



<http://www.cdpp.eu/>



# Overview of CDPP activities in space physics

**N. André**, V. Génot, C. Jacquety, M. Bouchemit, E. Budnik, Q. Brzustowski,  
M. Gangloff, F. Pitout, A. Rouillard, I. Plotnikov, N. Dufourg, D. Boucon,  
J. Durand, D. Heulet, M. Gangloff, B. Cecconi

***IHDEA meeting, 21 October 2020***



# CDPP

*Plasma Physics Data Centre*

- Established in 1998 from a CNES/CNRS collaboration for natural plasma [data distribution and archiving](#) : from the ionosphere to the heliosphere; about 5-8 FTE, engineers and scientists, main base in Toulouse, south of France
- Since 2006, CDPP is strongly involved in the development of data [analysis and visualization tools](#) including simulations
- CDPP expertise in data handling resulted in the participation to several [EU and ESA projects](#) aiming at enlarging data distribution via standards (Virtual Observatory concept) including simulations
- [Mission support activities](#) : quicklook visualization tool for the Rosetta Plasma Consortium team, role in discussion for Solar Orbiter, Bepi-Colombo and JUICE.
- These activities help [promoting science](#) (papers) and [education](#) (hands-on, tutorials)



## CDPP News

### CDPP and ESA/SSA

Integrating the ESA space weather portal

[Read more ...](#)

### A new web site !

Have a new look on CDPP

[Read more ...](#)

### CDPP is involved in ESA/Athena

When plasma physics helps X-ray astronomy

[Read more ...](#)

[All the news](#)

The CDPP is the French national data centre for natural plasmas of the solar system.

Created in 1998 jointly by **CNES** and **INSU**, the CDPP assures the long term preservation of data obtained primarily from Instruments built using French resources, and renders them readily accessible and exploitable by the international community. The CDPP also provides services to enable on-line data analysis (**AMDA**), 3D data visualization in context (**3DView**), **propagation tool** and **space weather tool** which bridges solar perturbations to in-situ measurements. The CDPP is involved in the development of interoperability, participates in several Virtual Observatory projects, and supports data distribution for scientific missions (Solar Orbiter, JUICE).

Direct access to our tools !



