

## 3DVIEW Tutorial Version 2.0



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### Revision History

Version	Date	Released by	Detail
1.0	July 17 <sup>th</sup> 2015	Michel Gangloff	Initial version
1.11	October 7 <sup>th</sup> 2016	Michel Gangloff	CDPP and Europlanet H2020 version Addition of a use case related to VESPA
1.11.2	May 4 <sup>th</sup> 2017	Laurent Beigbeder	Load map part completed and APIS map projection added for H2020 in §2.20
2.0	January 2 <sup>nd</sup> 2018	Michel Gangloff	Addition of a use case related to the Conjunction Search Tool §2.28

Note: Any notes here.

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## 1 INTRODUCTION

3DView offers 3D visualization of position and orientation of spacecraft and planetary ephemerides. This document contains several examples demonstrating some capabilities of 3DView developed during the IMPEX and Europlanet H2020 projects.

For a detailed description of the functions provided by 3DView, please read the User guide available at <http://3dview.cdpp.eu>

## 2 EXAMPLES

### 2.1 How to start 3DView

- Enter <http://3dview.cdpp.eu> in a browser

**CDPP** **3DView** **airap**

**Features:**

- Heliocentric view
- Bodies lighting and maps
- Orbit and attitude
- Instrument bore sight
- Bow shock and magnetopause
- Van allen belts (L-Shells)
- South Atlantic Anomaly
- Stars
- Ground traces
- Ground stations
- ASCII file data export
- Image and movies generation
- Simulation and observation data
- Cube, CDDA, spectra, vector and scalar visualisation

**2016/06/22 - V1.11**

- Parker spiral: Footprints of field lines are visible on the Sun
- Upload of trajectories in ASCII or VOtable
- 3D histogram for quantiles along spacecraft trajectories
- Addition of coordinate systems: RTN, RTP
- New orbit data for Pioneer 10&11, PVO, Phobos, ExoMars TGO
- Definition of the footprint altitude
- Addition of the ESA Cluster Science Archive
- Visualisation of CME
- Time interval and time step for individual S/C
- Plotting scalar quantiles along trajectories may be done in 4 possible orientations

[All release notes versions](#)

3DView/CDPP is a science tool that offers immediate 3D visualization of spacecraft position and attitude, planetary ephemerides, as well as scientific data representation (observations and models).

3DView/CDPP is a versatile, lightweight and interactive software, intended to be intuitive and easy to use.

The property licence is owned by CNES.

The following scientific missions are included: Cluster, Rosetta, Mars-Express, Venus-Express, Cassini, Galileo, Ulysses, Voyager1-2, Stereo, ACE, Wind, Geotail, SOHO, Giotto, Themis, Interball, ...

See the complete list [here](#).

Supplementary missions are regularly added.

3DView/CDPP is connected to the AMDA tools as well as to LATMOS, FMI and SINP model databases.

3DView/CDPP runs as a JAVA webstart application; it is compatible with WINDOWS XP, VISTA, SEVEN, as well as MAC OSX and LINUX \*

For a detailed description of the 3DView/CDPP capabilities, please read the [tutorial](#) and the [user guide](#).

\* JAVA 1.7.0\_45 or more recent required. See also [java3D requirements](#)

When using multiple screens, 3D scene must be initialized in main one.

[More pictures and movie samples](#)

[Launch 3DView](#)

**Logos:** cnes, Observatoire de Paris, CNRS, UNIVERSITÉ TOULOUSE III PAUL SABATIER, gfi, IMPEX, europlanet 2020 RI


**EUROPLANET 2020 RI**

Europlanet 2020 RI has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208

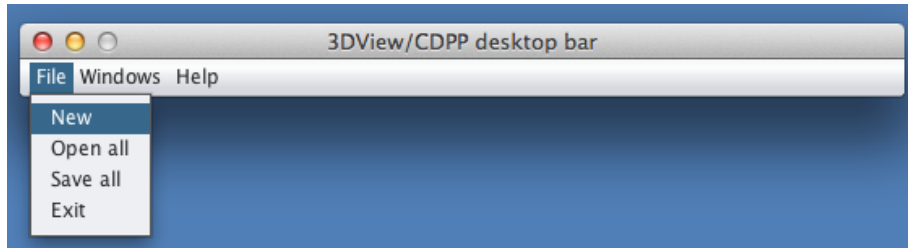
[disclaimer](#) [contact](#)



