http://www.cdpp.eu/

A quick tour of CDPP tools

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IHDEA meeting, october 2019

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
Plasma physics data center
http://www.cdpp.eu/
About
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CDPP and ESA/SSA
Integrating the ESA space weather portal
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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
SIPRO
TREPS

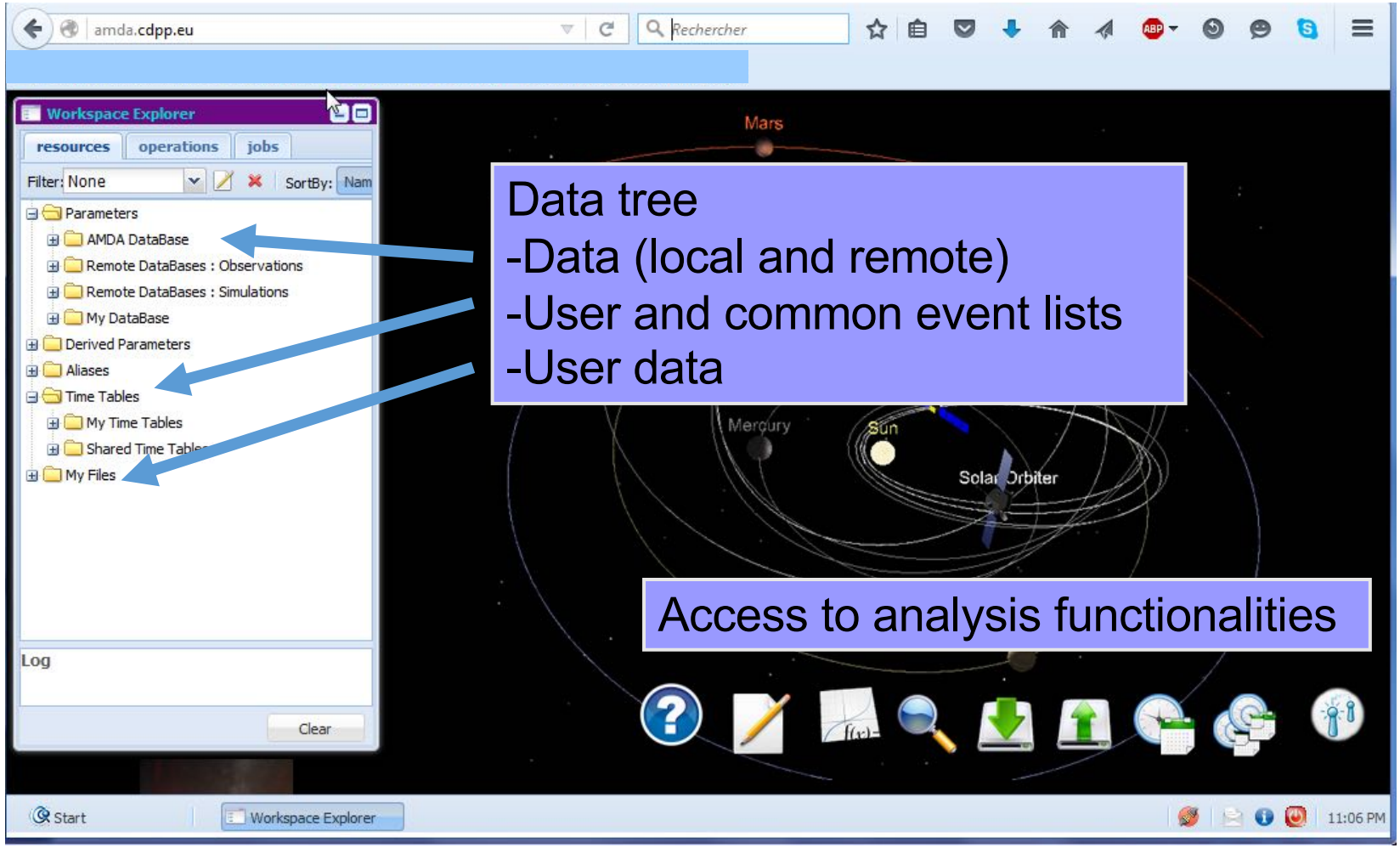
http://amda.cdpp.eu/

- **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**

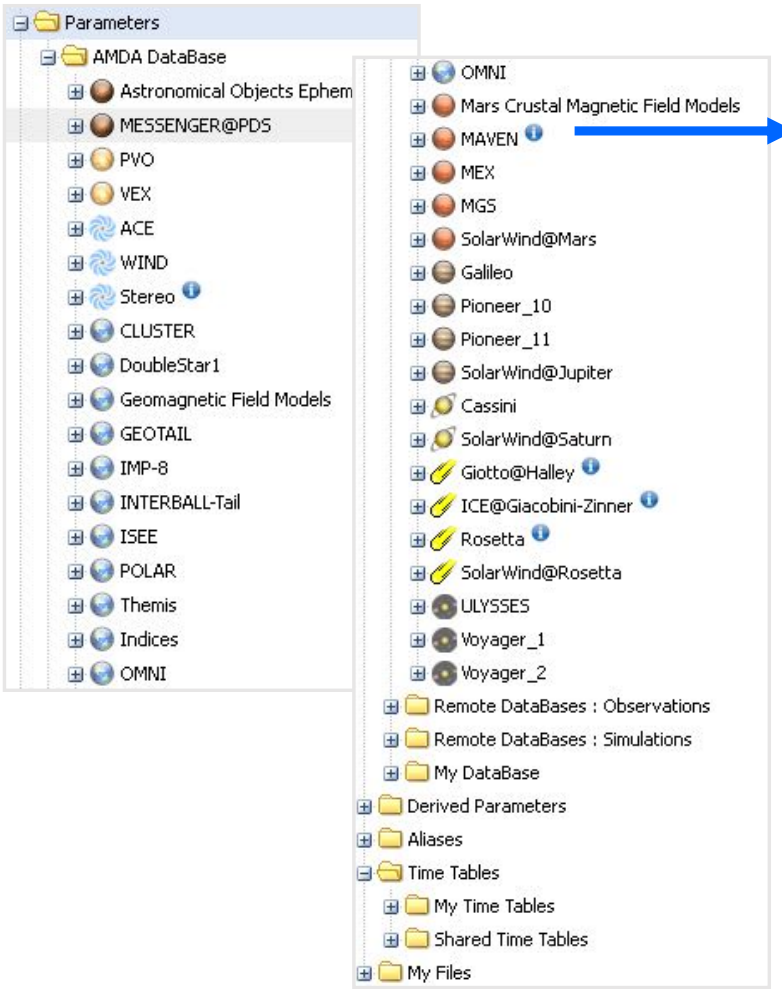
- **Sessions are saved (*so it's better to register !*)**
  - ***register at amda@irap.omp.eu***

