_AGC
!
START_VARIABLE = Frequency_BHW__C1_CP_STA_AGC
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency bin half widths"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 3
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin half widths"
   LABLAXIS           = "F_bhw"
   LABEL_1            = "A_bhw","B_bhw","C_bhw"
   SCALETYP           = Log
   DATA               = 27.1618,217.2948,1738.3584
END_VARIABLE = Frequency_BHW__C1_CP_STA_AGC
!
START_VARIABLE = B__C1_CP_STA_AGC
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Magnetic_Field"
   PROPERTY           = "Component"
   FLUCTUATIONS       = "Mean_Square_Level"
   CATDESC            = "Magnetic AGC"
   UNITS              = "nT^2 Hz^-1"
   SI_CONVERSION      = "1.0e-18>T^2 Hz^-1"
   TENSOR_ORDER       = 0
   TENSOR_FRAME       = "ISR2"
   FRAME              = "ISR2>xyz"
   COORDINATE_SYSTEM  = "ISR2"
   SIZES              = 3,2     ! 3 frequency bins x 2 components
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Magnetic AGC"
   LABLAXIS           = "Magnetic AGC"
   DEPEND_0           = Time__C1_CP_STA_AGC
   DEPEND_1           = Frequency__C1_CP_STA_AGC
   LABEL_2            = "Bz","Bxy"
   QUALITY            = 0
END_VARIABLE = B__C1_CP_STA_AGC
!
START_VARIABLE = E__C1_CP_STA_AGC
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Electric_Field"
   PROPERTY           = "Component"
   FLUCTUATIONS       = "Mean_Square_Level"
   CATDESC            = "Electric AGC"
   UNITS              = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION      = "1.0E-6>V^2 m^-2 Hz^-1"
   TENSOR_ORDER       = 0
   TENSOR_FRAME       = "ISR2"
   FRAME              = "ISR2>xyz"
   COORDINATE_SYSTEM  = "ISR2"
   SIZES              = 3     ! 3 frequency bins x 1 component
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Electric AGC"
   LABLAXIS           = "Electric AGC"
```

```
   DEPEND_0           = Time__C1_CP_STA_AGC
   DEPEND_1           = Frequency__C1_CP_STA_AGC
   LABEL_2            = "Exy"
   QUALITY            = 0
END_VARIABLE = E__C1_CP_STA_AGC
```

3.4.10 Dataset file example

Version 07: C1_CP_STA_AGC__20070101_V04.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                            File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_AGC__20070101_V07.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                          Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh           ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh               ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh               ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh            ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_AGC.ceh           ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_AGC__20070101_V07"
END_META = LOGICAL_FILE_ID
!
START_META = DATASET_VERSION
   ENTRY = "07"
END_META = DATASET_VERSION
!
START_META = VERSION_NUMBER
   ENTRY = "07"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2014-02-26T11:51:23.000Z
END_META = GENERATION_DATE
!
```

```
START_META = FILE_CAVEATS
   ENTRY = "Release V07 of STAFF-SA CAA Data"
   ENTRY = "Ted version 2.4.3 with lib 4.4.3 User patch 1"
   ENTRY = "STAFF-SA Processing software with C1_CT_STASA_20130124_V001.cal"
   ENTRY = "Prassadco software: Module Read_N2SA (2002Dec16)"
   ENTRY = "Caa software version 2.4 of January 2014"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                     Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! Each block of data is organized this way:
!
!  | ISO-TIME,INTERVAL DURATION,STAFF-SA STATUS,
!  | Bz (A band),  Bxy (A band)
!  | Bz (B band),  Bxy (B band)
!  | Bz (C band),  Bxy (C band)
!  | Exy (A band)
!  | Exy (B band)
!  | Exy (C band)$
!
!
!
!
!
DATA_UNTIL = EOF
!
2007-01-01T00:00:01.886Z,1.000,001700100,
 3.76E-02, 4.15E-02,
 3.22E-03, 1.35E-03,
 2.01E-04, 9.18E-05,
-1.00E+31,
-1.00E+31,
-1.00E+31$
!
2007-01-01T00:00:02.886Z,1.000,001700100,
 3.76E-02, 4.44E-02,
 3.22E-03, 1.35E-03,
 2.01E-04, 9.18E-05,
-1.00E+31,
-1.00E+31,
-1.00E+31$
!
...
```

3.5 Level 2 data - SA - Power Spectral Density Files (PSD)

3.5.1 Format: CEF

3.5.2 Standard: cf 2.2.

3.5.3 Production Procedure: cf 2.3.2.

3.5.4 Quality Control Procedure: cf 2.4.2.

3.5.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.5.6 Product Specification

One CEF file per day and per satellite is produced.
This CEF file contains the Power Spectral Densities values for the magnetic and the electric field.

$$\begin{pmatrix} B_x^2 & B_x.B_y^* & B_x.B_z^* & B_x.E_x^* & B_x.E_y^* \\ B_y.B_x^* & B_y^2 & B_y.B_z^* & B_y.E_x^* & B_y.E_y^* \\ B_z.B_x^* & B_z.B_y^* & B_z^2 & B_z.E_x^* & B_z.E_y^* \\ E_x.B_x^* & E_x.B_y^* & E_x.B_z^* & E_x^2 & E_x.E_y^* \\ E_y.B_x^* & E_y.B_y^* & E_y.B_z^* & E_y.E_x^* & E_y^2 \end{pmatrix}$$

Data are separated into two variables, one for the magnetic components and another for the electric ones:

- BB__C1_CP_STA_PSD is the float variable defined for the B_x^2 B_z^2 and B_z^2 values (where C1 stands for satellite 1 in this example), they are given in nT^2Hz^{-1} units.
- EE__C1_CP_STA_PSD is the float variable defined for the E_x^2 and E_y^2 values they are given in $mV^2m^{-2}Hz^{-1}$ units.

Each variable is sampled for 27 ranges of frequencies described in the Dimension_F__C1_CP_STA_PSD variable which summarizes the 27 bin centres (given in Hz).
This variable is linked to the Dimension_F_bin_half_width__C1_CP_STA_PSD variable which gives the half width of each bin.
Data are given in SR2 coordinate system. Note that coordinate transformation is not allowed since the information that is mandatory for such an operation is unknown.

3.5.7 Dataset metadata description

The CEF file version 07 includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_PSD.ceh.**

The introduction of dataset header gives the possibility to upload caveat files in the future and can be easily updated.

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CP_STA_PSD
  - DATA_TYPE = "CP"
  - DATASET_TITLE = "Power Spectral Density (1s resolution)"
  - CONTACT_COORDINATES = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr

Olga Alexandrova>Co-I >olga.alexandrova@obspm.fr
Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"

- DATASET_DESCRIPTION = "This dataset contains 1s resolution Power Spectral Density measurements of three SR2 components of the magnetic field and two components of the electric field at 27 frequencies distributed logarithmically between 8 HZ and 4 kHz."
- PROCESSING_LEVEL = "Calibrated"
- TIME_RESOLUTION = 1.0
- MIN_TIME_RESOLUTION = 2.0
- MAX_TIME_RESOLUTION = 0.125
- DATASET_CAVEATS = "*C1_CQ_STA_NOTSRP_CAVEATS Version 07 : New calibration tables plus addition of the interval duration and status. Removal of onboard calibration data. Warning to the users of versions lower than 07: Delta_plus of Time__C1_CP_STA_PSD variables is set to a fixed value instead of a value varying with the mode. This chosen fixed value is the usual minimum time resolution (1s) which is correct in most of the time (Normal Bit Rate). The time resolution is better in High Bit Rate. Note that the data themselves are correct. Version 04 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). The PSD negative values in the version 03 have been replaced by the fillvalue (-1.00E+31). Version 03: The data were time tagged using TED version 2.4.3 (TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group. Phase rotation corrected + exhaustive data. Older versions are obsolete and should not be used ! The negative values must not be taken into account by the users. Version 02 : Obsolete. This version may be used if Version 03 is not available, as long as only total B and total E power are used ! Version 01 : Obsolete. Should not be used !"

- Then, the following **Support data**:

Data are indexed by the **following variables**:

& Time which the ISO time of data acquisition (Universal Time). Its properties are:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-99-99T99:99:99.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"
- DELTA_MINUS = 0.
- DELTA_PLUS = Duration__C1_CP_STA_SM

&Duration defining the time interval between two measurements:

- CATDESC = "Interval duration"
- FIELDNAM = "Sampling interval length"

- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PSD
- FILLVAL = 9.999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 4
- UNITS = "s"
- VALUE_TYPE = FLOAT
- SIZES = 1

&Status defining the nine characters STAFF-SA status:

- CATDESC = "STAFF-SA Status"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PSD
- FIELDNAM = "STAFF-SA Status"
- FILLVAL = ZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_CAVEATS = "First nine characters of STAFF Status. See UG, Appendix C. We cannot certify the 9th character (EFW Sweep)"
- PARAMETER_TYPE = "Support_Data"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 9
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Frequency represents the 27 frequency bin centres expressed in Hz. Each bin is sized by the Frequency_BHW__C?_CP_STA_PSD which expresses the half width of the bin (=DELTA_MINUS and DELTA_MINUS):

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval centred frequency tag"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin centres"
- LABLAXIS = "F"
- LABEL_1 = "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F"
- DELTA_PLUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_PSD
- DELTA_MINUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_PSD
- SCALETYP = Log
- DATA = 8.7692, 11.0485, 13.9203, 17.5385, 22.0971, 27.8406, 35.0769, 44.1942, 55.6812, 70.1539, 88.3883, 111.3623, 140.3078, 176.7767, 222.7247,

280.6155, 353.5534, 445.4493, 561.2310, 707.1068, 890.8987, 1122.4620, 1414.2135, 1781.7975, 2244.9243, 2828.4270, 3563.5945

&Frequency_BHW represents the Frequency bin half widths expressed in Hz. Its values correspond to the 27 frequency bin centres (Frequency__C?_CP_STA_PSD) :

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency bin half widths"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin half widths"
- LABLAXIS = "F_bhw"
- LABEL_1 = "F_bhw", "F_bhw"
- SCALETYP = Log
- DATA = 1.0085, 1.2706, 1.6008, 2.0169, 2.5412, 3.2017, 4.0338, 5.0823, 6.4033, 8.0677, 10.1647, 12.8067, 16.1354, 20.3293, 25.6133, 32.2708, 40.6586, 51.2267, 64.5416, 81.3173, 102.4534, 129.0831, 162.6346, 204.9067, 258.1663, 325.2691, 409.8134

Data themselves:

&BB__xxyyzz_SR2__C1/C2/C3/C4_CP_STA_PSD variable stores the magnetic components of the power spectral density is an incomplete tensor of order 2. Since only B_x^2, B_y^2 and B_z^2 are present, its representation in SR2coordinate system (‘COORDINATE_SYSTEM = "SR2"’) is limited to “xx”, “yy” and “zz” (‘REPRESENTATION = xx” “yy” “zz”’) :

- PARAMETER_TYPE = "Data"
- ENTITY = "Magnetic Field"
- PROPERTY = "Vector"
- FLUCTUATIONS = "Wavelet_Power-spectrum"
- CATDESC = "Power spectrum 8-4000 Hz of the B-field components along the SR2 coordinate axes"
- UNITS = "nT^2Hz^-1"
- SI_CONVERSION = "1.0E-18>T^2Hz^-1"
- TENSOR_ORDER = 2
- TENSOR_FRAME = SR2
- FRAME SR2
- COORDINATE_SYSTEM SR2
- SIZES = 27,3 ! 27 frequency bins x 3 components
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3

- FILLVAL = -1.00E+31
- FIELDNAM = "Magnetic Power Spectral Density"
- LABLAXIS = "Magnetic Power Spectral Density"
- REPRESENTATION_2 = "xx","yy","zz"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PSD
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PSD
- LABEL_2 = "Bx^2","By^2","Bz^2"
- QUALITY = 0

&EE__xxyy_SR2__C1/C2/C3/C4_CP_STA_PSD variable stores the electric components of the power spectral density is an incomplete tensor of order 2. Since only E_x^2 and E_y^2 are present, its representation in SR2coordinate system is limited to “xx” and “yy”:

- PARAMETER_TYPE = "Data"
- ENTITY = "Electric Field"
- PROPERTY = "Vector"
- FLUCTUATIONS = "Wavelet_Power-spectrum"
- CATDESC = "Power spectrum 8-4000 Hz of the E-field components along the ISR coordinate axes"
- UNITS = "mV^2 m^-2 Hz^-1"
- SI_CONVERSION = "1.0E-6>V^ 2m^-2 Hz^-1"
- TENSOR_ORDER = 2
- TENSOR_FRAME = "SR2"
- FRAME = "SR2 >xyz"
- COORDINATE_SYSTEM = "SR2"
- SIZES = 27,2 ! 27 frequency bins x 2 components
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -1.00E+31
- FIELDNAM = "Electrical Power Spectral Density"
- LABLAXIS = "Electrical Power Spectral Density"
- REPRESENTATION_2 = "xx","yy"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PSD
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PSD
- LABEL_2 = "Ex^2","Ey^2"
- QUALITY = 0

3.5.8 File Metadata Specification

The version 4 CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_PSD.ceh** described above.

For the version 04, the CEF contains now only the static parameters (file and global metadata).

- The following file **metadata** keywords:
  - FILE_NAME = C1/C2/C3/C4_CP_STA_PSD__20010419_V04.cef

- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
  - FILE_TYPE = "cef"
  - LOGICAL_FILE_ID = "C1/C2/C3/C4_CP_STA_PSD__20070101_V04"
  - DATASET_VERSION = "04"
  - VERSION_NUMBER = "04"
  - METADATA_TYPE = "CAA"
  - METADATA_VERSION = "2.0"
  - FILE_TIME_SPAN = ex. 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
  - GENERATION_DATE = ex. 2009-09-20T15:20:11.000Z
  - FILE_CAVEATS = "Release V04 of STAFF-SA CAA Data. Ted version 2.4.3 with lib 4.4.3 User patch 1. STAFF-SA Processing software with C1_CT_STASA_20010110_V003.cal. Prassadco software: Module Read_N2SA (2002Dec16). Caa software version 2.0 of July 2009"