Amدا



Propagation Tool



SpaceWeather Tool



3DView



SIPRO



TREPS

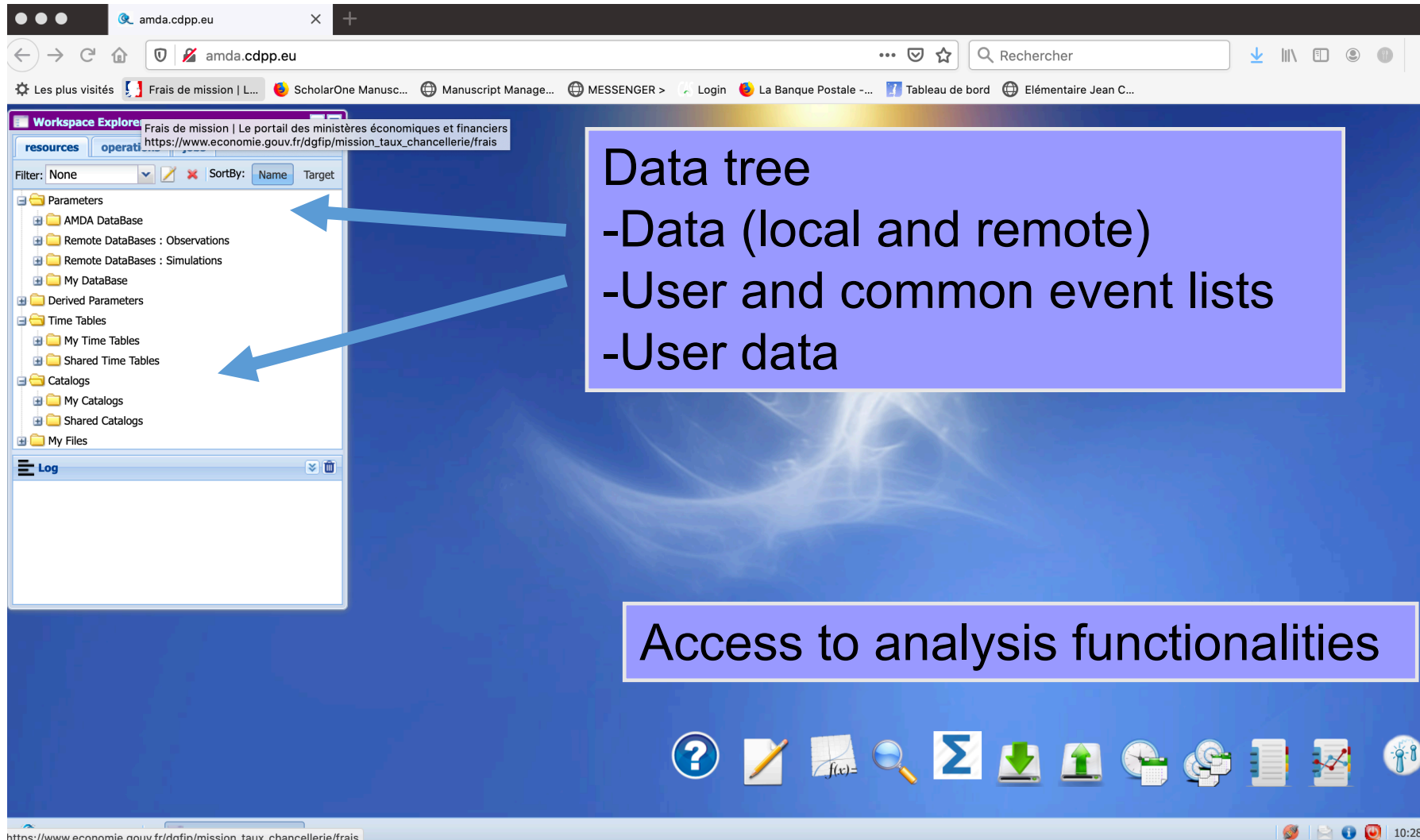
<http://amda.cdpp.eu/>



- A data analysis tool in your browser
  - *physical parameters not files !*
- Data are
  - replicated from ESA/Cluster Science Archive, NASA/PDS
  - or accessed remotely : CDAWeb, simulation and model databases, ...
  - public or restricted to communities
  - can be exported in companion tools (SAMP)
  - or uploaded by the user
  - can be accessed via web-services (SOAP/REST)
  - Are internally kept in netCDF
- Sessions are saved (*so it's better to register !*)
  - register at [amda@irap.omp.eu](mailto:amda@irap.omp.eu)
- Public access w/o registration also available



# <http://amda.cdpp.eu/>

The screenshot shows a web browser window with the URL 'amda.cdpp.eu'. The browser's address bar and tabs are visible at the top. Below the browser window, there is a 'Workspace Explorer' panel on the left side of the main content area. This panel has a 'resources' tab selected and shows a tree view of data resources. The tree includes folders for 'Parameters', 'Derived Parameters', 'Time Tables', 'Catalogs', and 'My Files'. Under 'Parameters', there are sub-folders for 'AMDA DataBase', 'Remote DataBases : Observations', 'Remote DataBases : Simulations', and 'My DataBase'. Under 'Time Tables', there are 'My Time Tables' and 'Shared Time Tables'. Under 'Catalogs', there are 'My Catalogs' and 'Shared Catalogs'. Two blue arrows point from the 'Data tree' text box to the 'Parameters' and 'Time Tables' folders in the tree view. The main content area has a blue background with a white, ethereal, smoke-like pattern. At the bottom of the main content area, there is a horizontal toolbar with various icons: a question mark, a pencil, a document with a formula, a magnifying glass, a summation symbol, a download arrow, an upload arrow, a clock, a document with a magnifying glass, a document with a checkmark, a document with a bar chart, and a key icon. The status bar at the very bottom shows the URL 'https://www.economie.gouv.fr/dafip/mission\_taux\_chancellerie/frais' and the time '10:28 P'.

