http://www.cdpp.eu/

CDPP : services du CDPP, certification et données théoriques

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

ASOV meeting, 23 Mars 2021

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 3-5 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

Plasma physics data center

http://www.cdpp.eu/

About Data Services Resources Mission support EU/ESA projects

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 !

Amda · Propagation Tool · SpaceWeather Tool · 3DView · SIPAD · TREPS

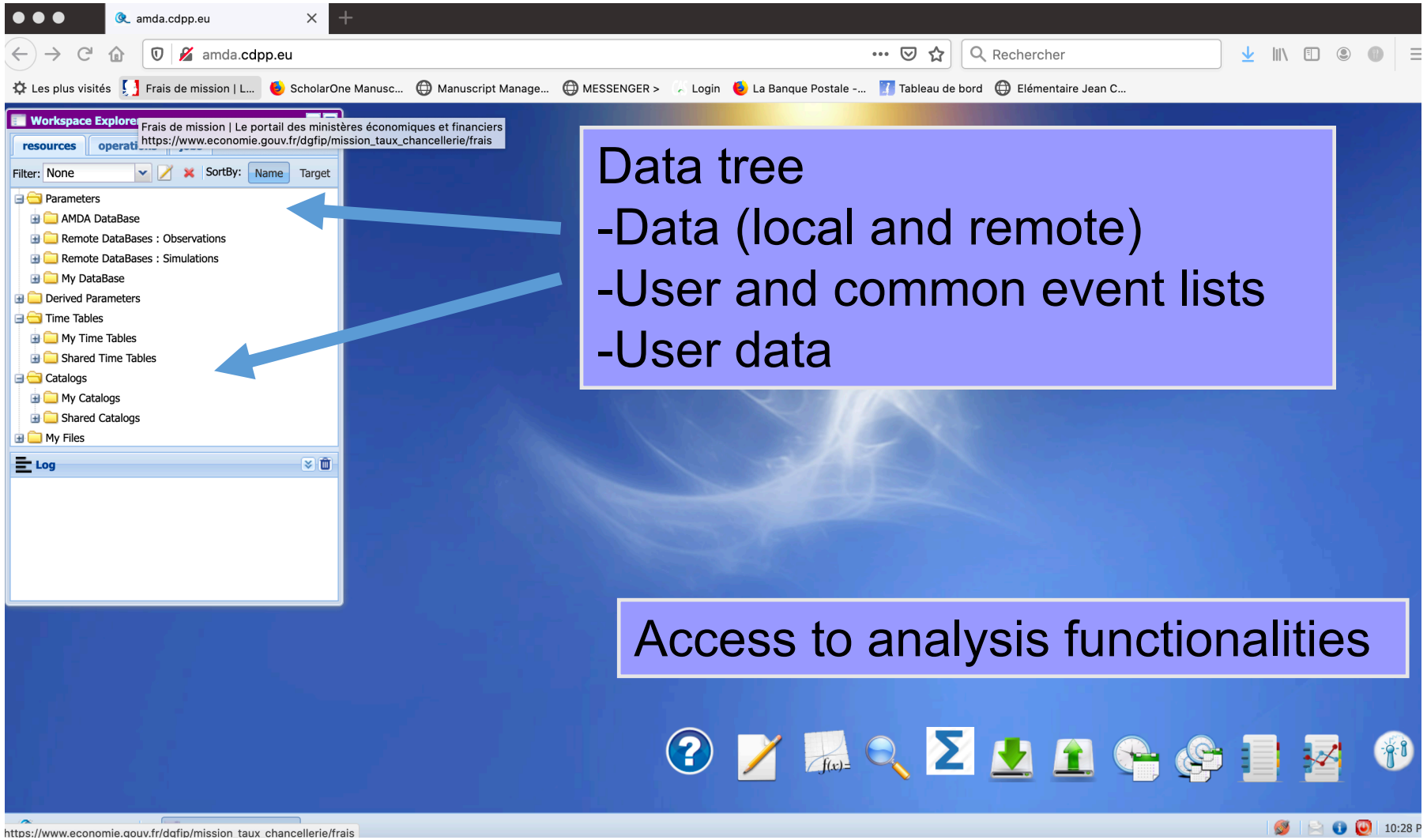
http://amda.cdpp.eu/

- **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**

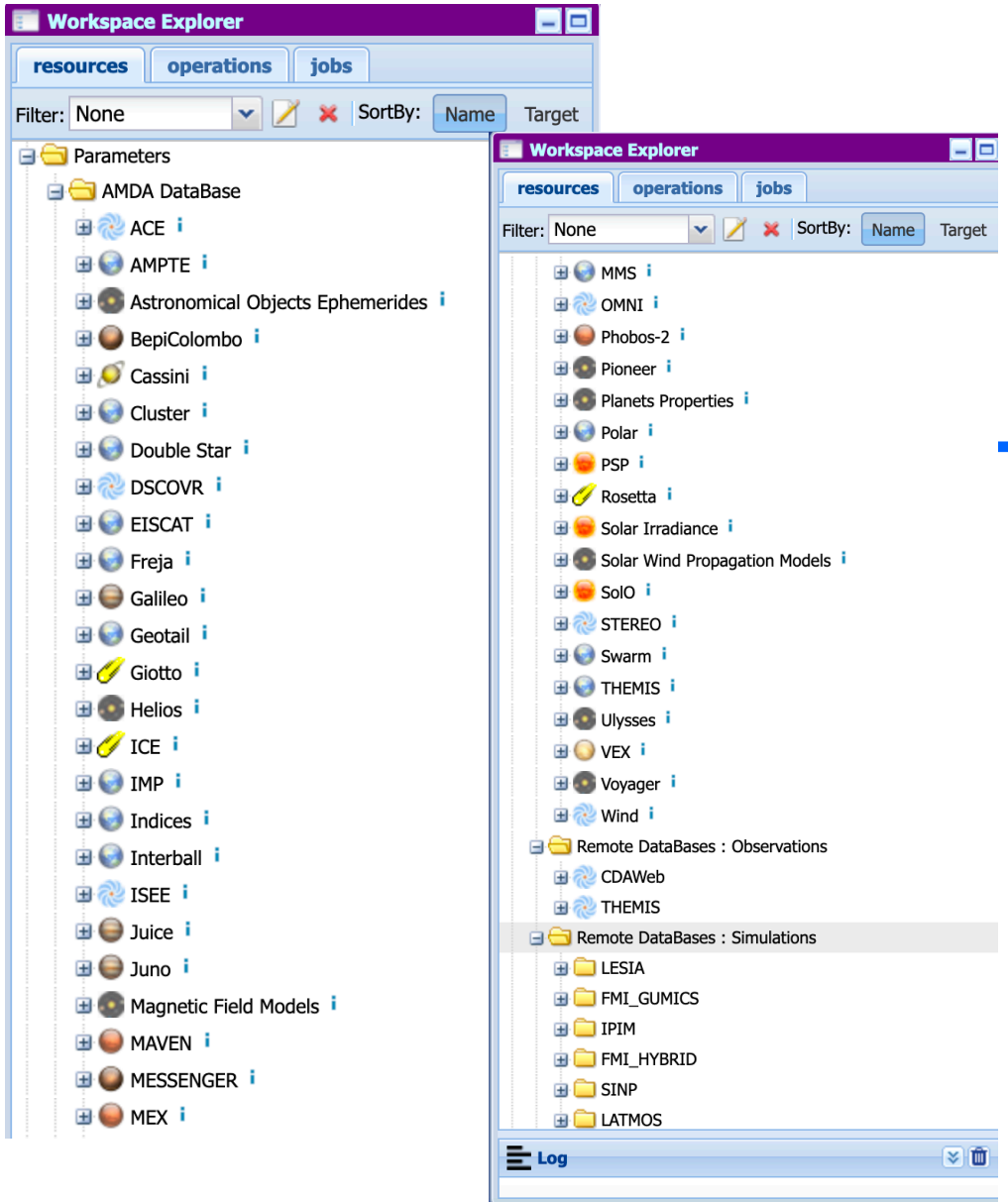
- **Sessions are saved (*so it's better to register !*)**
  - ***register at amda@irap.omp.eu***

