

# User feedback on CCMC services

**Vincent Génot**  
**IRAP, Toulouse, France**

With inputs from

- N. André, B. Lavraud (IRAP)
- B. Cecconi (LESIA)
- R. Modolo (LATMOS)

# User feedback on CCMC services

- Perspectives
  - CCMC models compared to in-situ data
  - CCMC models as input to other models
  - **Main point : CCMC data export to external tools**
- Focus on
  - Magnetospheric simulations
  - Heliospheric simulations

# CCMC use : Simulation/data comparison for SpaceWeather analysis at planets

**Vincent Génot** (IRAP)  
Baptiste Cecconi (LESIA)  
Nicolas André (IRAP)

# Goal

- Compare ENLIL results from CCMC with in-situ data of a Co-rotating Interaction Region passing at planets
- Use HELIO Solar Wind propagation tool to infer dates of passage at planets
- Upload ENLIL results and visualize them in AMDA
- Compare data/prediction/model results

# Analysis tools

- HELIO : European project (FP7) aiming at building a Virtual Observatory in heliophysics
  - Access at [www.helio-vo.org](http://www.helio-vo.org)
  - Used here to propagate the solar wind
- AMDA : online analysis tool developed by the CDPP (the French Plasma Physics Data Centre)
  - Access at [cdpp-amda.cesr.fr](http://cdpp-amda.cesr.fr)
  - Used here for data/simulation visualization

# Co-rotating Interaction Region list in AMDA

**Table Name**  
Jian\_CIR\_list

**Date of Generation**  
Thu, 22 Dec 2011 08:37:28 GMT shared t

**Description**  
Corotating Interaction Regions (CIR)  
from Wind and ACE Data during  
1995-2009  
Compiled by Dr. Lan Jian at UCLA/IGPP

**Source**  
Upload Time Table

**Operations on Intervals**

Extend (min):  Shift (min):

Filter:  sec ≤ duration ≤  sec

**Statistical info**

Intervals

Min  Max

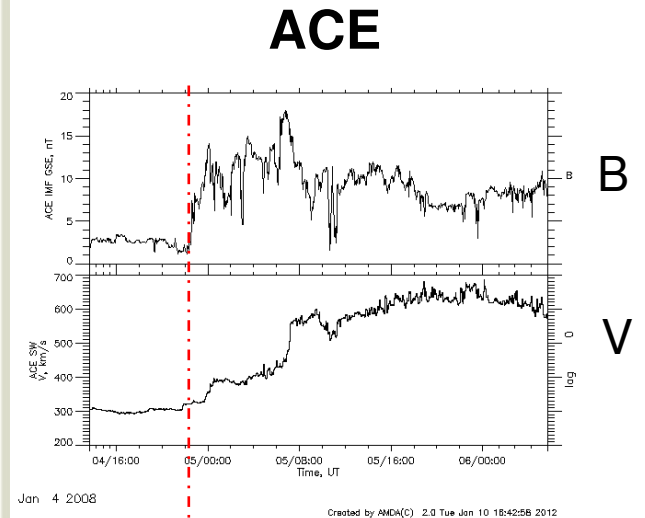
Mean  St.dev

Median  Density

Save My Time Table into

**StartTime - StopTime**  
yyyy-mm-ddThh:mm:ss yyyy-mm-ddThh:mm:ss

2007-08-14T17:00:00	2007-08-15T09:00:00	--	330
2007-08-26T07:00:00	2007-08-27T05:00:00	--	331
2007-08-30T18:00:00	2007-09-03T06:00:00	--	332
2007-09-06T09:00:00	2007-09-07T08:00:00	--	333
2007-09-14T13:43:00	2007-09-15T05:00:00	--	334
2007-09-20T09:23:00	2007-09-22T07:00:00	--	335
2007-09-27T10:54:00	2007-09-29T04:00:00	--	336
2007-10-02T17:00:00	2007-10-04T04:00:00	--	337
2007-10-11T03:00:00	2007-10-14T00:00:00	--	338
2007-10-17T09:00:00	2007-10-20T03:00:00	--	339
2007-10-25T10:42:42	2007-10-25T19:14:30	--	340
2007-10-29T13:00:00	2007-10-30T05:00:00	--	341
2007-11-07T22:00:00	2007-11-10T19:00:00	--	342
2007-11-12T06:00:00	2007-11-13T21:44:24	--	343
2007-12-10T00:00:00	2007-12-11T10:00:00	--	344
2007-12-17T01:53:24	2007-12-17T23:30:00	--	345
2007-12-25T19:00:00	2007-12-28T08:00:00	--	346
2008-01-04T13:39:00	2008-01-06T05:43:00	--	347
2008-01-12T05:30:00	2008-01-15T10:00:00	--	348
2008-01-24T08:00:00	2008-01-25T10:00:00	--	349
2008-01-31T10:42:30	2008-02-01T22:30:00	--	350
2008-02-09T14:30:00	2008-02-11T11:00:00	--	351
2008-02-27T13:00:00	2008-03-01T08:55:00	--	352
2008-03-08T04:00:00	2008-03-09T13:00:00	--	353
2008-03-25T00:00:00	2008-03-28T10:00:00	--	354
2008-04-04T02:00:00	2008-04-05T05:00:00	--	355
2008-04-22T11:00:00	2008-04-23T19:00:00	--	356
2008-04-30T15:02:00	2008-05-06T08:00:00	--	357
2008-05-17T18:00:00	2008-05-22T00:00:00	--	358
2008-05-28T01:17:30	2008-05-28T14:30:00	--	359
2008-06-06T01:42:00	2008-06-08T08:00:00	--	360
2008-06-14T11:00:00	2008-06-15T02:30:00	--	361
2008-06-24T19:10:30	2008-06-26T23:50:00	--	362
2008-07-04T04:00:00	2008-07-07T00:00:00	--	363
2008-07-11T00:00:00	2008-07-12T10:20:00	--	364
2008-07-22T06:33:00	2008-07-23T19:36:00	--	365
2008-08-08T23:24:30	2008-08-10T03:51:00	--	366
2008-08-17T15:30:00	2008-08-19T00:30:00	--	367



Stream interface at **22:20**  
will reach the Earth **~23:20**

**INPUT**

Start Time  
2007-12-31T09:00:00.000

---

Longitude  
0.00

---

SolarWind speed  
400.00

---

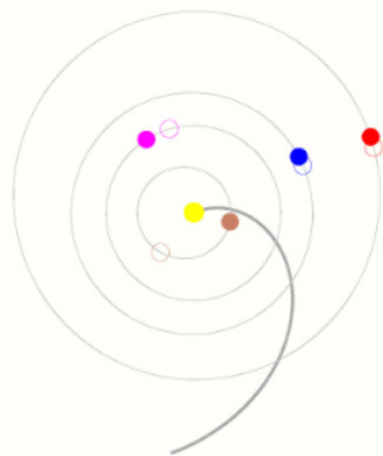
Output

Planet	ETA	Dt(days)
MERCURY	2008-01-25T04:48:45.149	24.83
VENUS	2008-01-10T18:28:22.380	10.39
EARTH	2008-01-04T23:20:41.951	4.60
MARS	2008-01-07T05:57:02.301	6.87
JUPITER	2008-01-09T11:02:40.979	9.09
SATURN	2008-01-18T04:57:52.979	17.83
URANUS	2007-12-31T11:50:03.132	0.12
NEPTUNE	2008-01-15T08:33:57.386	14.98
PLUTO	2008-01-17T08:25:56.954	16.98

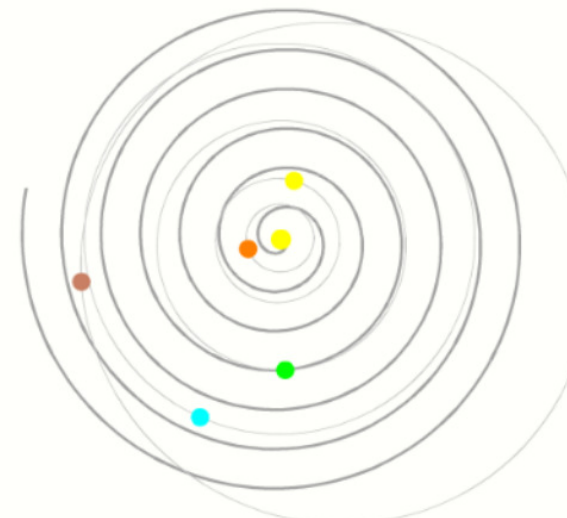
- [GOES plotter](#)
- [Flare plotter](#)
- [Solar Monitor for 31-Dec-2007](#)
- [Space Weather for 31-Dec-2007](#)