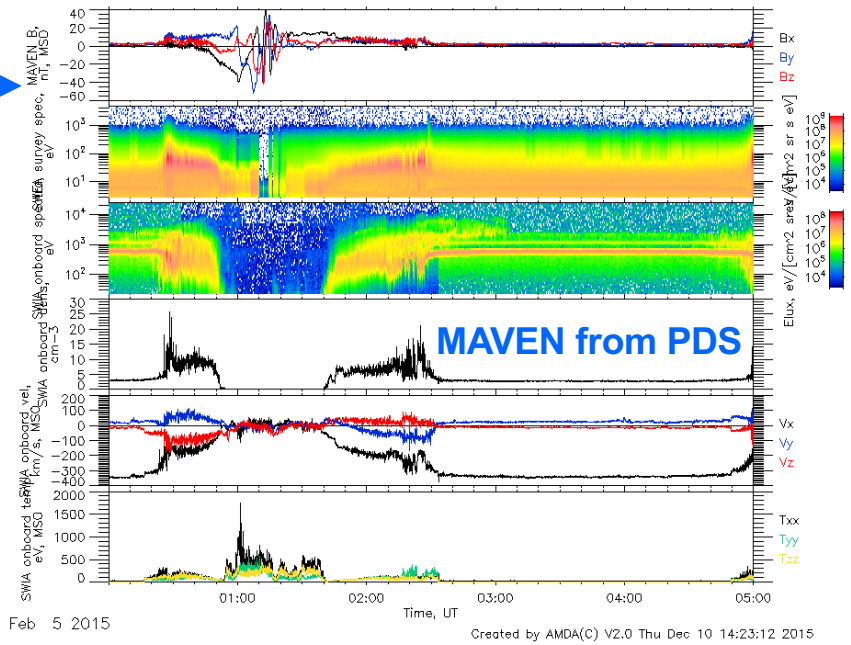
- **A new redesigned version was out in July 2018**

http://amda.cdpp.eu/



Datasets available in the online tool CDPP/AMDA

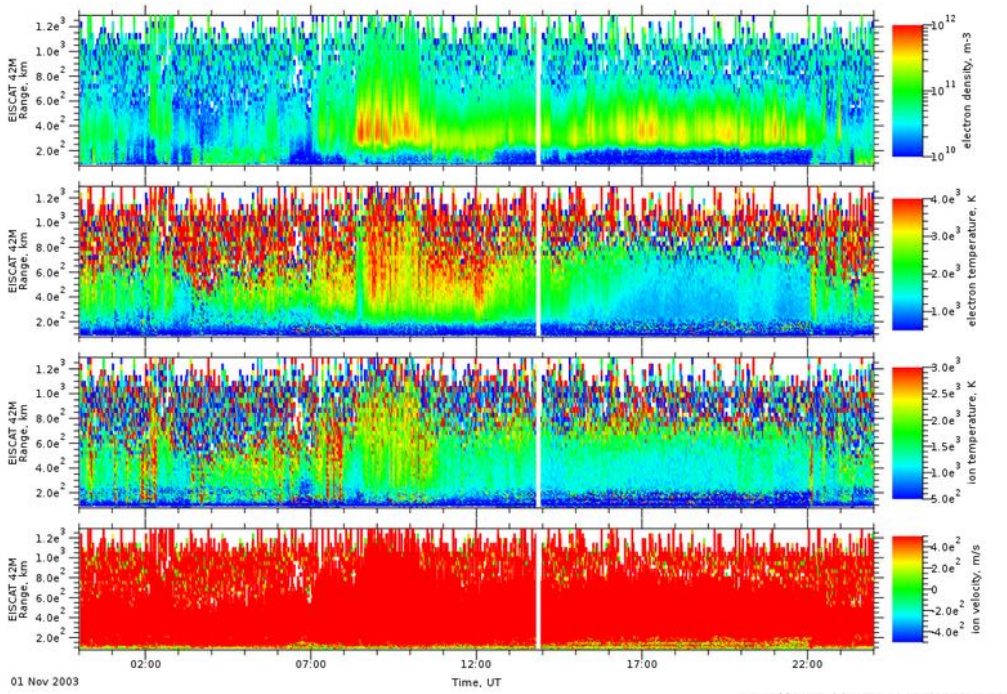




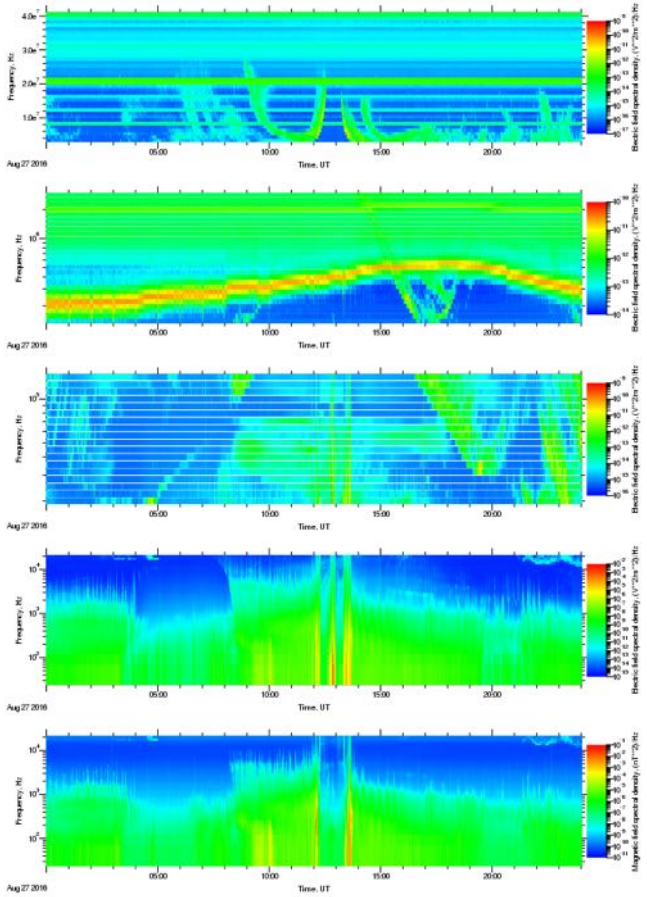
- Plot
- Data mining and combination
- Cataloguing (event lists)
- Upload / download (CDF, netCDF, VOTable, ASCII)
- Statistics (long term analysis)