3.5.9 Dataset header example

Example: C1_CH_STA_PSD.ceh

```
!CEH VALIDATION 12 Jan 2015 by LPP, header V07, (PC, NCW, RP, RK)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_PSD"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Power Spectral Density (8 Hz - 4 kHz)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
   ENTRY = "Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "Power Spectral Density measurements of three"
   ENTRY = "components of the magnetic field and two components"
   ENTRY = "of the electric field in SR2 reference frame,"
   ENTRY = "at 27 frequencies logarithmically distributed"
   ENTRY = "between 8 Hz and 4 kHz. The time resolution"
   ENTRY = "can vary between 0.125 and 0.250s in"
   ENTRY = "High Bit Rate and usually 1s (exceptionally"
   ENTRY = "0.5 and 2s) in Normal Bit Rate telemetry mode."
END_META = DATASET_DESCRIPTION
!
START_META = TIME_RESOLUTION
   ENTRY = 1.0
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   ENTRY = 2.0
```

```
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   ENTRY = 0.125
END_META = MAX_TIME_RESOLUTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "Version 07 : New calibration tables plus addition of the interval "
   ENTRY = "duration and status. Removal of onboard calibration data."
   ENTRY = "Warning to the users of versions lower than 07:"
   ENTRY = "Delta_plus of Time__C1_CP_STA_PSD variables is set to a fixed value"
   ENTRY = "instead of a value varying with the mode."
   ENTRY = "This chosen fixed value is the usual minimum time resolution (1s)"
   ENTRY = "which is correct in most of the time (Normal Bit Rate)."
   ENTRY = "The  time resolution is better in High Bit Rate."
   ENTRY = "Note that the data themselves are correct."
   ENTRY = "Version 04 : All the headers have been updated (laboratory name "
   ENTRY = "and email). Introduction of a new header file (Dataset). "
   ENTRY = "The PSD negative values in the version 03 have "
   ENTRY = "been replaced by the fillvalue (-1.00E+31)."
   ENTRY = "Version 03:"
   ENTRY = "The data were time tagged using TED version 2.4.3"
   ENTRY = "(TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group."
   ENTRY = "Phase rotation corrected + exhaustive data. Older versions "
   ENTRY = "are obsolete and should not be used ! The negative values must not be"
   ENTRY = "taken into account by the users."
   ENTRY = "Version 02 : Obsolete. This version may be used if Version 03 is not "
   ENTRY = "available, as long as only total B and total E power are used !"
   ENTRY = "Version 01 : Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_PSD
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval Start time tag"
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
   DELTA_MINUS        = 0.
   DELTA_PLUS         = Duration__C1_CP_STA_PSD
END_VARIABLE = Time__C1_CP_STA_PSD
!
START_VARIABLE = Duration__C1_CP_STA_PSD
   CATDESC            = "Interval duration"
   FIELDNAM           = "Sampling interval length"
   DEPEND_0           = Time__C1_CP_STA_PSD
   FILLVAL            = 9.999
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 4
   UNITS              = "s"
   VALUE_TYPE         = FLOAT
   SIZES              = 1
END_VARIABLE = Duration__C1_CP_STA_PSD
!
START_VARIABLE = Status__C1_CP_STA_PSD
   CATDESC            = "STAFF-SA Status"
   DEPEND_0           = Time__C1_CP_STA_PSD
   FIELDNAM           = "STAFF-SA Status"
   FILLVAL            = ZZZZZZZZZ
```

```
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "First nine characters of STAFF Status. See UG, Appendix C. \
                        We cannot certify the 9th character (EFW Sweep)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 9
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_PSD
!
START_VARIABLE = Frequency__C1_CP_STA_PSD
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval centred frequency tag"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin centres"
   LABLAXIS           = "F"
   LABEL_1                                                                              =
"F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F
","F","F","F"
   DELTA_PLUS         = Frequency_BHW__C1_CP_STA_PSD
   DELTA_MINUS        = Frequency_BHW__C1_CP_STA_PSD
   SCALETYP           = Log
   DATA               = 8.7692,11.0485,13.9203,17.5385,22.0971,27.8406,35.0769, \
                        44.1942,55.6812,70.1539,88.3883,111.3623,140.3078, \
                        176.7767,222.7247,280.6155,353.5534,445.4493,561.2310, \
                        707.1068,890.8987,1122.4620,1414.2135,1781.7975, \
                        2244.9243,2828.4270,3563.5945
END_VARIABLE = Frequency__C1_CP_STA_PSD
!
START_VARIABLE = Frequency_BHW__C1_CP_STA_PSD
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency bin half widths"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin half widths"
   LABLAXIS           = "F_bhw"
   LABEL_1                                                                              =
"F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw
","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_b
hw","F_bhw","F_bhw","F_bhw"
   SCALETYP           = Log
   DATA               = 1.0085,1.2706,1.6008,2.0169,2.5412,3.2017,4.0338, \
                        5.0823,6.4033,8.0677,10.1647,12.8067,16.1354,20.3293, \
                        25.6133,32.2708,40.6586,51.2267,64.5416,81.3173, \
                        102.4534,129.0831,162.6346,204.9067,258.1663,325.2691, \
                        409.8134
END_VARIABLE = Frequency_BHW__C1_CP_STA_PSD
!
START_VARIABLE = BB_xxyyzz_sr2__C1_CP_STA_PSD
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Magnetic_Field"
   PROPERTY           = "Vector"
   FLUCTUATIONS       = "Wavelet_Power-spectrum"
   CATDESC              = "Power spectrum 8-4000 Hz of the B-field components along the ISR
coordinate axes"
   UNITS              = "nT^2 Hz^-1"
   SI_CONVERSION      = "1.0E-18>T^2 Hz^-1"
   TENSOR_ORDER       = 2
   TENSOR_FRAME       = "SR2"
   FRAME              = "SR2>xyz"
   COORDINATE_SYSTEM  = "SR2"
   SIZES              = 27,3     ! 27 frequency bins x 3 components
   VALUE_TYPE         = FLOAT
```

```
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Magnetic Power Spectral Density"
   LABLAXIS           = "Magnetic Power Spectral Density"
   REPRESENTATION_2   = "xx","yy","zz"
   DEPEND_0           = Time__C1_CP_STA_PSD
   DEPEND_1           = Frequency__C1_CP_STA_PSD
   LABEL_2            = "Bx^2","By^2","Bz^2"
   QUALITY            = 3
END_VARIABLE = BB_xxyyzz_sr2__C1_CP_STA_PSD
!
START_VARIABLE = EE_xxyy_sr2__C1_CP_STA_PSD
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Electric_Field"
   PROPERTY           = "Vector"
   FLUCTUATIONS       = "Wavelet_Power-spectrum"
   CATDESC               = "Power spectrum 8-4000 Hz of the E-field components along the ISR
coordinate axes"
   UNITS              = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION      = "1.0E-6>V^2 m^-2 Hz^-1"
   TENSOR_ORDER       = 2
   TENSOR_FRAME       = "SR2"
   FRAME              = "SR2>xyz"
   COORDINATE_SYSTEM  = "SR2"
   SIZES              = 27,2     ! 27 frequency bins x 2 components
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Electrical Power Spectral Density"
   LABLAXIS           = "Electrical Power Spectral Density"
   REPRESENTATION_2   = "xx","yy"
   DEPEND_0           = Time__C1_CP_STA_PSD
   DEPEND_1           = Frequency__C1_CP_STA_PSD
   LABEL_2            = "Ex^2","Ey^2"
   QUALITY            = 3
END_VARIABLE = EE_xxyy_sr2__C1_CP_STA_PSD
```

3.5.10 Dataset file example

Version 07: C1_CP_STA_PSD__20070101_V04.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                    File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                    File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_PSD__20070101_V07.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                   Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh           ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh               ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh               ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh            ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_PSD.ceh           ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
```

```
END_META = FILE_TYPE
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_PSD__20070101_V07"
END_META = LOGICAL_FILE_ID
!
START_META = DATASET_VERSION
   ENTRY = "07"
END_META = DATASET_VERSION
!
START_META = VERSION_NUMBER
   ENTRY = "07"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2014-03-11T11:13:44.000Z
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Release V07 of STAFF-SA CAA Data"
   ENTRY = "Ted version 2.4.3 with lib 4.4.3 User patch 1"
   ENTRY = "STAFF-SA Processing software with C1_CT_STASA_20130124_V001.cal"
   ENTRY = "Prassadco software: Module Read_N2SA (2002Dec16)"
   ENTRY = "Caa software version 2.4 of January 2014"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                        Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! Each block of data is organized this way:
!
!  | ISO-TIME,INTERVAL DURATION,STAFF-SA STATUS,
!  | "Bx^2","By^2","Bz^2", | repeated 27 times for the 27 freq.
!  | ...
!  | "Ex^2","Ey^2", | repeated 27 times for the 27 freq.
!  | ... $
!
!
!
!
!
DATA_UNTIL = EOF
!
2007-01-01T00:00:01.886Z,1.000,001700100,
 2.40E-05, 3.60E-05, 1.81E-05,
 1.27E-05, 1.98E-05, 1.38E-05,
 2.71E-06, 6.77E-08, 1.33E-06,
 1.11E-07, 4.44E-07, 6.70E-07,
 4.77E-07, 1.28E-07, 3.04E-08,
 1.92E-07, 3.36E-07, 4.15E-07,
 4.42E-08, 2.89E-07, 2.27E-07,
 3.09E-08, 1.65E-07, 3.87E-08,
 1.72E-08, 1.23E-08, 3.38E-09,
 4.83E-09, 3.34E-09, 5.33E-09,
 1.29E-09, 1.89E-09, 3.90E-09,
 1.53E-09, 1.88E-09, 2.59E-09,
 1.21E-09, 9.68E-10, 2.35E-09,
 1.32E-09, 5.93E-10, 8.32E-10,
 4.12E-10, 4.39E-10, 1.12E-09,
```

```
 4.98E-10, 2.73E-10, 4.86E-10,
 3.59E-10, 2.33E-10, 2.98E-10,
 2.18E-10, 1.98E-10, 2.50E-10,
 1.07E-10, 9.06E-11, 1.15E-10,
 1.34E-10, 9.57E-11, 1.08E-10,
 2.13E-10, 1.77E-10, 1.49E-10,
 1.96E-10, 1.42E-10, 7.78E-11,
 2.03E-10, 1.74E-10, 1.29E-10,
 2.59E-10, 2.36E-10, 1.88E-10,
 3.08E-10, 2.50E-10, 1.80E-10,
 3.49E-10, 3.22E-10, 3.14E-10,
 4.16E-10, 4.16E-10, 4.86E-10,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31 $
!
2007-01-01T00:00:02.886Z,1.000,001700100,
 2.67E-06, 9.35E-07, 3.85E-07,
 4.26E-07, 3.55E-07, 1.15E-06,
 8.69E-07, 5.31E-07, 5.53E-07,
 1.09E-06, 1.27E-07, 2.58E-07,
 4.71E-07, 3.14E-07, 5.48E-07,
 1.44E-08, 1.28E-07, 2.70E-07,
 4.13E-07, 7.57E-07, 8.53E-07,
 1.65E-07, 3.31E-07, 5.80E-07,
 9.88E-09, 1.32E-09, 7.03E-08,
 1.67E-09, 4.46E-09, 4.92E-09,
 2.06E-09, 2.58E-09, 2.34E-09,
 1.06E-09, 1.53E-09, 2.84E-09,
 8.87E-10, 5.65E-10, 1.85E-09,
 4.61E-10, 8.57E-10, 1.66E-09,
 4.39E-10, 3.02E-10, 1.37E-09,
 3.73E-10, 2.74E-10, 9.72E-10,
 3.95E-10, 1.97E-10, 4.68E-10,
 1.98E-10, 1.49E-10, 2.50E-10,
 9.88E-11, 1.07E-10, 9.22E-11,
 1.15E-10, 1.24E-10, 9.93E-11,
 1.89E-10, 1.66E-10, 1.60E-10,
 1.42E-10, 1.25E-10, 1.04E-10,
 1.45E-10, 1.30E-10, 1.15E-10,
 2.12E-10, 2.36E-10, 1.88E-10,
 2.88E-10, 1.92E-10, 2.47E-10,
 3.22E-10, 3.22E-10, 3.49E-10,
 5.20E-10, 5.20E-10, 4.86E-10,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
```

```
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31 $
!
...
```

3.6 Level 2 data – SA- Spectral Matrices Files (SM)

3.6.1 Format: CEF

3.6.2 Standard: cf 2.2.

3.6.3 Production Procedure: cf 2.3.2.

3.6.4 Quality Control Procedure: cf 2.4.2.

3.6.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.6.6 Product Specification

One CEF file per day and per satellite is produced.
This CEF file contains the Spectral Matrix values for the magnetic electric cross-products.

$$\begin{pmatrix} B_x^2 & B_x.B_y^* & B_x.B_z^* & B_x.E_x^* & B_x.E_y^* \\ B_y.B_x^* & B_y^2 & B_y.B_z^* & B_y.E_x^* & B_y.E_y^* \\ B_z.B_x^* & B_z.B_y^* & B_z^2 & B_z.E_x^* & B_z.E_y^* \\ E_x.B_x^* & E_x.B_y^* & E_x.B_z^* & E_x^2 & E_x.E_y^* \\ E_y.B_x^* & E_y.B_y^* & E_y.B_z^* & E_y.E_x^* & E_y^2 \end{pmatrix}$$

Data are separated into three variables, one for the magnetic components BB, one for the electric components EE, and one for the BE cross-products:
For sake of homogeneity, all components are given in $mV^2m^{-2}Hz^{-1}$ units.

Each variable is sampled for 27 ranges of frequencies described in the Dimension_F__C1_CP_STA_PSD variable which summarizes the 27 bin centres (given in Hz). This variable is linked to the Dimension_F_bin_half_width__C1_CP_STA_PSD variable which gives the half width of each bin.
Data are given in SR2 coordinate system.

3.6.7 Dataset metadata description

The version 07 CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_SM.ceh**.

The introduction of dataset header gives the possibility to upload caveat files in the future and can be easily updated.

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

First, the following **global metadata** keywords:

- DATASET_ID = "C1/C2/C3/C4_CP_STA_SM"
- DATA_TYPE = "CP"
- DATASET_TITLE = "Spectral Matrix (8 Hz - 4 kHz)"
- CONTACT_COORDINATES = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr Olga Alexandrova>Co-I >olga.alexandrova@obspm.fr Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
- DATASET_DESCRIPTION = "Cross spectral matrices formed from 3 components of the magnetic field and 2 components of the electric field determined with 4s time resolution at 27 logarithmically distributed frequencies between 8 Hz and 4 kHz."
- PROCESSING_LEVEL = "Calibrated"
- TIME_RESOLUTION = 4.0
- MIN_TIME_RESOLUTION = 4.0
- MAX_TIME_RESOLUTION = 1.0
- DATASET_CAVEATS = "*C1_CQ_STA_SA_PSDNEG_CAVEATS *C1_CQ_STA_NOTSRP_CAVEATS. Version 07 : New calibration tables plus addition of the interval duration and status. Removal of onboard calibration data. Warning to the users of versions lower than 07: Delta_plus of Time__C1_CP_STA_SM variables is set to a fixed value instead of a value varying with the mode. This chosen fixed value is the minimum time resolution (4s) which is correct in most of the cases (Normal Bit Rate) Note that the data

themselves are correct. Version 04 : All the headers have been updated (laboratory name and email). Introduction of a new header file (Dataset). Units and Si Conversion of the variables BB and BE have been corrected. Version 03 : Phase rotation corrected + exhaustive data. The data were time tagged using TED version 2.4.3 (TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group. Older versions are obsolete and should not be used ! Version 02 : Obsolete. Should not be used ! Version 01 : Obsolete. Should not be used !"

Then, the following **Support Data**:

&Time_tags__C1/C2/C3/C4_CP_STA_SM which the ISO time of data acquisition (Universal Time).:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:59.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"
- DELTA_MINUS = 0.0
- DELTA_PLUS = Duration__C1_CP_STA_SM

&Duration defining the time interval between two measurements:

- CATDESC = "Interval duration"
- FIELDNAM = "Sampling interval length"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_SM
- FILLVAL = 9.999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 4
- UNITS = "s"
- VALUE_TYPE = FLOAT
- SIZES = 1

&Status defining the nine characters STAFF-SA status:

- CATDESC = "STAFF-SA Status"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_SM
- FIELDNAM = "STAFF-SA Status"
- FILLVAL = ZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_CAVEATS = "First nine characters of STAFF Status. See UG, Appendix C. We cannot certify the 9th character (EFW Sweep)"

- PARAMETER_TYPE = "Support_Data"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 9
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Frequency represents the 27 frequency bin centres expressed in Hz. Each bin is sized by Frequency_BHW which expresses the half width of the bin (=DELTA_MINUS and DELTA_MINUS):

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval centred frequency tag"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin centres"
- LABLAXIS = "F"
- LABEL_1 = "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F"
- DELTA_PLUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_SM
- DELTA_MINUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_SM
- SCALETYP = Log
- DATA = 8.7692, 11.0485, 13.9203, 17.5385, 22.0971, 27.8406, 35.0769, 44.1942, 55.6812, 70.1539, 88.3883, 111.3623, 140.3078, 176.7767, 222.7247, 280.6155, 353.5534, 445.4493, 561.2310, 707.1068, 890.8987, 1122.4620, 1414.2135, 1781.7975, 2244.9243, 2828.4270, 3563.5945

&Frequency_BHW represents the Frequency bin half widths expressed in Hz. Its values correspond to the 27 frequency bin centres (Frequency):

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency bin half widths"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin half widths"
- LABLAXIS = "F_bhw"
- LABEL_1 = "F_bhw", "F_bhw"
- SCALETYP = Log

- DATA = 1.0085, 1.2706, 1.6008, 2.0169, 2.5412, 3.2017, 4.0338, 5.0823, 6.4033, 8.0677, 10.1647, 12.8067, 16.1354, 20.3293, 25.6133, 32.2708, 40.6586, 51.2267, 64.5416, 81.3173, 102.4534, 129.0831, 162.6346, 204.9067, 258.1663, 325.2691, 409.8134

Data themselves:

&BB__xyz_xyz_sr2 variable stores the magnetic components of the Spectral Matrix is a complex tensor of order 2 :

- PARAMETER_TYPE = "Data"
- ENTITY = "Magnetic_Field"
- PROPERTY = "Vector"
- FLUCTUATIONS = "Wavelet_Cross-power-spectrum"
- CATDESC = "Cross-spectral matrix of the magnetic field at 27 frequencies form 8HZ to 4 kHz."
- UNITS = "mV^2 m^-2 Hz^-1"
- SI_CONVERSION = "1.1E-17>T^2 Hz^-1"
- TENSOR_ORDER = 2
- TENSOR_FRAME =
- FRAME = "
- COORDINATE_SYSTEM =
- SIZES = 27,2,3,3 ! 27 frequency bins x 2 (Re.+Im.) parts (3x3)matrix
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -1.00000E+31
- FIELDNAM = "Spectral Matrix,BB components "
- LABLAXIS = "Spectral Matrix, BB components"
- REPRESENTATION_3 = "x","y","z"
- REPRESENTATION_4 = "x","y","z"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_SM
- DEPEND_1 = Frequency__C1C1/C2/C3/C4_CP_STA_SM
- LABEL_2 = "Re","Im"
- LABEL_3 = "Bx","By","Bz"
- LABEL_4 = "Bx","By","Bz"
- QUALITY = 0

&EE__xy_xy_sr2 variable stores the electric components of the spectral matrix is a complex tensor of order 2 :

- PARAMETER_TYPE = "Data"
- ENTITY = "Electric_Field"
- PROPERTY = "Vector"
- FLUCTUATIONS = "Wavelet_Cross-power-spectrum"
- CATDESC = "Cross-spectral matrix of the electric field at 27 frequencies from 8 Hz to 4 kHz"
- UNITS = "mV^2m^-2Hz^-1"
- SI_CONVERSION = "1.0E-6>V^2m^-2Hz^-1"
- TENSOR_ORDER = 2

- SR2SR2SR2SIZES = 27,2,2,2 ! 27 frequency bins x 2 (Re.+Im.) parts x (2x2)matrix
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -1.00000E+31
- FIELDNAM = "Spectral Matrix, EE components"
- LABLAXIS = "Spectral Matrix, EE components"
- REPRESENTATION_3 = "x","y"
- REPRESENTATION_4 = "x","y"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_SM
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_SM
- LABEL_2 = "Re","Im"
- LABEL_3 = "Ex","Ey"
- LABEL_4 = "Ex","Ey"
- QUALITY = 0

- **BE__xyz_xy_sr2** variable stores the BE cross-product components of the spectral matrix is a complex tensor of order 2 :
  - PARAMETER_TYPE = "Data"
  - ENTITY = "Compound"
  - PROPERTY = "Vector"
  - FLUCTUATIONS = "Wavelet_Cross-spectrum"
  - CATDESC = "Electromagnetic cross-spectral ExB products at 27 frequencies from 8 Hz to 4 KHz"
  - UNITS = "mV^2 m^-2 Hz^-1"
  - SI_CONVERSION = "3.3E-15>T V m^-1 Hz^-1"
  - TENSOR_ORDER = 2
  - TENSOR_FRAME = "SR2"
  - FRAME = "SR2 >xyz"
  - COORDINATE_SYSTEM = "SR2"
  - SIZES = 27,2,3,2 ! 27 frequency bins x 2 (Re.+Im.) parts (3x2)matrix
  - VALUE_TYPE = FLOAT
  - SIGNIFICANT_DIGITS = 3
  - FILLVAL = -1.00000E+31
  - FIELDNAM = "Spectral Matrix, BE components"
  - LABLAXIS = "Spectral Matrix, BE components"
  - REPRESENTATION_3 = "x","y","z"
  - REPRESENTATION_4 = "x","y"
  - DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_SM
  - DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_SM
  - LABEL_2 = "Re","Im"
  - LABEL_3 = "Bx","By","Bz"
  - LABEL_4 = "Ex","Ey"
  - QUALITY = 0

3.6.8 File Metadata Specification

The version 07 CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_SM_.ceh** described above 7.

For the version 04, the CEF header contains now only the static parameters (file and global metadata):

- The following **file metadata** keywords:
  - FILE_NAME = C1/C2/C3/C4_CP_STA_SM__20070101_V04.cef
  - FILE_FORMAT_VERSION = "CEF-2.0"
  - END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
  - FILE_TYPE = “cef”
  - DATASET_VERSION = "04"
  - LOGICAL_FILE_ID = ex. "C1/C2/C3/C4_CP_STA_SM__20070101_V04"
  - VERSION_NUMBER = "04"
  - METADATA_TYPE = "CAA"
  - METADATA_VERSION = "2.0"
  - FILE_TIME_SPAN = ex. 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
  - GENERATION_DATE = ex. 2009-08-11T16:27:37.000Z
  - FILE_CAVEATS = "Release V04 of STAFF-SA CAA Data. Ted version 2.4.3 with lib 4.4.3 User patch 1. STAFF-SA Processing software with C1_CT_STASA_20010110_V003.cal. Prassadco software: Module Read_N2SA (2002Dec16). Caa software version 2.0 of July 2009"

3.6.9 Dataset header example

Example: C1_CH_STA_SM.ceh