Time of the SI at the Earth

[http://www.helio-vo.eu/services/service\\_interfaces.php](http://www.helio-vo.eu/services/service_interfaces.php) : HPM



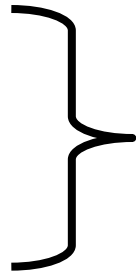
● Sun      Start Time    ● End Time  
● Mercury    ● Venus    ● Earth    ● Mars



● Sun      Start Time    ● End Time  
● Jupiter    ● Saturn    ● Uranus    ● Neptune    ● Pluto

# ENLIL simulation

- **Cedric\_Bonnevie\_032511\_SH\_1**
- Title/Introduction: KUL Student run. SOTERIA
- Key Word: cedric
- Model Type: Heliosphere  
Model: ENLIL  
Run Objective: cone\_model  
Initial State: analytic\_prescription  
Boundary Condition Type: Time-Independent  
Inner Boundary Condition: from\_WSA\_model input  
Outer Boundary: Cassini  
Simulation Grid: 256x30x90  
Carrington Rotation: 2065
- View [3D Data](#)
- View [control file](#) with input parameters for the run.
- View [quick look graphics for the run](#)  
Note: Quick look graphics has been designed by the model developer to enable quick evaluation of the results of the run. To find more information regarding this option please contact the CCMC staff.
- [ENLIL at Earth](#)  
[ENLIL at Jupiter](#)  
[ENLIL at Mars](#)  
[ENLIL at Mercury](#)  
[ENLIL at Messenger](#)  
[ENLIL at Saturn](#)  
[ENLIL at Stereo A](#)  
[ENLIL at Stereo B](#)  
[ENLIL at Venus](#)

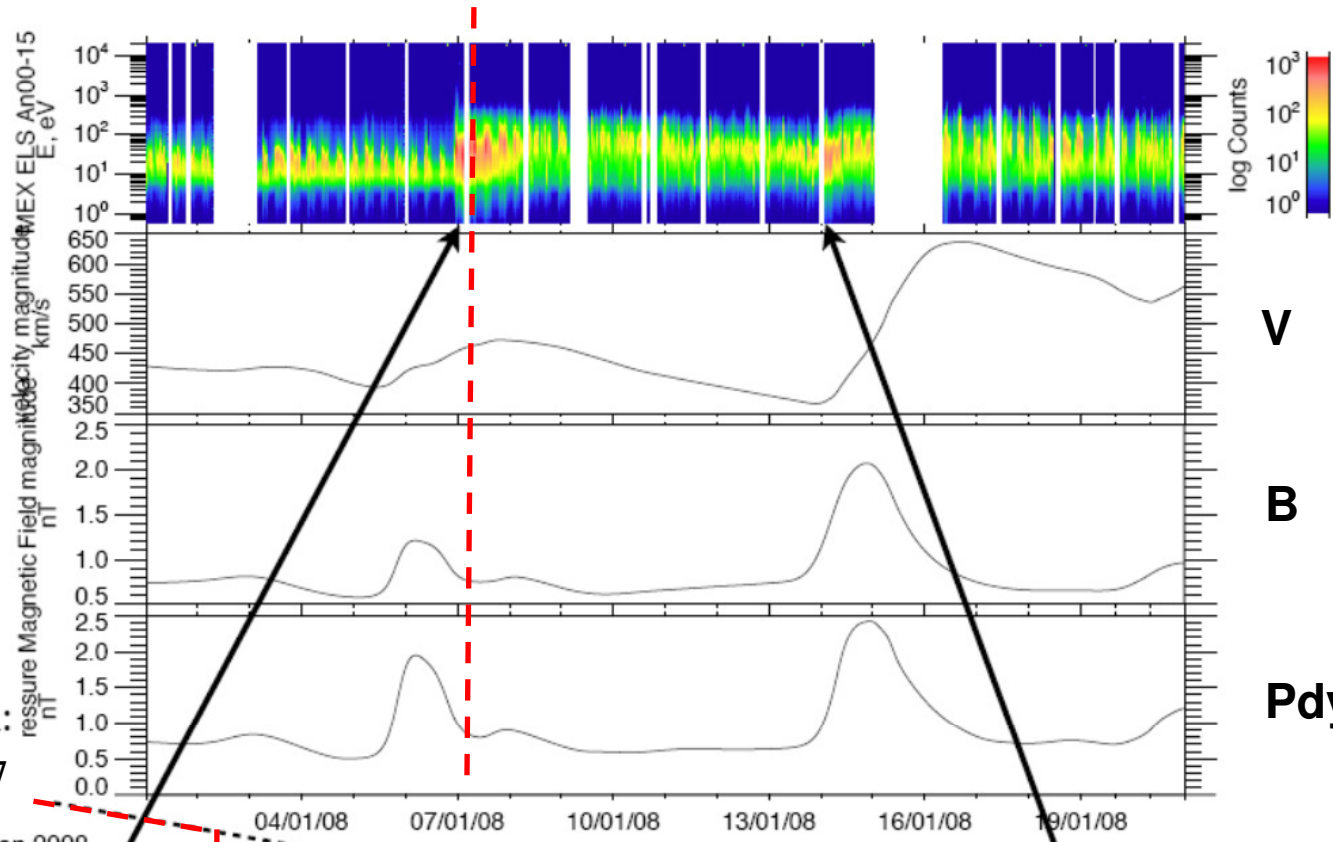


SW at planets



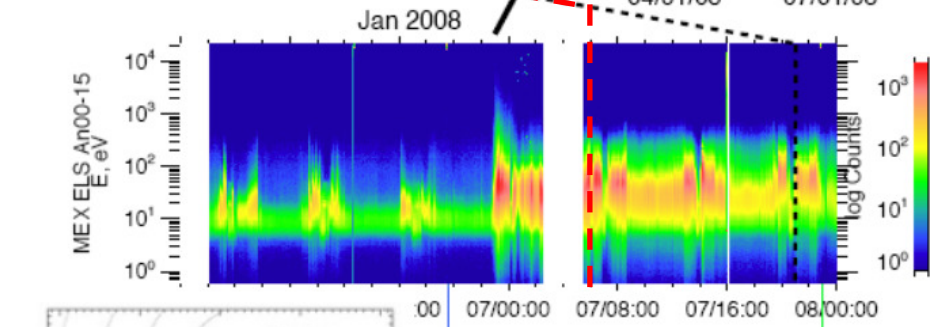


Mars  
MEX-ELS

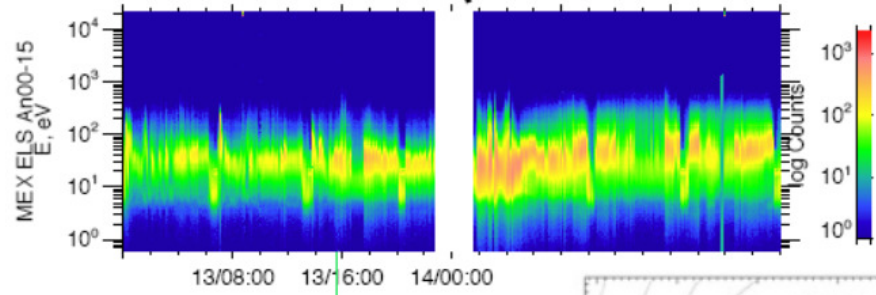


CCMC

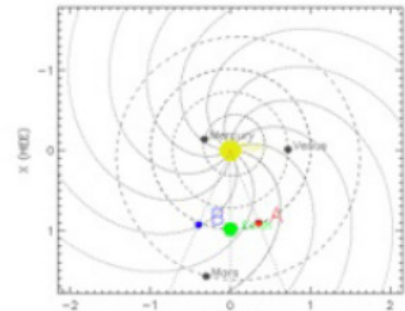
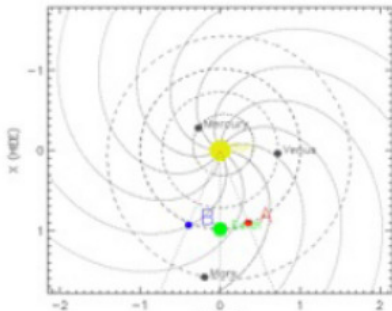
HELIO prediction:  
2008-01-07T05:57