- **Public access w/o registration also available**

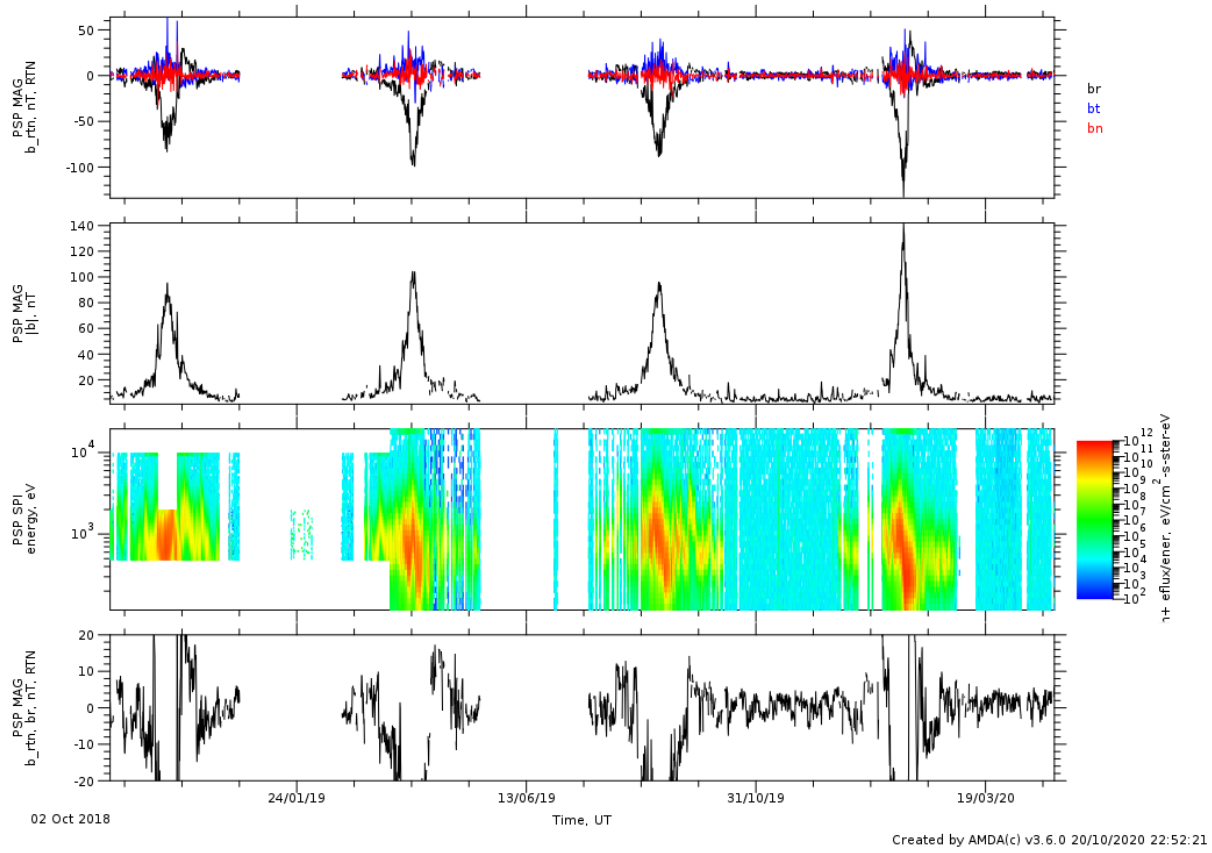
http://amda.cdpp.eu/



Datasets available in the online tool CDPP/AMDA



PSP

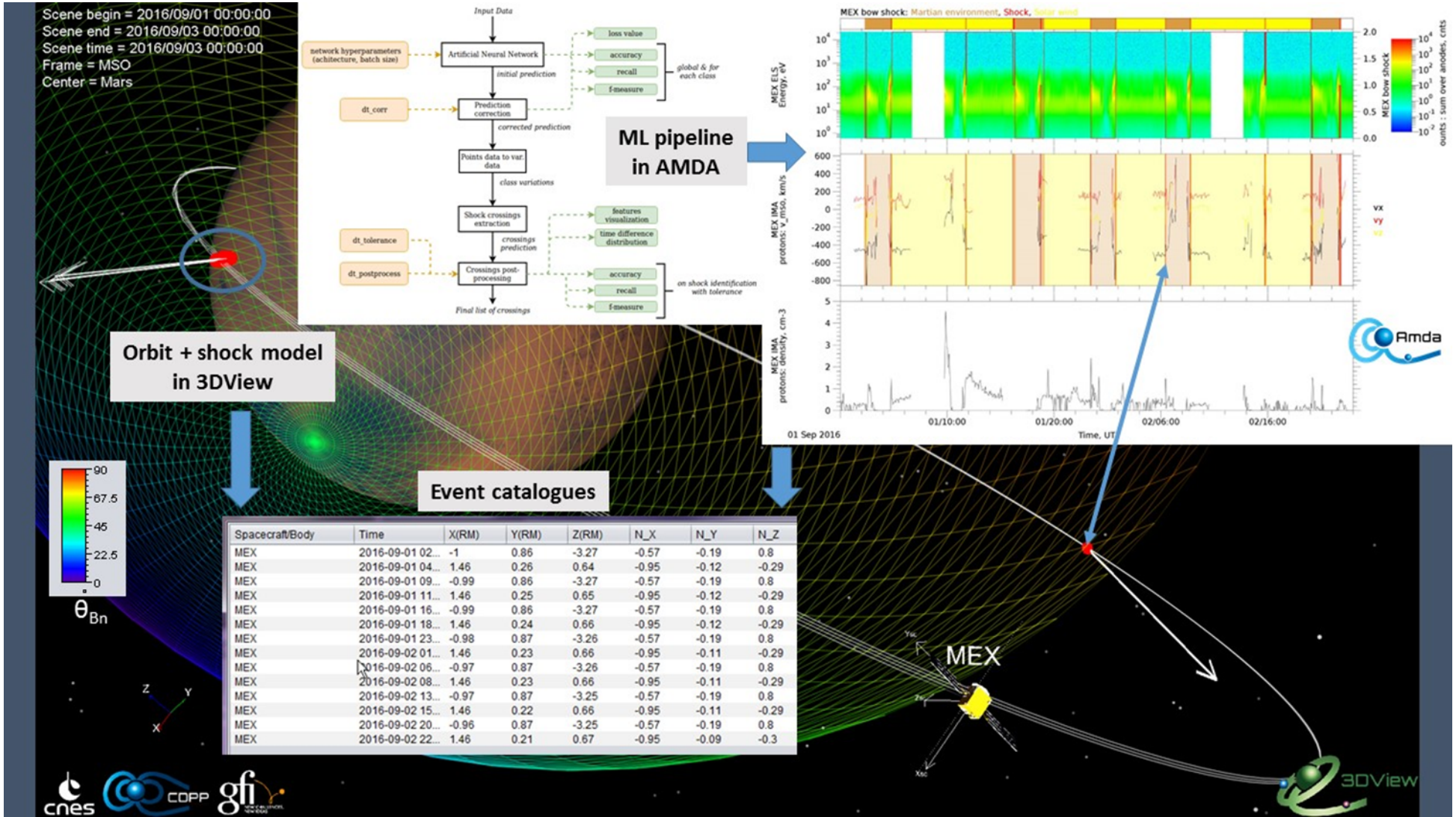


- Plot
- Data mining and combination
- Cataloguing (event lists)
- Upload / download (CDF, netCDF, VOTable, ASCII)
- Statistics (long term analysis)

Recent activities in AMDA

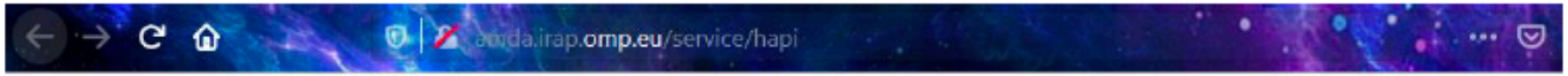
Machine learning: enhancing data visu & analysis

Python: amdapy / Jupyter notebook



AMDA and HAPI

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

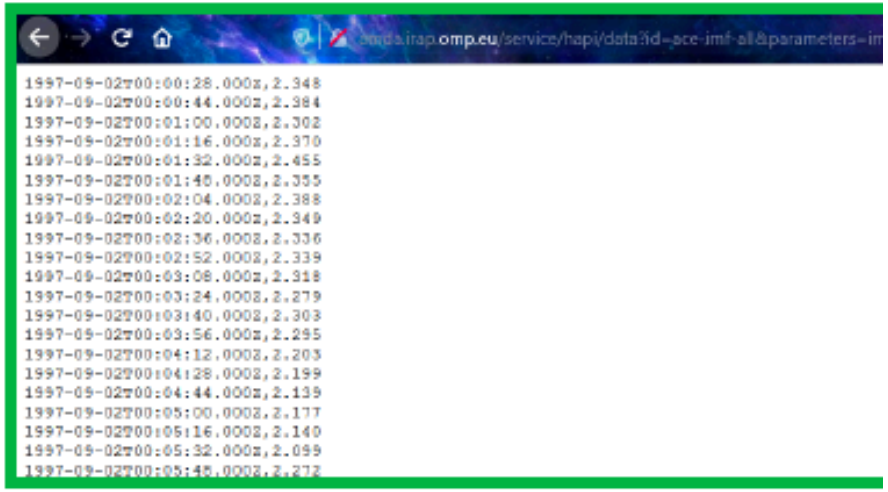


HAPI Server for amda datasets

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

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

gfi NEW CHALLENGES, NEW IDEAS cnes

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

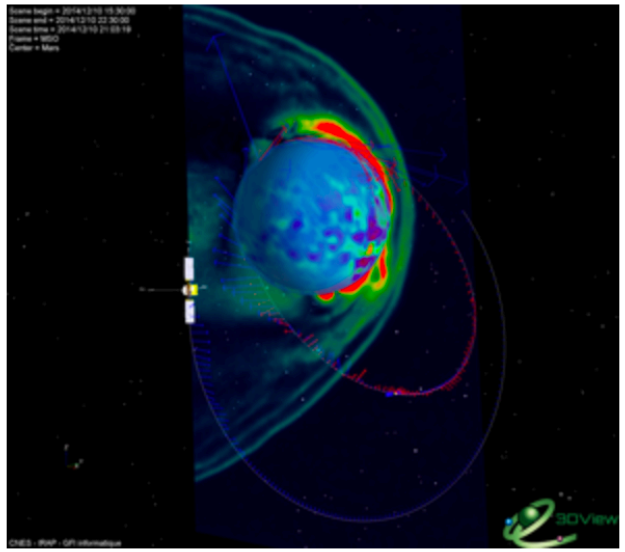
14 June 2018

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.