```
!CEH VALIDATION 12 Jan 2015 by LPP, header V08, (PC, NCW, RP, RK)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_SM"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Spectral Matrix (8 Hz - 4 kHz)"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
   ENTRY = "Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "Cross spectral matrices formed from"
   ENTRY = "3 components of the magnetic field"
   ENTRY = "and 2 components of the electric field determined"
   ENTRY = "with either 1or 4s time resolution at 27 logarithmically"
   ENTRY = "distributed frequencies between 8 Hz and 4 kHz"
```

```
END_META = DATASET_DESCRIPTION
!
START_META = TIME_RESOLUTION
   ENTRY = 4.0
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   ENTRY = 4.0
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   ENTRY = 1.0
END_META = MAX_TIME_RESOLUTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Calibrated"
END_META = PROCESSING_LEVEL
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_SA_PSDNEG_CAVEATS"
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "Version 07 : New calibration tables plus addition of the interval "
   ENTRY = "duration and status. Removal of onboard calibration data."
   ENTRY = "Warning to the users of versions lower than 07:"
   ENTRY = "Delta_plus of Time__C1_CP_STA_SM variables is set to a fixed value"
   ENTRY = "instead of a value varying with the mode."
   ENTRY = "This chosen fixed value is the minimum time resolution (4s)"
   ENTRY = "which is correct in most of the cases (Normal Bit Rate)"
   ENTRY = "Note that the data themselves are correct."
   ENTRY = "Version 04 : All the headers have been updated (laboratory name "
   ENTRY = "and email). Introduction of a new header file (Dataset). "
   ENTRY = "Units and Si Conversion of the variables BB and BE have been corrected."
   ENTRY = "Version 03 : Phase rotation corrected + exhaustive data. "
   ENTRY = "The data were time tagged using TED version 2.4.3"
   ENTRY = "(TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group."
   ENTRY = "Older versions are obsolete and should not be used ! "
   ENTRY = "Version 02 : Obsolete. Should not be used !"
   ENTRY = "Version 01 : Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_SM
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval Start time tag"
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
   DELTA_MINUS        = 0.0
   DELTA_PLUS         = Duration__C1_CP_STA_SM
END_VARIABLE = Time__C1_CP_STA_SM
!
START_VARIABLE = Duration__C1_CP_STA_SM
   CATDESC            = "Interval duration"
   FIELDNAM           = "Interval duration"
   DEPEND_0           = Time__C1_CP_STA_SM
   FILLVAL            = 9
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 1
   UNITS              = "s"
   VALUE_TYPE         = INT
   SIZES              = 1
END_VARIABLE = Duration__C1_CP_STA_SM
!
START_VARIABLE = Status__C1_CP_STA_SM
```

```
   CATDESC            = "STAFF-SA Status"
   DEPEND_0           = Time__C1_CP_STA_SM
   FIELDNAM           = "STAFF-SA Status"
   FILLVAL            = ZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "First nine characters of STAFF Status. See UG, Appendix C. \
                         We cannot certify the 9th character (EFW Sweep)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 9
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_SM
!
START_VARIABLE = Frequency__C1_CP_STA_SM
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval centred frequency tag"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin centres"
   LABLAXIS           = "F"
   LABEL_1                                                                             =
"F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F
","F","F","F"
   DELTA_PLUS         = Frequency_BHW__C1_CP_STA_SM
   DELTA_MINUS        = Frequency_BHW__C1_CP_STA_SM
   SCALETYP           = Log
   DATA               = 8.7692,11.0485,13.9203,17.5385,22.0971,27.8406,35.0769, \
                        44.1942,55.6812,70.1539,88.3883,111.3623,140.3078, \
                        176.7767,222.7247,280.6155,353.5534,445.4493,561.2310, \
                        707.1068,890.8987,1122.4620,1414.2135,1781.7975, \
                        2244.9243,2828.4270,3563.5945
END_VARIABLE = Frequency__C1_CP_STA_SM
!
START_VARIABLE = Frequency_BHW__C1_CP_STA_SM
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency bin half widths"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin half widths"
   LABLAXIS           = "F_bhw"
   LABEL_1                                                                             =
"F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw
","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_b
hw","F_bhw","F_bhw","F_bhw"
   SCALETYP           = Log
   DATA               = 1.0085,1.2706,1.6008,2.0169,2.5412,3.2017,4.0338, \
                        5.0823,6.4033,8.0677,10.1647,12.8067,16.1354,20.3293, \
                        25.6133,32.2708,40.6586,51.2267,64.5416,81.3173, \
                        102.4534,129.0831,162.6346,204.9067,258.1663,325.2691, \
                        409.8134
END_VARIABLE = Frequency_BHW__C1_CP_STA_SM
!
START_VARIABLE = BB_xyz_xyz_sr2__C1_CP_STA_SM
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Magnetic_Field"
   PROPERTY           = "Vector"
   FLUCTUATIONS       = "Wavelet_Cross-power-spectrum"
   CATDESC             = "Cross-spectral matrix of the magnetic field at 27 frequencies from 8
Hz to 4 kHz"
   UNITS              = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION      = "1.1E-17>T^2 Hz^-1"
   TENSOR_ORDER       = 2
   TENSOR_FRAME       = "SR2"
```

```
   FRAME               = "SR2>xyz"
   COORDINATE_SYSTEM   = "SR2"
   SIZES               = 27,2,3,3     ! 27 frequency bins x 2 (Re.+Im.) parts x (3x3)matrix
   VALUE_TYPE          = FLOAT
   SIGNIFICANT_DIGITS  = 3
   FILLVAL             = -1.00000E+31
   FIELDNAM            = "Spectral Matrix, BB components"
   LABLAXIS            = "Spectral Matrix, BB components"
   REPRESENTATION_3    = "x","y","z"
   REPRESENTATION_4    = "x","y","z"
   DEPEND_0            = Time__C1_CP_STA_SM
   DEPEND_1            = Frequency__C1_CP_STA_SM
   LABEL_2             = "Re","Im"
   LABEL_3             = "Bx","By","Bz"
   LABEL_4             = "Bx","By","Bz"
   QUALITY             = 3
END_VARIABLE = BB_xyz_xyz_sr2__C1_CP_STA_SM
!
START_VARIABLE = EE_xy_xy_sr2__C1_CP_STA_SM
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Electric_Field"
   PROPERTY            = "Vector"
   FLUCTUATIONS        = "Wavelet_Cross-power-spectrum"
   CATDESC              = "Cross-spectral matrix of the electric field at 27 frequencies from 8
Hz to 4 kHz"
   UNITS               = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION       = "1.0E-6>V^2 m^-2 Hz^-1"
   TENSOR_ORDER        = 2
   TENSOR_FRAME        = "SR2"
   FRAME               = "SR2>xyz"
   COORDINATE_SYSTEM   = "SR2"
   SIZES               = 27,2,2,2     ! 27 frequency bins x 2 (Re.+Im.) parts x (2x2)matrix
   VALUE_TYPE          = FLOAT
   SIGNIFICANT_DIGITS  = 3
   FILLVAL             = -1.00000E+31
   FIELDNAM            = "Spectral Matrix, EE components"
   LABLAXIS            = "Spectral Matrix, EE components"
   REPRESENTATION_3    = "x","y"
   REPRESENTATION_4    = "x","y"
   DEPEND_0            = Time__C1_CP_STA_SM
   DEPEND_1            = Frequency__C1_CP_STA_SM
   LABEL_2             = "Re","Im"
   LABEL_3             = "Ex","Ey"
   LABEL_4             = "Ex","Ey"
   QUALITY             = 3
END_VARIABLE = EE_xy_xy_sr2__C1_CP_STA_SM
!
START_VARIABLE = BE_xyz_xy_sr2__C1_CP_STA_SM
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Compound"
   PROPERTY            = "Vector"
   FLUCTUATIONS        = "Wavelet_Cross-spectrum"
   CATDESC              = "Electromagnetic cross-spectral ExB products at 27 frequencies from 8
Hz to 4 kHz"
   UNITS               = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION       = "3.3E-15>T V m^-1 Hz^-1"
   TENSOR_ORDER        = 2
   TENSOR_FRAME        = "SR2"
   FRAME               = "SR2>xyz"
   COORDINATE_SYSTEM   = "SR2"
   SIZES               = 27,2,3,2     ! 27 frequency bins x 2 (Re.+Im.) parts x (3x2)matrix
   VALUE_TYPE          = FLOAT
   SIGNIFICANT_DIGITS  = 3
   FILLVAL             = -1.00000E+31
   FIELDNAM            = "Spectral Matrix, BE components"
   LABLAXIS            = "Spectral Matrix, BE components"
   REPRESENTATION_3    = "x","y","z"
   REPRESENTATION_4    = "x","y"
   DEPEND_0            = Time__C1_CP_STA_SM
   DEPEND_1            = Frequency__C1_CP_STA_SM
   LABEL_2             = "Re","Im"
   LABEL_3             = "Bx","By","Bz"
   LABEL_4             = "Ex","Ey"
   QUALITY             = 3
```