2008-01-06T23:00:00



2008-01-14T02:00:00



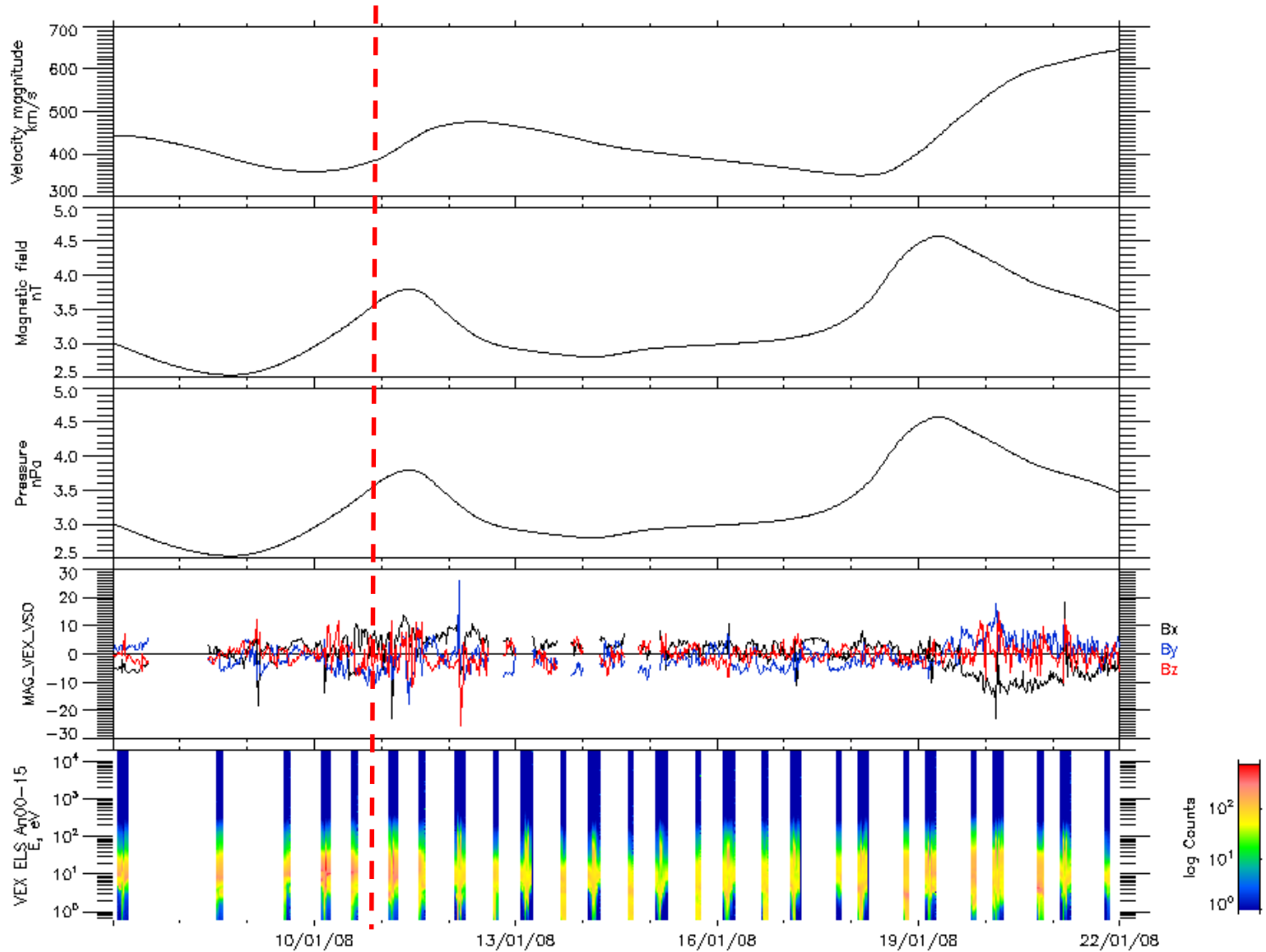
# Venus

HELIO prediction : 2008-01-10T18:28

CCMC

Vex/MAG

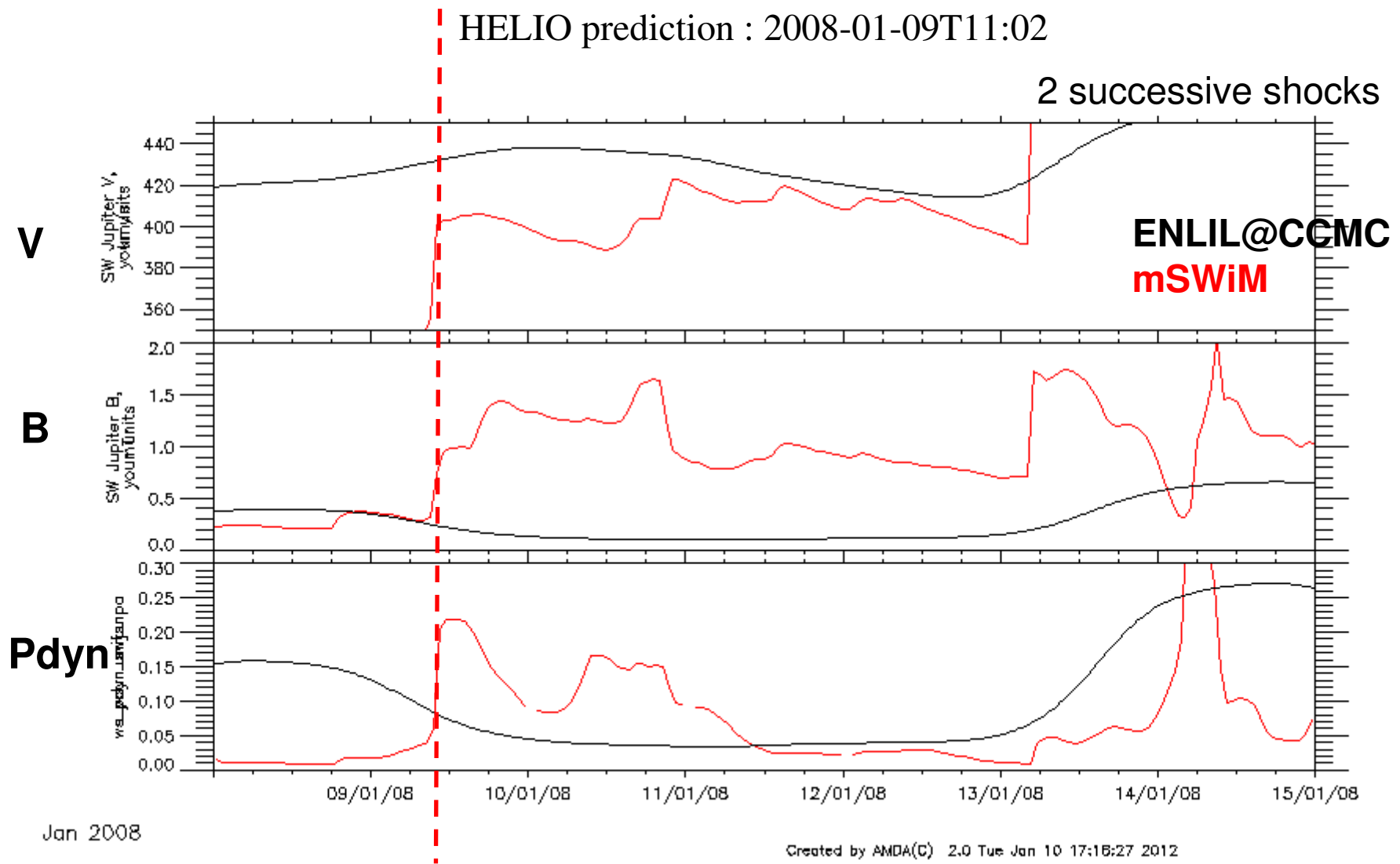
Vex/ELS



Jan 2008

Created by AMDA(C) 2.0 Tue Jan 10 16:25:17 2012

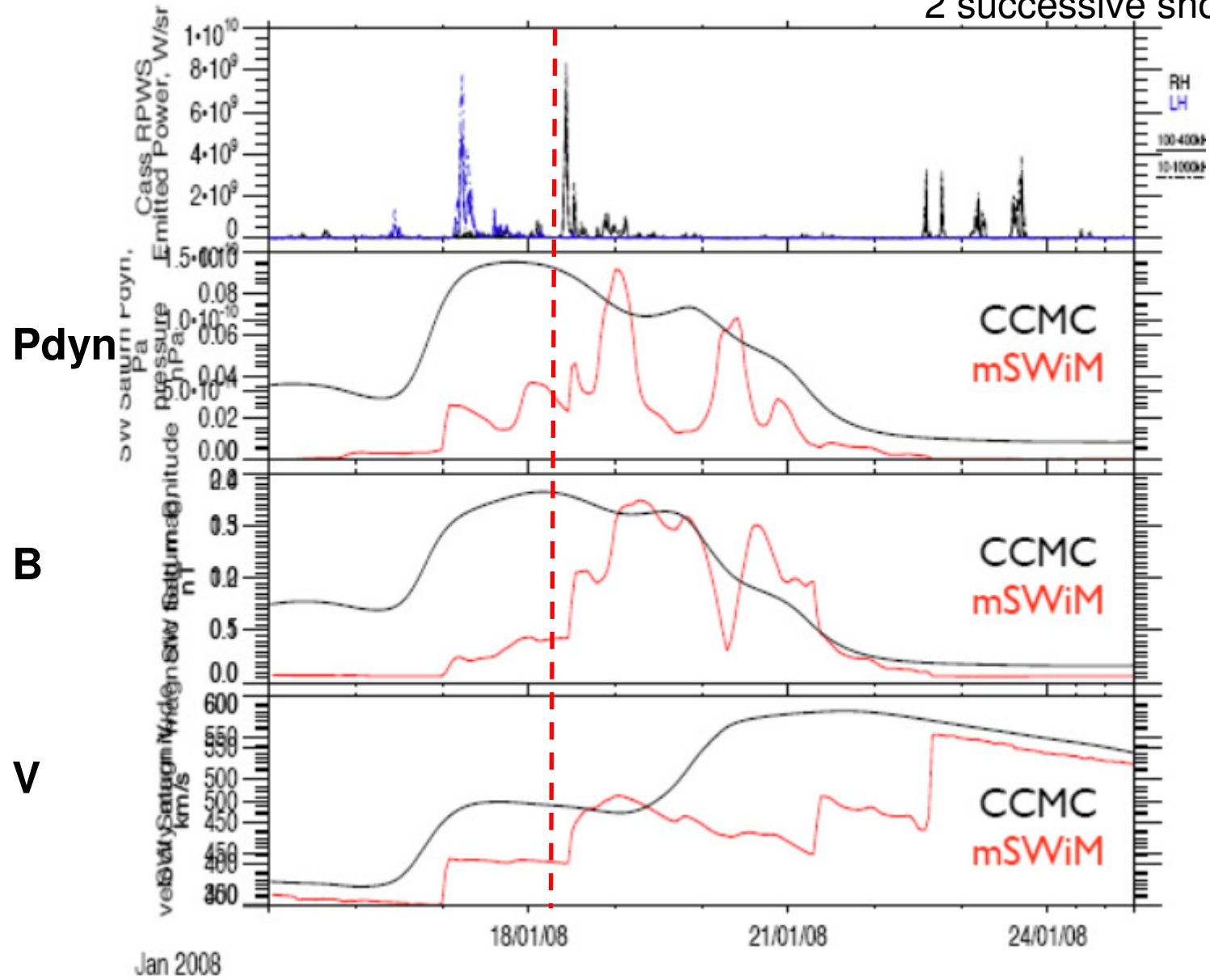
# Jupiter



# Saturn

HELIO prediction : 2008-01-18T04:57

2 successive shocks



# Conclusions

- A simple science case to learn how CCMC results could be used
- It showed that in-situ data/model comparison in my « preferred » tool (AMDA) is possible
- Interface : it would be nice to know which runs are available for a given period, and if data printouts at planets and S/C have been done for those runs  
→ *Virtual Model Repository for heliospheric models ?*

**CCMC use : ENLIL results as  
inputs for 3D hybrid simulations**

**Vincent Génot (IRAP)**

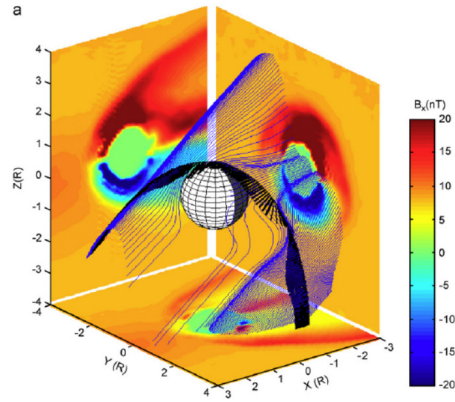
# Goal

- Use global heliospheric simulations to get environment at planets as input for 3D hybrid modeling