Datasets recently added in AMDA

EISCAT ESR/UHF/VHF

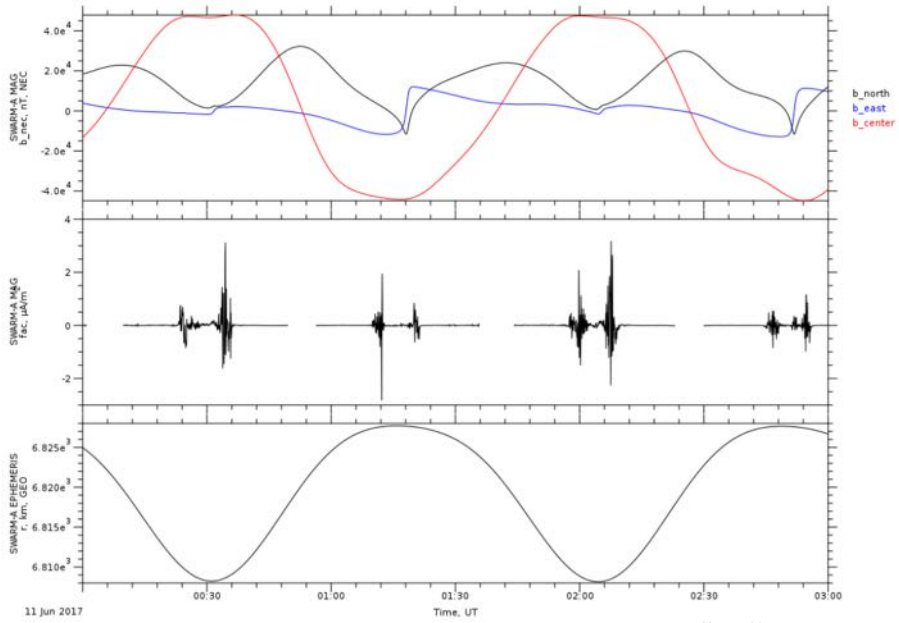


JUNO WAVES/MAG/particles



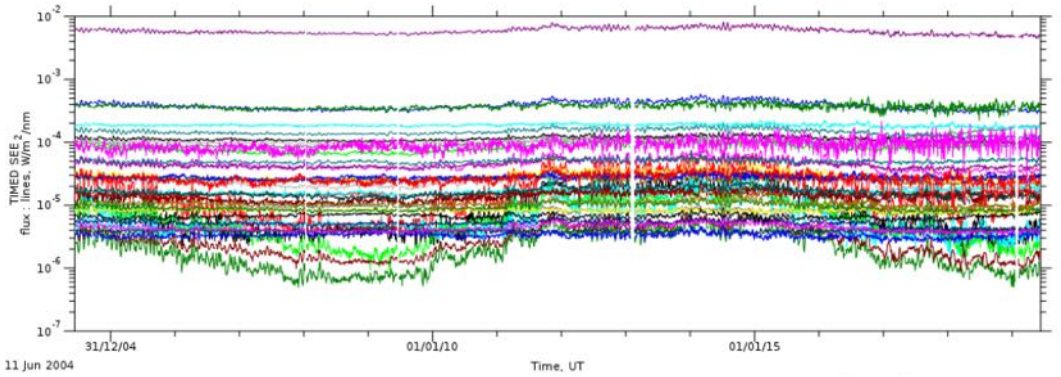
Datasets recently added in AMDA

SWARM
Ionospheric magnetic field and field aligned current



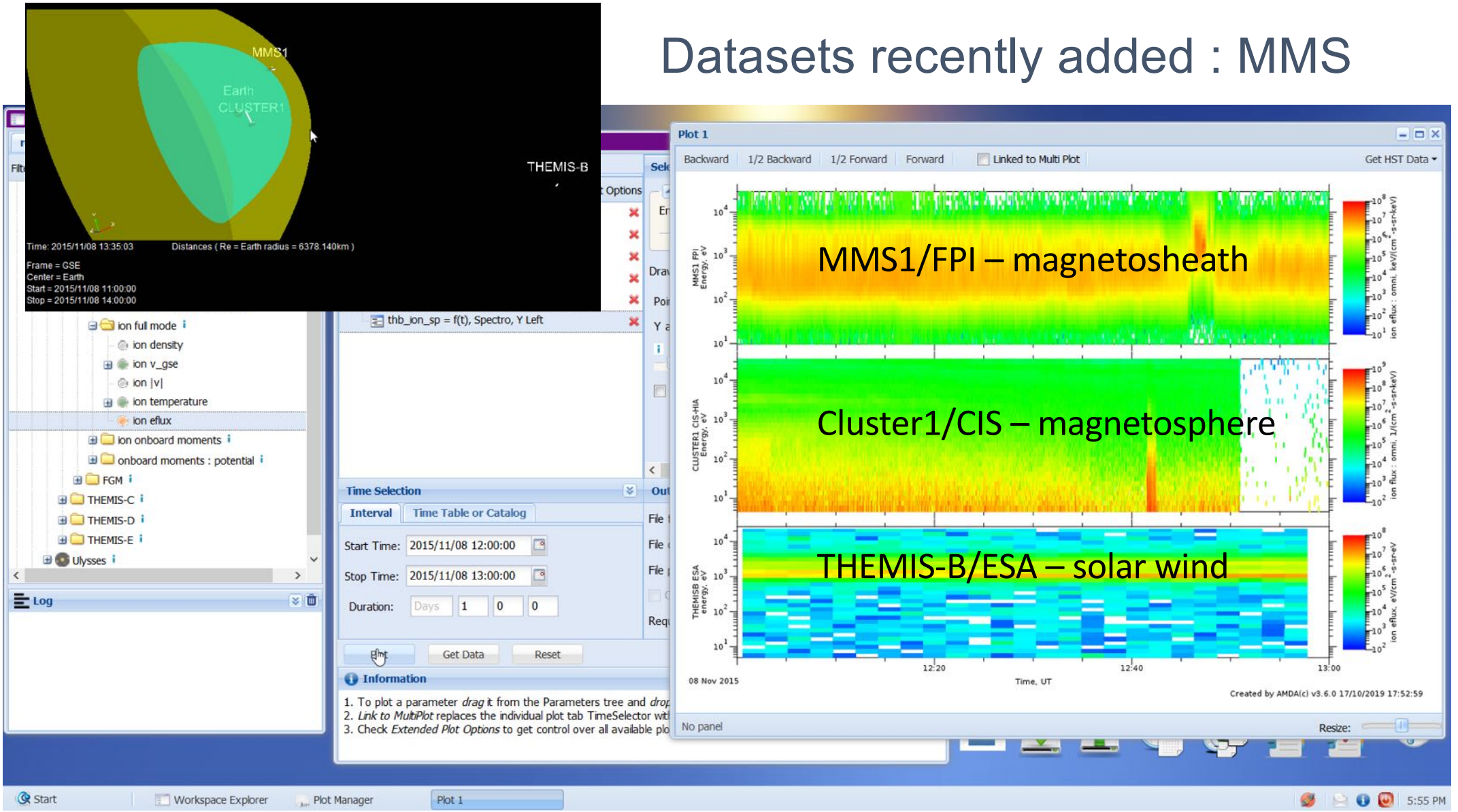
3 hours

TIMED/SEE
Solar irradiance



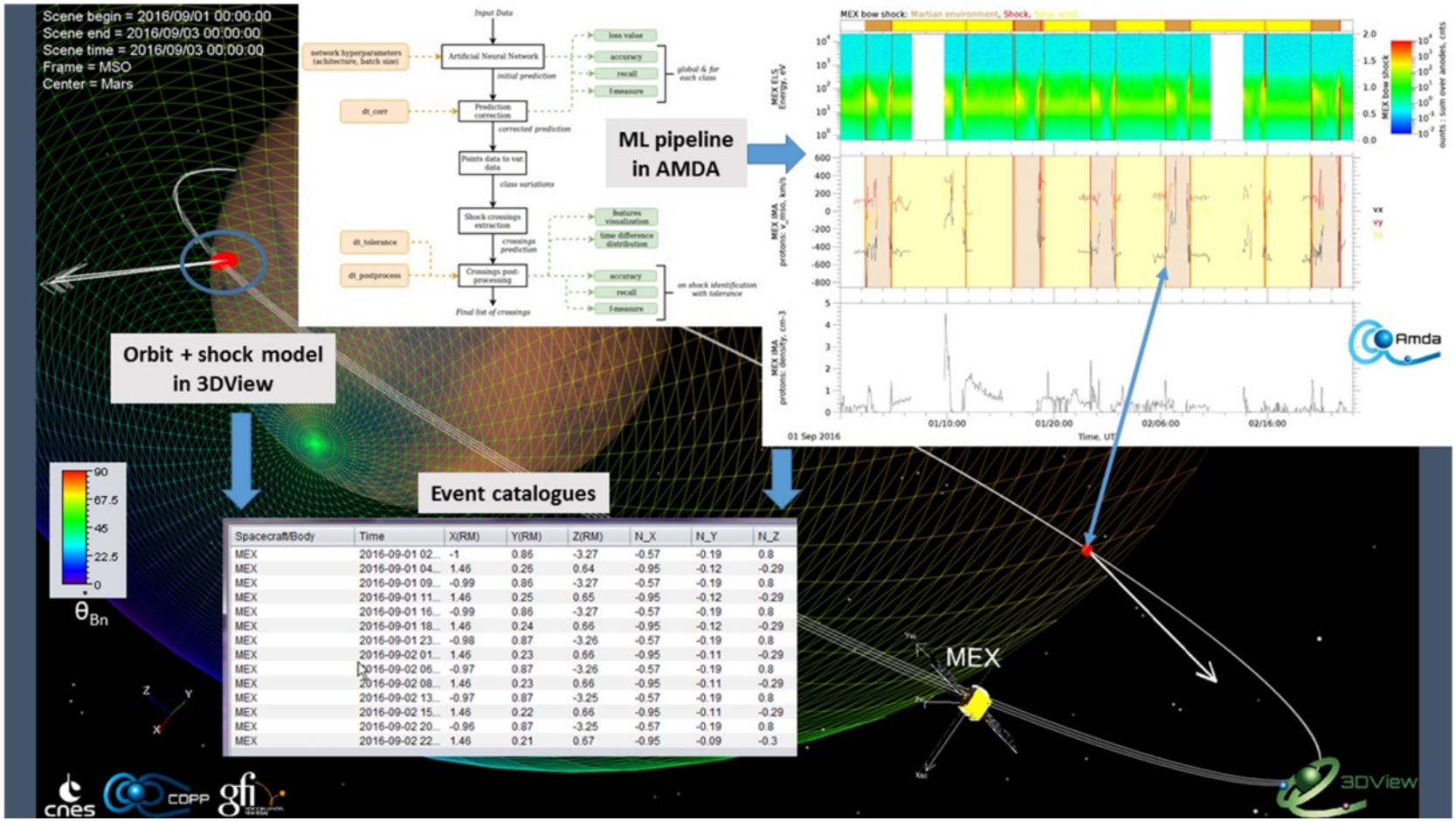
15 years

Datasets recently added : MMS



Recent activities in AMDA

Machine learning: enhancing data visu & analysis



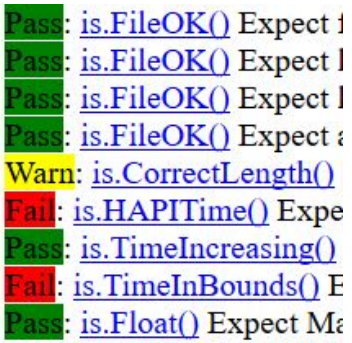
Spacecraft/Body	Time	X(RM)	Y(RM)	Z(RM)	N_X	N_Y	N_Z
MEX	2016-09-01 02...	-1	0.86	-3.27	-0.57	-0.19	0.8
MEX	2016-09-01 04...	1.46	0.26	0.64	-0.95	-0.12	-0.29
MEX	2016-09-01 09...	-0.99	0.86	-3.27	-0.57	-0.19	0.8
MEX	2016-09-01 11...	1.46	0.25	0.65	-0.95	-0.12	-0.29
MEX	2016-09-01 16...	-0.99	0.86	-3.27	-0.57	-0.19	0.8