```
END_VARIABLE = BE_xyz_xy_sr2__C1_CP_STA_SM
```

3.6.10 Dataset file example:

Version 04: C1_CP_STA_SM__20070101_V04.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                            File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_SM__20070101_V07.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                          Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh           ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh               ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh               ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh            ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_SM.ceh            ! Dataset level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_SM__20070101_V07"
END_META = LOGICAL_FILE_ID
!
START_META = DATASET_VERSION
   ENTRY = "07"
END_META = DATASET_VERSION
!
START_META = VERSION_NUMBER
   ENTRY = "07"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2007-01-01T00:00:00.000Z/2007-01-01T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2014-03-11T11:15:39.000Z
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Release V07 of STAFF-SA CAA Data"
   ENTRY = "Ted version 2.4.3 with lib 4.4.3 User patch 1"
   ENTRY = "STAFF-SA Processing software with C1_CT_STASA_20130124_V001.cal"
   ENTRY = "Prassadco software: Module Read_N2SA (2002Dec16)"
   ENTRY = "Caa software version 2.4 of January 2014"
END_META = FILE_CAVEATS
```

```
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                     Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! Each block of data is organized this way:
!
!  | ISO-TIME,INTERVAL DURATION,STAFF-SA STATUS,
! | "Re.Bx^2","Re.BxBy","Re.BxBz","Re.ByBx","Re.By^2","Re.ByBz","Re.BzBx","Re.BzBy","Re.Bz^2",
|
! | "Im.Bx^2","Im.BxBy","Im.BxBz","Im.ByBx","Im.By^2","Im.ByBz","Im.BzBx","Im.BzBy","Im.Bz^2",
| repeated 27 times for the 27 freq.
!  | ...
!  | "Re.Ex^2","Re.ExEy","Re.EyEx","Re.Ey^2", |
!  | "Im.Ex^2","Im.ExEy","Im.EyEx","Im.Ey^2", | repeated 27 times for the 27 freq.
!  | ...
!  | "Re.BxEx","Re.BxEy","Re.ByEx","Re.ByEy","Re.BzEx","Re.BzEy", |
!  | "Im.BxEx","Im.BxEy","Im.ByEx","Im.ByEy","Im.BzEx","Im.BzEy", | repeated 27 times for the
27 freq.
!  | ... $
!
!
!
!
!
DATA_UNTIL = EOF
!
2007-01-01T00:00:01.886Z,4,001700100,
 1.29421E+00,  2.71425E-01,  4.36797E-01,  2.71425E-01,  3.01084E+00,  1.88739E-01,  4.36797E-01,
1.88739E-01, 1.09649E+00,
 0.00000E+00,-3.69390E-01,-8.26858E-02,  3.69390E-01,  0.00000E+00,  6.11156E-01,  8.26858E-02,-
6.11156E-01, 0.00000E+00,
 4.62861E-01,-3.72086E-02,  1.87840E-01,-3.72086E-02,  5.97674E-01,  9.16734E-03,  1.87840E-01,
9.16734E-03, 5.76104E-01,
 0.00000E+00,-1.85144E-01,  1.79752E-02,  1.85144E-01,  0.00000E+00,  2.27386E-01,-1.79752E-02,-
2.27386E-01, 0.00000E+00,
 1.14142E-01,  1.95929E-02,  5.74307E-02,  1.95929E-02,  9.25721E-02,  3.36136E-02,  5.74307E-02,
3.36136E-02, 6.87550E-02,
 0.00000E+00,  8.93366E-03,  2.65134E-03,-8.93366E-03,  0.00000E+00,-6.17447E-03,-2.65134E-03,
6.17447E-03, 0.00000E+00,
 4.07138E-02,  7.17209E-04,-3.41528E-05,  7.17209E-04,  3.98150E-02,  1.25826E-04,-3.41528E-05,
1.25826E-04, 2.86704E-02,
 0.00000E+00,-1.77954E-03,-6.23738E-03,  1.77954E-03,  0.00000E+00,  2.30082E-02,  6.23738E-03,-
2.30082E-02, 0.00000E+00,
 3.23553E-02,  2.01322E-03,  2.17500E-03,  2.01322E-03,  5.11394E-02,  2.45361E-03,  2.17500E-03,
2.45361E-03, 2.89400E-02,
 0.00000E+00,  1.82448E-03,  3.72985E-03,-1.82448E-03,  0.00000E+00,-2.21993E-03,-3.72985E-03,
2.21993E-03, 0.00000E+00,
 1.16839E-02,-7.10019E-03,  5.53635E-03,-7.10019E-03,  3.01084E-02,  1.63574E-03,  5.53635E-03,
1.63574E-03, 2.86704E-02,
 0.00000E+00,  6.14751E-03,  3.49617E-05,-6.14751E-03,  0.00000E+00,-2.38171E-04,-3.49617E-05,
2.38171E-04, 0.00000E+00,
 3.90061E-02,-1.04256E-02,  3.48718E-03,-1.04256E-02,  4.28708E-02,-1.67169E-02,  3.48718E-03,-
1.67169E-02, 4.84431E-02,
 0.00000E+00,  2.84008E-02,-3.23553E-02,-2.84008E-02,  0.00000E+00,  7.35184E-03,  3.23553E-02,-
7.35184E-03, 0.00000E+00,
 1.86942E-02,-2.26487E-03,-4.34999E-04,-2.26487E-03,   2.16601E-02,-4.52075E-03,-4.34999E-04,-
4.52075E-03, 2.43564E-02,
 0.00000E+00,  7.07323E-03,-8.25959E-03,-7.07323E-03,  0.00000E+00,  1.59979E-03,  8.25959E-03,-
1.59979E-03, 0.00000E+00,
 1.28522E-03,  2.72324E-04,-1.42903E-05,  2.72324E-04,  4.74544E-04,-4.86228E-06,-1.42903E-05,-
4.86228E-06, 2.92096E-03,
 0.00000E+00,  1.29421E-04,-3.32541E-04,-1.29421E-04,  0.00000E+00,-1.22231E-04,  3.32541E-04,
1.22231E-04, 0.00000E+00,
 5.07799E-04,-6.99234E-06,  2.39968E-10,-6.99234E-06,  5.55433E-04,  8.22364E-09,  2.39968E-10,
8.22364E-09, 5.98573E-04,
 0.00000E+00,  4.32303E-08,-5.48243E-06,-4.32303E-08,  0.00000E+00,  2.84906E-06,  5.48243E-06,-
2.84906E-06, 0.00000E+00,
 2.06714E-04,-2.19297E-05,  3.91859E-06,-2.19297E-05,  2.66931E-04,-1.17737E-05,  3.91859E-06,-
1.17737E-05, 2.89400E-04,
 0.00000E+00,-8.30453E-09,-1.80650E-06,  8.30453E-09,  0.00000E+00,-5.00608E-07,  1.80650E-06,
5.00608E-07, 0.00000E+00,
 1.33016E-04,-1.24927E-05,  1.33915E-05,-1.24927E-05,  1.68967E-04,  6.24637E-06,  1.33915E-05,
6.24637E-06, 2.14803E-04,
```

```
 0.00000E+00,  0.00000E+00,-4.10733E-06,-0.00000E+00,  0.00000E+00,  7.58552E-06,  4.10733E-06,-
7.58552E-06, 0.00000E+00,
 8.79884E-05,  3.27148E-07,-2.81311E-07,  3.27148E-07,  8.54719E-05,  8.18769E-07,-2.81311E-07,
8.18769E-07, 1.43801E-04,
 0.00000E+00,  3.84669E-06,-1.49194E-09,-3.84669E-06,  0.00000E+00,-2.81311E-09,  1.49194E-09,
2.81311E-09, 0.00000E+00,
 6.32726E-05,-5.68015E-06,  3.61301E-07,-5.68015E-06,  7.63046E-05,  8.61909E-07,  3.61301E-07,
8.61909E-07, 1.06053E-04,
 0.00000E+00,  1.46498E-06,  2.13904E-07,-1.46498E-06,  0.00000E+00,-6.89348E-07,-2.13904E-07,
6.89348E-07, 0.00000E+00,
 3.15464E-05,-2.54349E-06,  2.27386E-06,-2.54349E-06,  3.60402E-05,  7.66641E-07,  2.27386E-06,
7.66641E-07, 9.52684E-05,
 0.00000E+00,-1.58181E-08,-1.31219E-07,  1.58181E-08,  0.00000E+00,  1.33016E-06,  1.31219E-07,-
1.33016E-06, 0.00000E+00,
 3.24452E-05,-1.34814E-06,  6.16548E-08,-1.34814E-06,  2.49855E-05,-2.05816E-07,  6.16548E-08,-
2.05816E-07, 4.52974E-05,
 0.00000E+00,  5.36559E-08,-7.91806E-07,-5.36559E-08,  0.00000E+00,  1.35713E-06,  7.91806E-07,-
1.35713E-06, 0.00000E+00,
 2.64235E-05,  1.86942E-07,-1.22231E-06,  1.86942E-07,  2.10309E-05,-3.67592E-07,-1.22231E-06,-
3.67592E-07, 3.00185E-05,
 0.00000E+00,  1.06952E-06,-6.83056E-07,-1.06952E-06,  0.00000E+00,  3.67592E-07,  6.83056E-07,-
3.67592E-07, 0.00000E+00,
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1.66270E-08, 2.41766E-05,
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1.38409E-07, 0.00000E+00,
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0.00000E+00, 9.34709E-06,
 0.00000E+00,  0.00000E+00,  0.00000E+00,-0.00000E+00,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
0.00000E+00, 0.00000E+00,
 1.06053E-05,  5.12292E-07,  0.00000E+00,  5.12292E-07,  9.25721E-06,  0.00000E+00,  0.00000E+00,
0.00000E+00, 9.07746E-06,
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0.00000E+00, 0.00000E+00,
 1.73460E-05,  6.48904E-07,  0.00000E+00,  6.48904E-07,  1.56384E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 1.42004E-05,
 0.00000E+00,  3.63098E-07,  0.00000E+00,-3.63098E-07,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
0.00000E+00, 0.00000E+00,
 1.33915E-05,  6.03966E-07,  0.00000E+00,  6.03966E-07,  1.20434E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 8.72694E-06,
 0.00000E+00,  4.04441E-09,  0.00000E+00,-4.04441E-09,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
0.00000E+00, 0.00000E+00,
 1.43801E-05,  3.68491E-07,  0.00000E+00,  3.68491E-07,  1.36611E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 1.13244E-05,
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0.00000E+00, 0.00000E+00,
 2.09411E-05,  6.67777E-07,  0.00000E+00,  6.67777E-07,  1.98626E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 1.66270E-05,
 0.00000E+00,  2.90299E-09,  0.00000E+00,-2.90299E-09,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
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 2.40867E-05,  8.43035E-07,  0.00000E+00,  8.43035E-07,  2.21095E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 2.02221E-05,
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0.00000E+00, 3.02882E-05,
 0.00000E+00,  5.54534E-09,  0.00000E+00,-5.54534E-09,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
0.00000E+00, 0.00000E+00,
 4.34100E-05,-3.92757E-07,  0.00000E+00,-3.92757E-07,  4.29607E-05,  0.00000E+00,  0.00000E+00,
0.00000E+00, 4.10733E-05,
 0.00000E+00,-1.43801E-08,  0.00000E+00,  1.43801E-08,  0.00000E+00,  0.00000E+00,-0.00000E+00,-
0.00000E+00, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
```

```
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
 0.00000E+00,-1.00000E+31,-1.00000E+31, 0.00000E+00,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
```