- Test on a simulation done at FMI by Kallio et al., 2008 (HYB model)
- CCMC : ENLIL run



# ENLIL simulation

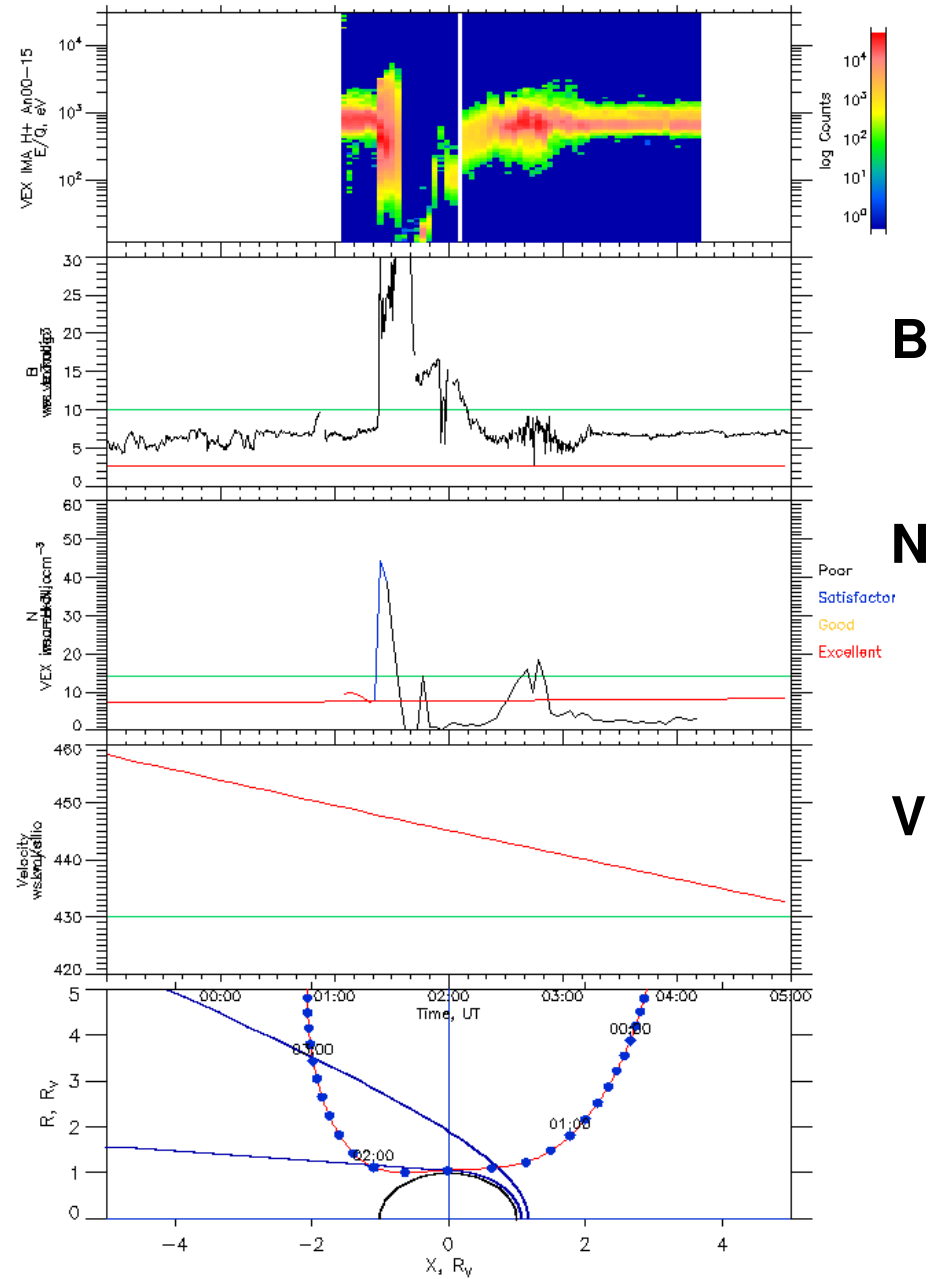
- **Vincent\_Genot\_092711\_SH\_1**
- Title/Introduction:
- Key Word: Vex\_enlil
- Model Type: Heliosphere  
Model: ENLIL  
Run Objective: stationary\_Solar\_Wind  
Initial State: analytic\_prescription  
Boundary Condition Type: Time-Independent  
Inner Boundary Condition: from\_MAS\_model input  
Outer Boundary: Mars  
Simulation Grid: 256x30x90  
Carrington Rotation: 2043
- View [3D Data](#)
- View [control file](#) with input parameters for the run.
- View [quick look graphics for the run](#)  
Note: Quick look graphics has been designed by the model developer to enable quick evaluation of the results of the run. To find more information regarding this option please contact the CCMC staff.
- [ENLIL at Earth](#)  
[ENLIL at Mars](#)  
[ENLIL at Mercury](#)  
[ENLIL at Messenger](#)  
[ENLIL at Venus](#)



