CDPP/AMDA, une base de données et un outil d'analyse en ligne pour les données plasma héliosphériques et planétaires

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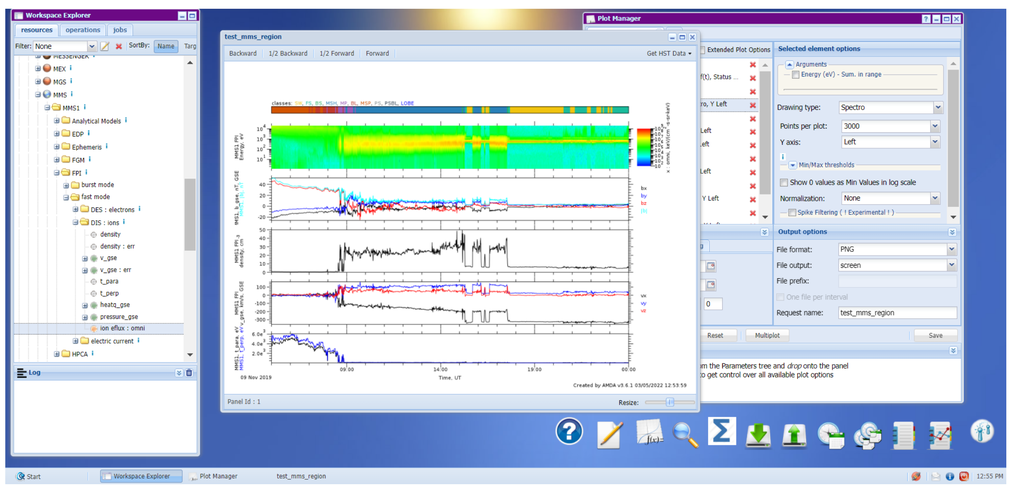
The French Plasma Physics Data Centre (CDPP, http://www.cdpp.eu/) addresses for nearly 20 years all issues pertaining to natural plasma data distribution and valorization. The CDPP is involved in the development of interoperability (IVOA, IPDA, SPASE) and participates in several Virtual Observatory projects (Europlanet, Helio, Vispanet, IMPEx).
This poster presents AMDA, a flexible and attractive online tool, which allows the user to combine and plot data from heterogeneous sources



Automated Multi-Dataset Analysis
In-situ database and analysis tool

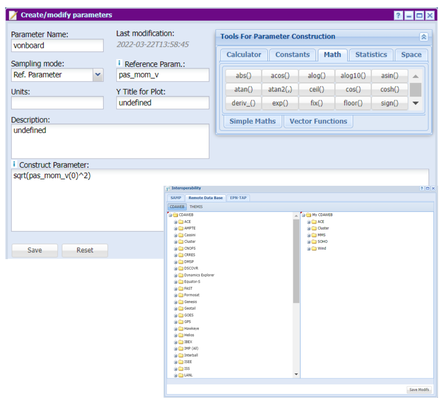
http://amda.cdpp.eu

Register at amda@irap.omp.eu

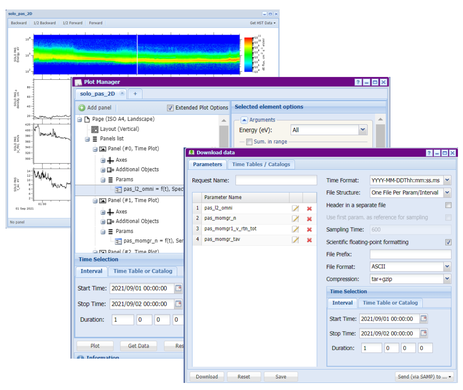
Reference paper:
Automated Multi-Dataset Analysis (AMDA): An on-line database and analysis tool for heliospheric and planetary plasma data
Vincent Génot, E. Budnik, C. Jacquey, M. Bouchemit, B. Renard, N. Dufourg, N. André et al.
Planetary and Space Science, Elsevier, 2021, 201, pp.105214.
https://doi.org/10.1016/j.pss.2021.105214

AMDA functionalities

Parameter Editor
Compute new parameters by editing a mathematical expression combining existing parameters.
Heterogeneous time bases are handled by AMDA transparently to the user (by interpolating/averaging data).