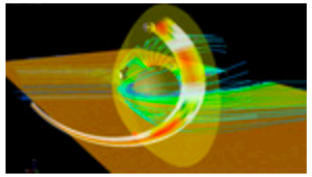
Visualisation of Mars' plasma environment.
Credit: CNES/IRAP/GFI informatique; LatHyS; 3DView

Search here

20-Oct-2020 21:02 UT

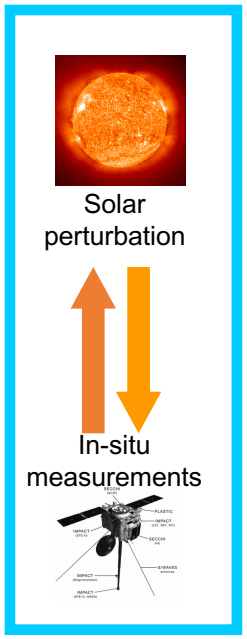
Shortcut URL
https://sci.esa.int/s/ApEdDGw

Images And Videos



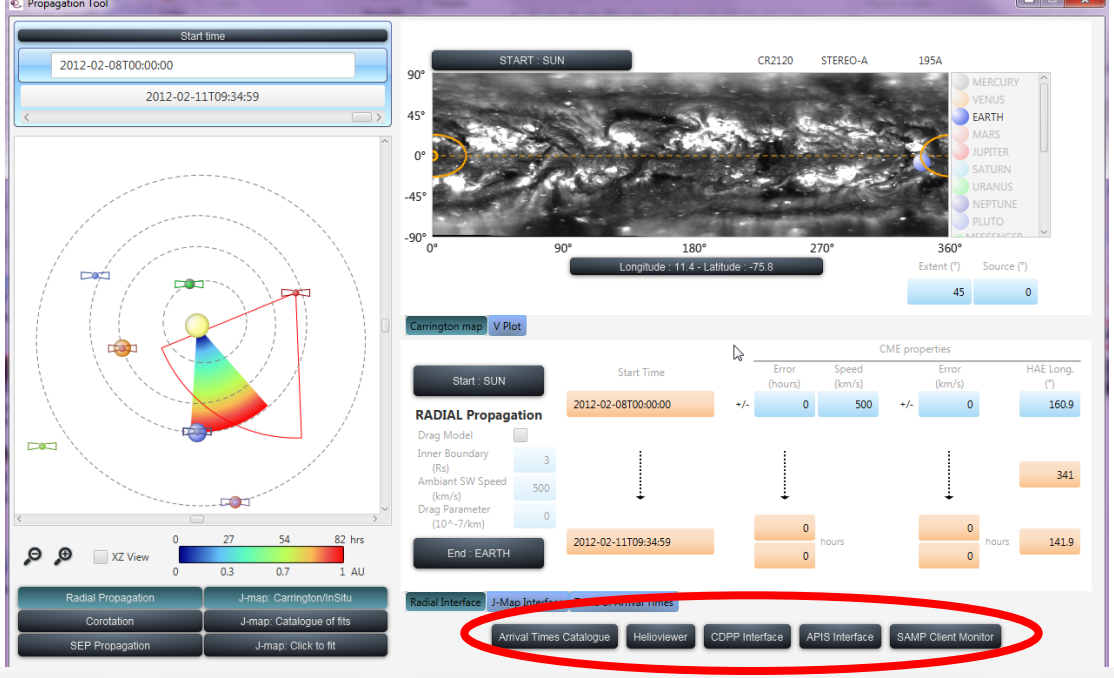
- Animated simulation of Mercury's plasma environment
- Animated simulation of Mars' plasma environment
- Visualisation of Mars' plasma environment
- Visualisation of the ionised environment of Ganymede

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

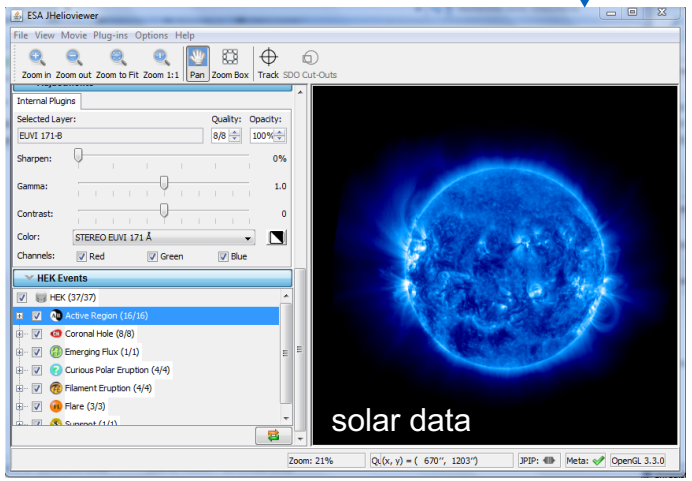
HELCATS catalogues propagated at a given source



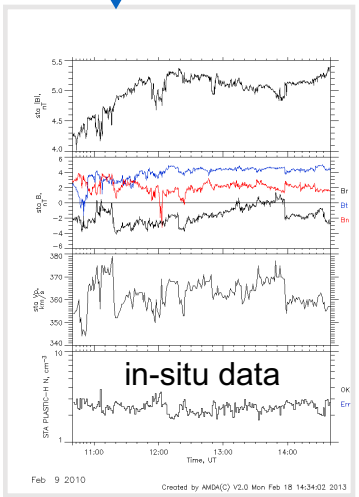
Data export to companion tools

Arrival Times Catalogue | Helioviewer | CDPP Interface | APIS Interface | SAMP Client Monitor