## 3DView 2.0 Tutorial

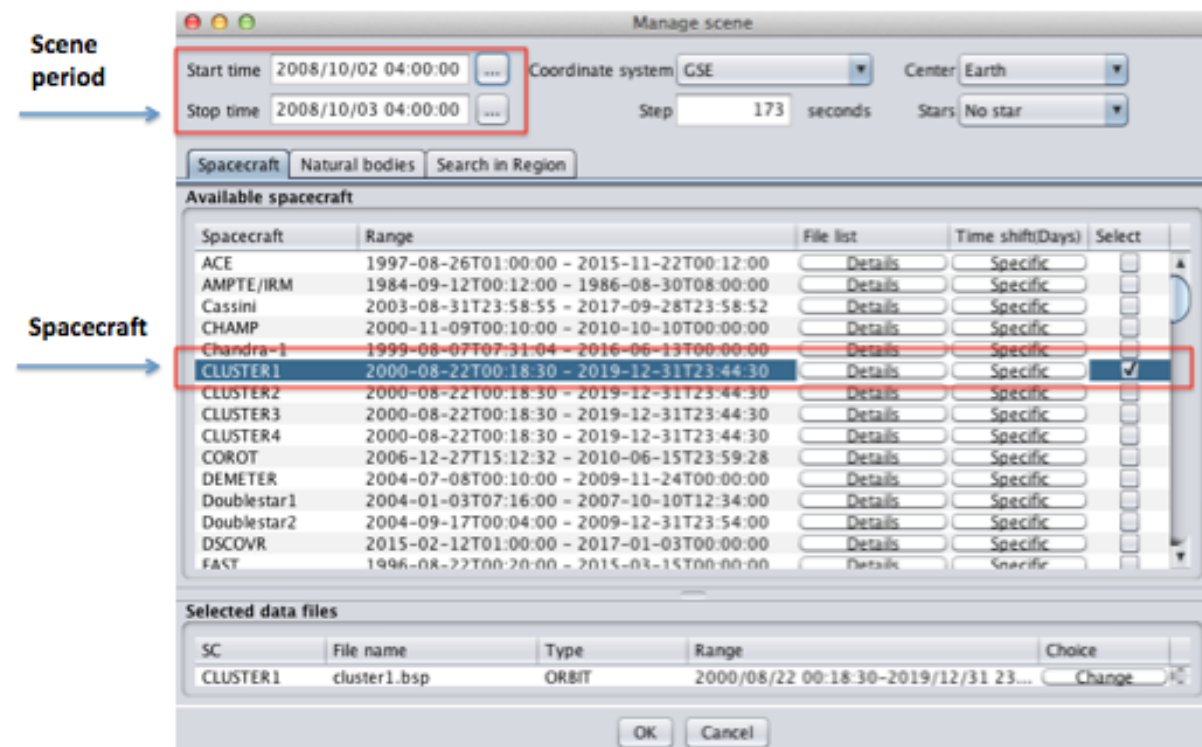
Click on , save the file as launch3dview.jnlp and run the application

- In the desktop bar, select “File/New to open a new 3D scene

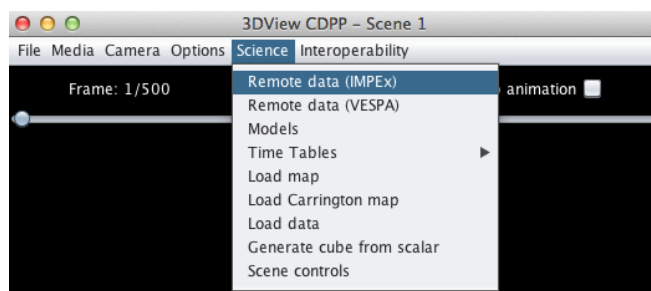


## 2.2 Compare simulations and observations along Cluster trajectory

- In the selection dialog box, select the following time interval  
Start time: 2008-10-02T04:00:00  
Stop time: 2008-10-03T04:00:00  
and the spacecraft: CLUSTER1