MEX	2016-09-01 18...	1.46	0.24	0.66	-0.95	-0.12	-0.29
MEX	2016-09-01 23...	-0.98	0.87	-3.26	-0.57	-0.19	0.8
MEX	2016-09-02 01...	1.46	0.23	0.66	-0.95	-0.11	-0.29
MEX	2016-09-02 06...	-0.97	0.87	-3.26	-0.57	-0.19	0.8
MEX	2016-09-02 08...	1.46	0.23	0.66	-0.95	-0.11	-0.29
MEX	2016-09-02 13...	-0.97	0.87	-3.25	-0.57	-0.19	0.8
MEX	2016-09-02 15...	1.46	0.22	0.66	-0.95	-0.11	-0.29
MEX	2016-09-02 20...	-0.96	0.87	-3.25	-0.57	-0.19	0.8
MEX	2016-09-02 22...	1.46	0.21	0.67	-0.95	-0.09	-0.3

AMDA and HAPI

- A prototype is installed since late 2018
- Only a few datasets can be accessed for the moment
- Lack of time prevented implementing HAPI completely
- *But on the todo list*

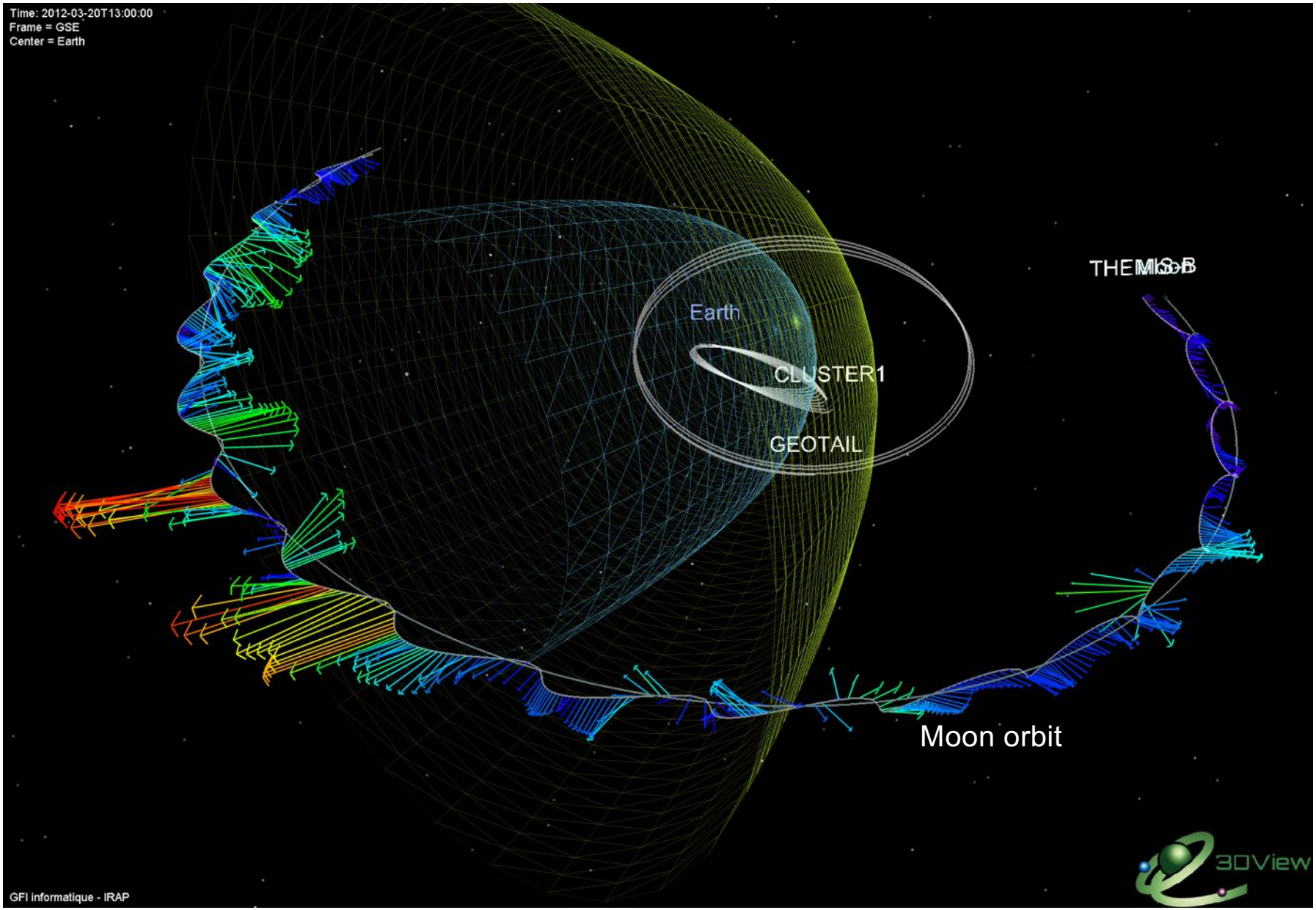
- Test : http://amda-dev.irap.omp.eu/hapi/data?id=tao-mars-sw&parameters=V&time.min=2007-09-02T00:00:00Z&time.max=2007-09-03T00:00:00.000Z