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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,
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-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31,-1.00000E+31 $
!
```

3.7 Level 3 data - Graphical Data (Plots)

3.7.1 Format: binary

Graphical products are delivered in PNG formats.

3.7.2 Standard: N.A.

3.7.3 Production Procedure: N.A.

3.7.4 Quality Control Procedure: N.A.

3.7.5 Delivery Procedure

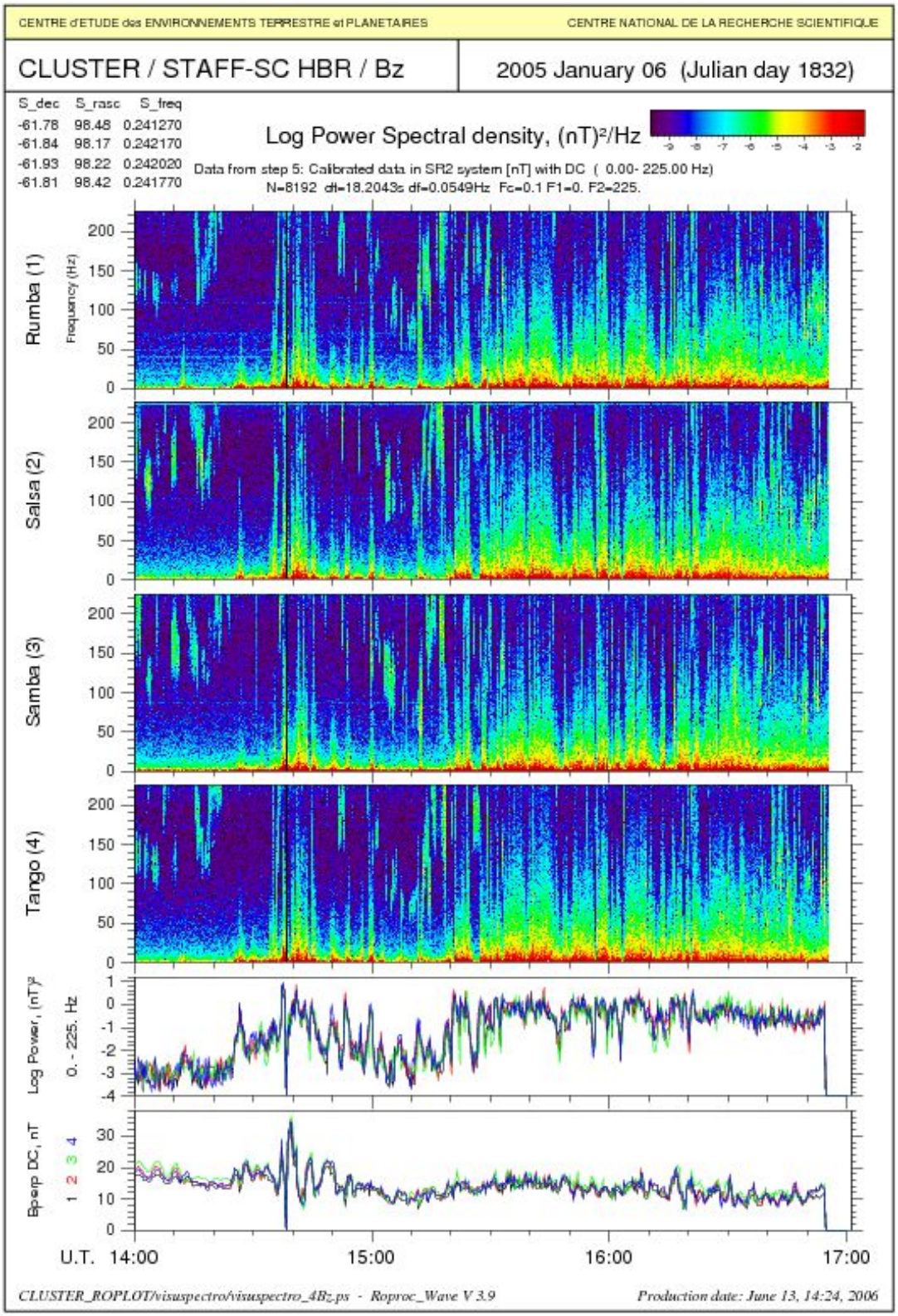
Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.7.6 Product Specification

3.7.6.1 STAFF-SC spectrograms

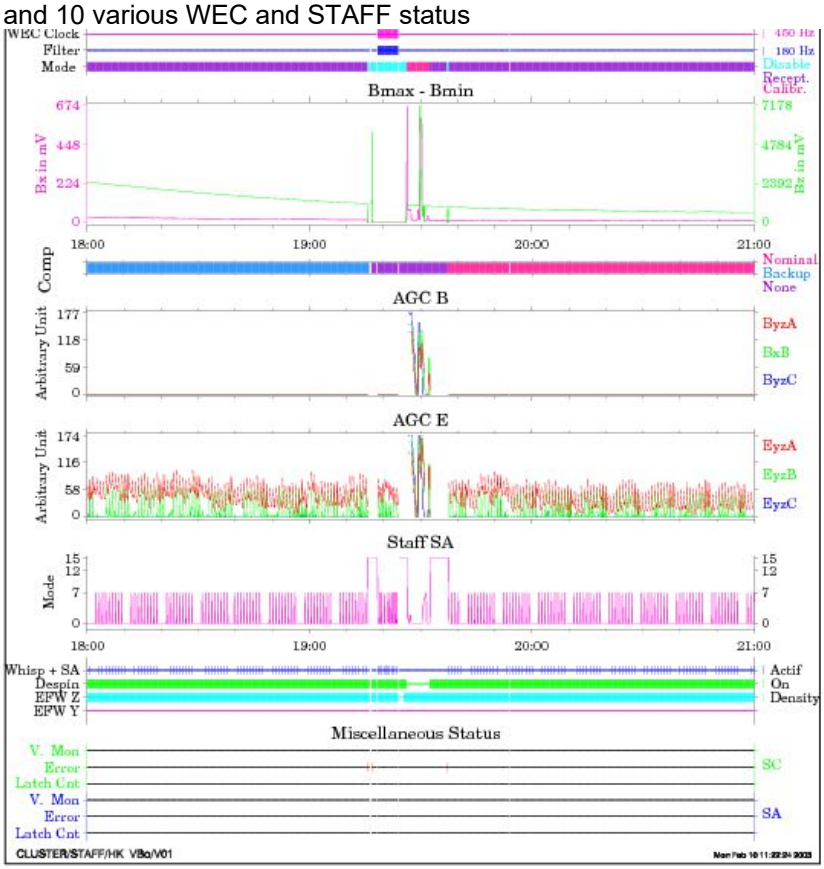
Plots are separated in time series of 3 hours, in other words we have 8 files per day (this is a maximum number, because if data don't exist files are not created). NBR and HBR plots are separated (2x8). They show the B_z (spin axis aligned) component of the magnetic field expressed as the Log Power Spectral Density (nT^2Hz^{-1}) for the 4 satellites. The range of covered frequencies is 0-12.5 Hz in Normal Bit Rate (NBR) and 0-225 Hz in High Bit Rate (HBR). Below these 4 plots (one per satellite) one finds the

integrated power curves for the 4 satellites in the range 0.2-12.5Hz (NBR) or 0.2-225Hz (HBR). At the very bottom the DC field in the plan perpendicular to the spin axis for the four spacecraft is given. An example of HBR plot is given next page.


CENTRE d'ETUDE des ENVIRONNEMENTS TERRESTRE et PLANETAIRES
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
CLUSTER / STAFF-SC HBR / Bz
2005 January 06 (Julian day 1832)
S_dec S_rasc S_freq
-61.78 98.48 0.241270
-61.84 98.17 0.242170
-61.93 98.22 0.242020
-61.81 98.42 0.241770
Log Power Spectral density, (nT)²/Hz
Data from step 5: Calibrated data in SR2 system [nT] with DC (0.00- 225.00 Hz)
N=8192 dt=18.2043s df=0.0549Hz Fc=0.1 F1=0. F2=225.
Rumba (1)
Salsa (2)
Samba (3)
Tango (4)
Frequency (Hz)
Log Power, (nT)² 0. - 225. Hz
Bperp DC, nT 1 2 3 4
U.T. 14:00
15:00
16:00
17:00
CLUSTER_ROPLOT/visuspectro/visuspectro_4Bz.ps - Roproc_Wave V 3.9
Production date: June 13, 14:24, 2006

3.7.6.2 STAFF house keeping plots

<DATASET_TITLE>
STAFF-HK-plot
</DATASET_TITLE>
<DATASET_DESCRIPTION>
These plots show a summary of housekeeping data extracted from WEC HK telemetry. There is one plot per S/C, of 3 hours duration each. HK time resolution is 5.15 seconds.
The plotted parameters allow verifying the mode of operation and the health of STAFF experiment, in the context of WEC and satellite mode of operation.
It permits in particular to understand data gaps.
The 10 plots, from top to bottom describe:
1-The S/C telemetry mode
2- STAFF relevant DWP status (as Application or TM overflow)
3-4-5 STAFF SC (3- mode; 4- maximum amplitude of the waveform; 5- compression mode)
6-7-8 STAFF SA (6 and 7- AGC level; 8-mode)
9 and 10 various WEC and STAFF status



Example of HK plot. There is a calibration mode in operation in the middle of the 3 hours time.

3.7.7 File Metadata Specification

N/A

3.8 Level 3 data - SA – Polarization and Propagation Parameters (PPP)

3.8.1 Format: CEF

3.8.2 Standard: cf 2.2.

3.8.3 Production Procedure: cf 2.3.2.

3.8.4 Quality Control Procedure: cf 2.4.2.

3.8.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.8.6 Product Specification

One CEF file per day and per satellite is produced.
This CEF file contains the Polarization and Propagation Parameters for the magnetic and the electric field.

Data are separated into seven variables:
The parameters calculated from the three magnetic components are:

- THSVD_mfa__C1_STA_PPP is the float variable defined for the polar angle value of the wave vector (where C1 stands for satellite 1 in this example), they are given in degree units.
- PHSVD_mfa__C1_STA_PPPis the float variable defined for the azymuthal angle value of the wave vector (where C1 stands for satellite 1 in this example), they are given in degree units.
- ELLSVD__C1_CP_STA_PPP is the float variable defined for the ellipticity of the polarization (unitless)
- POLSVD__C1_CP_STA_PPP is the float variable defined for the degree of polarization in the polarization plane.
- BSUM__C1_CP_STA_PPP is the float variable defined for the sum of the three auto-power spectra of the three magnetic antennae given in nT^2Hz^{-1} units.

- PVSIGN__C1_CP_STA_PPP is the float variables defined for the direction of the Poynting vector component parallel to the magnetic field. Positive (negative) values correspond to a parallel (anti-parallel) Z-component of the Poynting vector.
- ESUM__C1_CP_STA_PPP is the float variable defined for the sum of the two auto-power spectra of the two electric antennae given in $mV^2m^{-2}Hz^{-1}$ units.

Each variable is sampled for 27 ranges of frequencies described in the Dimension_F__C1_CP_STA_PPP variable which summarizes the 27 bin centres (given in Hz).
This variable is linked to the Dimension_F_bin_half_width__C1_CP_STA_PPP variable which gives the half width of each bin.
Data are given in MFA coordinate system. Note that coordinate transformation is not allowed since the information that is mandatory for such an operation is unknown.

3.8.7 Dataset metadata description:

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_PPP.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CP_STA_PPP
  - DATA_TYPE = "CP"
  - DATASET_TITLE = "Polarization and Propagation Parameter"
  - CONTACT_COORDINATES =
  "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr
  Olga Alexandrova>Co-I >olga.alexandrova@obspm.fr
  Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
  - DATASET_DESCRIPTION = "Polarization and propagation parameters derived from singular value decomposition (SVD) method of the cross-spectral matrix (sm) using the PRASSADCO program with 4s (or 1s) time resolution at 27 (or 18) logarithmically distributed frequencies between either 8 (or 64) Hz to 4 kHz. The SVD method is described in Santolik et al (2003). The parameters calculated from the three magnetic components are THSVD, PHSVD, ELLSVD,POLSVD and BSUM. BSUM is the sum of the three magnetic auto-power spectra. When BSUM is inferior to 1.0E-09 nT^2/Hz, the calculation of the other magnetic dependant parameters is meaningless. The theta and phi variables are respectively the wave vector polar and azimuthal angles in MFA coordinate system. PVSIGN is the direction of the Poynting vector component parallel to the magnetic field. It is given only when E component is valid. Positive (negative) values correspond to a parallel (anti-parallel) Z-component of the Poynting vector. ESUM is the the sum of auto-power spectra of the two electric antennae. The calculation of PVSIGN is meaningless when BSUM is inferior to 1.0E-09 nT^2/Hz, and ESUM to 3.0E-09mV^2m^2/Hz. The change of coordinate system has been done using FGM 5VPS data. “
  - PROCESSING_LEVEL = "Derived"
  - TIME_RESOLUTION = 4.0
  - MIN_TIME_RESOLUTION = 4.0
  - MAX_TIME_RESOLUTION = 1.0
  - DATASET_CAVEATS =
  "*C1_CQ_STA_SA_STATUS_CAVEATS.
  *C1_CQ_STA_SA_PSDNEG_CAVEATS.

*C1_CQ_STA_SA_NOTSRP_CAVEATS.The data were time tagged using TED version 2.4.3 (TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group"

- Then, the following **Support data**:

Data are indexed by the **following variables**:

& Time which the ISO time of data acquisition (Universal Time). Its properties are:
- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval time tag"
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- VALUE_TYPE = ISO_TIME
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:99.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"
- DELTA_MINUS = 2.0
- DELTA_PLUS = 2.0

& Frequency represents the 27 frequency bin centres expressed in Hz. Each bin is sized by the Frequency_BHW__C?_CP_STA_PSD which expresses the half width of the bin (=DELTA_MINUS and DELTA_MINUS):
- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Interval centred frequency tag"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 4
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin centres"
- LABLAXIS = "F"
- LABEL_1 = "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F", "F"
- DELTA_PLUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_PPP
- DELTA_MINUS = Frequency_BHW__C1/C2/C3/C4_CP_STA_PPP
- SCALETYP = Log
- DATA = 8.7692, 11.0485, 13.9203, 17.5385, 22.0971, 27.8406, 35.0769, 44.1942, 55.6812, 70.1539, 88.3883, 111.3623, 140.3078, 176.7767, 222.7247, 280.6155, 353.5534, 445.4493, 561.2310, 707.1068, 890.8987, 1122.4620, 1414.2135, 1781.7975, 2244.9243, 2828.4270, 3563.5945

& Duration which is the half-interval duration. Its properties are:
- CATDESC = "Half-interval duration"

- FIELDNAM = "Half-interval duration"
- DEPEND_0 = Time__C1_CP_STA_PPP
- FILLVAL = 9.999
- LABLAXIS = "s"
- PARAMETER_TYPE = "Support_Data"
- SI_CONVERSION = "1.0>s"
- SIGNIFICANT_DIGITS = 4
- UNITS = "s"
- VALUE_TYPE = FLOAT
- SIZES = 1

& Status is the STAFF-SA status. Its properties are:

- CATDESC = "STAFF-SA Status"
- DEPEND_0 = Time__C1_CP_STA_PPP
- FIELDNAM = "STAFF-SA Status"
- FILLVAL = ZZZZZZZZZ
- LABEL_1 = "Status"
- LABLAXIS = "Status"
- PARAMETER_CAVEATS = "First nine characters of STAFF Status. See UG, Appendix C. We cannot certify the 9th character (EFW Sweep)"
- PARAMETER_TYPE = "Support_Data"
- QUALITY = 1
- SIGNIFICANT_DIGITS = 9
- SIZES = 1
- UNITS = "unitless"
- VALUE_TYPE = CHAR

&Frequency_BHW represents the Frequency bin half widths expressed in Hz. Its values correspond to the 27 frequency bin centres (Frequency__C?_CP_STA_PPP) :

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Frequency bin half widths"
- UNITS = "Hz"
- SI_CONVERSION = "1.0>Hz"
- SIZES = 27
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 3
- FILLVAL = -999.99
- FIELDNAM = "Frequency bin half widths"
- LABLAXIS = "F_bhw"
- LABEL_1 = "F_bhw", "F_bhw"
- SCALETYP = Log
- DATA = 1.0085, 1.2706, 1.6008, 2.0169, 2.5412, 3.2017, 4.0338, 5.0823, 6.4033, 8.0677, 10.1647, 12.8067, 16.1354, 20.3293, 25.6133, 32.2708,

40.6586, 51.2267, 64.5416, 81.3173, 102.4534, 129.0831, 162.6346, 204.9067, 258.1663, 325.2691, 409.8134

Data themselves:

&THSVD_mfa__C1/C2/C3/C4_CP_STA_PPP variable stores the polar angle of the direction of propagation in MFA coordinate system (SVD).

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Direction"
- CATDESC = "Polar angle of the direction of propagation in MFA coordinate system (SVD)."
- UNITS = "deg"
- SI_CONVERSION = "1>degree"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 1
- FILLVAL = -999.
- FIELDNAM = "Polar angle (SVD) in MFA coordinate system."
- LABLAXIS = "THSVD"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& PHSVD_mfa__C1/C2/C3/C4_CP_STA_PPP variable stores the azymuthal angle of the direction of propagation in MFA coordinate system (SVD).

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Direction"
- CATDESC = "Azymuthal angle of the direction of propagation in MFA coordinate system (SVD)."
- UNITS = "deg"
- SI_CONVERSION = "1>degree"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 1
- FILLVAL = -999.
- FIELDNAM = "Azymuthal angle (SVD) in MFA coordinate system."
- LABLAXIS = "PHSVD"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& ELLSVD__C1/C2/C3/C4_CP_STA_PPP variable stores the ellipticity of the polarization (SVD).

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Magnitude"

- CATDESC = "Ellipticity of the polarization (SVD)."
- UNITS = "Unitless"
- SI_CONVERSION = "1>unitless"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 2
- FILLVAL = -9.9
- FIELDNAM = "Ellipticity of the polarization (SVD)."
- LABLAXIS = "ELLSVD"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& POLSVD__C1/C2/C3/C4_CP_STA_PPP variable stores the degree of polarization in the polarizationplane (SVD).

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Magnitude"
- CATDESC = "Degree of polarization in the polarization plane (SVD)."
- UNITS = "Unitless"
- SI_CONVERSION = "1>unitless"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 2
- FILLVAL = -9.9
- FIELDNAM = "Degree of polarization in the polarization plane (SVD)."
- LABLAXIS = "POLSVD"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& BSUM__C1/C2/C3/C4_CP_STA_PPP variable stores the sum of the three magnetic auto-power spectra.

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Magnitude"
- CATDESC = "Sum of the three magnetic auto-power spectra."
- UNITS = "nT^2 Hz^-1"
- SI_CONVERSION = "1.0E-18>T^2 Hz^-1"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 2
- FILLVAL = -1.00E-31
- FIELDNAM = "Sum of the three magnetic auto-power spectra."
- LABLAXIS = "BSUM"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& PVSIGN__C1/C2/C3/C4_CP_STA_PPP variable stores the parallel component of the Poynting vector normalized by its standard deviation.

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Component"
- CATDESC = "Parallel component of the Poynting vector normalized by its standard deviation."
- UNITS = "Unitless"
- SI_CONVERSION = "1>Unitless"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 2
- FILLVAL = -1.00E-31
- FIELDNAM = "Normalized Z-component of the Poynting vector.“
- LABLAXIS = "PVSIGN"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

& ESUM__C1/C2/C3/C4_CP_STA_PPP variable stores the sum of the two electric auto-power spectra.

- PARAMETER_TYPE = "Data"
- ENTITY = "Compound"
- PROPERTY = "Magnitude"
- CATDESC = "Sum of the two electric auto-power spectra."
- UNITS = "mV^2 m^-2 Hz^-1"
- SI_CONVERSION = "1.0E-6>V^2 m^-2 Hz^-1"
- SIZES = 27 ! 27 frequency bins
- VALUE_TYPE = FLOAT
- SIGNIFICANT_DIGITS = 2
- FILLVAL = -1.00E-31
- FIELDNAM = "Sum of the two electric auto-power spectra.“
- LABLAXIS = "ESUM"
- DEPEND_0 = Time__C1/C2/C3/C4_CP_STA_PPP
- DEPEND_1 = Frequency__C1/C2/C3/C4_CP_STA_PPP
- QUALITY = 3

3.8.8 File Metadata Specification

The version 4 CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_PPP.ceh** described above.

For the version 01, the CEF contains now only the static parameters (file and global metadata).

- The following file **metadata** keywords:

- FILE_NAME = C1/C2/C3/C4_CP_STA_PPP__20010201_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
  - FILE_TYPE = "cef"
  - LOGICAL_FILE_ID = "C1/C2/C3/C4_CP_STA_PPP__20070101_V04"
  - DATASET_VERSION = "01"
  - VERSION_NUMBER = "01"
  - METADATA_TYPE = "CAA"
  - METADATA_VERSION = "2.0"
  - FILE_TIME_SPAN = ex. 2001-02-01T00:00:00.000Z/2001-02-01T23:59:59.999Z
  - GENERATION_DATE = ex. 2010-04-26T18:59:06.000Z
  - FILE_CAVEATS = "Release V01 of STAFF-SA CAA Data. TED version 2.4.3 with lib 4.4.3 User Patch 1. STAFF-SA Processing software with C1_CT_STASA_20010110_V003.cal.Prassadco software: Module read_N2SA(2010Feb10) and module PRASSADCO(2010Feb01). Caa software version 2.0 of July 2009"

3.8.9 Dataset header example

Example: C1_CH_STA_PPP.ceh

```
!CEH VALIDATION 21 July 2015 by LPP, header V07, (PC, NCW, RK, RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CP_STA_PPP"
END_MElTA = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CP"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Polarization and Propagation Parameters"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
   ENTRY = "Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "Polarization and propagation parameters"
   ENTRY = "derived from singular value decomposition (SVD) method"
   ENTRY = "of the cross-spectral matrix (sm) using the PRASSADCO program"
   ENTRY = "with 4s (or 1s) time resolution at 27 (or 18) logarithmically"
   ENTRY = "distributed frequencies between either 8 (or 64) Hz to 4 kHz."
   ENTRY = "The SVD  method is described in Santolik et al (2003)."
   ENTRY = "The parameters calculated from the three magnetic components are"
   ENTRY = "THSVD, PHSVD, ELLSVD,POLSVD and BSUM. BSUM is the sum of the"
   ENTRY = "three magnetic auto-power spectra. When BSUM is inferior to"
   ENTRY = "1.0E-09 nT^2/Hz, the calculation of the other magnetic dependant parameters"
   ENTRY = "is meaningless. The theta and phi variables"
   ENTRY = "are respectively the wave vector polar and azimuthal angles"
   ENTRY = "in MFA coordinate system. PVSIGN is the direction of the"
   ENTRY = "Poynting vector component parallel to the magnetic field. It is given"
```

```
   ENTRY = "only when E component is valid. Positive (negative) values correspond"
   ENTRY = "to a parallel (anti-parallel) Z-component of the Poynting vector."
   ENTRY = "ESUM is the the sum of auto-power spectra of the two electric antennae."
   ENTRY = "The calculation of PVSIGN is meaningless when BSUM is inferior to"
   ENTRY = "1.0E-09 nT^2/Hz, and ESUM to 3.0E-09mv^2m^-2/Hz. "
   ENTRY = "The change of coordinate system has been done using"
   ENTRY = "FGM 5VPS data."
END_META = DATASET_DESCRIPTION
!
START_META = TIME_RESOLUTION
   ENTRY = 4.0
END_META = TIME_RESOLUTION
!
START_META = MIN_TIME_RESOLUTION
   ENTRY = 4.0
END_META = MIN_TIME_RESOLUTION
!
START_META = MAX_TIME_RESOLUTION
   ENTRY = 1.0
END_META = MAX_TIME_RESOLUTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Derived"
END_META = PROCESSING_LEVEL
!
START_META = DATASET_CAVEATS
   ENTRY = "*C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS"
   ENTRY = "*C1_CQ_STA_SA_PSDNEG_CAVEATS"
   ENTRY = "*C1_CQ_STA_NOTSRP_CAVEATS"
   ENTRY = "Version 07 : New calibration tables plus addition of the half-interval "
   ENTRY = "duration and status. Removal of onboard calibration data."
   ENTRY = "Now with FGM induced gaps. FGM file used described in the FILE_CAVEATS "
   ENTRY = "metadata section. "
   ENTRY = "Warning to the users of versions lower than 07:"
   ENTRY = "Delta_plus of Time__C1_CP_STA_PPP variables was set to a fixed value"
   ENTRY = "instead of a value varying with the mode."
   ENTRY = "This chosen fixed value is the minimum time resolution (4s)"
   ENTRY = "which is correct in most of the cases (Normal Bit Rate)."
   ENTRY = "Note that the data themselves are correct."
   ENTRY = "The data were time tagged using TED version 2.4.3"
   ENTRY = "(TED Library 4.4.3 User Patch 1), provided by the Sheffield DWP Group."
   ENTRY = "Version 05: used the new calibration tables (feb 2013)."
   ENTRY = "Version 03: AUX files in CDF format used are 26 hours."
   ENTRY = "Same data than version02 but less missing values."
   ENTRY = "Version 02: Data format corrected."
   ENTRY = "Version 01: Obsolete. Should not be used !"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval time tag"
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   VALUE_TYPE         = ISO_TIME
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
   DELTA_MINUS        = Duration__C1_CP_STA_PPP
   DELTA_PLUS         = Duration__C1_CP_STA_PPP
END_VARIABLE = Time__C1_CP_STA_PPP
!
START_VARIABLE = Frequency__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Interval centred frequency tag"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
```

```
   SIGNIFICANT_DIGITS = 4
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin centres"
   LABLAXIS           = "F"
   LABEL_1                                                                                          =
"F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F","F
","F","F","F"
   DELTA_PLUS         = Frequency_BHW__C1_CP_STA_PPP
   DELTA_MINUS        = Frequency_BHW__C1_CP_STA_PPP
   SCALETYP           = Log
   DATA               = 8.7692,11.0485,13.9203,17.5385,22.0971,27.8406,35.0769, \
                        44.1942,55.6812,70.1539,88.3883,111.3623,140.3078, \
                        176.7767,222.7247,280.6155,353.5534,445.4493,561.2310, \
                        707.1068,890.8987,1122.4620,1414.2135,1781.7975, \
                        2244.9243,2828.4270,3563.5945
END_VARIABLE = Frequency__C1_CP_STA_PPP
!
START_VARIABLE = Duration__C1_CP_STA_PPP
   CATDESC            = "Half-interval duration"
   FIELDNAM           = "Half-interval duration"
   DEPEND_0           = Time__C1_CP_STA_PPP
   FILLVAL            = 9.999
   LABLAXIS           = "s"
   PARAMETER_TYPE     = "Support_Data"
   SI_CONVERSION      = "1.0>s"
   SIGNIFICANT_DIGITS = 4
   UNITS              = "s"
   VALUE_TYPE         = FLOAT
   SIZES              = 1
END_VARIABLE = Duration__C1_CP_STA_PPP
!
START_VARIABLE = Status__C1_CP_STA_PPP
   CATDESC            = "STAFF-SA Status"
   DEPEND_0           = Time__C1_CP_STA_PPP
   FIELDNAM           = "STAFF-SA Status"
   FILLVAL            = ZZZZZZZZZ
   LABEL_1            = "Status"
   LABLAXIS           = "Status"
   PARAMETER_CAVEATS  = "First nine characters of STAFF Status. See UG, Appendix C. We cannot
certify the 9th character (EFW Sweep)"
   PARAMETER_TYPE     = "Support_Data"
   QUALITY            = 1
   SIGNIFICANT_DIGITS = 9
   SIZES              = 1
   UNITS              = "unitless"
   VALUE_TYPE         = CHAR
END_VARIABLE = Status__C1_CP_STA_PPP
!
START_VARIABLE = Frequency_BHW__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Frequency bin half widths"
   UNITS              = "Hz"
   SI_CONVERSION      = "1.0>Hz"
   SIZES              = 27
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 3
   FILLVAL            = -999.99
   FIELDNAM           = "Frequency bin half widths"
   LABLAXIS           = "F_bhw"
   LABEL_1                                                                                          =
"F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw
","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_bhw","F_b
hw","F_bhw","F_bhw","F_bhw"
   SCALETYP           = Log
   DATA               = 1.0085,1.2706,1.6008,2.0169,2.5412,3.2017,4.0338, \
                        5.0823,6.4033,8.0677,10.1647,12.8067,16.1354,20.3293, \
                        25.6133,32.2708,40.6586,51.2267,64.5416,81.3173, \
                        102.4534,129.0831,162.6346,204.9067,258.1663,325.2691, \
                        409.8134
END_VARIABLE = Frequency_BHW__C1_CP_STA_PPP
!
START_VARIABLE = THSVD_mfa__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
```