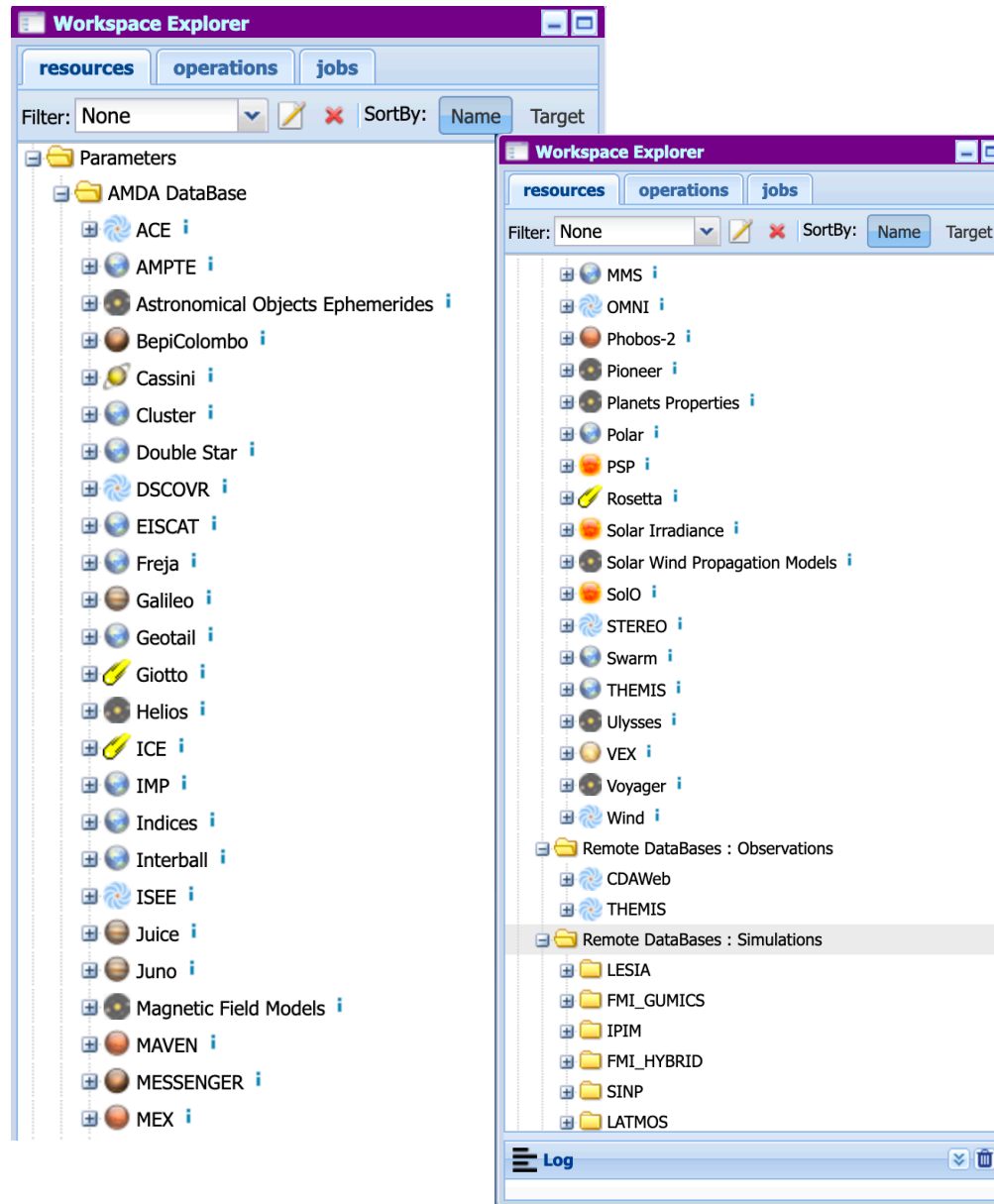
## Data tree

- Data (local and remote)
- User and common event lists
- User data

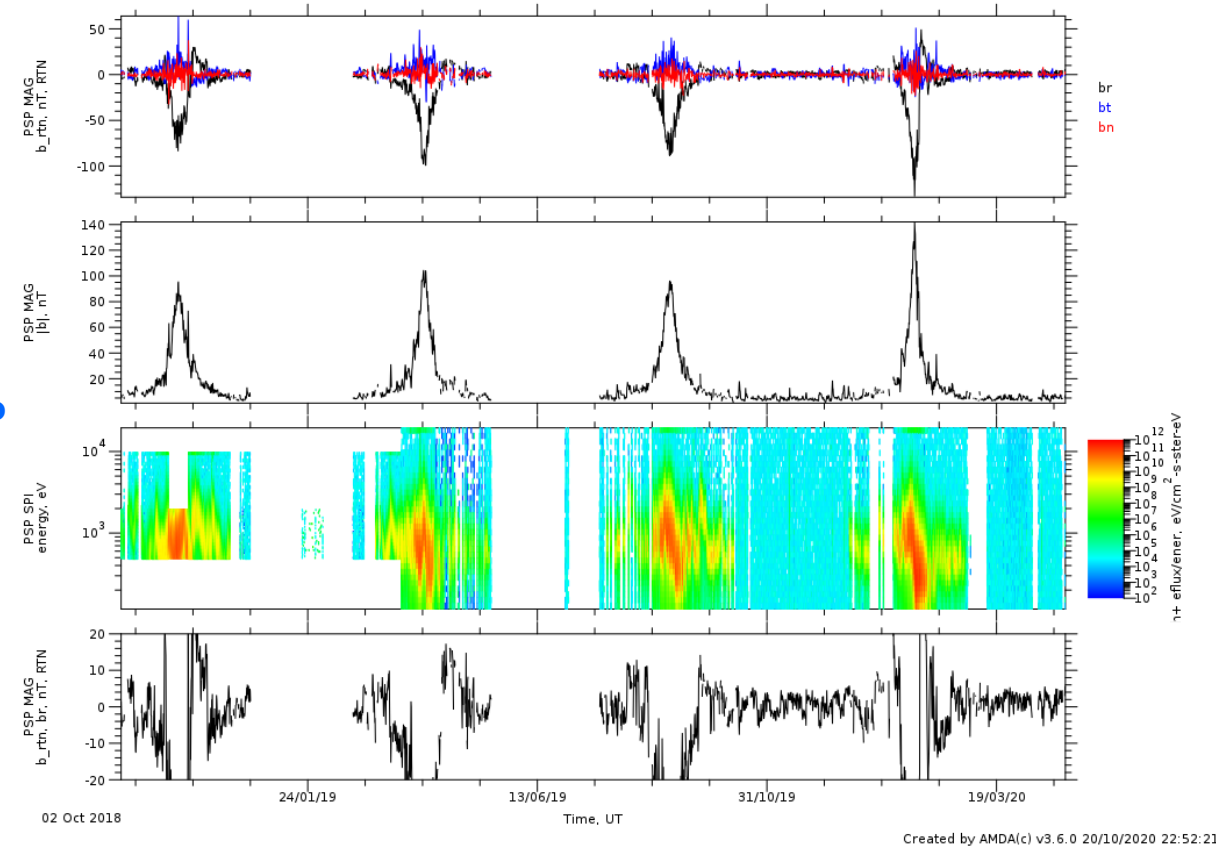
Access to analysis functionalities

- **First public Solar Orbiter in situ data (MAG, PAS, EPD)**
- **First Parker Solar Probe in situ data (MAG, SWEAP, ISIS)**
- **STEREO energetic particles (HEP, SEP)**
- **ULYSSES particles (SWOOPS, SWICS)**
- **Helios (MAG)**
- **AMPTE magnetic field & plasma**