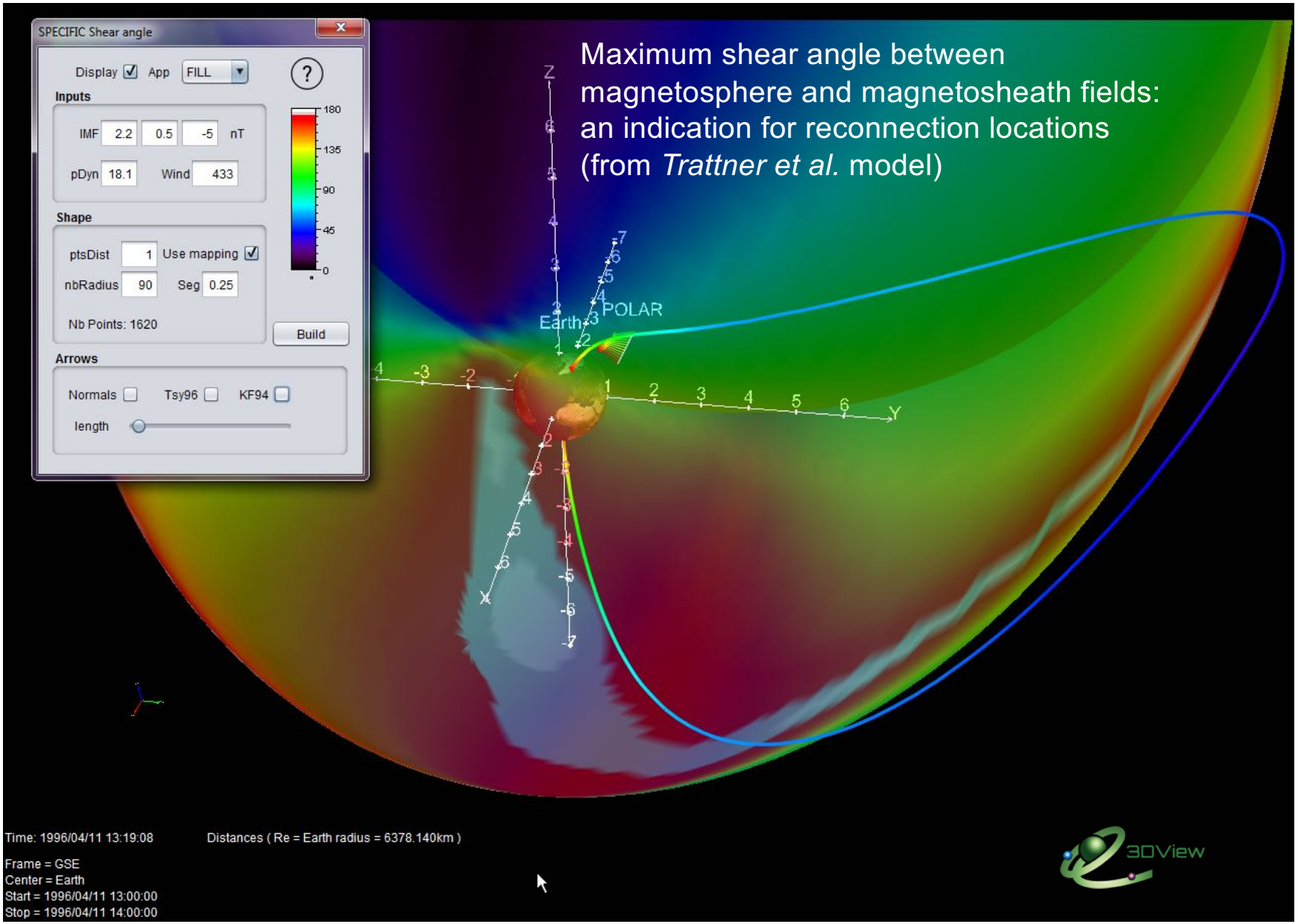
- Verifier : http://hapi-server.org/verify?url=http://amda-dev.irap.omp.eu/hapi
  mostly green , some red