Data (Vex)

CCMC

Simulation inputs in Kallio et al.

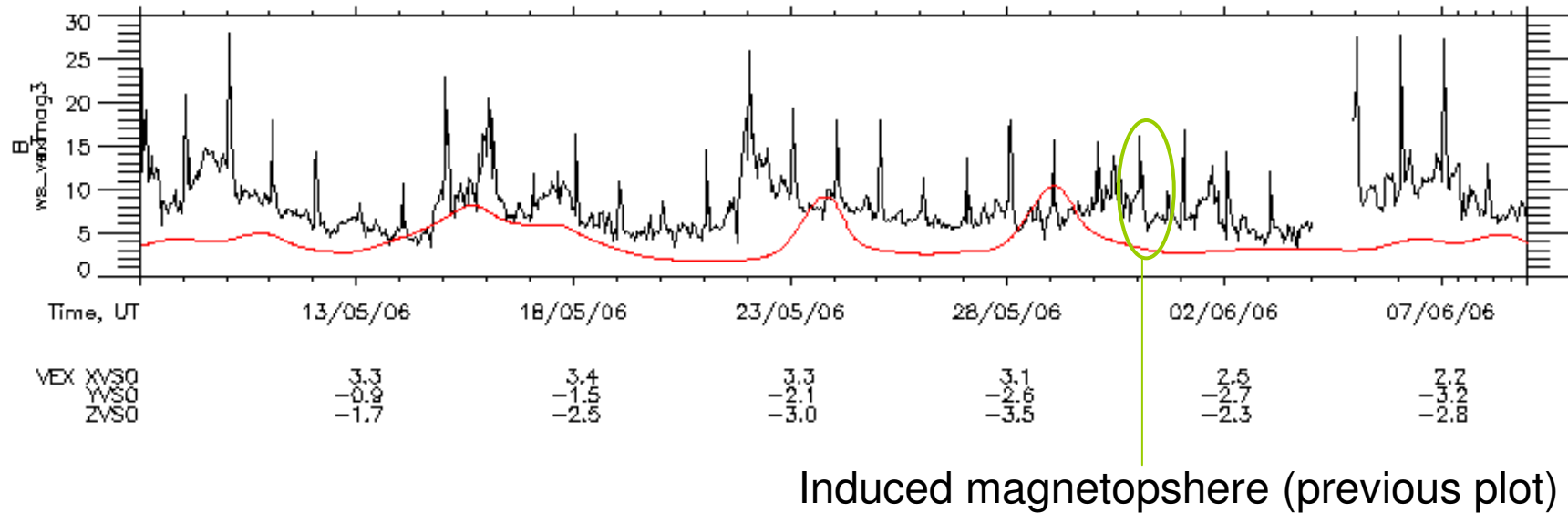


May 31 2006

Created by AMDA(C) 2.0 Mon Oct 17 16:28:51 2011

# ENLIL - Vex/MAG comparison over CR 2043

Vex/MAG  
CCMC



***B\_ENLIL too small in slow wind ?***

***→ ENLIL scaling issue for B***

***→ not visible on the CCMC interface ?***

# CCMC use : magnetospheric data/simulation comparisons along S/C tracks

**Vincent Génot (IRAP)**

# Goal

- Visualize/compare magnetospheric simulations results with in-situ data
- Use CCMC results made accessible via the Virtual Model Repository (VMR)
- Upload results in AMDA for data/model comparison

# Choosing a run at VMR

Virtual Modeling Repository: CCMC Visualization - Mozilla Firefox

vmr.engin.umich.edu/visualize/ccmc\_mag/oneview2?run=645

**VMR - VIRTUAL MODEL REPOSITORY**

Home **Models & Visualization** Data Discovery Downloads Publications & Presentations Other VxOs About Help

> UM SWMF Runs > CCMC Event Runs > HEIDI > AMIE > Satellite Plots > IR/DMSP

[Return](#) **Detail view for CCMC event run Victor\_Sergeev\_100705\_1**

Satellite Data Available	Data-Model Comparison	Model on Satellite Track	Run information:
<b>Satellite</b> Cluster-1 N/A Cluster-2 N/A Cluster-3 N/A Cluster-4 N/A GOES-8 <a href="#">plot B data</a> <a href="#">plot B data +/- 1 day</a> GOES-9 N/A GOES-10 <a href="#">plot B data</a> <a href="#">plot B data +/- 1 day</a> GOES-11 N/A Geotail <a href="#">plot B data</a> <a href="#">plot B data +/- 1 day</a> IMP-8 N/A Polar <a href="#">plot B data</a> <a href="#">plot B data +/- 1 day</a> Wind <a href="#">plot B data</a> <a href="#">plot B data +/- 1 day</a>	<b>Satellite</b> Cluster-1 Cluster-2 Cluster-3 Cluster-4 GOES-8 <a href="#">plot B</a> GOES-9 GOES-10 <a href="#">plot B</a> GOES-11 Geotail <a href="#">plot B</a> IMP-8 Polar <a href="#">plot B</a> Wind	<b>Satellite</b> Cluster-1 <a href="#">plot model</a> Cluster-2 <a href="#">plot model</a> Cluster-3 <a href="#">plot model</a> Cluster-4 <a href="#">plot model</a> GOES-8 <a href="#">plot model</a> GOES-9 <a href="#">plot model</a> GOES-10 <a href="#">plot model</a> GOES-11 <a href="#">plot model</a> Geotail <a href="#">plot model</a> IMP-8 <a href="#">plot model</a> Polar <a href="#">plot model</a> Wind	<a href="#">View run at CCMC site.</a> Event Date October 20 2001 Start Time 2001/10/20 7:00 End Time 2001/10/20 11:00 Key Words Flapping1 Model BATSRUS Model Version v7.73 Validation Level 2 Coordinate System for Input GSM Coordinate System for Output GSM Dipole Tilt, in the X-Z Plane, at Start deg -21.40 Dipole Tilt, in Y-Z GSE plane, deg -28.30 Update Dipole Orientation with Time yes Inflow Boundary R_E 33 F10.7 150 Conductance Model auroral Corotation yes Run Number Victor_Sergeev_100705_1 3D files saved 121

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**M** UNIVERSITY OF MICHIGAN