- **Interball magnetic field & plasma**
- **Freja magnetic field & electron**
- **Cluster electron (PEACE)**
- **MMS**
- **Phobos 2 magnetic field & plasma (MAG, ASPERA)**
- **Solar wind propagation 1D MHD at planets and spacecraft**

# Datasets available in the online tool CDPP/AMDA



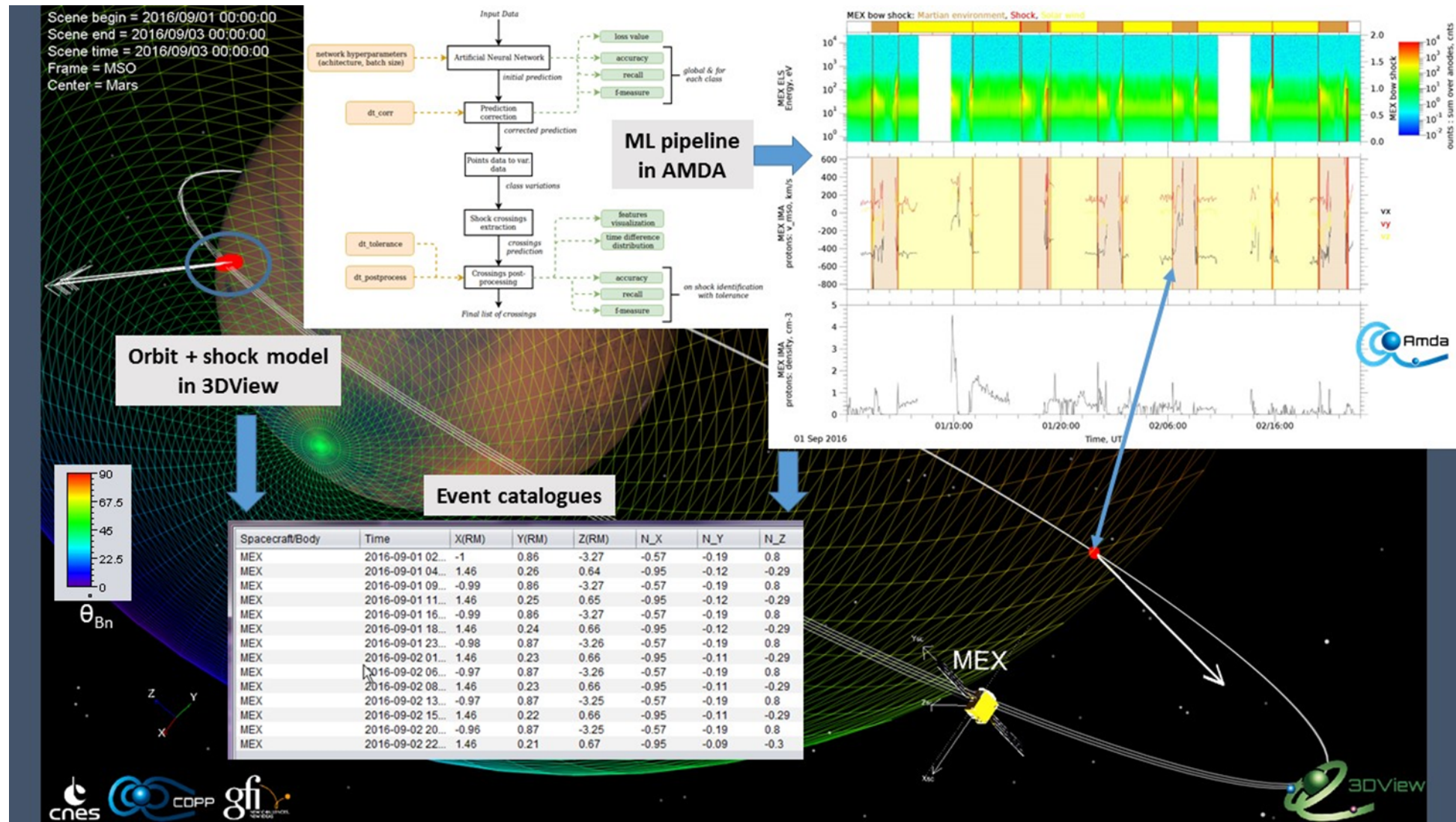
PSP



- Plot
- Data mining and combination
- Cataloguing (event lists)
- Upload / download (CDF, netCDF, VOTable, ASCII)
- Statistics (long term analysis)