```
   PROPERTY           = "Direction"
   CATDESC             = "Polar Angle of the direction of propagation in MFA coordinate system
(SVD)."
   UNITS              = "deg"
   SI_CONVERSION      = "1>degree"
   SIZES              = 27   ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 1
   FILLVAL            = -999.
   FIELDNAM           = "Polar angle (SVD) in MFA coordinate system"
   LABLAXIS           = "THSVD"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = THSVD_mfa__C1_CP_STA_PPP
!
START_VARIABLE = PHSVD_mfa__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
   PROPERTY           = "Direction"
   CATDESC              = "Azimuthal Angle of the direction of propagation in MFA coordinate
system (SVD)."
   UNITS              = "deg"
   SI_CONVERSION      = "1>degree"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 1
   FILLVAL            = -999.
   FIELDNAM           = "Azimuthal angle (SVD) in MFA coordinate system"
   LABLAXIS           = "PHSVD"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = PHSVD_mfa__C1_CP_STA_PPP
!
START_VARIABLE = ELLSVD__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
   PROPERTY           = "Magnitude"
   CATDESC            = "Ellipticity of the polarization (SVD)."
   UNITS              = "Unitless"
   SI_CONVERSION      = "1.0>unitless"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 2
   FILLVAL            = -9.9
   FIELDNAM           = "Ellipticity  of the polarization (SVD)"
   LABLAXIS           = "ELLSVD"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = ELLSVD__C1_CP_STA_PPP
!
START_VARIABLE = POLSVD__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
   PROPERTY           = "Magnitude"
   CATDESC            = "Degree of polarization in the polarization plane (SVD)."
   UNITS              = "Unitless"
   SI_CONVERSION      = "1.0>unitless"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 2
   FILLVAL            = -9.9
   FIELDNAM           = "Degree of polarization in the polarization plane (SVD)."
   LABLAXIS           = "POLSVD"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = POLSVD__C1_CP_STA_PPP
!
START_VARIABLE = BSUM__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
```

```
   PROPERTY           = "Magnitude"
   CATDESC            = "Sum of the three magnetic auto-power spectra."
   UNITS              = "nT^2 Hz^-1"
   SI_CONVERSION      = "1.0E-18>T^2 Hz^-1"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 2
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Sum of the three magnetic auto-power spectra."
   LABLAXIS           = "BSUM"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = BSUM__C1_CP_STA_PPP
!
START_VARIABLE = PVSIGN__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
   PROPERTY           = "Component"
   CATDESC             = "Parallel component of the Poynting vector normalized by its standard
deviation."
   UNITS              = "Unitless"
   SI_CONVERSION      = "1.0>unitless"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 2
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Normalized Z-component of the Poynting vector"
   LABLAXIS           = "PVSIGN"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = PVSIGN__C1_CP_STA_PPP
!
START_VARIABLE = ESUM__C1_CP_STA_PPP
   PARAMETER_TYPE     = "Data"
   ENTITY             = "Compound"
   PROPERTY           = "Magnitude"
   CATDESC            = "Sum of the two electric auto-power spectra."
   UNITS              = "mV^2 m^-2 Hz^-1"
   SI_CONVERSION      = "1.0E-6>V^2 m^-2 Hz^-1"
   SIZES              = 27     ! 27 frequency bins
   VALUE_TYPE         = FLOAT
   SIGNIFICANT_DIGITS = 2
   FILLVAL            = -1.00E+31
   FIELDNAM           = "Sum of the two electric auto-power spectra."
   LABLAXIS           = "ESUM"
   DEPEND_0           = Time__C1_CP_STA_PPP
   DEPEND_1           = Frequency__C1_CP_STA_PPP
   QUALITY            = 3
END_VARIABLE = ESUM__C1_CP_STA_PPP
!
```

3.8.10 Dataset file example

Version 01: C1_CP_STA_PPP__20010201_V01.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                             File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CP_STA_PPP__20010201_V02.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                           Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
```

```
INCLUDE= CL_CH_MISSION.ceh           ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh               ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh               ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh            ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_PPP.ceh           ! Dataset level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "02"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CP_STA_PPP__20010201_V02"
END_META = LOGICAL_FILE_ID
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = VERSION_NUMBER
   ENTRY = "02"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2001-02-01T00:00:00.000Z/2001-02-01T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2010-05-07T15:30:32.000Z
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Release V02 of STAFF-SA CAA Data"
   ENTRY = "TED version 2.4.3 with lib 4.4.3 User Patch 1"
   ENTRY = "STAFF-SA Processing software with C1_CT_STASA_20010110_V003.cal"
ENTRY = "Prassadco software:"
   ENTRY = "Module read_N2SA(2010Feb10) and module PRASSADCO(2010Feb01)"
   ENTRY = "Caa software version 2.0 of July 2009"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                      Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! Each block of data is organized this way:
!
!  |"ISO-TIME",
!  | Parameters depending on the magnetics fields.
!  | THSVD,   repeated 27 times for the 27 freq.
!  | PHSVD,   repeated 27 times for the 27 freq.
!  | ELLSVD,  repeated 27 times for the 27 freq.
!  | POLSVD,  repeated 27 times for the 27 freq.
!  | BSUM,    repeated 27 times for the 27 freq.
!  | Parameters depending on the magnetics and electric fields
!  | PVSIGN,   repeated 27 times for the 27 freq.
!  | ESUM,     repeated 27 times for the 27 freq.
!  | ...$
!
!
!
DATA_UNTIL = EOF
```

```
!
2001-02-01T00:00:14.587Z,
-999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -
999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999.,
 -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -
999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999., -999.,
-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-
9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,
-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-
9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,-9.9,
-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,
-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-
1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31,-1.00E+31 $
!
...
!
```

3.9 Auxilliary data –CAVEAT file for SM/PPP STAFF-SA – PSDNEG

3.9.1 Format: CEF

3.9.2 Standard: cf 2.2.

3.9.3 Production Procedure: cf 2.3.2.

3.9.4 Quality Control Procedure: cf 2.4.2.

3.9.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.9.6 Product Specification

One CEF file per day and per satellite.
This CEF file contains the caveats for the SM/PPP datasets from the STAFF-SA instrument. For a given time and frequency, this caveat file indicates the PSD negative values that have been replaced in the PSD data product by a fillvalue.

3.9.7 Dataset metadata description

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_SA_PSDNEG_CAVEATS.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CQ_STA_SA_PSDNEG_CAVEATS
  - DATA_TYPE = "CQ"
  - DATASET_TITLE = "PSD negative value"
  - CONTACT_COORDINATES = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr" "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
    DATASET_DESCRIPTION = "This dataset contains caveats for the SM datasets from the STAFF-SA instrument. For a given time and frequency are given the PSD negative values that have been replaced in the PSD data product by a fillvalue.
    PROCESSING_LEVEL = "Auxilliary"

- Then, the following **Support data**:

Data are indexed by the **following variables**:

& Time which is the ISO time of data acquisition (Universal Time). Its properties are:
- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Time tag"
- VALUE_TYPE = ISO_TIME
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- DELTA_MINUS = 0
- DELTA_PLUS = 0
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:99.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"

Data themselves:

& Text__C1/C2/C3/C4_CQ_STA_SA_PSDNEG_CAVEATS variable stores the polar angle of the direction of propagation in MFA coordinate system (SVD).
- PARAMETER_TYPE = "Data"
- ENTITY = "Instrument"
- VALUE_TYPE = CHAR
- PROPERTY = "Status"
- CATDESC = "PSD negative values used to compute the SM."
- UNITS = "Unitess"
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 85
- FIELDNAM = "Caveats."

- FILLVAL = “NA”
- DEPEND_0 = Time__C1_CQ_STA_SA_PSDNEG_CAVEATS
- QUALITY = 0

3.9.8 File Metadata Specification

The CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_PSDNEG_CAVEATS.ceh** described above.

The CEF contains only the static parameters (file and global metadata).

- The following file **metadata** keywords:
  - FILE_NAME = C1/C2/C3/C4_CQ_STA_PSDNEG_CAVEATS__20010402_V01.cef
  - FILE_FORMAT_VERSION = "CEF-2.0"
  - END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
  - FILE_TYPE = "cef"
  - LOGICAL_FILE_ID = "C1/C2/C3/C4_CP_STA_SA_PSDNEG__CAVEATS__20010402_V01"
  - DATASET_VERSION = "01"
  - VERSION_NUMBER = "01"
  - METADATA_TYPE = "CAA"
  - METADATA_VERSION = "2.0"
  - FILE_TIME_SPAN = ex. 2001-04-02T00:00:00.000Z/2001-04-02T23:59:59.999Z
  - GENERATION_DATE = ex. 2009-11-30T17:15:38.000Z
  - FILE_CAVEATS = " Produced using software version 2.2 of September 2011 "

3.9.9 Dataset header example

Example: C1_CH_STA_SA_PSDNEG_CAVEATS.ceh

```
!CEH VALIDATION 07 August 2015 by LPP, header V04, (RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CQ_STA_SA_PSDNEG_CAVEATS"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CQ"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "PSD negative value"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
END_META = CONTACT_COORDINATES
```

```
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains caveats for the SM datasets from "
   ENTRY = "the STAFF-SA instrument."
   ENTRY = "For a given time and frequency are given"
   ENTRY = "the PSD negative values that have been replaced"
   ENTRY = "in the PSD data product by a fillvalue."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Auxiliary"
END_META = PROCESSING_LEVEL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                               Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CQ_STA_SA_PSDNEG_CAVEATS
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Time tag"
   VALUE_TYPE         = ISO_TIME
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   DELTA_MINUS        = 0.0
   DELTA_PLUS         = 0.0
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
END_VARIABLE = Time__C1_CQ_STA_SA_PSDNEG_CAVEATS
!
START_VARIABLE = Text__C1_CQ_STA_SA_PSDNEG_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "PSD negative values used to compute the SM"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT_DIGITS  = 85
   FIELDNAM            = "Caveats"
   FILLVAL             = "NA"
   DEPEND_0            = Time__C1_CQ_STA_SA_PSDNEG_CAVEATS
   QUALITY             = 0
END_VARIABLE = Text__C1_CQ_STA_SA_PSDNEG_CAVEATS
!
```

3.9.10 Dataset file example

Version 01: C1_CQ_STA_SA_PSDNEG_CAVEATS__20010402_V01.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                           File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CQ_STA_SA_PSDNEG_CAVEATS__20010402_V01.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                         Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh           ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh               ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh               ! Experiment level metadata.
!
```

```
INCLUDE= C1_CH_STA_SA.ceh            ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_SA_PSDNEG_CAVEATS.ceh ! Dataset Caveat level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "01"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CQ_STA_SA_PSDNEG_CAVEATS__20010402_V01"
END_META = LOGICAL_FILE_ID
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = VERSION_NUMBER
ENTRY = "01"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2001-04-02T00:00:00.000Z/2001-04-02T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2009-11-30T17:15:38.000Z
END_META = GENERATION_DATE
!
START_META = DATASET_CAVEATS
   ENTRY = "Produced using software version 2.0 of July 2009"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                      Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = EOF
! PSD negative values:
! Each block of data is organized this way:
!
!  |"ISO-TIME","f=55.6812 Hz PSD_Bxx=-8.76E-12 nT^2 Hz^-1 " $
!  |"ISO-TIME","f=353.5534 Hz PSD_Exx=-4.98E-05 mV^2 m^-2 Hz^-1" $
!
2001-04-02T01:41:42.765Z,"f=55.6812 Hz PSD_Bxx=-7.39E-14 nT^2 Hz^-1 " $
2001-04-02T02:30:43.695Z,"f=55.6812 Hz PSD_Bxx=-3.40E-12 nT^2 Hz^-1 " $
2001-04-02T02:32:16.692Z,"f=445.4493 Hz PSD_Exx=-9.54E-09 mV^2 m^-2 Hz^-1 " $
2001-04-02T02:48:22.669Z,"f=445.4493 Hz PSD_Exx=-7.73E-08 mV^2 m^-2 Hz^-1 " $
2001-04-02T02:48:50.668Z,"f=445.4493 Hz PSD_Exx=-7.74E-08 mV^2 m^-2 Hz^-1 " $
2001-04-02T02:49:38.667Z,"f=445.4493 Hz PSD_Exx=-1.77E-09 mV^2 m^-2 Hz^-1 " $
2001-04-02T02:49:53.667Z,"f=445.4493 Hz PSD_Exx=-1.52E-07 mV^2 m^-2 Hz^-1 " $
!
…
!
```

3.10 Auxilliary data – CAVEAT file for PPP STAFF-SA – UNDEFINED MFA CAVEATS

3.10.1 Format: CEF

3.10.2 Standard: cf 2.2.

3.10.3 Production Procedure: cf 2.3.2.

3.10.4 Quality Control Procedure: cf 2.4.2.

3.10.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.10.6 Product Specification

One CEF file per day and per satellite.
This CEF contains caveats for the PPP (L3) datasets from the STAFF-SA instrument. Here are given times where there are either low coverage FGM data or low auxiliary data time coverage to transform SM data in MFA coordinate system.

3.10.7 Dataset metadata description

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_SA_UNDEFINED_MFA_CAVEATS.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CQ_STA_SA_ UNDEFINED_MFA _CAVEATS
  - DATA_TYPE = "CQ"
  - DATASET_TITLE = " Reason of undefined MFA coordinate system "
  - CONTACT_COORDINATES =
  "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
  "Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
  "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
  DATASET_DESCRIPTION = "caveats for the PPP (L3) datasets from the STAFF-SA instrument. Here are given times where there are either low coverage FGM

data or low auxiliary data time coverage to transform SM data in MFA coordinate system.
PROCESSING_LEVEL = "Auxilliary”

- Then, the following **Support data**:

Data are indexed by the **following variables**:

& Time which is the ISO time of data acquisition (Universal Time). Its properties are:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Time tag"
- VALUE_TYPE = ISO_TIME
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- DELTA_MINUS = 0
- DELTA_PLUS = 0
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:99.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"

Data themselves:

& Text__C1/C2/C3/C4_CQ_STA_SA_ UNDEFINED MFA_CAVEATS variable stores the reason of undefined MFA coordinate system.

- PARAMETER_TYPE = "Data"
- ENTITY = "Instrument"
- VALUE_TYPE = CHAR
- PROPERTY = "Status"
- CATDESC = " Reason of undefined MFA coordinate system."
- UNITS = "Unitess"
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 85
- FIELDNAM = "Caveats."
- FILLVAL = “NA”
- DEPEND_0 = Time__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
- QUALITY = 0

3.10.8 File Metadata Specification

The CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_UNDEFINED_MFA_CAVEATS.ceh** described above.

The CEF contains only the static parameters (file and global metadata).

- The following file **metadata** keywords:

- FILE_NAME = C1/C2/C3/C4_ CQ_STA_SA_UNDEFINED_MFA_CAVEATS__20010402_V04.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:

- FILE_TYPE = "cef"
- LOGICAL_FILE_ID = “C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS__20010402_V04”
- DATASET_VERSION = "04"
- VERSION_NUMBER = "04"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = ex. 2001-04-02T00:00:00.000Z/2001-04-02T23:59:59.999Z
- GENERATION_DATE = ex. 2009-11-30T17:15:38.000Z
- FILE_CAVEATS = "Prassadco software: Module read_N2SA(2011Sep30). Caa software version 2.0 of July 2009."

3.10.9 Dataset header example

Example: C1_CH_STA_SA_UNDEFINED_MFA_CAVEATS.ceh

```
!CEH VALIDATION 22 March 2016 by LPP, header V03, (RK,RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CQ"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Reason of undefined MFA coordinate system"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
   ENTRY = "Ondrej Santolik>Co-I>ondrej.santolik@mff.cuni.cz"
   ENTRY = "Olga Alexandrova>Co-I>olga.alexandrova@obspm.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains caveats for the PPP (L3) datasets from "
   ENTRY = "the STAFF-SA instrument."
   ENTRY = "Here are given times where there are either low coverage FGM data or"
   ENTRY = "low auxiliary data time coverage to transform SM data in MFA coordinate system."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Auxiliary"
END_META = PROCESSING_LEVEL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                 Variables    !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
```

```
START_VARIABLE = Time__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Time tag"
   VALUE_TYPE         = ISO_TIME
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   DELTA_MINUS        = 0.0
   DELTA_PLUS         = 0.0
   SIGNIFICANT_DIGITS = 24
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
END_VARIABLE = Time__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
!
START_VARIABLE = Text__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "Reason of undefined MFA coordinate system"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT_DIGITS  = 85
   FIELDNAM            = "Caveats"
   FILLVAL             = "NA"
   DEPEND_0            = Time__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
   QUALITY             = 0
END_VARIABLE = Text__C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS
!
```

3.10.10 Dataset file example

Version 04: C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS__20010402_V04.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS__20010402_V04.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                              Global Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh                      ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh                          ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh                          ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh                       ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_SA_UNDEFINED_MFA_CAVEATS.ceh  ! Dataset level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "04"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CQ_STA_SA_UNDEFINED_MFA_CAVEATS__20010402_V04"
END_META = LOGICAL_FILE_ID
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
```

```
!
START_META = VERSION_NUMBER
   ENTRY = "04"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2001-04-02T00:00:00.000Z/2001-04-02T23:59:59.999Z"
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2016-03-05T00:44:06.329Z"
END_META = GENERATION_DATE
!
START_META = FILE_CAVEATS
   ENTRY = "Prassadco software:"
   ENTRY = "Module read_N2SA(2011Sep30)"
   ENTRY = "Caa software version 2.0 of July 2009"
END_META = FILE_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                      Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
! UNDEFINED MFA for a given time
! Each block of data is organized this way:
!
!  |"ISO-TIME","Low attitude coverage" $
!  | or
!  |"ISO-TIME","Low FGM coverage" $
!
!
!
DATA_UNTIL = EOF
!
2001-04-02T01:37:16.692Z, "Low FGM coverage" $
2001-04-02T01:37:20.692Z, "Low FGM coverage" $
2001-04-02T01:37:24.692Z, "Low FGM coverage" $
2001-04-02T01:37:28.692Z, "Low FGM coverage" $
...
```

3.11 Auxilliary data – CAVEAT file for PSD/SM/PPP STAFF-SA – PROBEFAIL_CAVEATS

3.11.1 Format: CEF

3.11.2 Standard: cf 2.2.

3.11.3 Production Procedure: cf 2.3.2.

3.11.4 Quality Control Procedure: cf 2.4.2.

3.11.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.11.6 Product Specification

One CEF file per satellite.
This CEF file contains the caveats for the PSD/SM/PPP datasets from the STAFF-SA instrument.