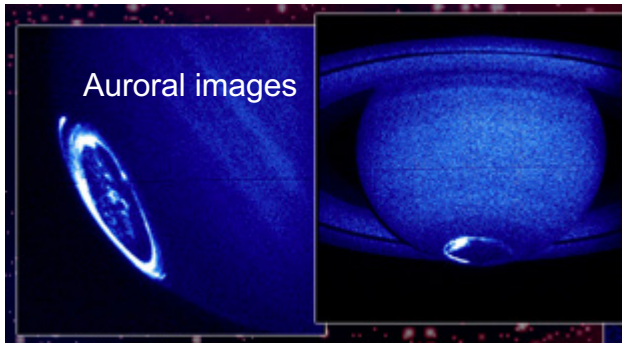
MEDOC database / JHelioviewer



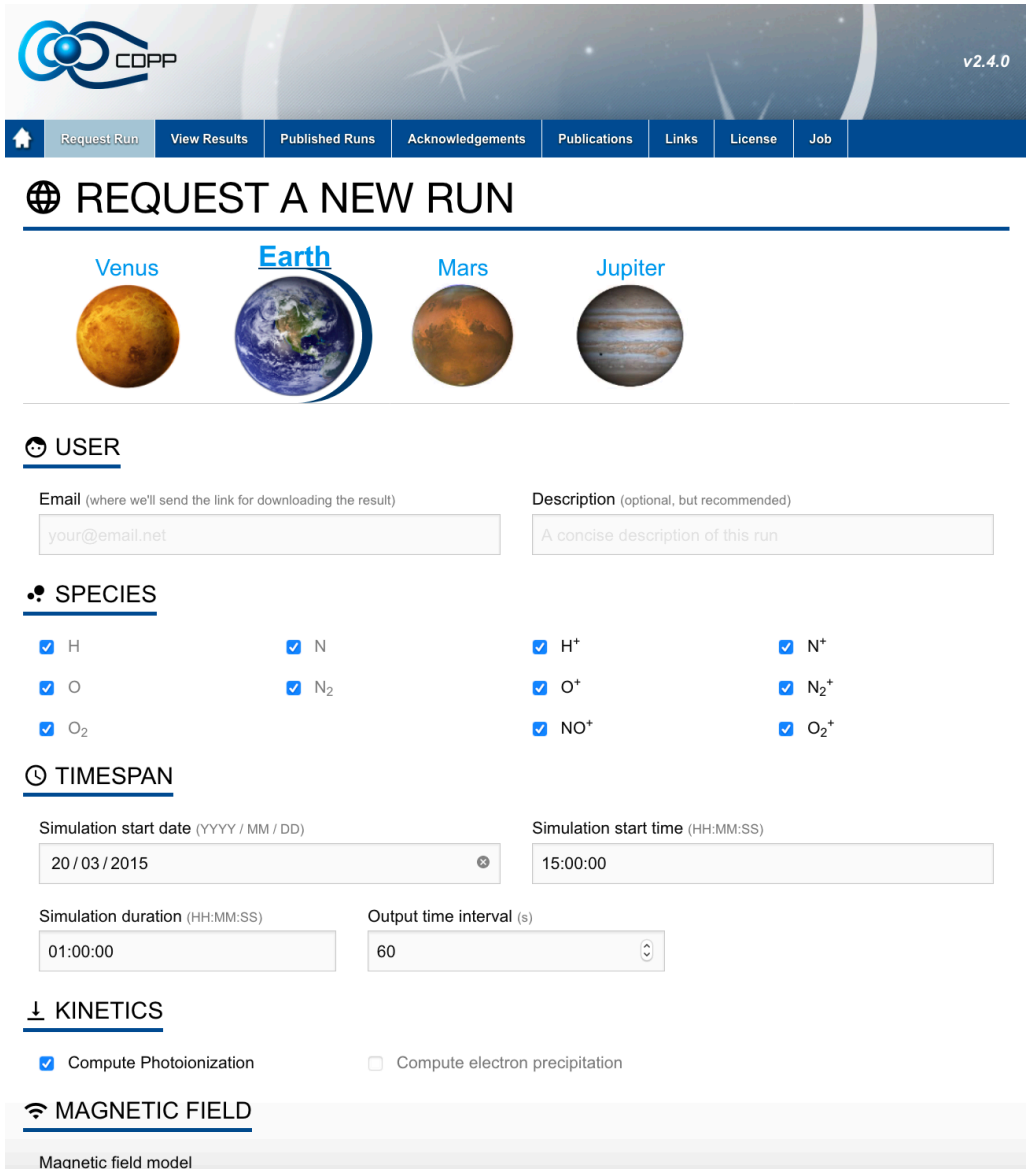
AMDA plot

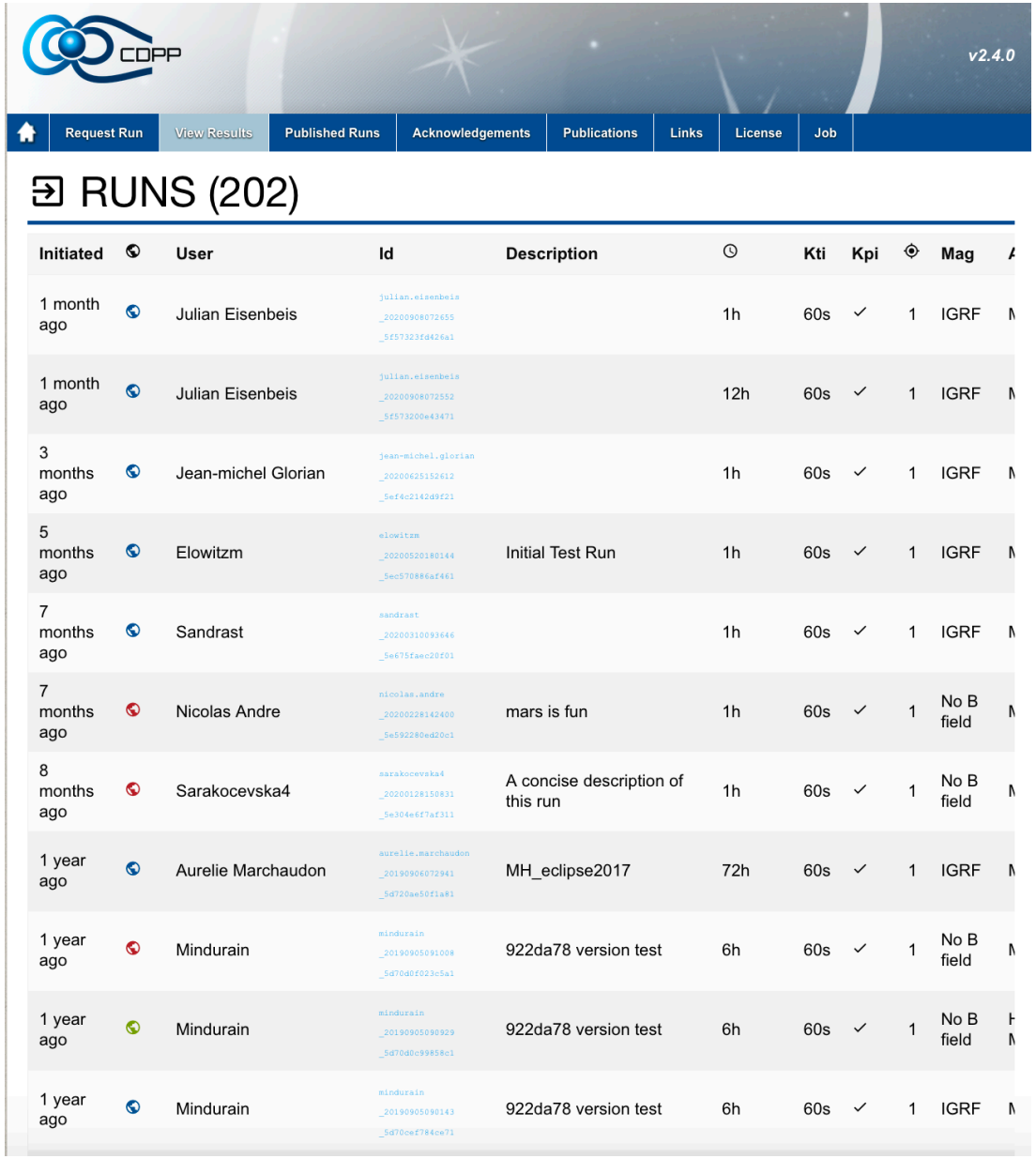


APIS



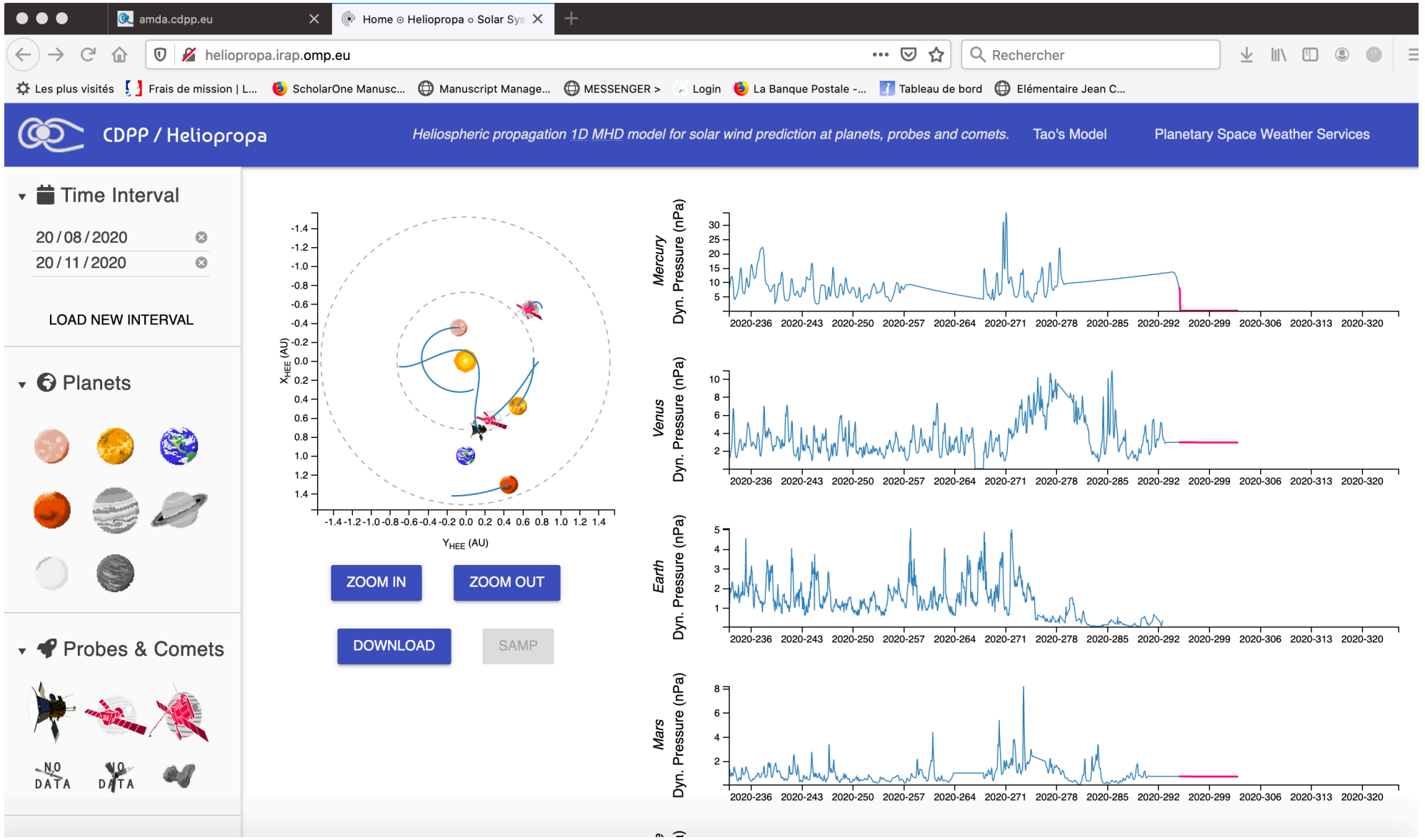
Transplanet: http://transplanet.irap.omp.eu