# Recent activities in AMDA

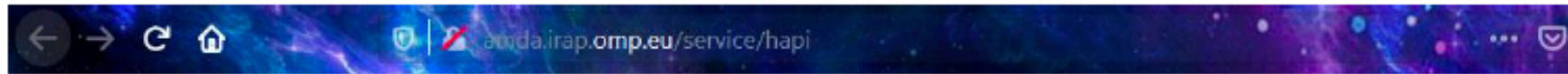
Machine learning: enhancing data visu & analysis





# AMDA and HAPI

<http://amda.irap.omp.eu/service/hapi>

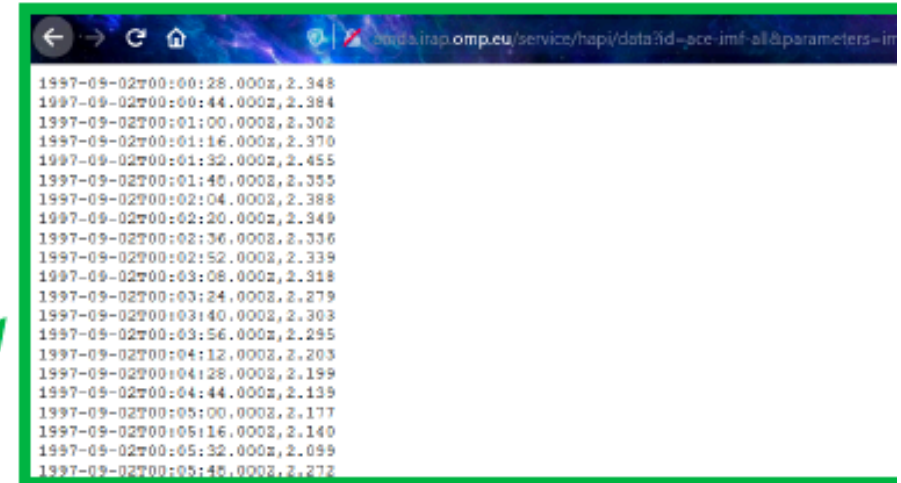


## HAPI Server for amda datasets

This server supports the [HAPI 2.0 API](#) specification for delivery of time series data.

The server responds to GET requests to the following [HAPI endpoints](#):

- [capabilities](#) - list the API version and output options
- [catalog](#) - list the datasets that are available (499 total) **Now 649**
- [info](#) - list information about parameters in a dataset, e.g.:
  - [./hapi/info?id=ace-imf-all](#)
  - [./hapi/info?id=ace-mag-real](#)
  - [./hapi/info?id=ace-swe-all](#)
  - [./hapi/info?id=ace-swepam-real](#)
  - [./hapi/info?id=ace-swp-all](#)
- [data](#) - stream data for parameters in a dataset. Examples for first dataset:
  - [./hapi/data?id=ace-imf-all&parameters=imf\\_mag&time.min=1997-09-02T00:00:12Z&time.max=1997-09-03T00:00:12.000Z](#)
  - [./hapi/data?id=ace-imf-all&parameters=imf&time.min=1997-09-02T00:00:12Z&time.max=1997-09-03T00:00:12.000Z](#)
  - [./hapi/data?id=ace-imf-all&parameters=imf\\_gsm&time.min=1997-09-02T00:00:12Z&time.max=1997-09-03T00:00:12.000Z](#)



Contact: [amda@irap.omp.eu](mailto:amda@irap.omp.eu)

[Run Validation Tests](#)



- <http://3dview.cdpp.eu/>
- In development for about 10 years (JAVA application, GPLv3)
  - Took a lot of inspiration from NASA/VISBARD
- Contractant: GFI, with CNES and EU project supports (IMPEX, Europlanet, ...)
- From an orbit viewer (NAIF/SPICE kernel) to a space physics data rendering system
- It now includes **access to several databases** (CDAWeb, ESA/CSA, Madrigal,...), and offers 3D representations for **data** and **model, statistics** capabilities, movies ...
- See *Génot et al.*, 2017, PSS for a full functionality description



## Missions

- Show All Missions

## Science Programme

- Cosmic Vision  
2015-2025
- Future Missions  
Department
- Collaborative Missions
- Director's Desk

## Community Areas

- Astrophysics
- Fundamental Physics
- Solar System

## Resources

- News Archive
- Multimedia gallery
- Publication Archive
- Status Reports Archive
- Calendar of Events