This caveats dataset provides the users time interval when EFW electric probes have problems and what to do with such data.

3.11.7 Dataset metadata description

The detached dataset header is called: **C1/C2/C3/C4_ CQ_STA_SA_PROBEFAIL_CAVEATS.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_ CQ_STA_SA_PROBEFAIL_CAVEATS
  - DATA_TYPE = "CQ"
  - DATASET_TITLE = " Probe failure consequences"
  - CONTACT_COORDINATES =
    "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
    "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"

DATASET_DESCRIPTION = "This dataset contains caveats for some STAFF SA datasets. This caveats dataset provides the users time interval when probes have problems and what to do with such data."

- PROCESSING_LEVEL = "Auxilliary"

- Then, the following **Support data**:

& Time_range which the ISO time range where other parameters are valid. Its properties are:

- CATDESC = "Time interval with probe failure."
- VALUE_TYPE = ISO_TIME_RANGE
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- SIGNIFICANT_DIGITS = 49
- FILLVAL = 9999-12-31T23:59:59.999Z/9999-12-31T23:59:59.999Z
- FIELDNAM = " Universal Time Range"
- LABLAXIS = "UT"

3.11.8 File Metadata Specification

The CEF file includes a detached dataset header called: **C1/C2/C3/C4_**CQ_STA_SA_PROBEFAIL_CAVEATS**.ceh** described above.

The CEF file contains only the static parameters (file and global metadata).

- The following file **metadata** keywords:

- FILE_NAME = C1/C2/C3/C4_CP_STA_NOTSRP__20010402_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:

- FILE_TYPE = "cef"
- LOGICAL_FILE_ID = "C1/C2/C3/C4_CQ_STA_SA_PROBEFAIL_CAVEATS__20010101_V02 "
- DATASET_VERSION = "02"
- VERSION_NUMBER = "02"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = ex. 2001-01-01T00:00:00.000Z/2025-12-31T23:59:59.999Z
- GENERATION_DATE = ex. 2017-02-10T12:15:20.000Z

3.11.9 Dataset header example

Example: C1_CQ_STA_SA_PROBEFAIL_CAVEATS.ceh

```
!CEH VALIDATION 01 June 2015 by LPP, header V01, (RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CQ_STA_SA_PROBEFAIL_CAVEATS"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CQ"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Probe failure consequences"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains caveats for some STAFF SA datasets."
   ENTRY = "This caveats dataset provides the users "
   ENTRY = "time interval when probes have problems and"
   ENTRY = "what to do with such data."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Auxiliary"
END_META = PROCESSING_LEVEL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time_range__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   VALUE_TYPE         = ISO_TIME_RANGE
   CATDESC            = "Time interval with probe failure."
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   SIGNIFICANT_DIGITS = 49
   FILLVAL            = 9999-12-31T23:59:59.999Z/9999-12-31T23:59:59.999Z
   FIELDNAM           = "Universal Time Range"
   LABLAXIS           = "UT"
END_VARIABLE = Time_range__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
!
START_VARIABLE = Quality_flag__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "Quality flag as described in the STAFF UG table 5"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT_DIGITS  = 7
   FIELDNAM            = "Quality flag"
   FILLVAL             = "NA     "
   DEPEND_0            = Time_range__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   QUALITY             = 0
END_VARIABLE = Quality_flag__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
!
START_VARIABLE = Action__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "What to do with these data"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT DIGITS  = 34
   FIELDNAM            = "Action"
```

```
   FILLVAL             = "NA     "
   DEPEND_0            = Time_range__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   QUALITY             = 0
END_VARIABLE = Action__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
!
START_VARIABLE = Reason__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "Reason why data should be used carefully"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT_DIGITS  = 40
   FIELDNAM            = "Reason"
   FILLVAL             = "NA     "
   DEPEND_0            = Time_range__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
   QUALITY             = 0
END_VARIABLE = Reason__C1_CQ_STA_SA_PROBEFAIL_CAVEATS
!
```

3.11.10 Dataset file example

Version 02: C1_CQ_STA_SA_PROBEFAIL_CAVEATS__20010101_V02.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                          File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CQ_STA_SA_PROBEFAIL_CAVEATS__20010101_V02.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                         Global Metadata    !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh                    ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh                        ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh                        ! Experiment level metadata.
!
INCLUDE= C1 CH STA SA.ceh                     ! Instrument level metadata.
!
INCLUDE= C1_CQ_STA_SA_PROBEFAIL_CAVEATS.ceh   ! Dataset Caveat level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "02"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CQ_STA_SA_PROBEFAIL_CAVEATS__20010101_V02"
END_META = LOGICAL_FILE_ID
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = VERSION_NUMBER
   ENTRY = "02"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
```

```
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2001-01-01T00:00:00.000Z/2025-12-31T23:59:59.999Z
END_META  = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2017-02-10T12:15:20.000Z
END_META = GENERATION_DATE
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                      Data     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
!
! Data quality definition as defined in the STAFF User Guide, table 5
!
! 4  : good quality
! 2  : no saturation - caution to absolute values :
!      2a : one probe is set to zero (density mode, V=0) ;
!           power underestimated : ~0.625 of the power in mV2 m-1 Hz-1
!      2b : 2 probes are set to zero : power underestimated by a factor of 2
!           (~0.5 of the power in mV2 m-1 Hz-1)
! 1  : don't consider band A data (8-64 Hz, the 9 lower frequency data points)
!      because of solar aspect angle is close to 90 degrees
! 0  : one component saturates; do not consilder using STAFF SA electric component
!      or E field deduced parameters (Poynting Vector component)
! 0* : many successive operations
! XX : special tests; be cautious
!
!
DATA_UNTIL = EOF
2001-01-01T00:00:00.000Z/2001-12-28T03:02:56.999Z,"4                    ","Normal   behaviour
","Normal behaviour                        "$
2001-12-28T03:02:57.000Z/2002-01-26T23:59:59.999Z,"0           ","Be  cautious  may  saturate
","Probe 1 failure                         "$
2002-01-27T00:00:00.000Z/2007-06-12T23:59:59.999Z,"2a      ","Power to be multiplied by ~1.6
","Probe 1 permanently in density mode, V=0 "$
2007-06-13T00:00:00.000Z/2007-06-13T23:59:59.999Z,"XX                          ","Dont     use
","Special operations                      "$
2007-06-14T00:00:00.000Z/2009-04-19T07:29:00.000Z,"2a      ","Power to be multiplied by ~1.6
","Probe 1 permanently in density mode, V=0 "$
2009-04-19T07:29:00.001Z/2009-05-07T17:44:21.999Z,"0           ","Be  cautious  may  saturate
","Probe 4 failure                         "$
2009-05-07T17:44:22.000Z/2009-10-14T06:59:59.999Z,"2a      ","Power to be multiplied by ~1.6
","Probe 4 restarts working                "$
2009-10-14T07:00:00.001Z/2009-11-27T23:59:59.999Z,"0           ","Be  cautious  may  saturate
","Probe 4 failure                         "$
2009-11-28T00:00:00.000Z/2014-05-18T23:59:59.999Z,"2b       ","Power to be multiplied by ~2.
","Probe 4 permanently in density mode, V=0 "$
2014-05-19T00:00:00.000Z/2025-12-31T23:59:59.999Z,"1 or 2b","1 if F lt 64Hz (A band), else 2
","Due to solar aspect angle               "
!
```

3.12 Auxilliary data –CAVEAT file for STAFF data – NOTSRP

3.12.1 Format: CEF

3.12.2 Standard: cf 2.2.

3.12.3 Production Procedure: cf 2.3.2.

3.12.4 Quality Control Procedure: cf 2.4.2.

3.12.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.12.6 Product Specification

One CEF file per day and per satellite.
This CEF file contains the caveats for the PSD/SM/PPP datasets from the STAFF-SA instrument and for the CWF/CS datasets from the STAFF-SC instrument.
This caveats dataset provides the users time interval when no Sun pulse (TSRP) was recorded in the S/C housekeeping data. Note that it can be in eclipse period but not especially.

3.12.7 Dataset metadata description

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_NOTSRP_CAVEATS.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CQ_STA_NOTSRP_CAVEATS
  - DATA_TYPE = "CQ"
  - DATASET_TITLE = "Time Interval with no TSRP"
  - CONTACT_COORDINATES =

“Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr”
“Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr”
"Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"

  - DATASET_DESCRIPTION = "This dataset contains caveats for some of the STAFF datasets. It provides the users time intervals when no Sun pulse

(TSRP) was recorded in the S/C housekeeping data. Note that it can be in eclipse period but not especially."
- PROCESSING_LEVEL = "Auxilliary"

- Then, the following **Support data**:

& Time_range which the ISO time interval (Universal Time) with no TSRP in the S/C housekeeping. Its properties are:
- CATDESC = "Time intervals with no TSRP in the S/C housekeeping."
- VALUE_TYPE = ISO_TIME_RANGE
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- SIZES = 1
- SIGNIFICANT_DIGITS = 49
- FILLVAL = 9999-12-31T23:59:59.999Z/9999-12-31T23:59:59.999Z
- FIELDNAM = "Universal Time Range"
- LABLAXIS = "UT"

3.12.8 File Metadata Specification

The CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_NOTSRP_CAVEATS.ceh** described above.

The CEF contains only the static parameters (file and global metadata).

- The following file **metadata** keywords:
- FILE_NAME = C1/C2/C3/C4_CQ_STA_NOTSRP_CAVEATS__20010402_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:
- FILE_TYPE = "cef"
- LOGICAL_FILE_ID = "C1/C2/C3/C4_CP_STA_SA_NOTSRP_CAVEATS__20010402_V01"
- DATASET_VERSION = "01"
- VERSION_NUMBER = "01"
- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = ex. 2001-04-02T00:00:00.000Z/2001-04-02T23:59:59.999Z
- GENERATION_DATE = ex. 2009-11-30T17:15:38.000Z
- FILE_CAVEATS = "Produced using software version 2.2 of September 2011 "

3.12.9 Dataset header example

Example: C1_CH_STA_SA_NOTSRP_CAVEATS.ceh

```
!CEH VALIDATION 09 May 2012 by LPP, header V02, (RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CQ_STA_NOTSRP_CAVEATS"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CQ"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Time Intervals with no TSRP"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"   ENTRY
= "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains caveats for some of the STAFF datasets."
   ENTRY = "It provides the users time intervals when"
   ENTRY = "no Sun pulse (TSRP) was recorded in the S/C housekeeping data."
   ENTRY = "Note that it can be in eclipse period but not especially."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Auxiliary"
END_META = PROCESSING_LEVEL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time_range__C1_CQ_STA_NOTSRP_CAVEATS
   VALUE_TYPE         = ISO_TIME_RANGE
   CATDESC            = "Time intervals with no TSRP in the S/C housekeeping."
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   SIZES              = 1
   SIGNIFICANT_DIGITS = 49
   FILLVAL            = 9999-12-31T23:59:59.999Z/9999-12-31T23:59:59.999Z
   FIELDNAM           = "Universal Time Range"
   LABLAXIS           = "UT"
END_VARIABLE = Time_range__C1_CQ_STA_NOTSRP_CAVEATS
!
```

3.12.10 Dataset file example

Version 01: C1_CQ_STA_SA_NOTSRP_CAVEATS__20010401_V01.cef

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                File Metadata     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CQ_STA_SA_NOTSRP_CAVEATS__20010401_V01.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
END_OF_RECORD_MARKER = "$"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                              Global Metadata     !
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh              ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh                  ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh                  ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SA.ceh               ! Instrument level metadata.
!
INCLUDE= C1_CH_STA_SA_NOTSRP_CAVEATS.ceh !Dataset Caveat level metadata.
!
START_META = DATASET_VERSION
   ENTRY = "01"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CQ_STA_SA_NOTSRP_CAVEATS__20010401_V01"
END_META = LOGICAL_FILE_ID
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = VERSION_NUMBER
   ENTRY = "01"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = 2001-04-01T00:00:00.000Z/2001-04-01T23:59:59.999Z
END_META  =   FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = 2009-11-30T17:14:15.000Z
END_META = GENERATION_DATE
!
START_META = DATASET_CAVEATS
   ENTRY = "Produced using software version 2.0 of July 2009"
END_META = DATASET_CAVEATS
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                    Data      !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = EOF
! No time of the Sun Reference Pulse (TSRP) in the S/C housekeeping
! data during the following time intervals:
2001-04-01T00:30:39.371Z/2001-04-01T00:30:47.384Z $
2001-04-01T01:18:08.175Z/2001-04-01T01:18:16.189Z $
2001-04-01T02:05:36.980Z/2001-04-01T02:05:49.000Z $
2001-04-01T03:40:58.630Z/2001-04-01T03:41:06.644Z $…
!
```

3.13 Auxilliary data –CAVEAT file for STAFF data – CALIBRATION

3.13.1 Format: CEF

3.13.2 Standard: cf 2.2.

3.13.3 Production Procedure: cf 2.3.2.

3.13.4 Quality Control Procedure: cf 2.4.2.

3.13.5 Delivery Procedure

Secured ftp from LPP (lantana.lpp.polytechnique.fr) to ESTEC (caa.estec.esa.int).

3.13.6 Product Specification

One CEF file per day and per satellite.
This CEF file contains the caveats for the STAFF datasets.
This caveats dataset provides the users time where there is an onboard calibration.

3.13.7 Dataset metadata description

The detached dataset header is called: **C1/C2/C3/C4_CH_STA_CALIBRATION_CAVEATS.ceh.**

In this header, only the static parameters (global metadata, support data and data themselves description) are included.

- First, the following **global metadata** keywords:
  - DATASET_ID = C1/C2/C3/C4_CP_STA_CALIBRATION_CAVEATS
  - DATA_TYPE = "CQ"
  - DATASET_TITLE = "Information concerning onboard calibration"
  - CONTACT_COORDINATES = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr" "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
  - DATASET_DESCRIPTION = "This dataset contains caveats indicating when the STAFF instruments are in calibration mode."
  - PROCESSING_LEVEL = "Auxilliary"

- Then, the following **Support data**:

& Time which the ISO time of data acquisition (Universal Time). Its properties are:

- PARAMETER_TYPE = "Support_Data"
- CATDESC = "Time tag"
- VALUE_TYPE = ISO_TIME
- UNITS = "s"
- SI_CONVERSION = "1.0>s"
- DELTA_MINUS = 0
- DELTA_PLUS = 0
- SIGNIFICANT_DIGITS = 24
- FILLVAL = 9999-12-31T23:59:99.999Z
- FIELDNAM = "UT Time"
- LABLAXIS = "UT"

& Text to show that it is an onboard calibration

- PARAMETER_TYPE = "Data"
- ENTITY = "Instrument"
- VALUE_TYPE = CHAR
- PROPERTY = "Status"
- CATDESC = "Calibration mode is active"
- UNITS = "unitless"
- SI_CONVERSION = "1>unitless"
- SIGNIFICANT_DIGITS = 18
- FIELDNAM = "Caveats"
- FILLVAL = "NA"
- DEPEND_0 = Time__C1_CQ_STA_CALIBRATION_CAVEATS
- QUALITY = 0

3.13.8 File Metadata Specification

CEF file includes a detached dataset header called: **C1/C2/C3/C4_CH_STA_CALIBRATION_CAVEATS.ceh** described above.