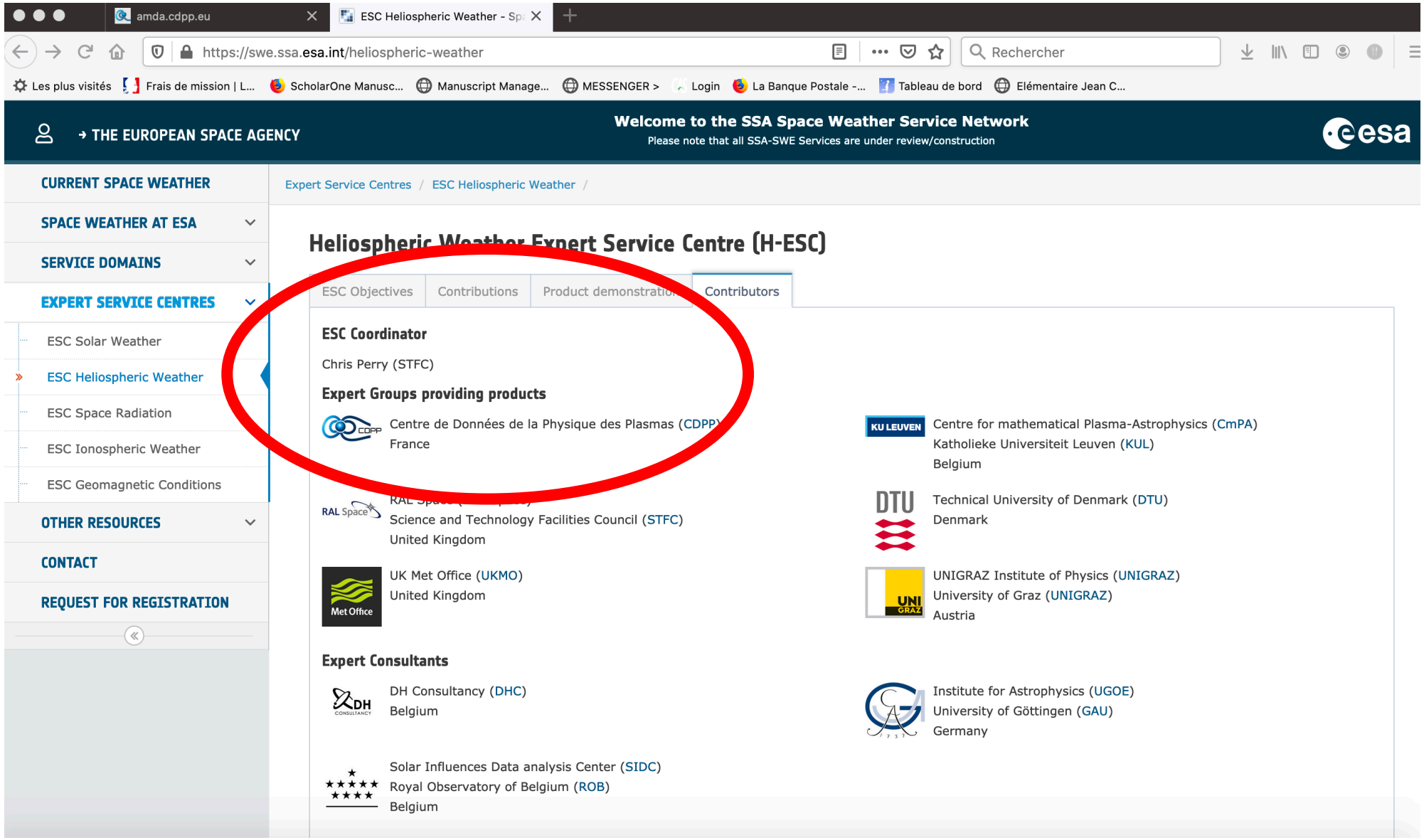


Initiated	User	Id	Description		Kti	Kpi		Mag	A
1 month ago	Julian Eisenbeis	julian.eisenbeis _20200908072655 _5f57323fd426a1		1h	60s	✓	1	IGRF	M
1 month ago	Julian Eisenbeis	julian.eisenbeis _20200908072552 _5f573200e43471		12h	60s	✓	1	IGRF	M
3 months ago	Jean-michel Glorian	jean-michel.glorian _20200625152612 _5ef4c2142d9f21		1h	60s	✓	1	IGRF	M
5 months ago	Elowitzm	elowitzm _20200520180144 _5ec570886af461	Initial Test Run	1h	60s	✓	1	IGRF	M
7 months ago	Sandrast	sandrast _20200310093646 _5e675faec20f01		1h	60s	✓	1	IGRF	M
7 months ago	Nicolas Andre	nicolas.andre _20200228142400 _5e592280ed20c1	mars is fun	1h	60s	✓	1	No B field	M
8 months ago	Sarakocevska4	sarakocevska4 _20200128150831 _5e304e6f7af311	A concise description of this run	1h	60s	✓	1	No B field	M
1 year ago	Aurelie Marchaudon	aurelie.marchaudon _20190906072941 _5d720ae50f1a81	MH_eclipse2017	72h	60s	✓	1	IGRF	M
1 year ago	Mindurain	mindurain _20190905091008 _5d70d0f023c5a1	922da78 version test	6h	60s	✓	1	No B field	M
1 year ago	Mindurain	mindurain _20190905090929 _5d70d0c99858c1	922da78 version test	6h	60s	✓	1	No B field	H M
1 year ago	Mindurain	mindurain _20190905090143 _5d70cef784ce71	922da78 version test	6h	60s	✓	1	IGRF	M

Heliopropa: http://heliopropa.irap.omp.eu



ESA/Space Situational Awareness



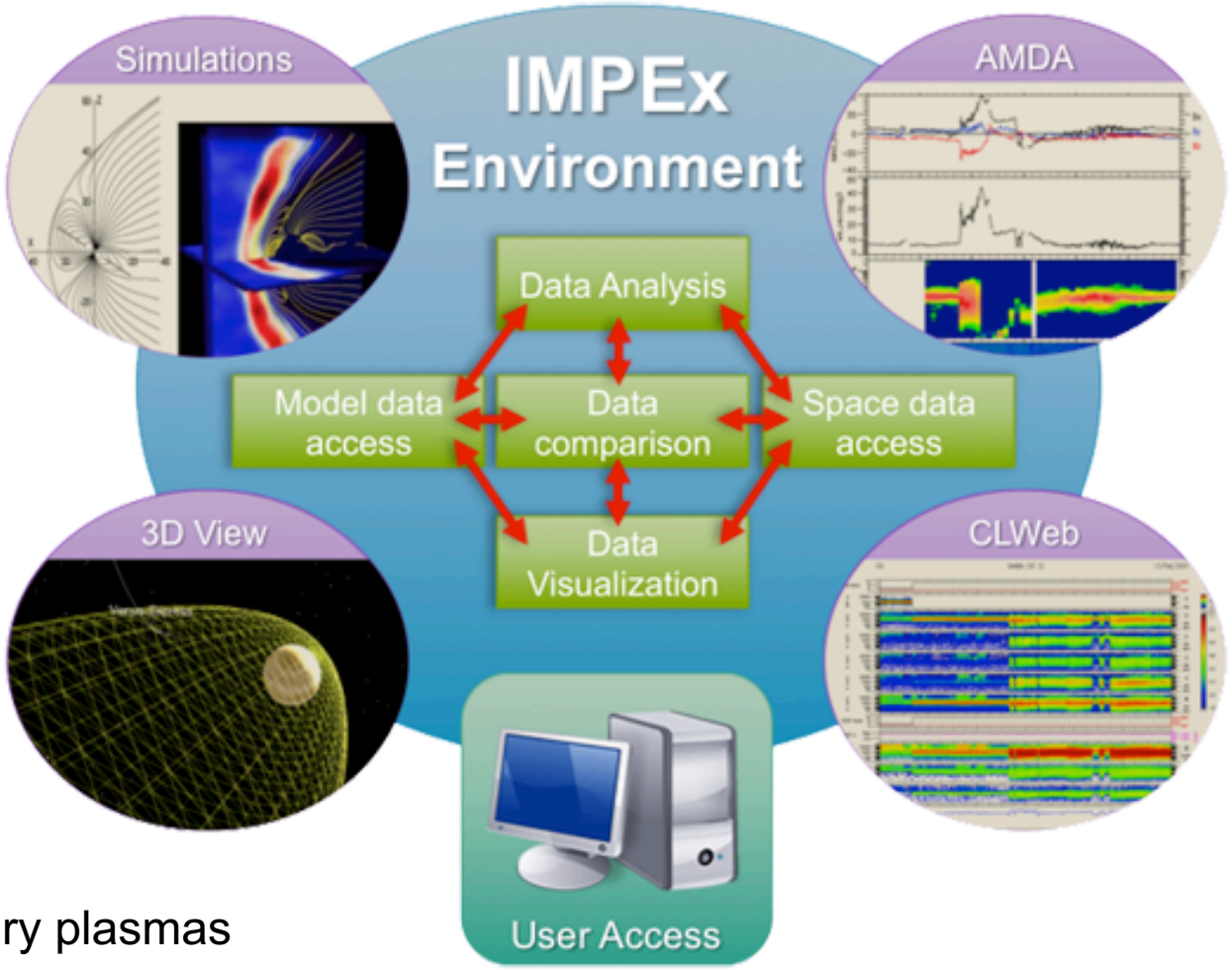
A community infrastructure

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

http://impex-fp7.oeaw.ac.at/

- 4 year FP7 project (2011-2015)
- 4 partners project :
  - •LATMOS, CDPP (France)
  - •FMI (Finland)
  - •SINP (Russia)
  - •IWF (Austria, *coordinator*)



Key features

-No centralization

-Comparison Observations / Simulations for planetary plasmas

- Fly virtual S/C in 3D simulation results

- Visualisation 2D/3D

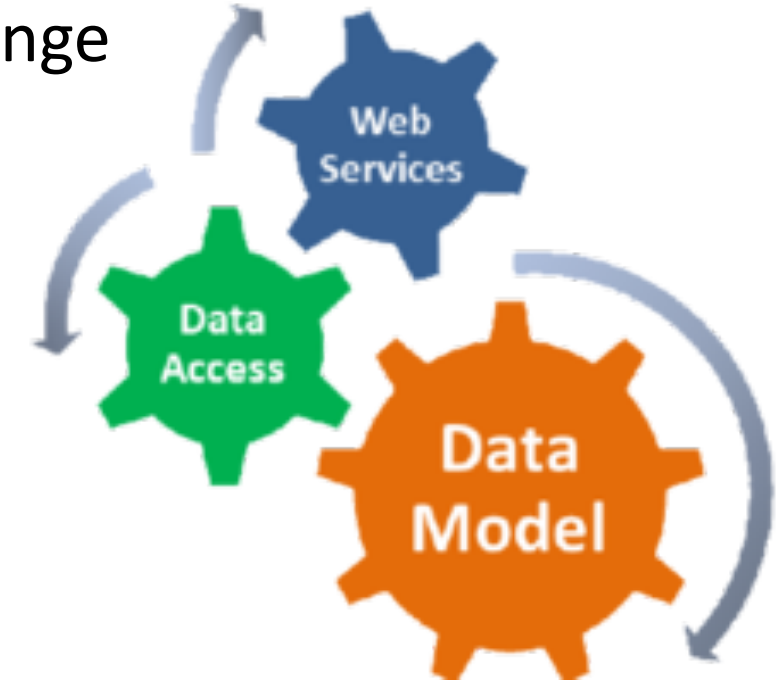
- Data along S/C trajectories, 3D model cuts, boundaries

- Event lists

- Method to find most relevant runs for given observations

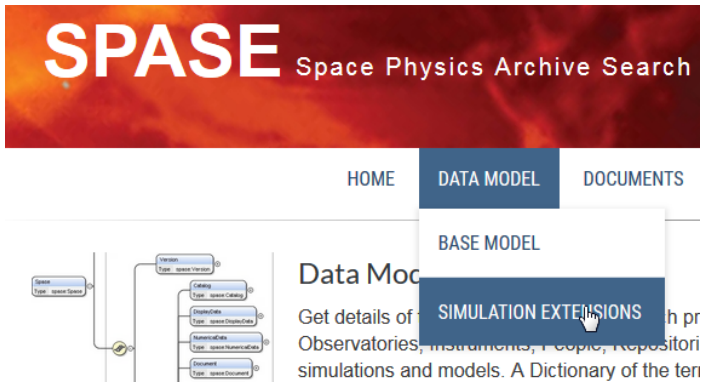
IMPEx : how to share information ?
The use of a unified protocol

- A standard/unique dictionary for describing observations and simulations
  - Use of an extended version of SPASE
- Standard methods for machine to machine exchange
  - REST/SOAP web services definition
  - Implemented in all tools and databases
- Standard formats
  - netCDF, VOTable