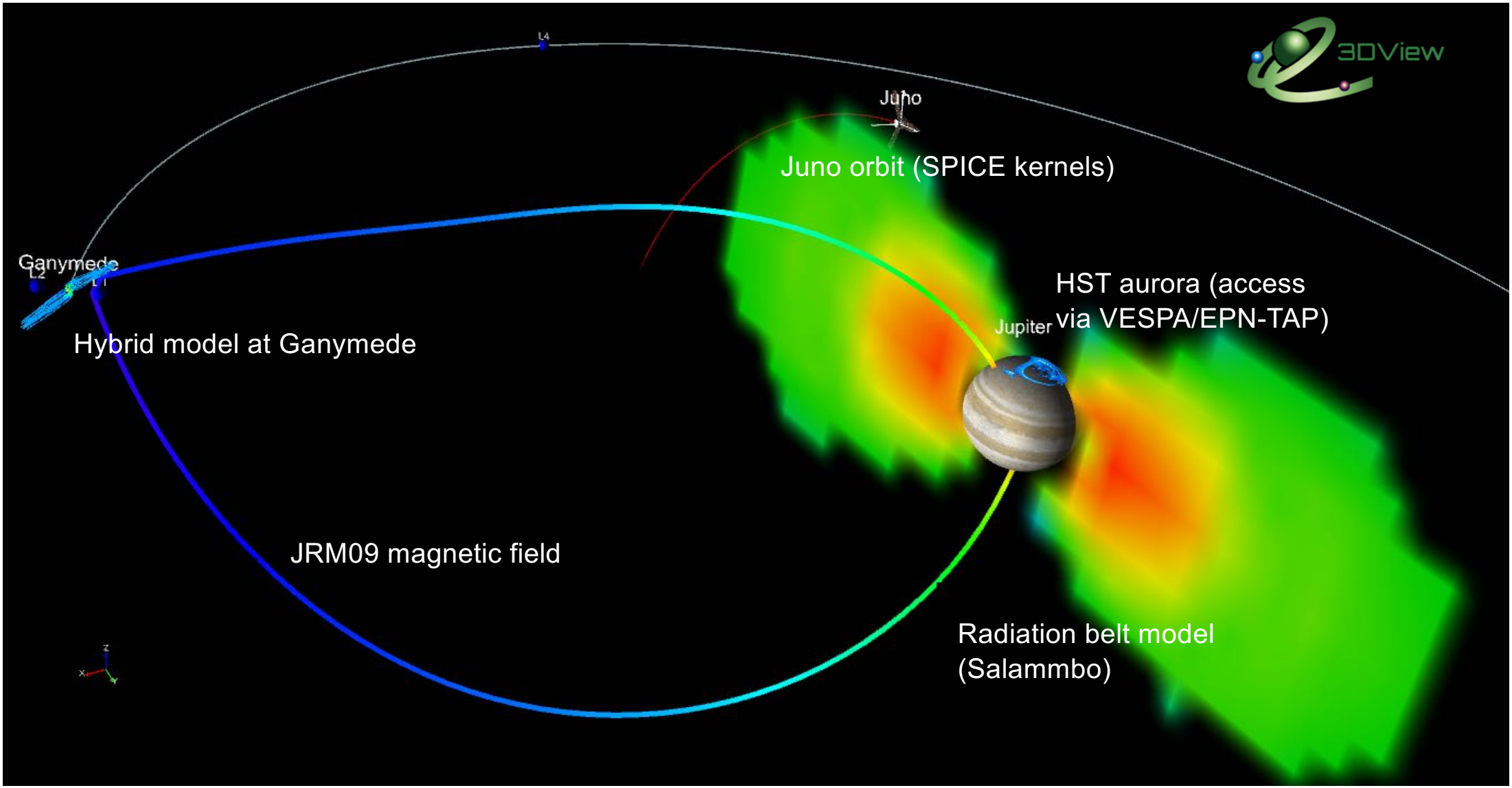


- http://3dview.cdpp.eu/
- In development for about 10 years (JAVA application, GPLv3)
  - Took a lot of inspiration from NASA/VISBARD
- Contractant: GFI, with CNES and EU project supports (IMPEx, Europlanet, …)
- From an orbit viewer (NAIF/SPICE kernel) to a space physics data rendering system
- It 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

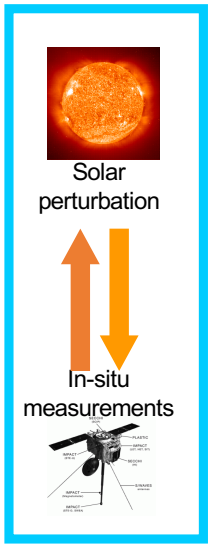
gfi cnes


Time: 2012-03-20T13:00:00
Frame = GSE
Center = Earth
Earth
CLUSTER1
GEOTAIL
THEMIS-B
Moon orbit
3DView
GFI informatique - IRAP


SPECIFIC Shear angle
Display App FILL
Inputs
IMF 2.2 0.5 -5 nT
pDyn 18.1 Wind 433
Shape
ptsDist 1 Use mapping
nbRadius 90 Seg 0.25
Nb Points: 1620
Build
Arrows
Normals Tsy96 KF94
length
180
135
90
45
0
Maximum shear angle between magnetosphere and magnetosheath fields: an indication for reconnection locations (from *Trattner et al.* model)
Earth
POLAR
Time: 1996/04/11 13:19:08
Distances (Re = Earth radius = 6378.140km)
Frame = GSE
Center = Earth
Start = 1996/04/11 13:00:00
Stop = 1996/04/11 14:00:00
3DView

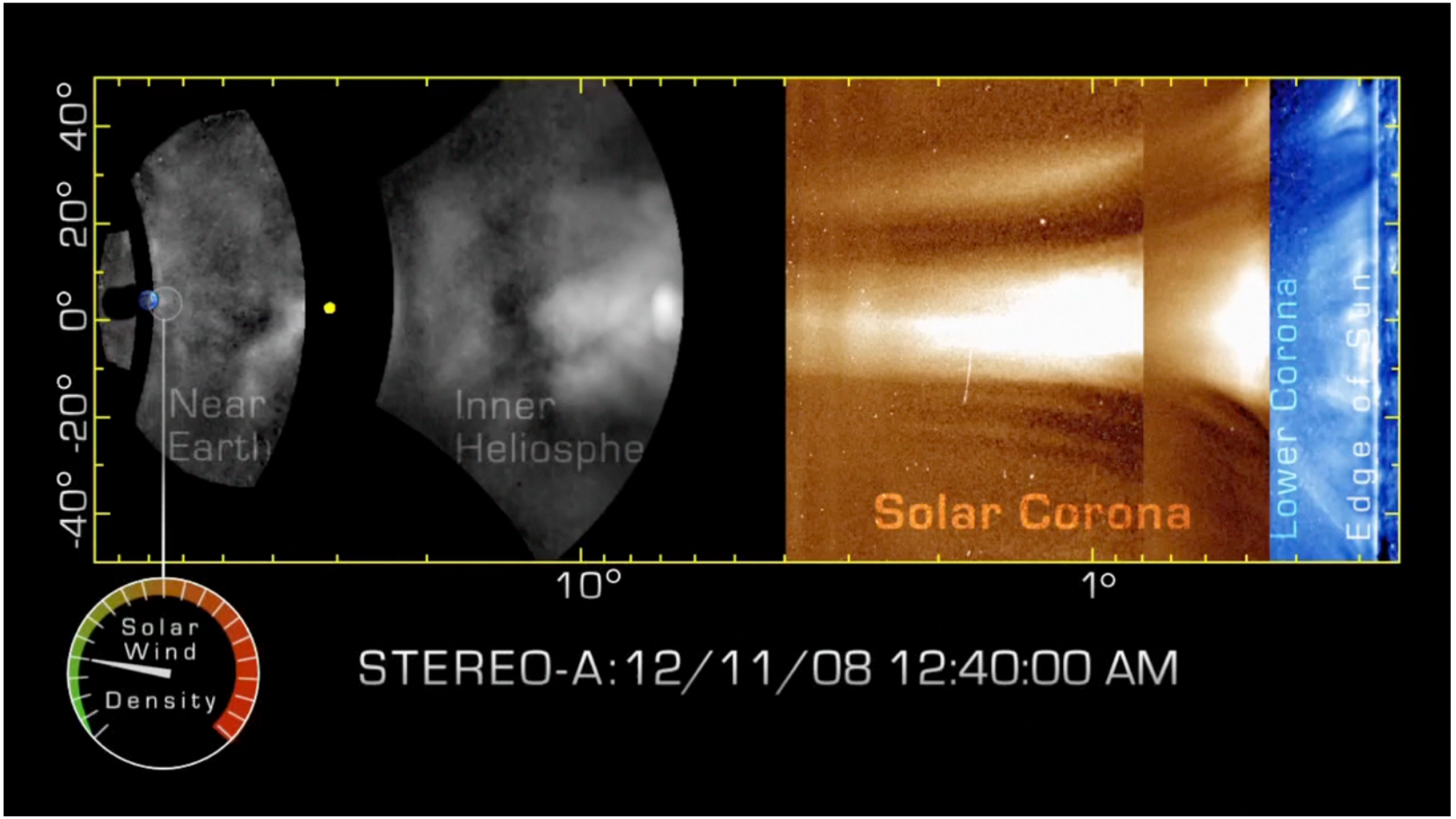

L4
Juno
Juno orbit (SPICE kernels)
Ganymede
L2
L1
Hybrid model at Ganymede
HST aurora (access via VESPA/EPN-TAP)
Jupiter
JRM09 magnetic field
Radiation belt model (Salammbo)
3DView