The CEF file contains only the static parameters (file and global metadata).

- The following file **metadata** keywords:

- FILE_NAME = C1_CQ_STA_CALIBRATION_CAVEATS__20010109_V01.cef
- FILE_FORMAT_VERSION = "CEF-2.0"
- END_OF_RECORD_MARKER = "$"

- And the following **global metadata** keywords:

- FILE_TYPE = "cef"
- LOGICAL_FILE_ID = "C1/C2/C3/C4_CQ_STA_CALIBRATION_CAVEATS__20010109_V01"
- DATASET_VERSION = "01"
- VERSION_NUMBER = "01"

- METADATA_TYPE = "CAA"
- METADATA_VERSION = "2.0"
- FILE_TIME_SPAN = ex. 2001-01-09T00:00:00.000000Z/2001-01-09T23:59:59.999999Z
- GENERATION_DATE = ex. 2013-05-22T15:41:13.000Z

3.13.9 Dataset header example

Example: C1_CQ_STA_CALIBRATION_CAVEATS.ceh

```
!CEH VALIDATION 15 Jan 2013 by LPP, header V01, (RP)
!
START_META = DATASET_ID
   ENTRY = "C1_CQ_STA_CALIBRATION_CAVEATS"
END_META = DATASET_ID
!
START_META = DATA_TYPE
   ENTRY = "CQ"
END_META = DATA_TYPE
!
START_META = DATASET_TITLE
   ENTRY = "Information concerning onboard calibration"
END_META = DATASET_TITLE
!
START_META = CONTACT_COORDINATES
   ENTRY = "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY = "Nicole Cornilleau-Wehrlin>Deputy-PI>nicole.cornilleau@lpp.polytechnique.fr"
END_META = CONTACT_COORDINATES
!
START_META = DATASET_DESCRIPTION
   ENTRY = "This dataset contains caveats indicating when the STAFF instruments"
   ENTRY = "are in calibration mode."
END_META = DATASET_DESCRIPTION
!
START_META = PROCESSING_LEVEL
   ENTRY = "Auxiliary"
END_META = PROCESSING_LEVEL
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  Variables     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
START_VARIABLE = Time__C1_CQ_STA_CALIBRATION_CAVEATS
   PARAMETER_TYPE     = "Support_Data"
   CATDESC            = "Time tag"
   VALUE_TYPE         = ISO_TIME
   UNITS              = "s"
   SI_CONVERSION      = "1.0>s"
   DELTA_MINUS        = 0.0
   DELTA_PLUS         = 0.0
   SIGNIFICANT_DIGITS = 27
   FILLVAL            = 9999-12-31T23:59:59.999Z
   FIELDNAM           = "UT Time"
   LABLAXIS           = "UT"
END_VARIABLE = Time__C1_CQ_STA_CALIBRATION_CAVEATS
!
START_VARIABLE = Text__C1_CQ_STA_CALIBRATION_CAVEATS
   PARAMETER_TYPE      = "Data"
   ENTITY              = "Instrument"
   VALUE_TYPE          = CHAR
   PROPERTY            = "Status"
   CATDESC             = "Calibration mode is active"
   UNITS               = "unitless"
   SI_CONVERSION       = "1>unitless"
   SIGNIFICANT_DIGITS  = 18
```

```
   FIELDNAM            = "Caveats"
   FILLVAL             = "NA"
   DEPEND_0            = Time__C1_CQ_STA_CALIBRATION_CAVEATS
   QUALITY             = 0
END_VARIABLE = Text__C1_CQ_STA_CALIBRATION_CAVEATS
!
```

3.13.10 Dataset file example

Ex: C1_CQ_STA_CALIBRATION_CAVEATS__20010109_V01.cef

```
   !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                  File Metadata !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
FILE_NAME = "C1_CQ_STA_CALIBRATION_CAVEATS__20010109_V01.cef"
FILE_FORMAT_VERSION = "CEF-2.0"
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                 Global Metadata   !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
INCLUDE= CL_CH_MISSION.ceh                          ! Mission level metadata.
!
INCLUDE= C1_CH_OBS.ceh                        ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh                        ! Experiment level metadata.
!
INCLUDE= C1_CH_STA_SC.ceh                     ! Instrument level metadata.
!
INCLUDE= C1_CQ_STA_CALIBRATION_CAVEATS.ceh       ! Data level metadata.
!
START_META = FILE_TYPE
   ENTRY = "cef"
END_META = FILE_TYPE
!
START_META = DATASET_VERSION
   ENTRY = "01"
END_META = DATASET_VERSION
!
START_META = LOGICAL_FILE_ID
   ENTRY = "C1_CQ_STA_CALIBRATION_CAVEATS__20010109_V01"
END_META = LOGICAL_FILE_ID
!
START_META = VERSION_NUMBER
   ENTRY = "01"
END_META = VERSION_NUMBER
!
START_META = METADATA_TYPE
   ENTRY = "CAA"
END_META = METADATA_TYPE
!
START_META = METADATA_VERSION
   ENTRY = "2.0"
END_META = METADATA_VERSION
!
START_META = FILE_TIME_SPAN
   VALUE_TYPE = ISO_TIME_RANGE
   ENTRY = "2001-01-09T00:00:00.000000Z/2001-01-09T23:59:59.999999Z"
END_META = FILE_TIME_SPAN
!
START_META = GENERATION_DATE
   VALUE_TYPE = ISO_TIME
   ENTRY = "2013-05-22T15:41:13.000Z"
END_META = GENERATION_DATE
!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!                                                                          Data     !
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!
DATA_UNTIL = "END_OF_FILE"
2001-01-09T15:17:11.038718Z, "Calibration data"
2001-01-09T15:17:11.078717Z, "Calibration data"
2001-01-09T15:17:11.118716Z, "Calibration data"
2001-01-09T15:17:11.158715Z, "Calibration data"
```

3.14 Report on In-Flight Calibration Sequence

3.14.1 Format: Non CEF

The reports were delivered as text file

3.14.2 Standard: N/A

3.14.3 Production Procedure

Routine analysis of Calibration sequences in DWF files

3.14.4 Quality Control Procedure

Random checks, incomplete files were not delivered

3.14.5 Delivery Procedure

Secured ftp from LPP (Staff.lpp.polytechnique.fr) to ESTEC

3.14.6 Production Specification

The file contains a brief report of different steps of the in-flight calibration sequence
One Report per orbit if data can be processed

3.14.7 Dataset metadata description: N/A

3.14.8 Product Specification

The detached dataset header is called C?_CE_STA IFCReport.ceh

3.14.9 Dataset header example

Example: C4_CE_STA_IFCReport.ceh

```
! CEH VALIDATION 31 March 2025 by LPP, V01 (VB)
!
!
INCLUDE= CL_CH_MISSION.ceh  ! Mission level metadata.
!
INCLUDE= C4_CH_OBS.ceh      ! Observatory level metadata.
!
INCLUDE= CL_CH_STA.ceh      ! Experiment level metadata.
!
INCLUDE= C4_CH_STA_SC.ceh   ! Instrument level metadata.
!
START_META     =   DATASET_ID
   ENTRY       =   "C4_CE_STA_IFCReport"
END_META       =   DATASET_ID
!
START_META     =   DATA_TYPE
   ENTRY       =   "CE>CAA Non-CEF (external) Product"
```

```
END_META       =   DATA_TYPE
!
START_META     =   CONTACT_COORDINATES
   ENTRY       =   "Patrick Canu>PI>patrick.canu@lpp.polytechnique.fr"
   ENTRY       =   "Rodrigue Piberne>Archive Manager>rodrigue.piberne@lpp.polytechnique.fr"
END_META       =   CONTACT_COORDINATES
!
START_META     =   ACKNOWLEDGEMENT
    ENTRY      =   "Please acknowledge the STAFF team and the ESA Cluster Archive in any
publication based upon use of this data."
    ENTRY      =   "Digital Object Identifier for the STAFF archive: doi.org/10.5270/esa-
yrzyijm"
END_META       =   ACKNOWLEDGEMENT
!
START_META     =   DATASET_CAVEATS
   ENTRY       =   "This is a non-CEF product. You will need your own software to
open/manipulate these data."
   ENTRY       =   "DATASET VERSION HISTORY"
   ENTRY       =   "VERSION 01: The first version of this dataset to be ingested by the CAA"
END_META       =   DATASET_CAVEATS
!
START_META     =   DATASET_VERSION
   ENTRY       =   "01"
END_META       =   DATASET_VERSION
!
START_META     =   METADATA_TYPE
   ENTRY       =   "CAA"
END_META       =   METADATA_TYPE
!
START_META     =   METADATA_VERSION
   ENTRY       =   "2.0"
END_META       =   METADATA_VERSION
!
START_META     =   DATASET_TITLE
   ENTRY       =   "STAFF-SC In flight calibration report from Cluster-4"
END_META       =   DATASET_TITLE
!
START_META     =   DATASET_TYPE
    ENTRY      =   "Support_Data"
END_META       =   DATASET_TYPE
!
START_META     =   DATASET_DESCRIPTION
   ENTRY       =   "This file contains a brief analysis of a STAFF-SC in-flight calibration
sequence."
   ENTRY       =   "In operation, the calibration mode is performed at least once per orbit
and "
   ENTRY       =   "depending on telemetry cadence. Normal mode (NBR) is most often used."
   ENTRY       =   "It consists of sending a known current into the sensor loops of each
axis."
   ENTRY       =   "The sequence consists of 23 steps described in the Staff Status file."
   ENTRY       =   "Step duration depends on NBR or HBR mode."
   ENTRY       =   "The comparison between the most significant step measurements and the
ground reference values"
   ENTRY       =   "is listed here. An anomaly message is generated each time a measurement
step"
   ENTRY       =   "has values that differ by 50% of the reference value for magnetic
component"
   ENTRY       =   "and 30 degrees for phase between magnetic sensors."
   ENTRY       =   "The files are stored in a non-standard ASCII format."
   ENTRY       =   "The filename indicates the span of the calibration sequence."
   ENTRY       =   "START and END of CALIBRATION SEQUENCE as YYYYMMDD_HHMMSS_YYYYMMDD_HHMMSS"
   ENTRY       =   "Each IFCReport file has an introductory comment line that starts with "
   ENTRY       =   "a semicolon (;). The comment line contains the parameters that have "
   ENTRY       =   "been used when running the calibration program. "
   ENTRY       =   "See Staff CR/UG for a complete description. "
END_META       =   DATASET_DESCRIPTION
!
START_META     =   PROCESSING_LEVEL
   ENTRY       =   "Auxiliary"
END_META       =   PROCESSING_LEVEL
!
START_META     =   FILE_TYPE
   ENTRY       =   "txt"
END_META       =   FILE_TYPE
```

3.14.10 Dataset file example

Example: C2_CE_STA_IFCReport__20010618_062610_20010618_063218_V01.txt

```
;PROCESSING DATE: Wed Feb  6 15:28:20 2013
;CALIBRATION CARACTERISTICS ARE
;       SPACECRAFT NUMBER: 2
;       EXPERIMENT      : STAFF SC
;       TELEMETRY CADENCE: NORMAL BIT RATE
;CALIBRATION DATE: 2001-06-18 06:26:10
;

 Step   Band (Hz)    Bx (Vr)     By (Vr)     Bz (Vr)
*****************************************************
1 - 4    1  - 3      3.02e-03    6.23e-03    6.10e-03
         3  - 6      1.82e-03    2.52e-03    2.43e-03
         6  - 9      2.03e-03    2.45e-03    2.31e-03
         9  - 11     1.55e-03    1.92e-03    2.00e-03
         11 - 12.5   1.20e-03    1.07e-03    1.17e-03

 Band :  7 - 9  Hz
 Step    Bx (Vr)     By (Vr)     Bz (Vr)
****************************************
 12      1.80e-03    2.00e-03    2.15e-03
 13      7.51e-04    9.79e-04    1.27e-03

 Frequency : 7.20 Hz
 Step    Bx (Vr)     By (Vr)     Bz (Vr)     Ph. Bx/Bz    Ph. By/Bz
*********************************************************************
 14      1.96e-01    1.96e-01    1.29e+00    242.9        243.3
 15      1.96e-01    1.97e-01    1.91e-01    358.3        359.2
 16      8.98e-03    1.01e-02    6.39e-02    236.9        242.5
 17      1.04e-02    1.03e-02    1.12e-02    354.2        353.5
 18      1.66e-03    7.25e-04    3.18e-03    307.7         71.3
 19      7.08e-04    8.32e-04    1.25e-03     23.8         85.2
 22      9.64e-03    1.04e-02    8.72e-03    356.1        351.7

 Band :  6 - 9  Hz
 Step    Bx (Vr)     By (Vr)     Bz (Vr)
****************************************
 20      9.57e-03    1.89e-02    2.54e-02
 21      1.07e-02    1.44e-02    2.93e-02

 Step   Band (Hz)    Bx (Vr)     By (Vr)     Bz (Vr)
*****************************************************
 23      0  - 3      5.34e-02    4.12e-01    4.19e-01
         3  - 6      2.97e-02    3.25e-02    4.58e-02
         6  - 9      1.93e-02    2.63e-02    2.64e-02
         9  - 12.5   1.19e-02    1.59e-02    1.86e-02

ANOMALIES ARE:
STEP 1 TO 4
BAND 1.0 - 3.0  ANOMALY ON BX  3.02e-03   REF = 3.00e-04   DEVIATION  906.00 %
STEP 1 TO 4
BAND 3.0 - 6.0  ANOMALY ON BX  1.82e-03   REF = 1.10e-03   DEVIATION  65.45 %
```

APPENDIX A - REFERENCES FOR STAFF DESCRIPTION

[1] ESA-SP1159
[2] CLU-CP-122-2021-CET “DECOMMUTATION STAFF-SC”
[3] CLU-CP-122-2021-CET “DECOMMUTATION STAFF-SA”
[4] DDID – CL-ESC-ID-2001.”Data Delivery Interface document”.
[5] Santolik, O.: PRopagation Analysis of STAFF-SA Data with COherency tests (PRASSADCO), http://aurora2.troja.mff.cuni.cz/~santolik/PRASSADCO/staff_sa/guide.pdf (2003)
[6] DS-QMW-TN-0010 “Cluster Exchange Format – Data File Syntax”
[7] User'sGuide to the STAFF measurements in the Cluster Science Archive (CSA), CAA-EST-CR-001, V4.0, 2025. https://www.cosmos.esa.int/web/csa/documentation
[8] Calibration Report of the STAFF measurements in the Cluster Science Archive (CSA), CAA-EST-CR-001, V5.0, 2025. https://www.cosmos.esa.int/web/csa/documentation

APPENDIX B – LIST OF ACRONYMS

AGC	Automated Gain Control
ASCII	American Standard Code for Information Interchange
CAA	Cluster Active Archive
CCSDS	Consultative Committee on Space Data System
CEF	Cluster Exchange Format
CS	Complex Spectra
CETP	Centre d'étude des Environnements Terrestre et Planétaires
Co-I	Co-Investigator
DWF	Decommutated Wave Form
DWP	Digital Wave Processing
EFW	Electric Field and Wave
ESA	European Space Agency
ESTEC	European Space Research and Technology Centre
FGM	Flux Gate Magnetometer
FTP	File Transfer Protocol
GEI	Geocentric Equatorial Inertial reference frame
GSE	Geocentric Solar Ecliptic reference frame
HBR	High Bit rate
IDL	Interactive Data Language
ISR2	Inverted SR2
LESIA	Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique
LPP	Laboratoire de Physique des Plasmas
MFA	Magnetic Field Aligned reference frame
NBR	Normal Bit Rate
PI	Principal Investigator
PDF	Portable Document Format
PNG	Portable Network Graphics
PPP	Polarization and Propagation Parameters
PRASSADCO	Propagation Analysis of STAFF-SA data with Coherency tests
PSD	Power Spectral Density
RCL	Roproc Command Language
RFF	Roproc File Format
Roproc	Robert's procedures
SFTP	Secured-FTP
SM	Spectral Matrix
SR2	Spin Reference frame 2
SSW6RF	STAFF Sensor WEC6 Reference Frame
STAFF	Spatio-Temporal Analysis of Field Fluctuations
STAFF-SA	STAFF digital Spectrum Analyser
STAFF-SC	STAFF on-board waveform unit (SC stands for Search Coil)
SVD	Singular Value Decomposition
TED	Telemetry Extraction and Decommutation package
WEC	Wave Experiment Consortium
WECSS	WEC Sample Sync
WHISPER	Waves of HIgh frequency and Sounder for Probing the Electron density by Relaxation