Status of the IMPEx data model

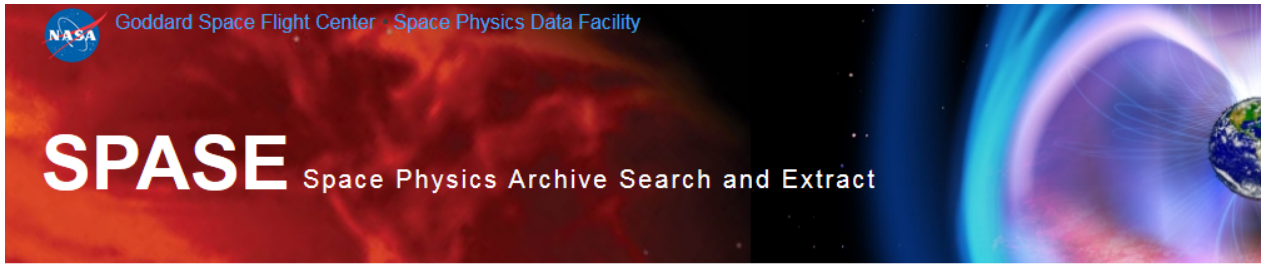
- Has been developed during 2011-2014
- Has been endorsed by the SPASE consortium as a « simulation extension»

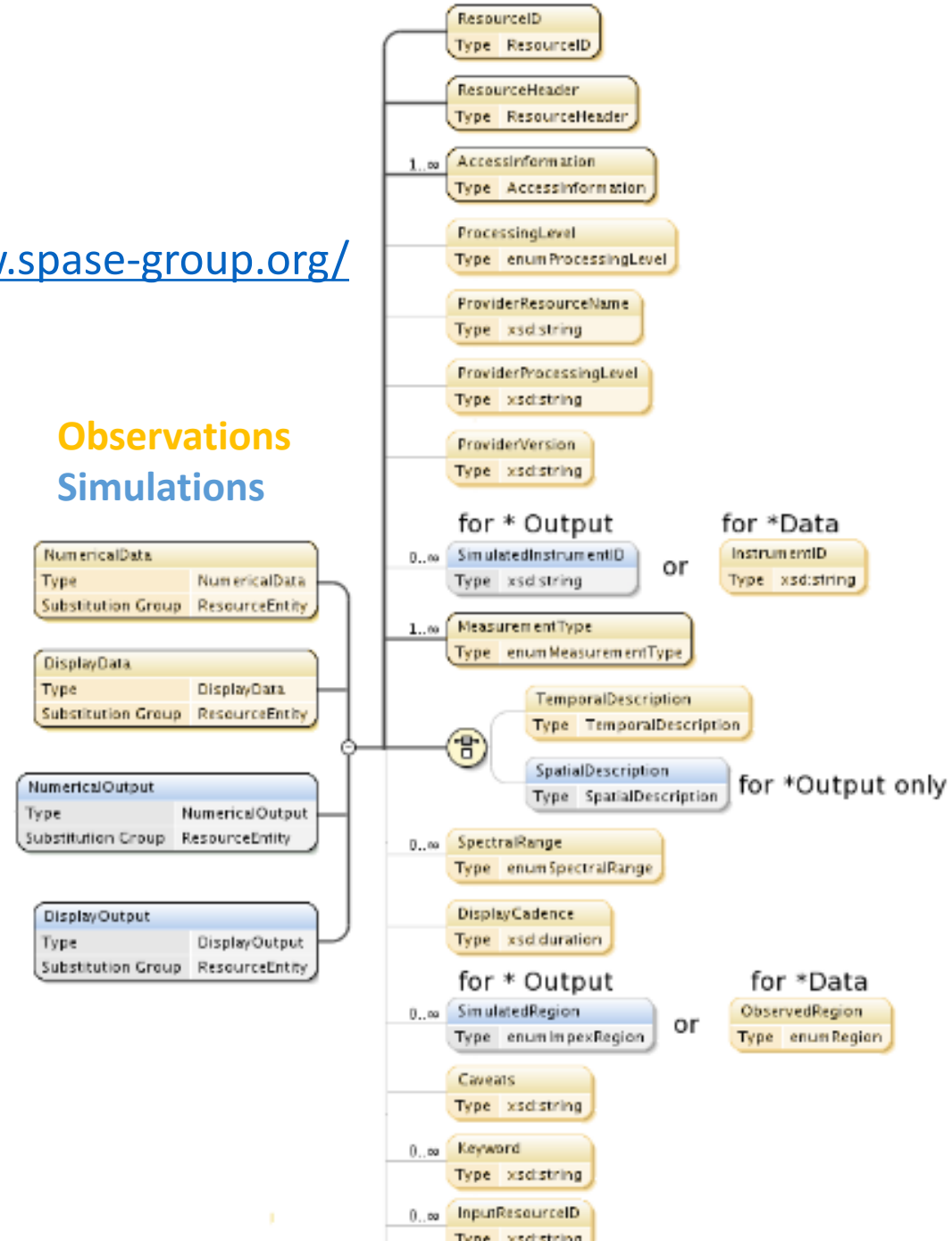


- Has been used for the Transplanet on-demand platform (Europlanet/PSWS)
- Has been re-used by CCMC for their large number of codes
- Is used (and extended) in France for a project concerning magnetosphere/exosphere code coupling (ANR TEMPETE)

Extension of the SPASE data model

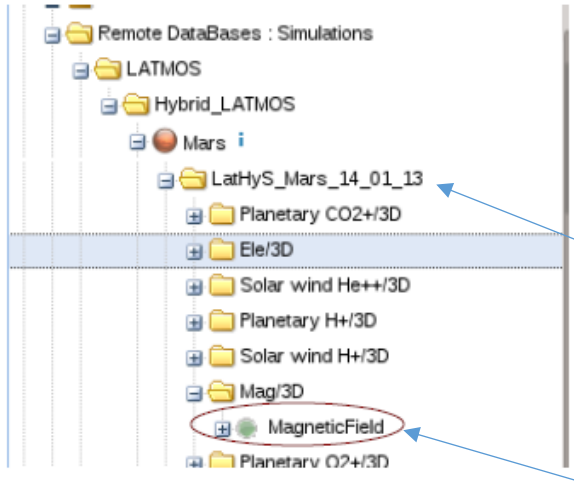
http://www.spase-group.org/



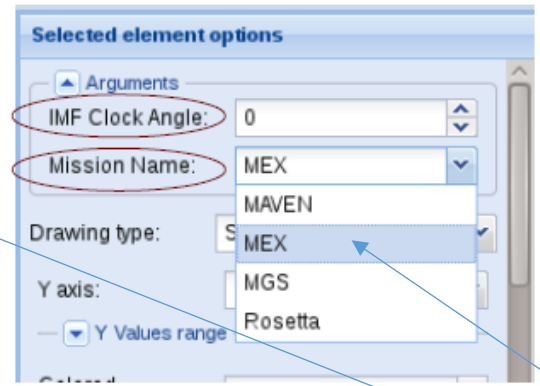


AMDA : Getting Parameters : *getDataPointValue()* IMPEX WebService

Select Parameters



Select Arguments (&Time)



AMDA => IMPEX

getDataPointValue(RunID, ParameterID, XYZ_URL, extraParams)

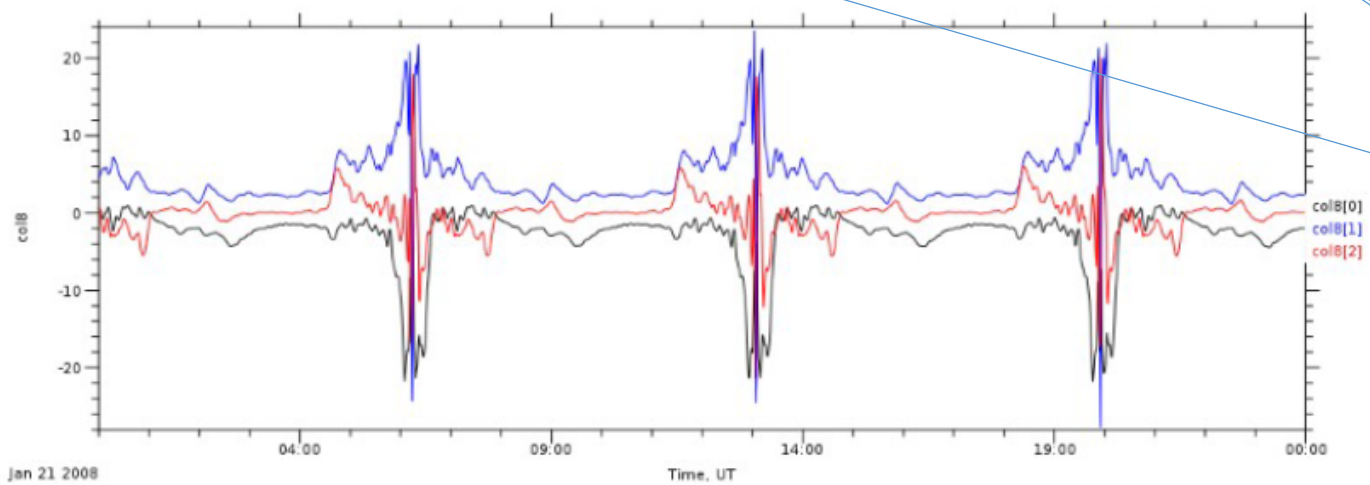
AMDA *XYZ_URL*:

XYZ file is run-time generated from *mission /time* info

AMDA <= IMPEX

get File (URL)

Result



Paramètre de la simulation 3D interpolé le long de la trajectoire du satellite sélectionné