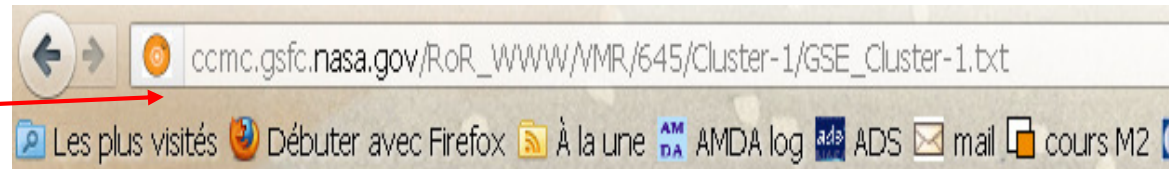
zotero

# MHD simulation along S/C tracks

## File list

### [Return](#) to folder list

- [645](#)
  - Cluster-1
    - [GSE Cluster-1.txt](#) (236K)
    - [GSE\\_extract.txt](#) (144K)
    - [GSE\\_ranges.txt](#) (8.0K)
    - [GSM Cluster-1.txt](#) (236K)
    - [GSM\\_extract.txt](#) (144K)
    - [GSM\\_ranges.txt](#) (8.0K)
    - [SM Cluster-1.txt](#) (236K)
    - [SM\\_extract.txt](#) (144K)
    - [SM\\_ranges.txt](#) (8.0K)
  - Cluster-2
    - [GSE Cluster-2.txt](#) (40K)
    - [GSE\\_extract.txt](#) (20K)
    - [GSE\\_ranges.txt](#) (8.0K)
    - [GSM Cluster-2.txt](#) (40K)
    - [GSM\\_extract.txt](#) (20K)
    - [GSM\\_ranges.txt](#) (8.0K)
    - [SM Cluster-2.txt](#) (40K)
    - [SM\\_extract.txt](#) (20K)
    - [SM\\_ranges.txt](#) (8.0K)
  - Cluster-3
    - [GSE Cluster-3.txt](#) (40K)
    - [GSE\\_extract.txt](#) (20K)
    - [GSE\\_ranges.txt](#) (8.0K)
    - [GSM Cluster-3.txt](#) (40K)



```
# Data printout from CCMC-simulation: version 1.1
# Data type: BATSUS magnetosphere
# Run name: Victor_Sergeev_100705_1 Missing data: NaN
# Coordinate System: GSM
# Satellite Track: Cluster-1
# Output data: field with 1x1201=1201 elements
# Year Month Day Hour Min Sec X Y Z N V_x V_y V_z B_x B_y B_z P J_x J_y J_z
# year month day h m s R_E R_E R_E 1/cm3 km/s
2001 10 20 7 0 0.000 -12.5 9.07 6.73 0.937
2001 10 20 7 0 12.000 -12.5 9.07 6.73 0.932
2001 10 20 7 0 23.000 -12.5 9.07 6.73 0.927
2001 10 20 7 0 36.000 -12.5 9.08 6.73 0.921
2001 10 20 7 0 47.000 -12.5 9.08 6.72 0.916
```

Welcome to AMDA - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

manunja.cesr.fr/~budnik/AMDANEW/DDHTML/HTML/loginreq.php

Help Feedback Logout

My Data My Parameters My Time Tables My Catalogs Plot Data Download Data Search in Data Add External Data

**My Data**

- MY PARAMETERS
- b\_simu\_geotail

**Selected parameter**

- MY FILES
- GSE\_geotail.bt
- GSE\_Cluster-1.bt

**Uploaded file**

**Upload File**

max size: 30MB

file format:  ASCII  CDF  CEF

time format:  Standard  NonStandard

define time format: Y m d H i s.u

time sampling:  Constant  Variable

From Local Machine

From URL

VMR/645/Cluster-1/GSE\_Cluster-1.bt

**URL at CCMC**

**Define Parameter**

Parameter Name: GSE\_Cluster-1.bt

File Mask: GSE\_Cluster-1.bt

Parameter Type: FLOAT

Parameter Size:

Time Sampling (sec): 1209

Fill Value (optional):

Units (optional):

Y Title (optional):

Legend (optional):

Save Parameter into /

Reset

**GSE\_Cluster-1.txt**

```
# Data printout from CCMC-simulation: version 1.1
# Data type: BATSRUS magnetosphere
# Run name: Victor_Sergeev_100705_1 Missing data: NaN
# Coordinate System: GSM
# Satellite Track: Cluster-1
# Output data: field with 1x1201=1201 elements
# Year Month Day Hour Min Sec X Y Z N V_x V_y V_z B_x B_y B_z P J_x J_y J_z
# year month day h m s R E R E R E 1/cm3 km/s km/s km/s nT nT nT nPa muA/m2 muA/m2 muA/m2
2001 10 20 7 0 0.000 -12.5 9.07 6.73 0.937 -96.6 61.6 9.06 22.6 -5.94 -4.45 0.00666 4.81E-05 1.09E-05 2.53E-05
2001 10 20 7 0 12.000 -12.5 9.07 6.73 0.932 -96.6 61.8 8.83 22.6 -5.93 -4.44 0.00666 4.81E-05 1.08E-05 2.54E-05
2001 10 20 7 0 23.000 -12.5 9.07 6.73 0.927 -96.8 61.6 8.87 22.6 -5.94 -4.43 0.00667 4.80E-05 1.05E-05 2.41E-05
.....
```

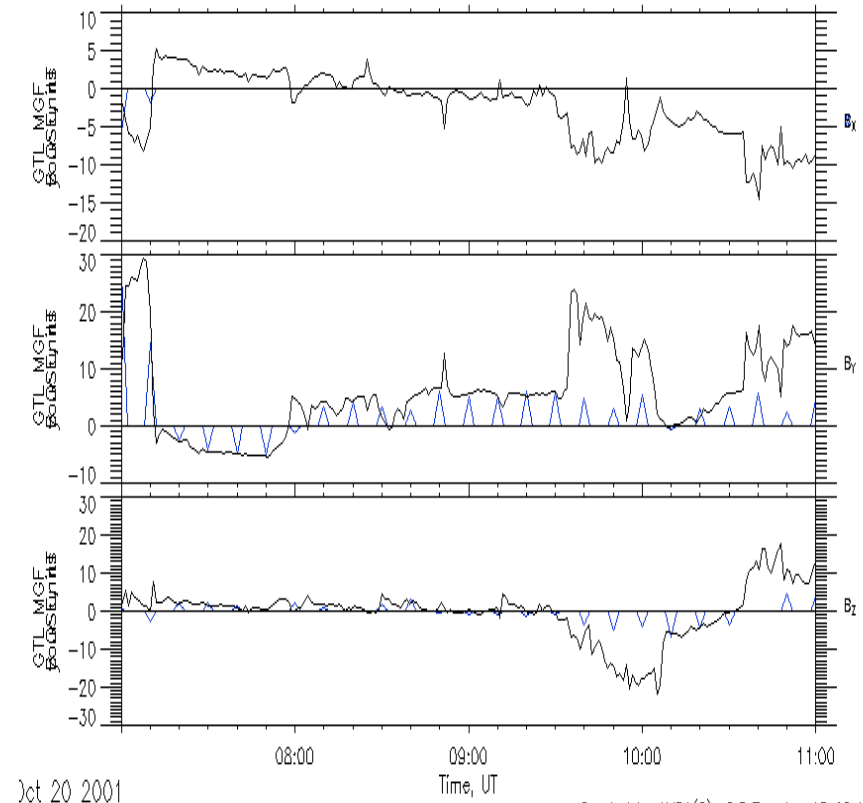
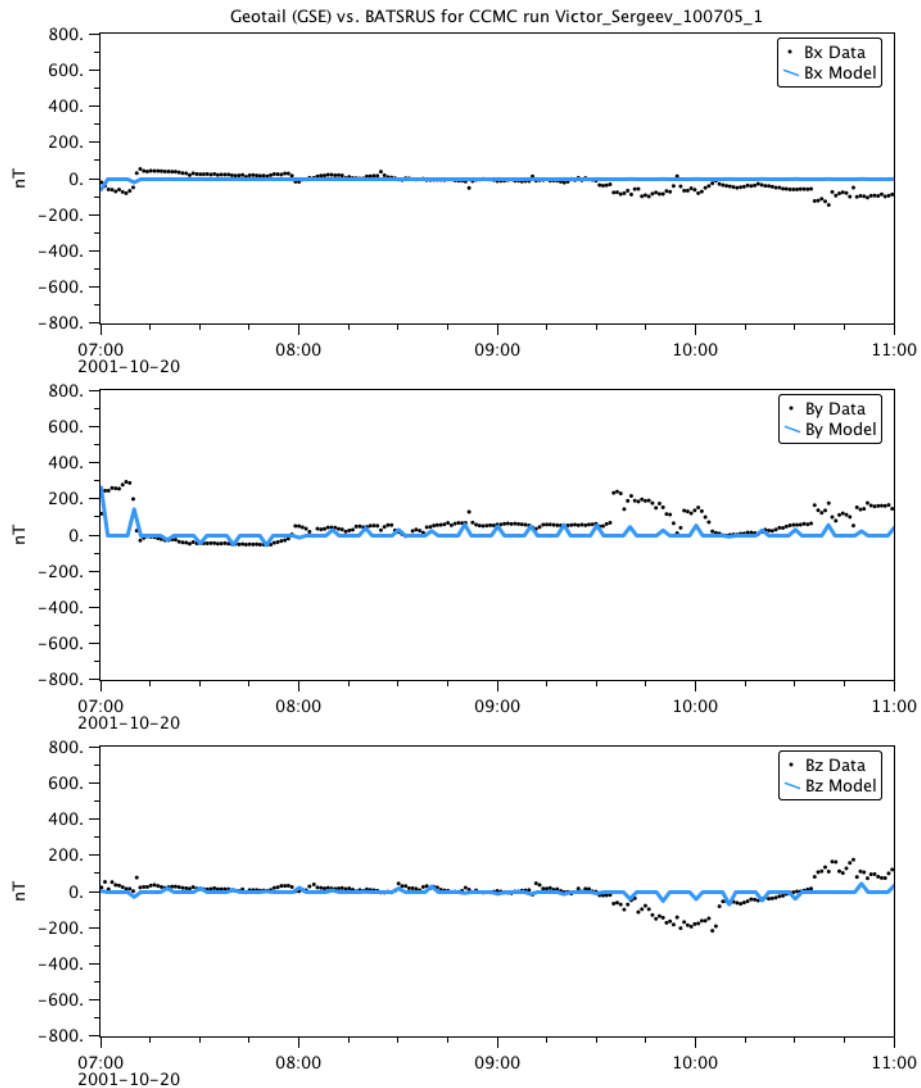
Parameter Start Position [ >= 1 ]:

# Upload in AMDA

zotero



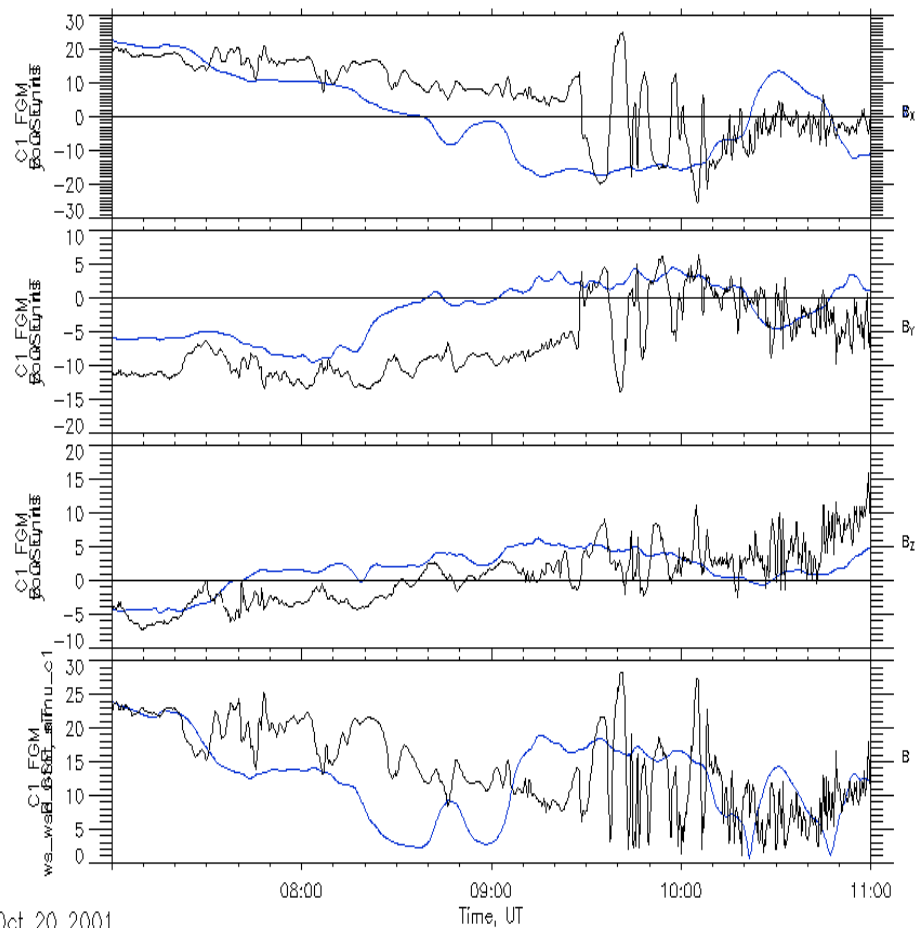
# VMR and AMDA plots for Geotail



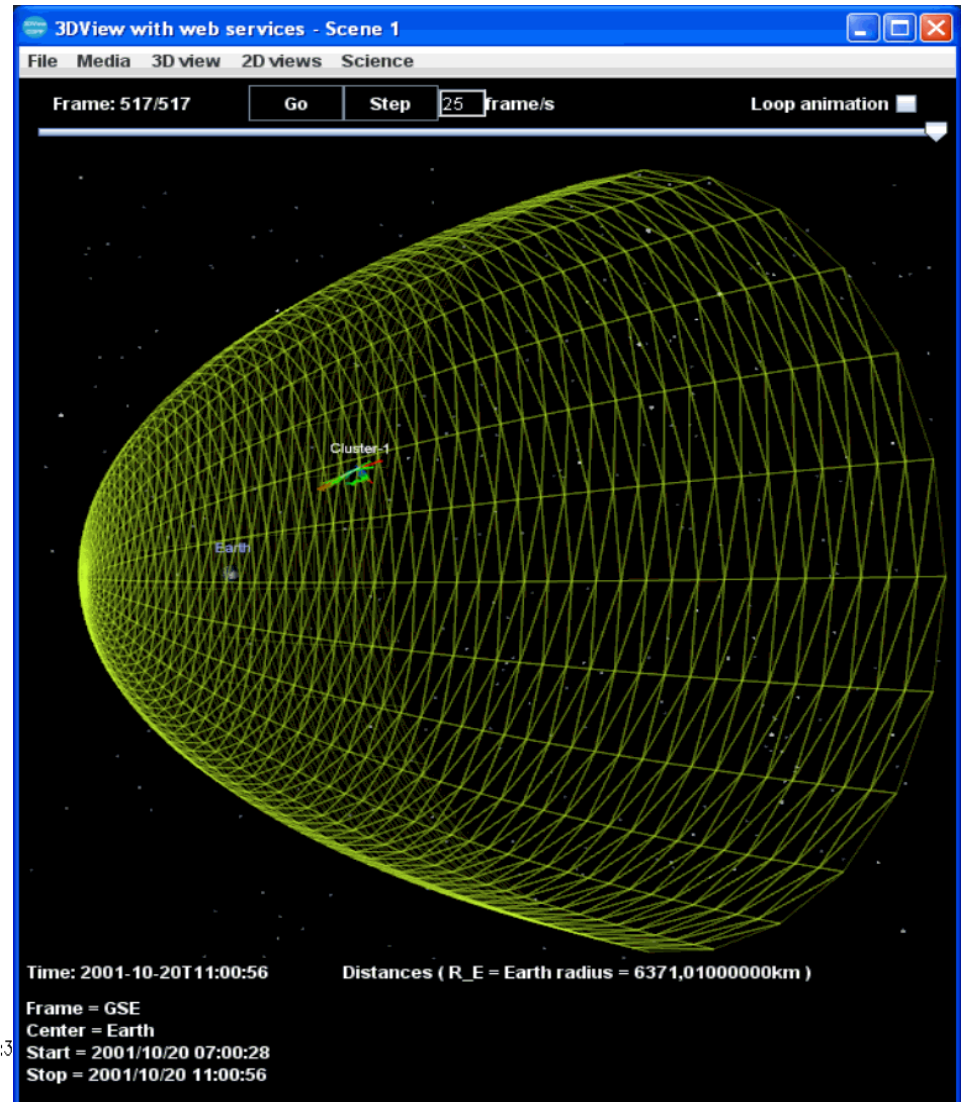
Oct 20 2001

Created by AMDA(C) 2.0 Tue Jan 10 12:44:46 201

# AMDA plots for CLUSTER and 3DView



Created by AMDA(C) 2.0 Tue Jan 10 12:55:3



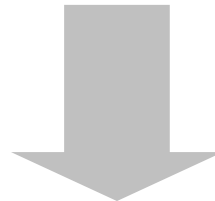
# Feedback on data interpolation outputs