The Propagation Tool



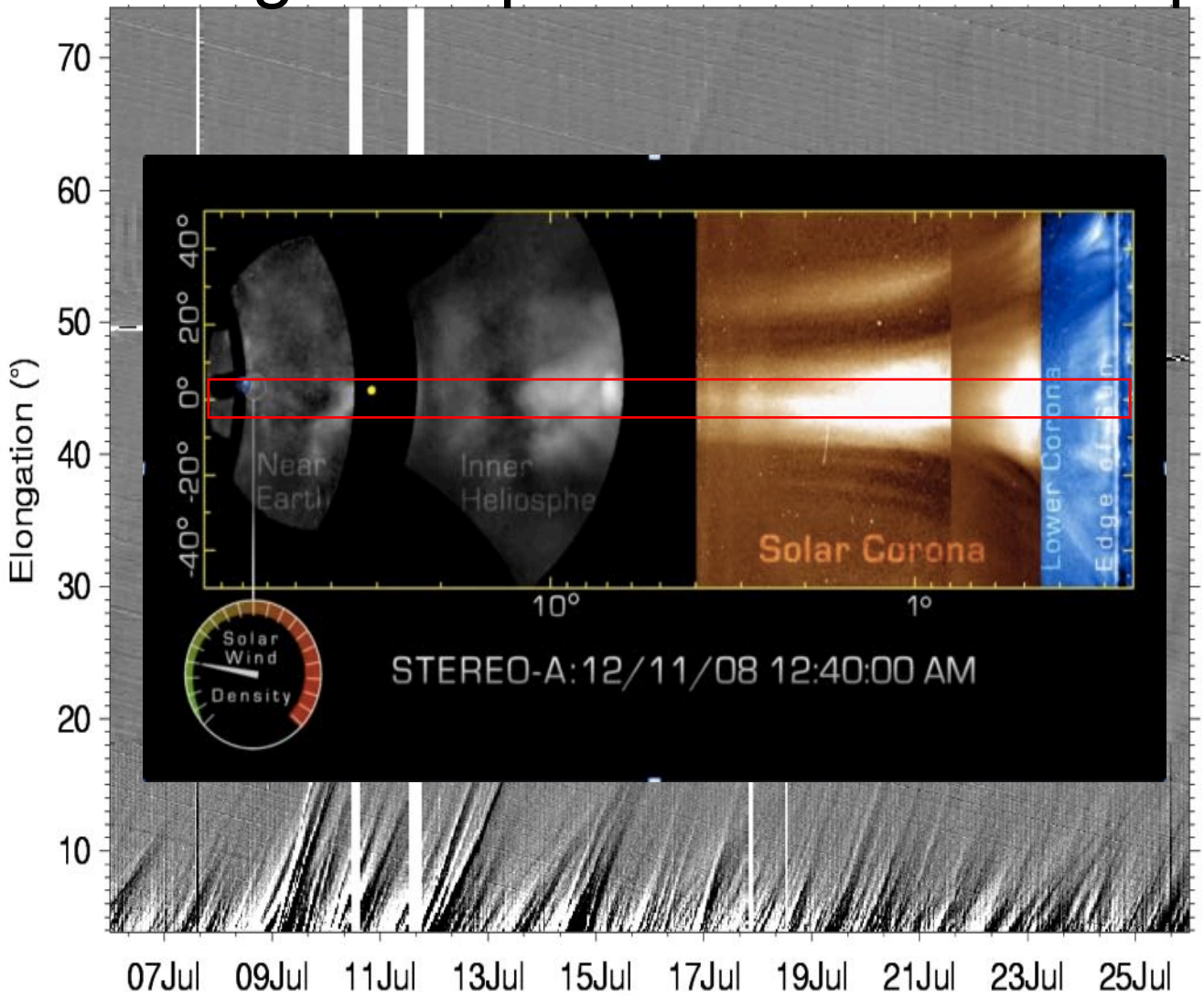
- http://propagationtool.cdpp.eu/
- Computes timing for radial propagation of CME (inc. Drag model), co-rotation (CIR), and SEP propagation
  - ***linking in-situ and remote observations***
- First version : 2013 (JAVA application, GPLv3)
- Contractant: GFI, with CNES and EU project supports (Europlanet)
- 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

