





Cluster STAFF experiment data products at ESA Cluster Active Archive

C. Burlaud 1, N. Cornilleau-Wehrlin 1, P. Robert 1, V. Bouzid 1, L. Mirioni 1, M. Maksimovic 2, Y. de Conchy 2, O. Santolik 3, B. Grison 3 ¹ LPP/CNRS/Ecole Polytechnique, F-91128, Palaiseau; ² LESIA, Observatoire de Paris, F-92195 Meudon; ³Institute of Atmospheric Physics, CR-14131 Praha

Abstract

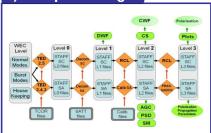
The Cluster STAFF high time resolution products presently delivered to CAA for free use by the scientific community are issued from the two parts of the experiment, the 3 magnetic wave form components up to either 10 or 180 Hz and the complex spectral matrix calculated by onboard spectrum analyser for the 5 components of the wave, 3 x B + 2 x E, in the frequency range 8 Hz - 4 kHz. Among the different products, are the spectral densities in physical units from 2001 up to the end of 2009. Those and other products are described below, as well as some recommendations for use of the data.

1) Instrumentation

The Spatio Temporal Analysis of Field Fluctuations (STAFF) experiment [1,2] is one of the five experiments which constitute the Cluster Wave Experiment Consortium (WEC). STAFF consists of 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 electronic box that houses a waveform unit (up to either 10 Hz or 180 Hz) and a Spectrum Analyser (8Hz to 4 kHz). The latter combines the 3 magnetic components of the waves with the two electric components measured by the Electric Fields and Waves experiment (EFW) to calculate in real time the 5 x 5 Hermitian cross-spectral matrix at 27 frequencies distributed logarithmically in the frequency range 8 Hz to 4 kHz.



2) Data processing



3) STAFF-SC products available at CAA

Those products are issued from wave form data.

L1, L2 and L3 available from 2001 to 2009.

3.1 L1 DWF Decommutated Wave Form

Data with all information for possible further reprocessing, best time accuracy use of TCOR data, compression accuracy. Non calibrated: not recommended for use by not

3.2 L2 CS Calibrated Complex Spectra (in GSE)

10s time resolution, for a better quality of despinning. Production of spectral density plots, (e.g. On demand), possibility to calculate propagation and polarisation.

3.3 L3 SPECTROgrams : Dynamic spectra images 4 S/C, 3 Hours, along spin axis, for browsing purpose .

4) STAFF-SA products available at CAA

Those products are issued from the onboard spectrum analyser.

4.1 L2 products (in ISR2): 2001-2009

AGC Automatic Gain Control: Statistical Use.

PSD Power Spectral Density:

Resolution: from 0.125 to 1 s.

SM Spectral Matrix:

Resolution from 1 to 4 s

4.2 L3 products (in B₀/MFA coordinate system) Production is starting.

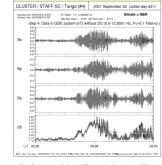
PPP Polarisation and Propagation Parameters Resolution: 1 to 4 s. Come from SM, using PRASSADCO.

Caveat FILES:

NOTSRP, PSDNEG and UNDEFINED MFA.

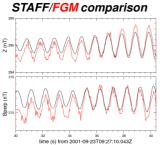
5) CWF (L3) Coming soon

Continuous Calibrated Waveform



5 minutes of data filtered above 0.5Hz

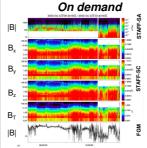
6) Cross Calibration



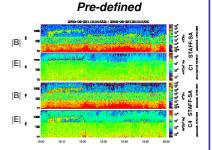
Very good phase agreement.

~10% difference on amplitude, constant

7) Examples



Cluster in the magnetosheath in HBR (see the "lion roars" waves), passage in the Solar Wind when in NBR for S/C #1.



Electric and magnetic components spectral density from STAFF SA in the Magnetosheath.

Conclusion

NBR GSF

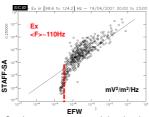
- •DWF: to secure the durability of basic data but not useful for not experts.
- · Already power spectra density data and quicklook plots from STAFF-SC, and all level 2 STAFF-SA products available to download for years 2001-2009.
- STAFF-SA Level 3:

Polarisation and Propagation Parameters are now in production phase.

•CWF: to be delivered next.

•Still some improvements to be performed : New caveats for STAFF-SA about EFW data use, new L2 STAFF-SA data with more information (STATUS, time resolution and quality on both parameters).

STAFF/EFW comparison



Good agreement, provided the signal level being above a given threshold $(\sim 10^{-3} - 10^{-4} \text{ mV}^2/\text{m}^2/\text{Hz}, depending on}$ the frequency, corresponding to EFW

STAFF-SC Spectro

Quicklook

Multiple bow shock crossing

STAFF-SA PPP

Chorus and equatorial noise close to perigee. From top to bottom : Magnetic and electric

density, polarisation (percentage, ellipticity, θ and ϕ angles), direction of propagation.

One can deduce : chorus is right hand polarised, propagates away from equator, equatorial noise propagates perpendicular to B₀.

PPP are valid for wave power above a given threshold.

Here BSUM threshold:

1.0E⁻⁷nT²/Hz.

References

- Cornilleau-Wehrlin et al, 1997; Cornilleau-Wehrlin et al, 2003
- Prassadco: http://aurora2.troja.mff.cuni.cz/~santolik/PRASSADCO/guide.pdf
- CAA documentation: STAFF User Guide, Cross calibration report, Interface Control Document: http://caa.estec.esa.int/caa/ug_cr_icd.xml