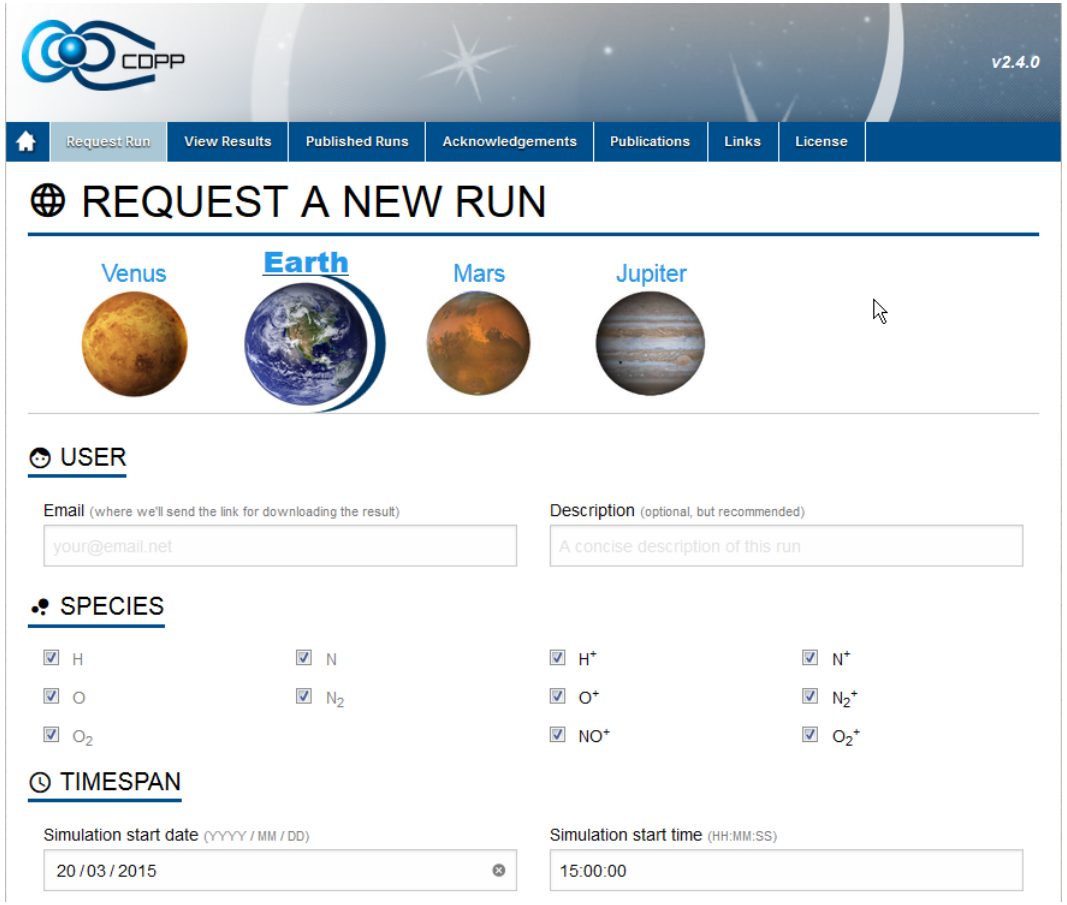
Perspectives

- Suite à la demande de collègues : réflexion sur un archivage de simulations au CDPP
  - Stockage des résultats sur baies (volume d'une simu ~ 200 Go)
  - Environnement d'analyse (méthodes d'interpolation et coupes) dispo au LATMOS à dupliquer au CDPP

Transplanet

Financement Europlanet

- http://transplanet.cdpp.eu
- Interface web → Request Run



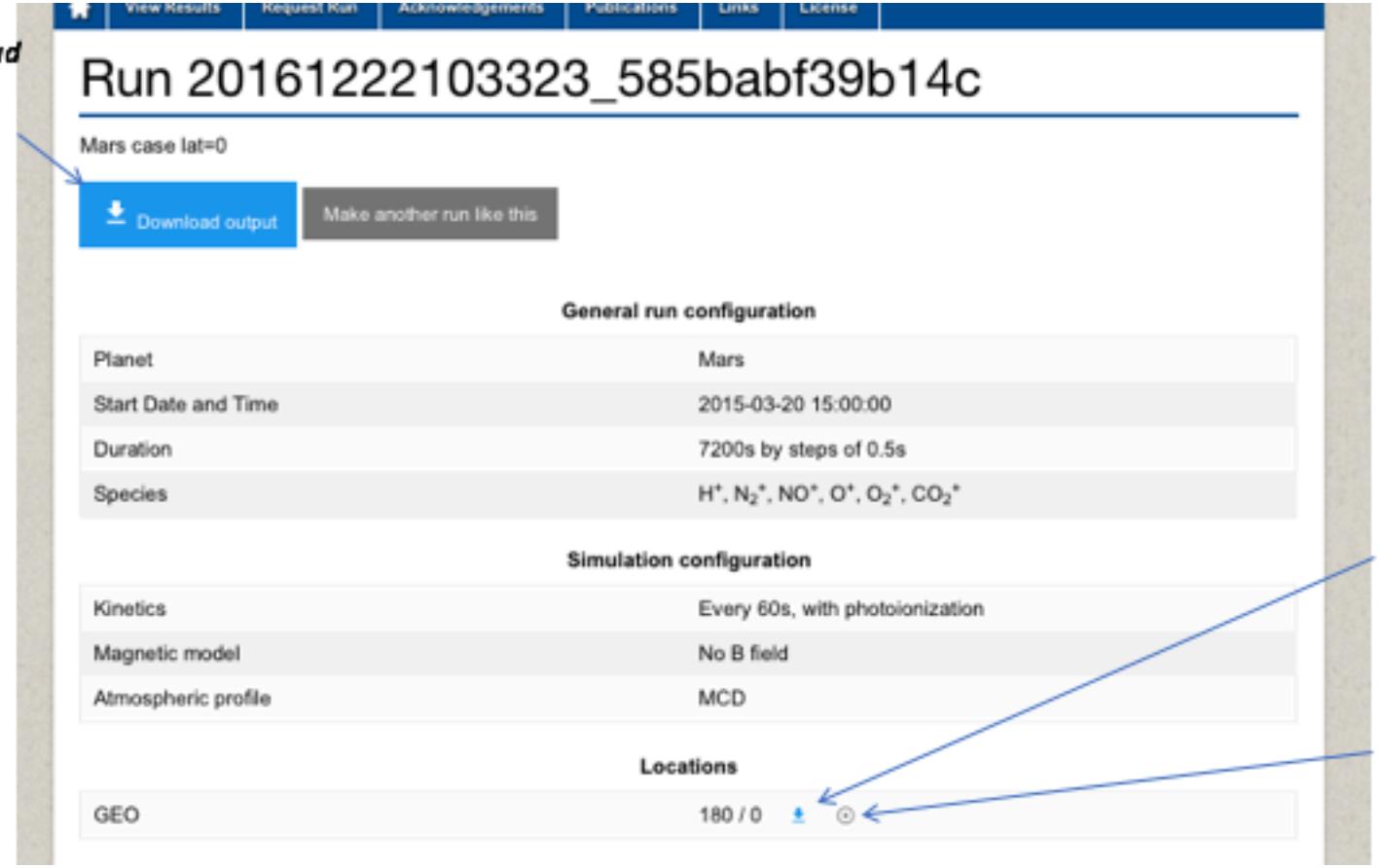
- Lancement de la simulation sur le serveur de calcul
- Estimation de la durée du calcul
- Mail : YOUR REQUEST HAS BEEN SUBMITTED
  Expected result in XX minutes
- Tâche sync entre le serveur web et le serveur de calcul toutes les 5'
  → retourne l'état des runs

- Mail : Your run id_XX is finished
  You can download the results here : lien

RUNS (204)

Initiated		User	Id	Description		Kti	Kpi		Mag
26 days ago		Nicolas Bergeot	nicolas.bergeot_20210203193312_601afa78b43991	test	1h	60s	✓	1	IGRF
1 month ago		Nicolas Andre	nicolas.andre_20210103211018_5ff232ba9ae471	test	1h	60s	✓	1	No B field

Download Zip File



Download CDF

Send via SAMP

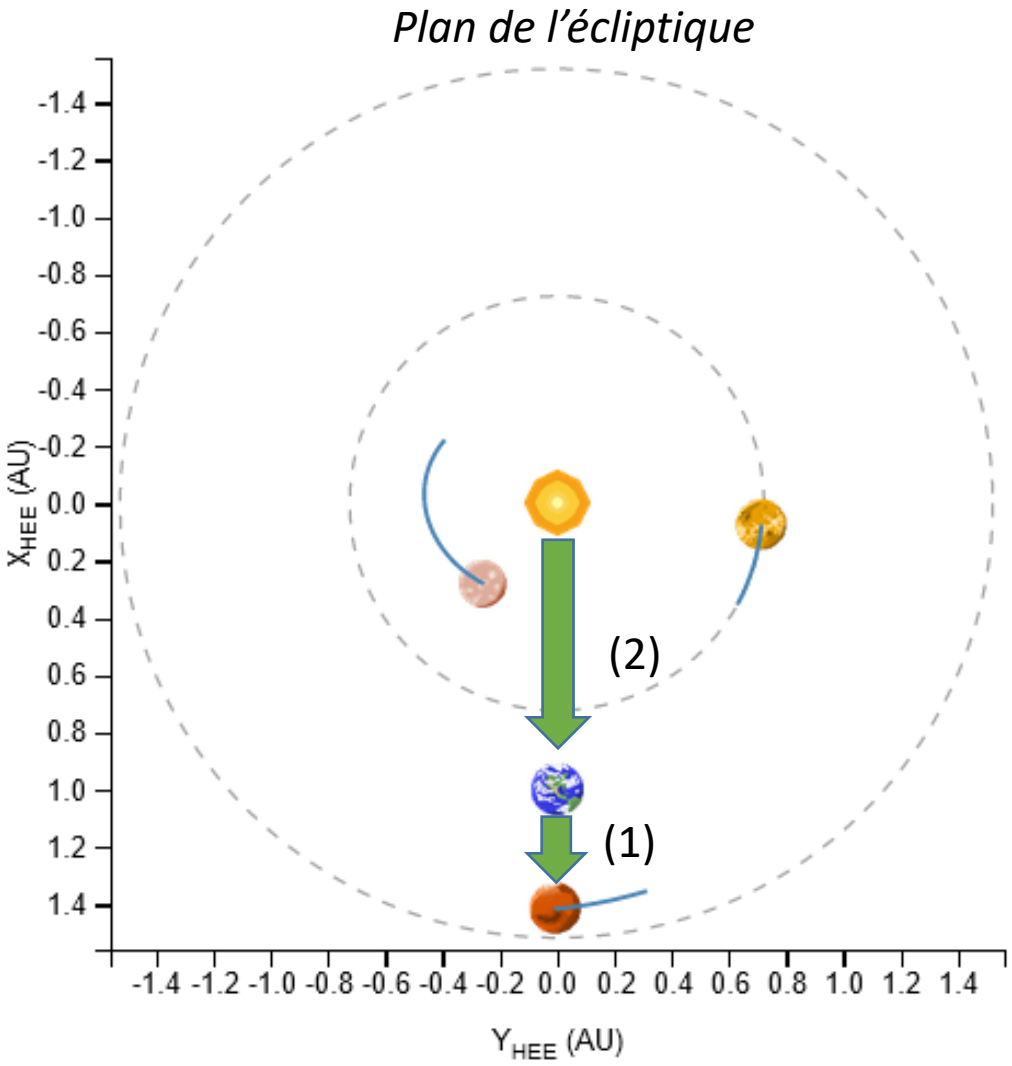
- 204 simulations , taille sur disque 31 Go
- 1 répertoire par simu avec un zip des fichiers en cdf (800 Ko – 700 Mo)