## EXPLORING PLANETARY PLASMA ENVIRONMENTS FROM YOUR LAPTOP

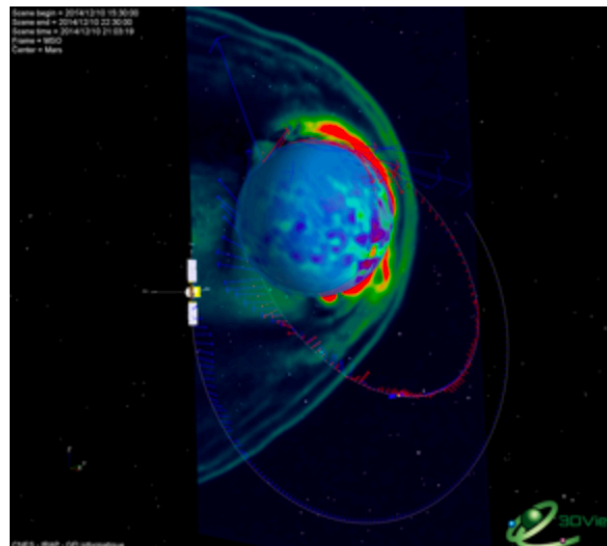
14 June 2018

**A new database of plasma simulations, combined with observational data and powerful visualisation tools, is providing planetary scientists with an unprecedented way to explore some of the Solar System's most interesting plasma environments.**

This digital space exploration story starts with the Integrated Medium for Planetary Exploration (IMPEX), a collaborative project to create a common data hub for space missions.

While planetary missions are crucial to understand how the solar wind interacts with the magnetospheres of planets and moons in our Solar System, numerical models are, in turn, essential to fully comprehend the measurements and improve our knowledge of planetary plasma environments.

The IMPEX project brought together experts from Austria, France, Finland and Russia to find a common language to combine data from various simulation models and to compare these numerical results with observational data collected by space missions across the Solar System.



Visualisation of Mars' plasma environment.  
*Credit: CNES/IRAP/GFI informatique; LatHyS;  
3DView*



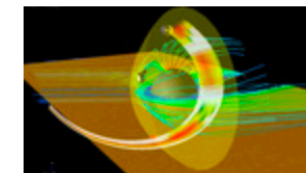
20-Oct-2020 21:02 UT

## Shortcut URL

<https://sci.esa.int/s/ApEdDGw>

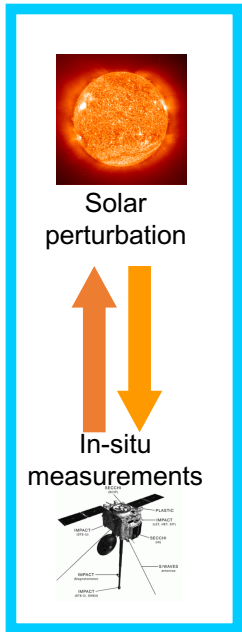


## Images And Videos



- Animated simulation of Mercury's plasma environment
- Animated simulation of Mars' plasma environment
- 📷 Visualisation of Mars' plasma environment
- 📷 Visualisation of the ionised environment of Ganymede


# The Propagation Tool



- <http://propagationtool.cdpp.eu/>
- Computes timing for radial propagation of CME (inc. Drag model), co-rotation (CIR), and SEP propagation
  - *linking in-situ and remote observations*
- First version : 2013 (JAVA application, GPLv3)
- Contractant: GFI, with CNES and EU project supports (Europlanet)
- Designed by A. Rouillard, B. Lavraud and the STORMS team at IRAP based on a FP7 HELIO initial concept
- Used to distribute STEREO catalogues obtained during the FP7 HELCATS projects <http://www.helcats-fp7.eu/>
- Gives access to J-Maps (real and simulated), Carrington maps, catalogues, ...
- Connects to external tools and databases for further analysis



# Transplanet: <http://transplanet.irap.omp.eu>

 v2.4.0

[Request Run](#) [View Results](#) [Published Runs](#) [Acknowledgements](#) [Publications](#) [Links](#) [License](#) [Job](#)

## REQUEST A NEW RUN

Venus

Earth

Mars

Jupiter

### USER

Email (where we'll send the link for downloading the result)

Description (optional, but recommended)

### SPECIES

☒ H ☒ N ☒ H<sup>+</sup> ☒ N<sup>+</sup>  
☒ O ☒ N<sub>2</sub> ☒ O<sup>+</sup> ☒ N<sub>2</sub><sup>+</sup>  
☒ O<sub>2</sub> ☒ NO<sup>+</sup> ☒ O<sub>2</sub><sup>+</sup>

### TIMESPAN

Simulation start date (YYYY / MM / DD)

Simulation start time (HH:MM:SS)

Simulation duration (HH:MM:SS)


Output time interval (s)