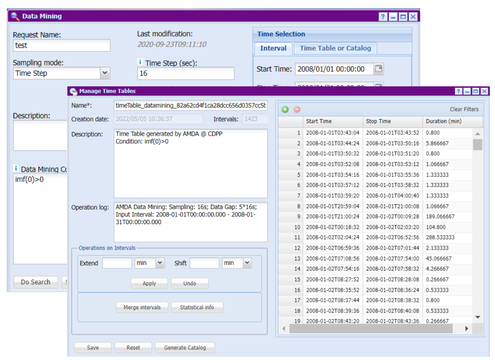
Remote Data Access
The user can browse through the parameters of the distant databases, like CDAWeb, select the desired ones and save them in his/her own external data tree. Any data centers whose data are described by the SPASE datamodel may be reachable by AMDA.



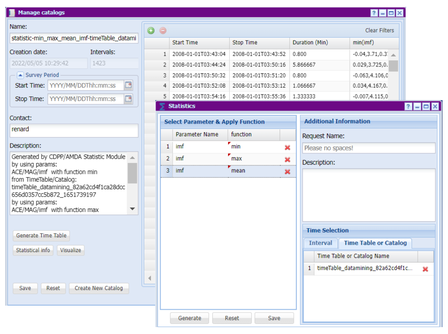
Plot Data
The user can edit a figure combining any available parameters with the desired options. From the window presenting the resulting plot, it is possible to zoom in/out (with the mouse) or move the interval backward/forward in time. The user can save a figure in format PNG, PDF, PS or SVG.

Download Data
All AMDA parameters can be equally downloaded by the user in different formats (plain ASCII, CDF, VOTable) and with a chosen resolution. Time series may optionally be joined on a common time basis before exporting.

Data Mining
Automatically detect time intervals when a particular condition applied on given parameters is fulfilled. Result can be saved as a TimeTable in the user workspace.



TimeTable Edition
TimeTables produced by visual inspection or conditional search may be edited, modified and saved. TimeTables may be also imported/exported in ASCII, VOTable or HPEvent formats.

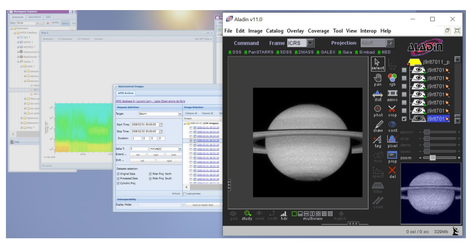


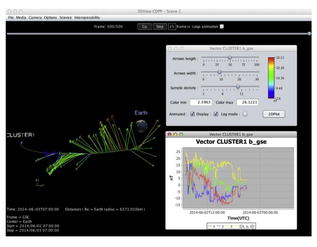
Statistics
Apply a statistical function (mean, max, min, median, standard deviation, skewness, kurtosis) on a chosen parameter on all the intervals of a TimeTable to produce a catalog.

Catalog Edition
Catalogs produced by a statistical process may be edited, modified and saved. Catalogs may be also imported/exported in ASCII, VOTable or HPEvent formats.

Interoperability

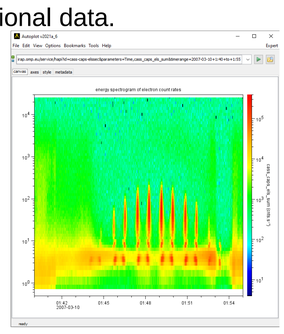
IVOA standards & protocols
Thanks to the AMDA EPN-TAP server, you can query AMDA data from the VESPA portal: http://vespa.obspm.fr
User can also query APIS service (https://apis.obspm.fr/) directly from AMDA to retrieve UV spectro-imaging auroral observations, and open FITS image in Aladin tool with the SAMP protocol.