- Clé DSA pour communication entre serveur web et serveur calcul

- Framework Php Silex avec composants Symfony et Twig
- Utilisation du modèle SPASE
- Un fichier tree en xml contient les métadonnées de tous les runs

1D-MHD

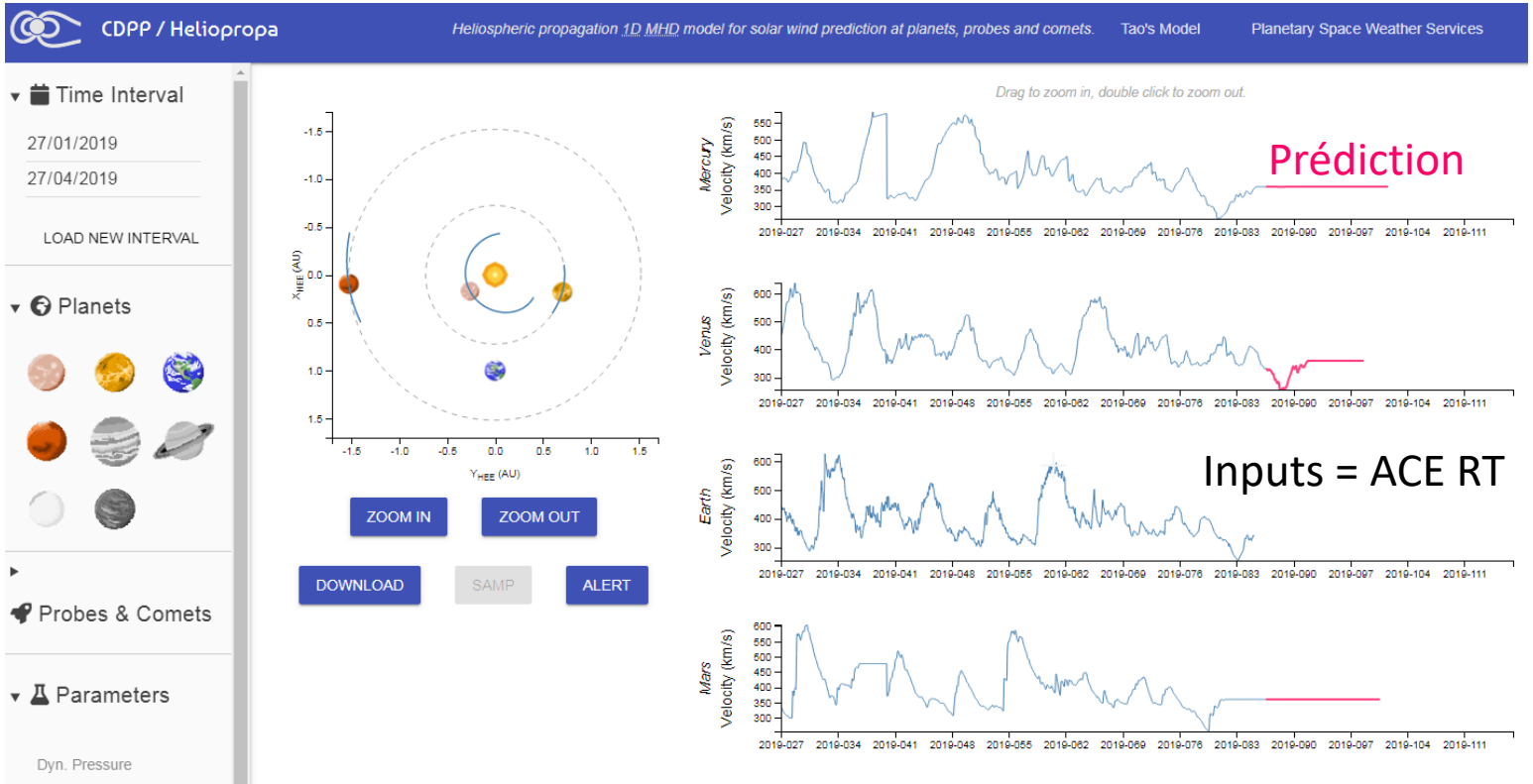
- Un modèle « simple et léger » permettant de simuler la propagation du vent solaire (N, V, T, B) entre 2 points de l'héliosphère
- 1. de la Terre aux planètes et sondes : données dans AMDA et HelioPropa
- 2. du Soleil (21.5R_{sun}) à la Terre : projet H2020 SafeSpace (*ensemble forecasting* pour trouver la meilleure prédiction)
- Nouveaux inputs tous les jours → nouvelle simu tous les jours



Heliopropa

Financement Europlanet

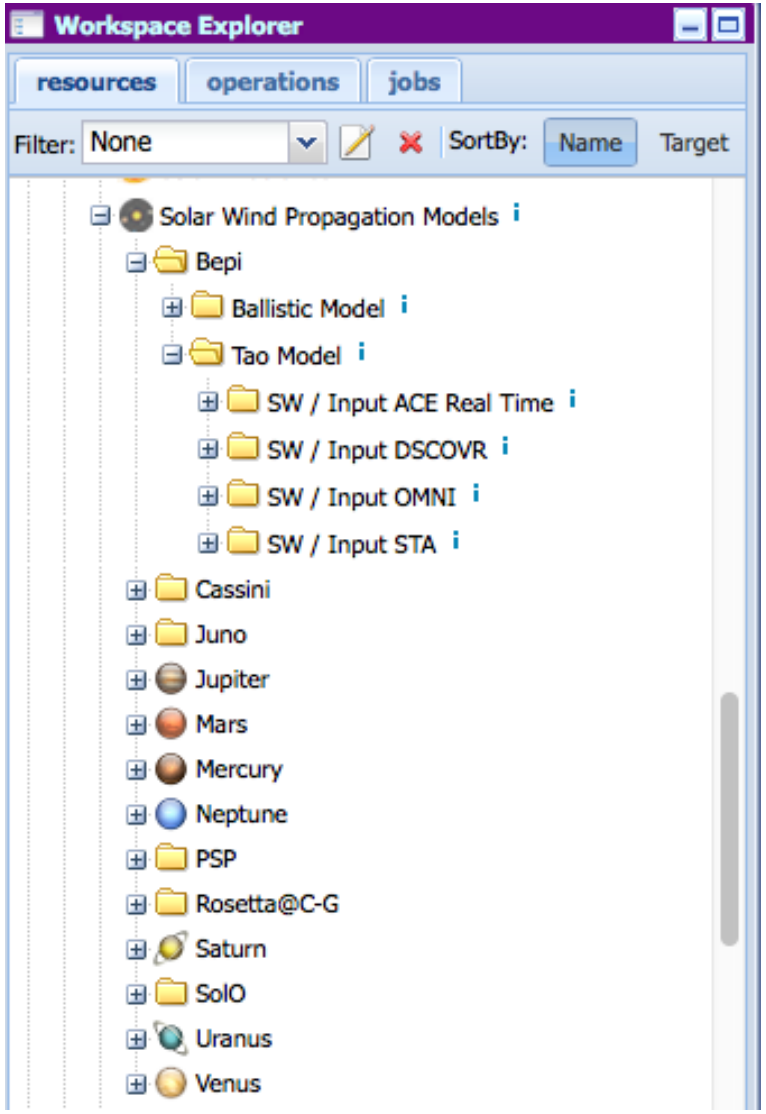
- Paramètres du vent solaire propagés à différentes planètes et sondes (code 1D MHD *Tao et al,* 2005)
- Interface web : appel à AMDA → visualisation
- Utilisation de données « real time » (ACE, DSCOVR) pour une prédiction à qq jours (Mars, Jupiter, Saturne)



Retours :

- Suivi de perturbations dans l'héliosphère
- Prédiction des conditions aux planètes
- Intégré au portail ESA/SSA
- Ajout de nouvelles sondes (PSP, SO, BepiColombo)

Données TAO dans AMDA



- Tâche cron toutes les nuits pour lancer le modèle de TAO (propagation des paramètres du vent solaire àdifférentes planètes et sondes)
  → Exécution script python sur machine distante
  → Vérification toutes les 10’ de l’état du process
  → Transfert des données dans la base AMDA
- Mise à jour de l’arbre AMDA par script

Données TAO dans Héliopropa

- Tâche cron toutes les nuits récupére les données de TAO à partir d'AMDA par webservice
- Fichiers netcdf transformés en csv
- Stockage de ces fichiers dans le cache

- Les données peuvent être téléchargées ou envoyées par SAMP vers une autre application

- Serveur web Flask et d3.js pour les tracés