### KINETICS

☒ Compute Photoionization ☐ Compute electron precipitation

### MAGNETIC FIELD

Magnetic field model

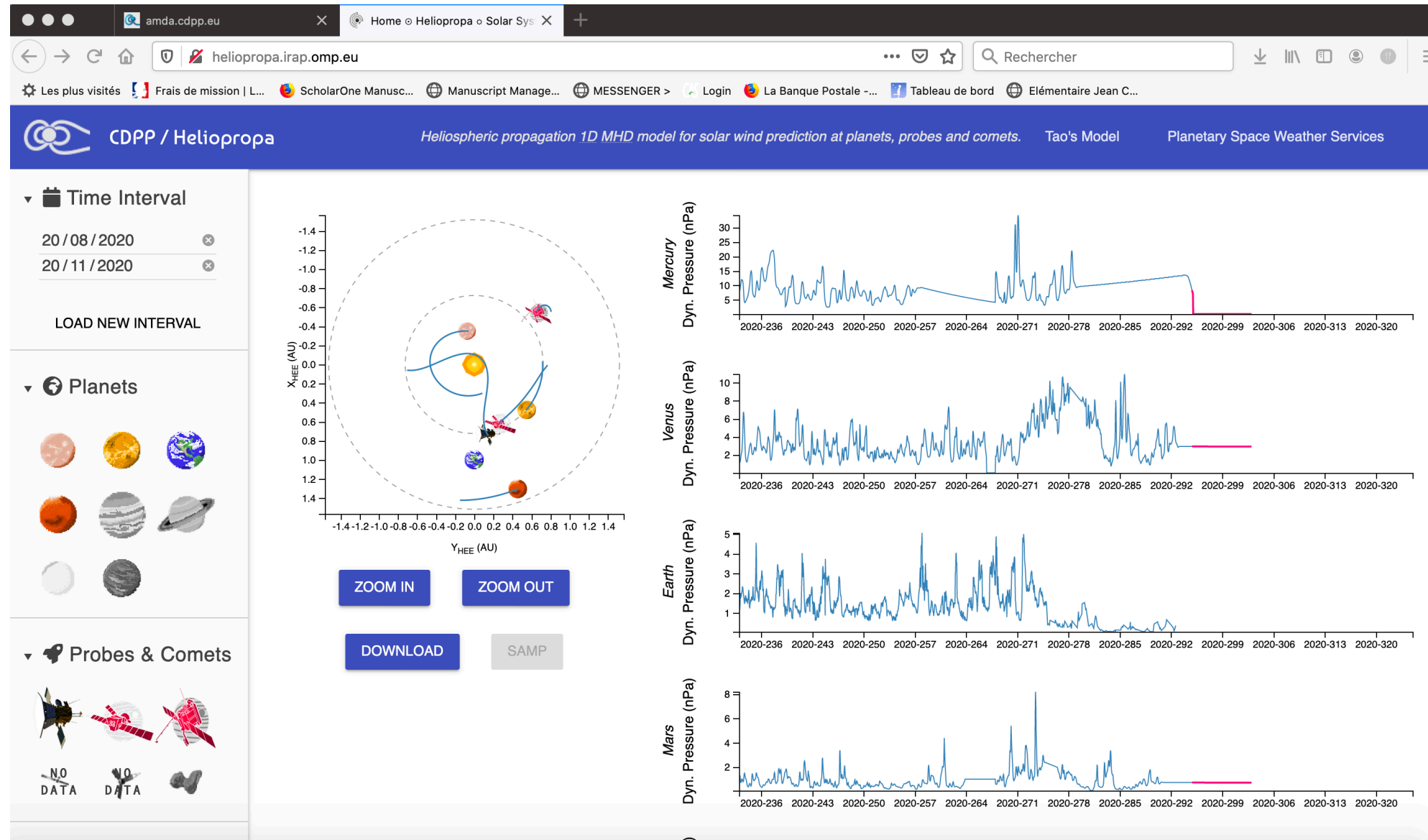
 v2.4.0

[Request Run](#) [View Results](#) [Published Runs](#) [Acknowledgements](#) [Publications](#) [Links](#) [License](#) [Job](#)

## RUNS (202)

Initiated	User	Id	Description	Kti	Kpi	Mag
1 month ago	Julian Eisenbeis	julian.eisenbeis_20200908072655_5f57323f6d26a1		1h	60s ✓	1 IGRF
1 month ago	Julian Eisenbeis	julian.eisenbeis_20200908072552_5f573205e43471		12h	60s ✓	1 IGRF
3 months ago	Jean-michel Glorian	jean-michel.glorian_20200425152412_5ef4c2142d9f21		1h	60s ✓	1 IGRF
5 months ago	Elowitzm	elowitzm_20200520180144_5ec570886af461	Initial Test Run	1h	60s ✓	1 IGRF
7 months ago	Sandrastr	sandrastr_20200310093646_5e475fawc28f01		1h	60s ✓	1 IGRF
7 months ago	Nicolas Andre	nicolas.andre_20200228142400_5e592280ed20c1	mars is fun	1h	60s ✓	1 No B field
8 months ago	Sarakocevska4	sarakocevska4_20200128150831_5e304e467af311	A concise description of this run	1h	60s ✓	1 No B field
1 year ago	Aurelie Marchaudon	aurelie.marchaudon_20190904072941_5d720ae50f1a81	MH_eclipse2017	72h	60s ✓	1 IGRF
1 year ago	Mindurain	mindurain_20190905091008_5d7040f023c5a1	922da78 version test	6h	60s ✓	1 No B field
1 year ago	Mindurain	mindurain_20190905090929_5d7040c99858c1	922da78 version test	6h	60s ✓	1 No B field
1 year ago	Mindurain	mindurain_20190905090143_5d7040ed7846e71	922da78 version test	6h	60s ✓	1 IGRF