Tracking solar perturbations : J-maps



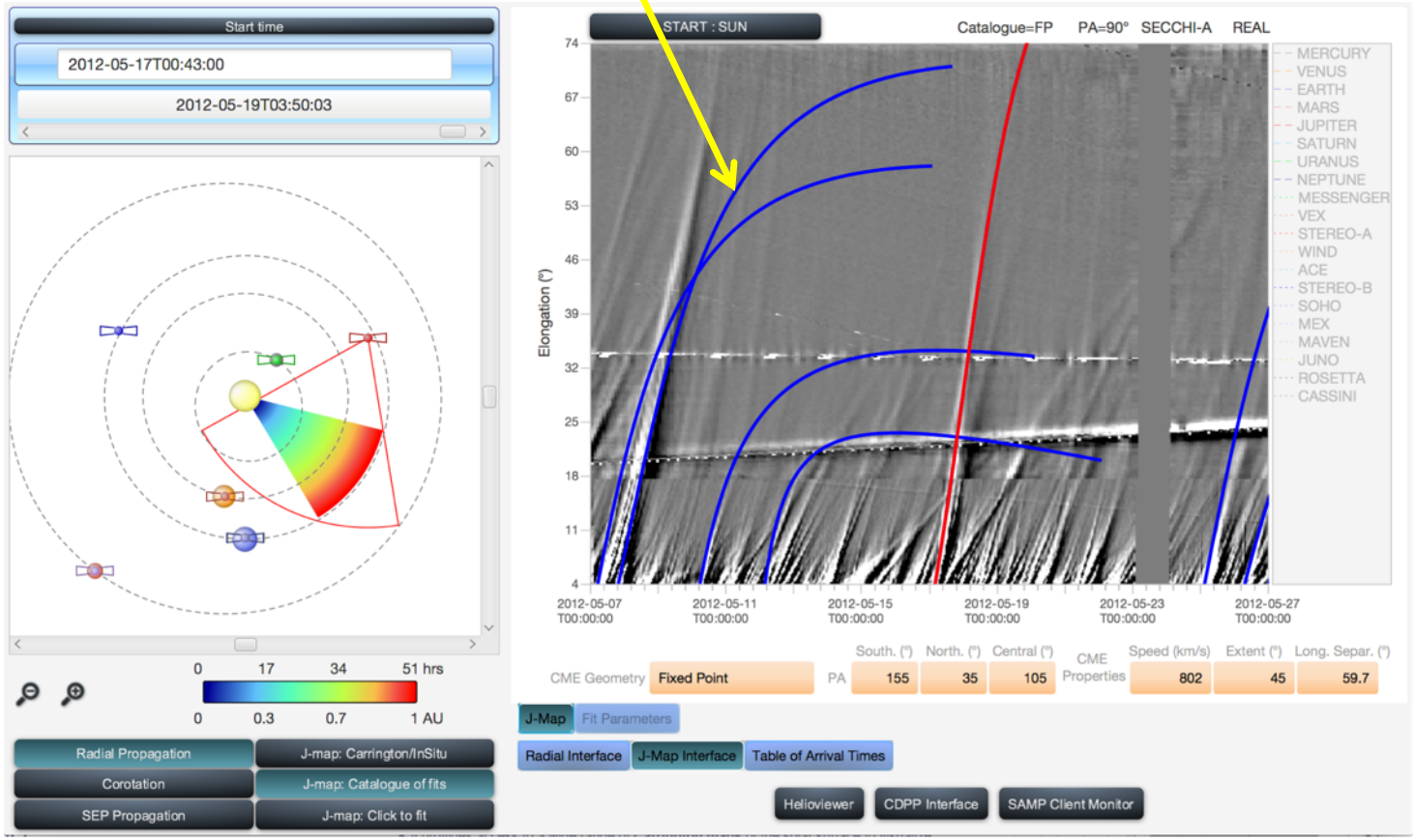
Source: Craig Deforest

Tracking solar perturbations : J-maps

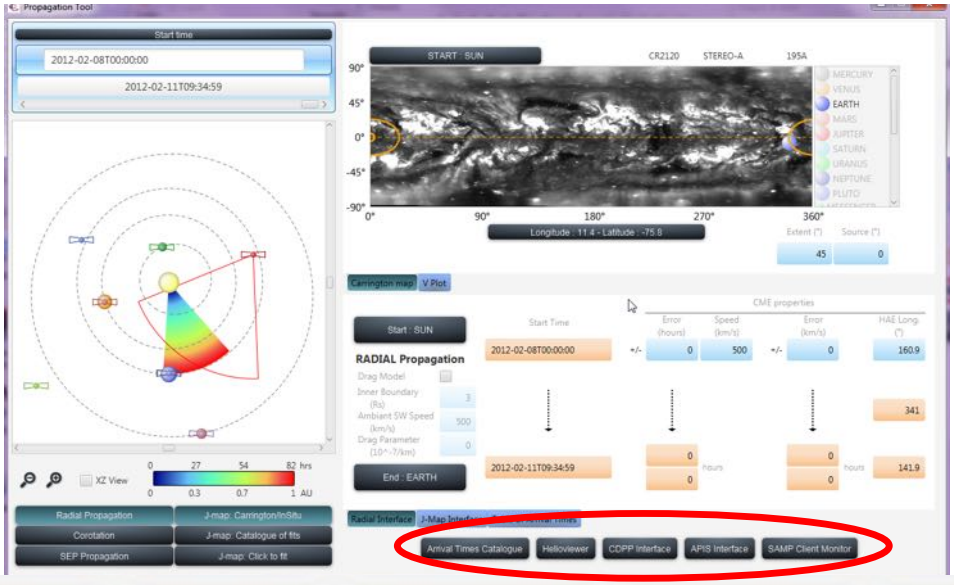


Tracking solar perturbations : J-maps

Solar structures from catalogues can be over-plotted or fitted by the user



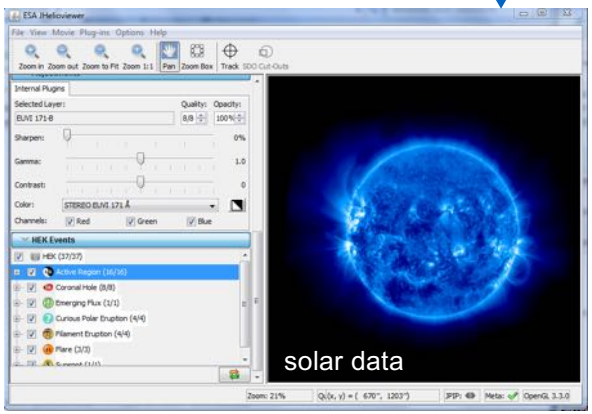
HELCATS catalogues propagated at a given source



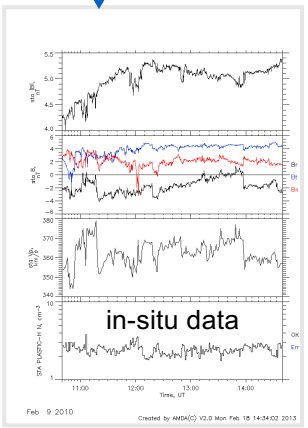
Data export to companion tools

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

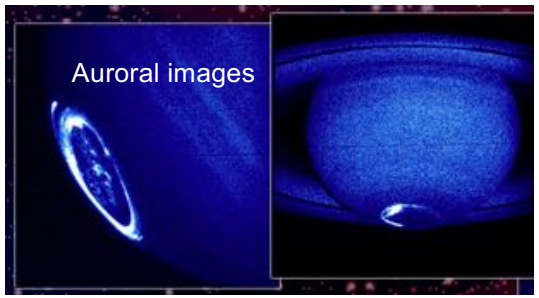
MEDOC database / JHelioviewer



AMDA plot

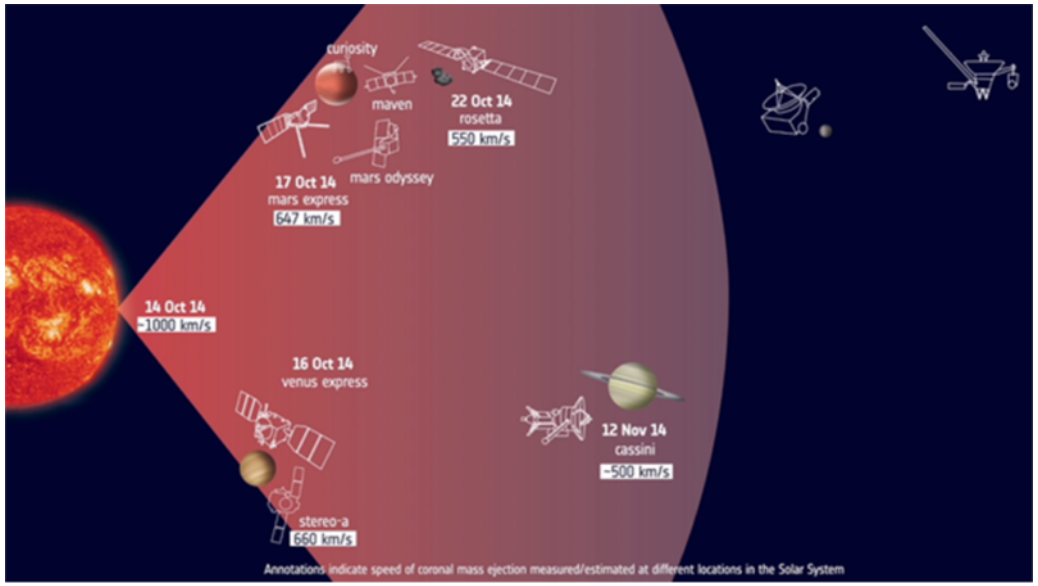


APIS



Use of the Propagation Tool

- To establish CIR & CME catalogues made available in the frame of the FP7 HELCATS project (~ 5 publications)
- Several PSP studies (submitted papers)
- **Interplanetary coronal mass ejection observed at STEREO-A, Mars, comet 67P/C-G, Saturn, and New Horizons en-route to Pluto. Comparison of its Forbush decreases at 1.4, 3.1 and 9.9 AU**, *Witasse et al.*, JGR 2017



The multi-spacecraft observations allowed the derivation of certain properties of the ICME, including its speed as a function of distance. These data permitted to validate the propagation models used in the tool.

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

CDPP tools in IHDEA

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