- Direct upload from URL is possible and simple, *once the general structure is understood*
- The «Have data printed to text file» option is not intuitive
  - Why click on « Update plot » to produce the text file to be retrieved ?
- Direct URL for the files at planets or S/C could be given directly on the run page
- Metadata for the run should be homogenized
  - For instance : time format is different for heliospheric model outputs and outputs at VMR
  - Time format : ISO 8601 standard
  - Order of the physical quantities (ex : Time R Lat Lon V\_r V\_lon V\_lat B\_r B\_lon B\_lat)
  - Satellite or planet information should be given
- Current discussion with HDMC folks on ASCII catalog format definition could help choosing a standard

```

# Data printout from CCMC-simulation: version 1.1
# Data type: ENLIL Heliosphere
# Run name: Cedric_Bonnevie_032511_SH_1 Missing data: -1.09951e+12
# Start Date, time: 2007/12/29 00:00:00
# Time R Lat Lon V_r V_lon V_lat B_r B_lon B_lat N T E_r E_lon E_lat V B P_ram BP
# day AU deg deg km/s km/s km/s nT nT nT cm^-3 K mV/m mV/m mV/m km/s nT nPa []
8.59623E-03 7.20000E-01 -3.73974E+00 2.61775E+02 5.48638E+02 1.78623E+00 ...
2.66782E-02 7.20000E-01 -3.73920E+00 2.61786E+02 5.49581E+02 1.68447E+00 ...
4.47099E-02 7.20000E-01 -3.73866E+00 2.61797E+02 5.50542E+02 1.57939E+00 ...

```



IDL routine (*by B. Cecconi*)  
needed to get proper time representation

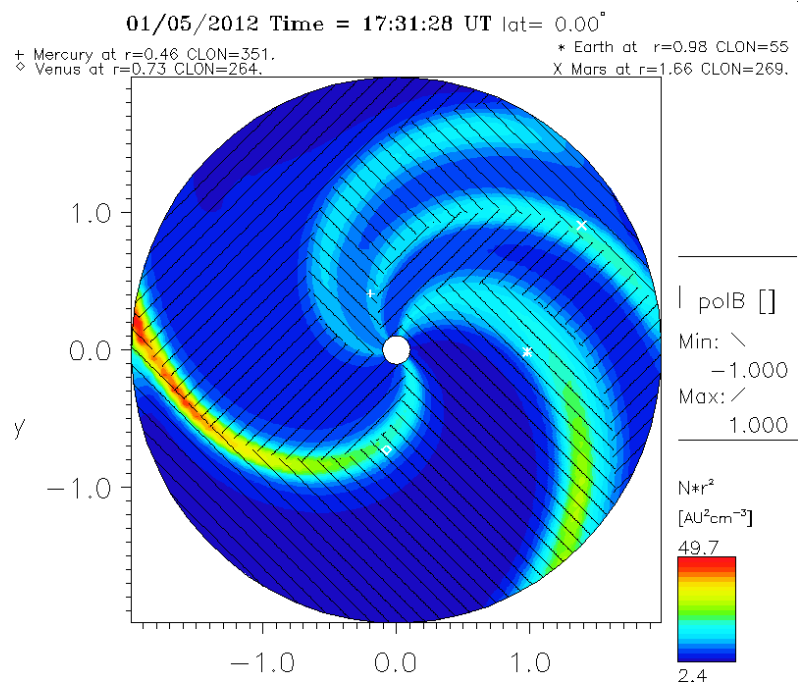
```

# Data printout from CCMC-simulation: version 1.1
# Data type: ENLIL Heliosphere
# Run name: Cedric_Bonnevie_032511_SH_1 Missing data: -1.09951e+12
# Start Date, time: 2007/12/29 00:00:00
# Time R Lat Lon V_r V_lon V_lat B_r B_lon B_lat N T E_r E_lon E_lat V B P_ram BP
# day AU deg deg km/s km/s km/s nT nT nT cm^-3 K mV/m mV/m mV/m km/s nT nPa []
2007-12-29T00:12:22.000 7.20000E-01 -3.73974E+00 2.61775E+02 5.48638E+02 1.78623E+00 ...
2007-12-29T00:38:24.000 7.20000E-01 -3.73920E+00 2.61786E+02 5.49581E+02 1.68447E+00 ...
2007-12-29T01:04:22.000 7.20000E-01 -3.73866E+00 2.61797E+02 5.50542E+02 1.57939E+00 ...

```

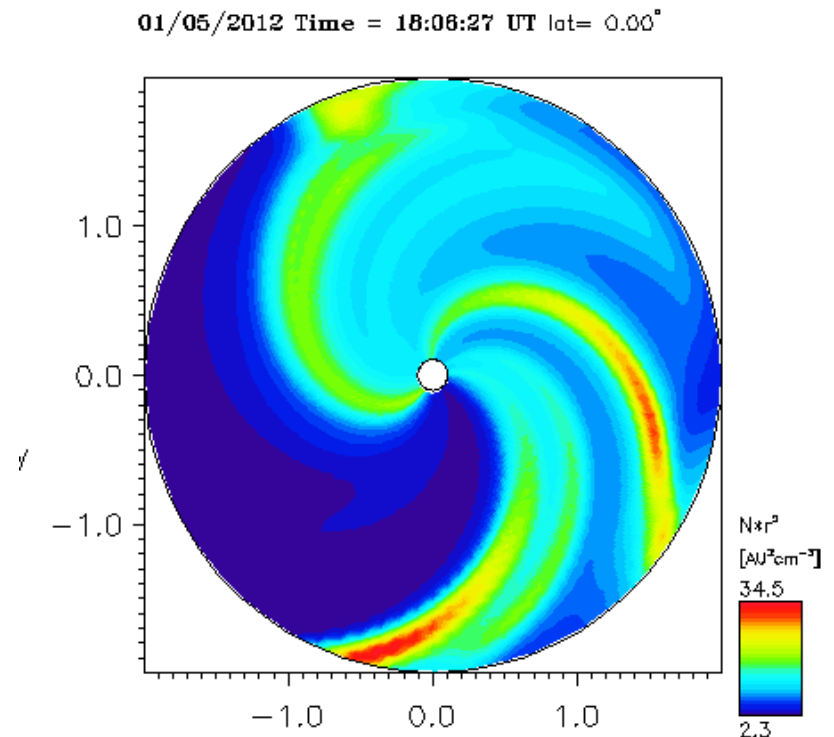
# Different interfaces : ex. with the STEREO support page

*CCMC link leads to this iSWA plot*



Model at CCMC: ENLIL

*CCMC interface produces this plot*



Model at CCMC: ENLIL

Different time, no planet (right), no polB (right), ...

# General

- Relation between CCMC and iSWA results unclear:
  - Jumps from a CCMC page to ISWA page
  - Different plots, different times, different resolutions
- Data export to other tools is not straightforward – downloading/uploading files is tedious and WebServices-like access would be nice
- Output format (*data printout*) may be improved
- Despite these comments, CCMC is a very useful service for many usages; thank you and go on !