# Heliopropa: <http://heliopropa.irap.omp.eu>





# ESA/Space Situational Awareness

The screenshot shows the ESA Heliospheric Weather Expert Service Centre (H-ESC) website. The browser address bar displays <https://swe.ssa.esa.int/heliospheric-weather>. The page header includes the ESA logo and the text "Welcome to the SSA Space Weather Service Network". The left sidebar contains a menu with the following items: "CURRENT SPACE WEATHER", "SPACE WEATHER AT ESA", "SERVICE DOMAINS", "EXPERT SERVICE CENTRES", "OTHER RESOURCES", "CONTACT", and "REQUEST FOR REGISTRATION". The "EXPERT SERVICE CENTRES" menu is expanded, showing a list of service centres: "ESC Solar Weather", "ESC Heliospheric Weather" (highlighted with a red circle), "ESC Space Radiation", "ESC Ionospheric Weather", and "ESC Geomagnetic Conditions". The main content area is titled "Heliospheric Weather Expert Service Centre (H-ESC)" and features a tabbed interface with the following tabs: "ESC Objectives", "Contributions", "Product demonstration", and "Contributors" (highlighted with a red circle). The "Contributors" tab displays a list of contributing organizations, including the Centre de Données de la Physique des Plasmas (CDPP) in France, the Science and Technology Facilities Council (STFC) in the United Kingdom, the UK Met Office (UKMO) in the United Kingdom, the Centre for mathematical Plasma-Astrophysics (CmPA) at Katholieke Universiteit Leuven (KUL) in Belgium, the Technical University of Denmark (DTU) in Denmark, the UNIGRAZ Institute of Physics (UNIGRAZ) at the University of Graz in Austria, the Institute for Astrophysics (UGOE) at the University of Göttingen (GAU) in Germany, and the Solar Influences Data analysis Center (SIDC) and Royal Observatory of Belgium (ROB) in Belgium.

amda.cdpp.eu ESC Heliospheric Weather - Sp X

https://swe.ssa.esa.int/heliospheric-weather

Rechercher

Les plus visités Frais de mission | L... ScholarOne Manusc... Manuscript Manage... MESSENGER > Login La Banque Postale -... Tableau de bord Elémentaire Jean C...

THE EUROPEAN SPACE AGENCY

Welcome to the SSA Space Weather Service Network

Please note that all SSA-SWE Services are under review/construction

esa

CURRENT SPACE WEATHER

SPACE WEATHER AT ESA

SERVICE DOMAINS

EXPERT SERVICE CENTRES

ESC Solar Weather

ESC Heliospheric Weather

ESC Space Radiation

ESC Ionospheric Weather

ESC Geomagnetic Conditions

OTHER RESOURCES

CONTACT

REQUEST FOR REGISTRATION

Expert Service Centres / ESC Heliospheric Weather /

Heliospheric Weather Expert Service Centre (H-ESC)

ESC Objectives Contributions Product demonstration Contributors

ESC Coordinator

Chris Perry (STFC)

Expert Groups providing products

CDPP Centre de Données de la Physique des Plasmas (CDPP) France

RAL Space Science and Technology Facilities Council (STFC) United Kingdom

UK Met Office (UKMO) United Kingdom

Expert Consultants

DH Consultancy (DHC) Belgium

Solar Influences Data analysis Center (SIDC)

Royal Observatory of Belgium (ROB) Belgium

KU LEUVEN Centre for mathematical Plasma-Astrophysics (CmPA) Katholieke Universiteit Leuven (KUL) Belgium

DTU Technical University of Denmark (DTU) Denmark

UNIGRAZ Institute of Physics (UNIGRAZ) University of Graz (UNIGRAZ) Austria

Institute for Astrophysics (UGOE) University of Göttingen (GAU) Germany



# A community infrastructure

## CDPP tools

- Are used by a wide community of scientists
  - Eg, about 400 AMDA sessions / month
  - Including students (courses, projects, thematic schools)
- Are regularly reviewed by a user committee
- Help/facilitate scientific publication
  - About 10-15 papers / year

# CDPP tools in IHDEA

Tool	Protocols	Data models	Web services	Formats	Licences
AMDA	SAMP <i>HAPI (prototype)</i> EPN-TAP	SPASE EPN-core	SOAP/REST – for data distribution	CDF, netCDF, VOTable	Shared property ( <i>not ideal</i> ) <i>on gitlab</i>
3DView	SAMP EPN-TAP	no	SOAP – for coordinate transformation	CDF, netCDF, VOTable	GPLv3 <i>on gitlab</i>
Propagation Tool	SAMP	no	no	FITS, VOTable	GPLv3 <i>on gitlab</i>