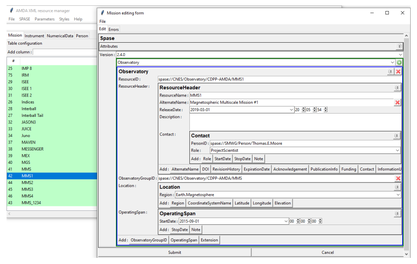


AMDA REST WebService
AMDA WebService give the possibility to access AMDA data (time series, TimeTables & Catalogs): http://amda.irap.omp.eu/help/apidoc/
For example, AMDA WebService is used by CDPP/3DView tool (http://3dview.irap.omp.eu/) to access observational data.

Access AMDA data through our HAPI server
HAPI is an API, metadata, and data streaming format specification for time-series data.
AMDA data can be easily retrieve with a simple URL, and dataset description with this URL too.
For example, thanks this server, you have a direct access to AMDA data from Autoplot (http://autoplot.org/):



In-situ database



More than 80 missions and 800 datasets

Fully described in the SPASE data model

ACE: MFI, SWEPAM
DSCOVR: MAG, Faraday Cup
ISEE: FGM, FVA
OMNI
WIND: MFI, SWE
STEREO: HET, LET, MAG, PLASTIC, SEPT, SIT, SWEA

Venus-Express: ELS, IMA, MAG
PVO: MAG

MMS: EDP, FGM, FPI, HPCA
THEMIS: ESA, FGM
ARTEMIS: ESA, FGM
Cluster: CODIF, HIA, EFW, FGM, PEACE, STAFF, WHISPER
Geotail: CPI, EFD, EPIC, LEP, MGF
Double Star: FGM, HIA
AMPTE: CCE, IRM, & UKS
EISCAT: ESR 32M, ESR 42M, UHF, VHF
JASON3: AMBRE
Swarm: GNSS, EFI/LP, ASM/VFM, EFI/TII
Indices: DST, AE, AL, SME, SML, …
Freja: ESP, MFE
IMP-8: MAG, MIT
Interball Tail: Corall, DOK2, MIF-M
Polar: HYDRA, MFE

Rosetta: AUX, IES, LAP, MAG, MIP, ROSINA
Giotto: IMS, JPA, MAG, RPA
ICE: MAG

Helios: AUX, E1, E3, MAG
Pioneer 10&11: CPI, CRT, GTT, MAG
Astronomical Objects Ephemerides
Planets Properties
Magnetic Field Models: T96, Morschhauser, Cain, JRM09
Solar Wind Propagation Models
Ulysses: FGM, SWICS, SWOOPS, URAP
Voyager 1&2: CRS, LECP, MAG, PLS, PWS

Solar Orbiter: EPD, MAG, PAS, RPW
Parker Solar Probe: MAG, SWEAP, ISOIS
Solar Irradiance: FERMI (LAT), TIMED (SEE)

Bepi Colombo: MEA, MIA, ENA, MSA, MGF
MESSENGER: MAG, FIPS, EPS
Mariner 10: MAG, PLS

MAVEN: EUV, LPW, MAG, NGIMS, SEP, STATIC, SWEA, SWIA
Mars-Express: ELS, IMA, MARSIS
MGS: ER, MAG, Proxy
Phobos-2: ASPERA, MAG

JUNO: FGM, JADE, JEDI, WAVES
JUICE: CReMA
Galileo: EPD, MAG, PLS, PWS

Cassini: CAPS, MAG, MIMI-LEMMS, RPWS

AMDA has been integrated in the **Space Weather Service Network** of the European Space Agency.

Data from simulations and models

Compare models, derived from MHD and hybrid codes (from LATMOS and FMI) and analytical paraboloid models (from SINP) for the magnetic field, **with the observational data**.

Run routinely and expose the results of the 1D MHD **solar wind propagation model** (Tao et al. 2005).

Python & Machine Learning

Access AMDA data in Python with Speasy module & view predictions produced by machine learning algorithms in AMDA:
Python tools for CDPP/AMDA and Machine Learning
Alexandre Schulz et al.
sciencesconf.org:pnst-2022:400219

Use AMDA for a Machine Learning study:
Automatic Detection of Martian bow shock crossings using data of the Mars Express mission: A Deep Learning Approach
Menouar AZIB et al.
sciencesconf.org:pnst-2022:399962