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Implementation of the interface for sPECtral Matrix ANalyzer (iPECMAN)

D. Píša (1), O. Santolík (1,2), J. Souček (1), and U. Taubenschuss (1)
(1) Institute of Atmospheric Physics, Czech Academy of Sciences, Prague, Czechia, (2) Charles University, Prague, Czechia (dp@ufa.cas.cz)

Abstract

Interface for a sPECtral Matrix ANalyzer (iPECMAN) is an online data analysis tool aimed at multi-dimensional measurements of planetary electromagnetic fields. It calculates characteristics of electromagnetic waves from in-situ spacecraft measurements. These characteristics are the key signatures of fundamental processes in the solar wind and planetary magnetospheres. The interface is developed as a part of VESPA (Virtual European Solar and Planetary Access) work packages in the frame of Europlanet-H2020-RI.

1. Introduction

The iPECMAN is based on the PRASSADCO (PRopagation Analysis of STAFF-SA Data with COherency tests) analysis tool [1], developed originally in the frame of the ESA Cluster Project. PRASSADCO implements a number of methods used to estimate polarization and propagation parameters, such as the degree of wave polarization, sense of elliptic polarization and axes of polarization ellipse, the wave vector direction, the Poynting vector or the refractive index.

The above methods have been previously used for data analysis and validation from the STAFF-SA instruments onboard the four Cluster spacecraft (e.g. [2]), the STAFF/DWP instrument onboard the Double Star TC-1 spacecraft, the LFEW instrument onboard the Double Star polar TC-2 spacecraft, the Cassini RPWS data, the IMSC and ICE instruments on the DEMETER spacecraft (e.g. [3]), the Polar PWI-HFWR data, and data from the EMFISIS Waves instruments onboard the NASA Van Allen Probes Spacecraft (Fig. 1).

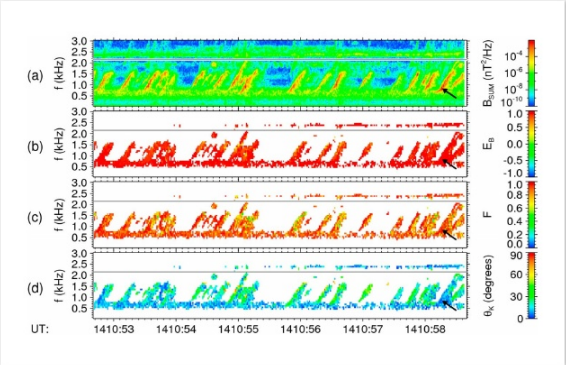

Figure 1: Example of the PRASSADCO output as presented in [4]. Analysis of one snapshot of magnetic field waveforms recorded by the EMFISIS Waves instruments onboard Van Allen Probe A on 14 November 2012.

2 iPECMAN

IPECMAN is a tool designed to provide different visual formats of the electromagnetic wave characteristics observed in the solar wind and planetary magnetospheres. It interfaces the VESPA data services or user provided data with the PRASSADCO analysis tool. The interface is written in PHP and requires Apache 2 web server and PostgreSQL database. This gives sufficient performance and painless portability.

The input data are in CDF (Common Data Format) [5]. The interface implements the existing Cluster STAFF-SA Spectral Matrix data [6] or generic CDF files [7]. The input CDF file must be structured with a header section containing the global attributes, and a data section containing the variables and the associated variable attributes. Metadata compliant with the EPNcore data model, used by the VESPA project for its data distribution protocol EPN-TAP [8], can also be included. The input data can be directly uploaded to the interface through a form or url query. Another

way to provide data is to use SAMP [9]. SAMP is a messaging protocol that enables various software tools (e.g. TOPCAT) to interoperate and supports communication between applications on the desktop and in web browsers.

An uploaded CDF file is converted to the PRASSADCO input format. Then a two-step configuration of an output file format is done. In the first step, common definitions and output formats are set (Fig. 2). Consequently, an output panel setting is made. A user fills a simple form or selects output from several predefined options. Finally, input data are processed by PRASSADCO using an user-defined configuration and visual files are returned. A user is allowed to edit his options in every step of configuration.

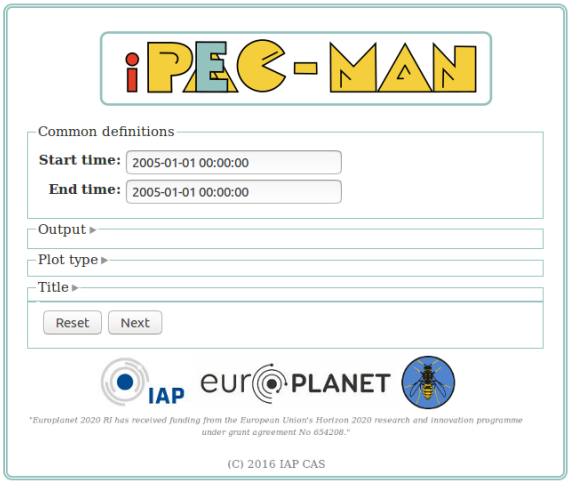

Figure 2: A screenshot of common definition form for the iPECMAN output configuration.

3 Summary

We developed the web interface (iPECMAN) dedicated to calculation and visualization of multi-dimensional electromagnetic wave analysis. It can be used to analyze characteristics of electromagnetic waves from in-situ spacecraft measurements that are the key signatures of fundamental processes in the wide range of space plasma environments. The interface implements the existing data or allows to upload user-defined data using a generic CDF data format.

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References

[1] http://aurora.troja.mff.cuni.cz/~santolik/PRASSADCO/staff_sa/

[2] Santolík, O., D. A. Gurnett, and J. S. Pickett, Multipoint investigation of the source region of storm-time chorus, Ann. Geophys., 22, 2555-2563, doi:10.5194/angeo-22-2555-2004, 2004.

[3] Píša, D., M. Parrot, O. Santolík, and J. D. Menietti, EMIC waves observed by the low-altitude satellite DEMETER during the November 2004 magnetic storm, J. Geophys. Res. Space Physics, 120, 2015.

[4] Santolik, O., C. A. Kletzing, W. S. Kurth, G. B. Hospodarsky, S. R. Bounds, Fine structure of large-amplitude chorus wave packets, Geophys. Res. Lett., 41 (2): 293–299, 2014.

[5] http://ppi.pds.nasa.gov/doc/cdf/PDS4-Archiving-of-CDF-Files-v3.pdf

[6] https://caa.estec.esa.int/documents/UG/CAA_EST_UG_STA_v35.pdf

[7] http://ipecman.ufa.cas.cz/files/Generic-iPECMAN-CDF-Dataset-V02.pdf

[8] https://voparis-confluence.obspm.fr/display/VES/EPNcore+v2

[9] http://www.ivoa.net/documents/SAMP/