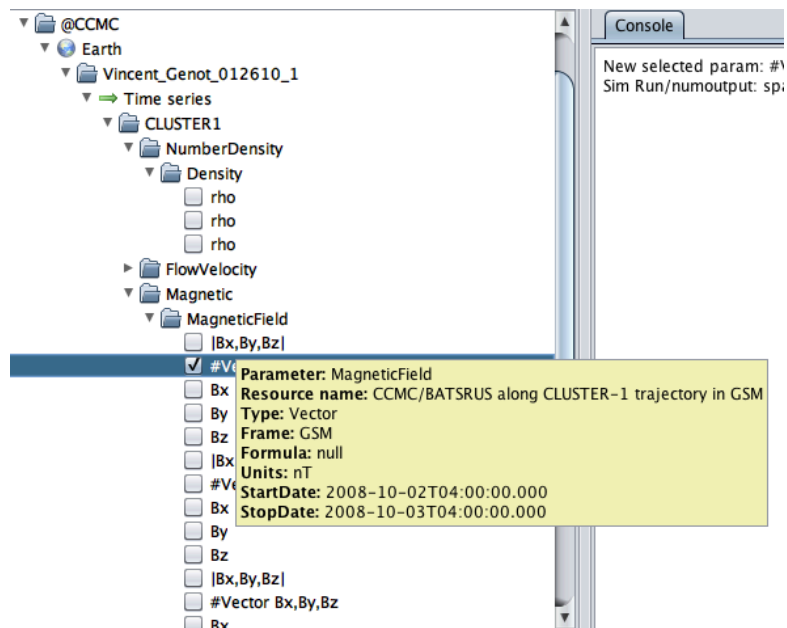


- Select **Remote data (IMPEX)** in the **Science** menu

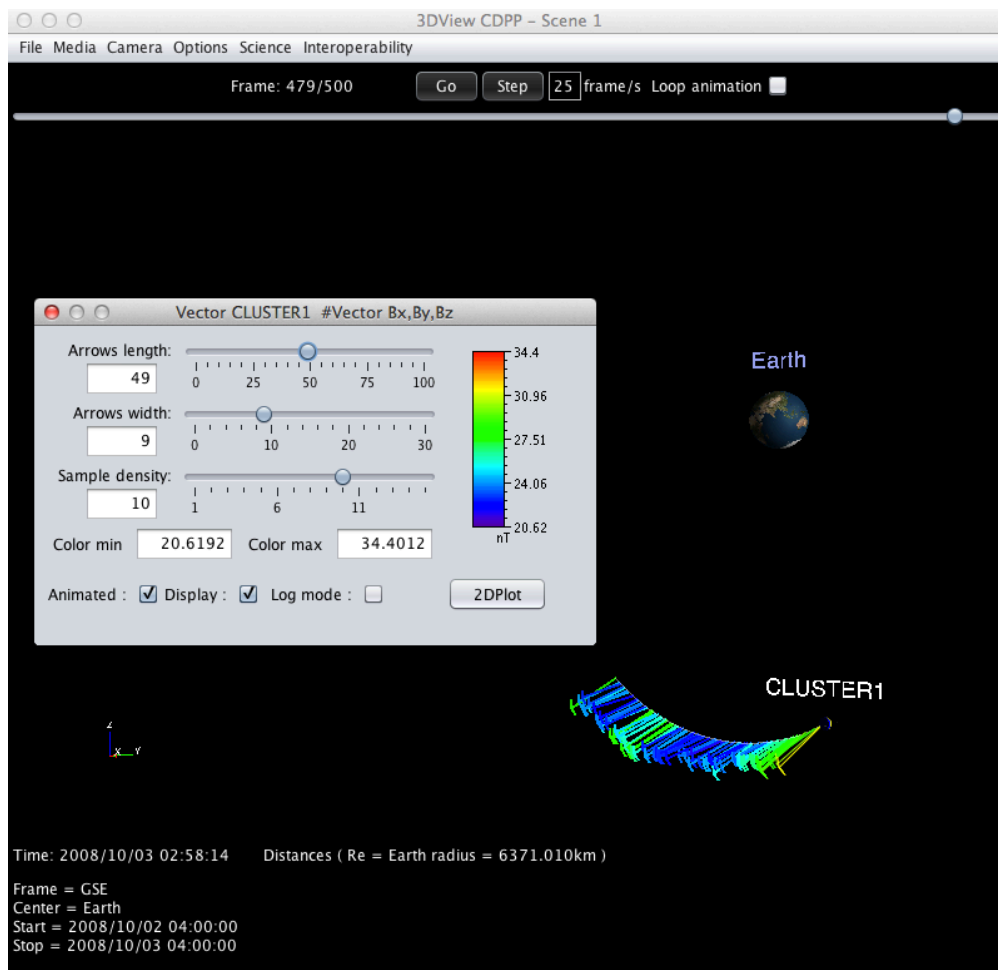


## 3DView 2.0 Tutorial

- Select the following simulation data

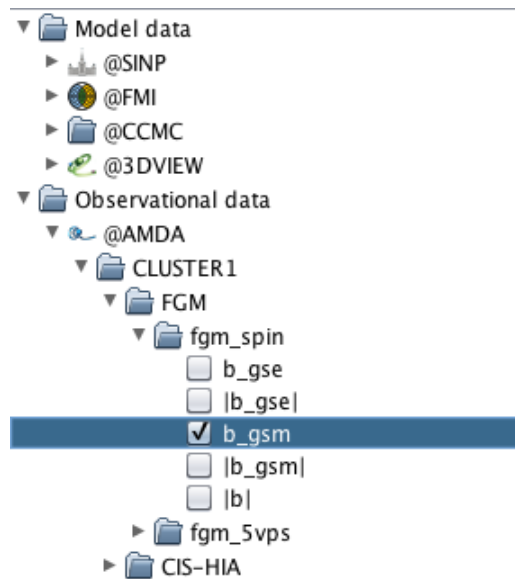


- Click on **Add selected data to 3Dscene**; a control window is opened and the magnetic field vector is displayed along the trajectory of the S/C

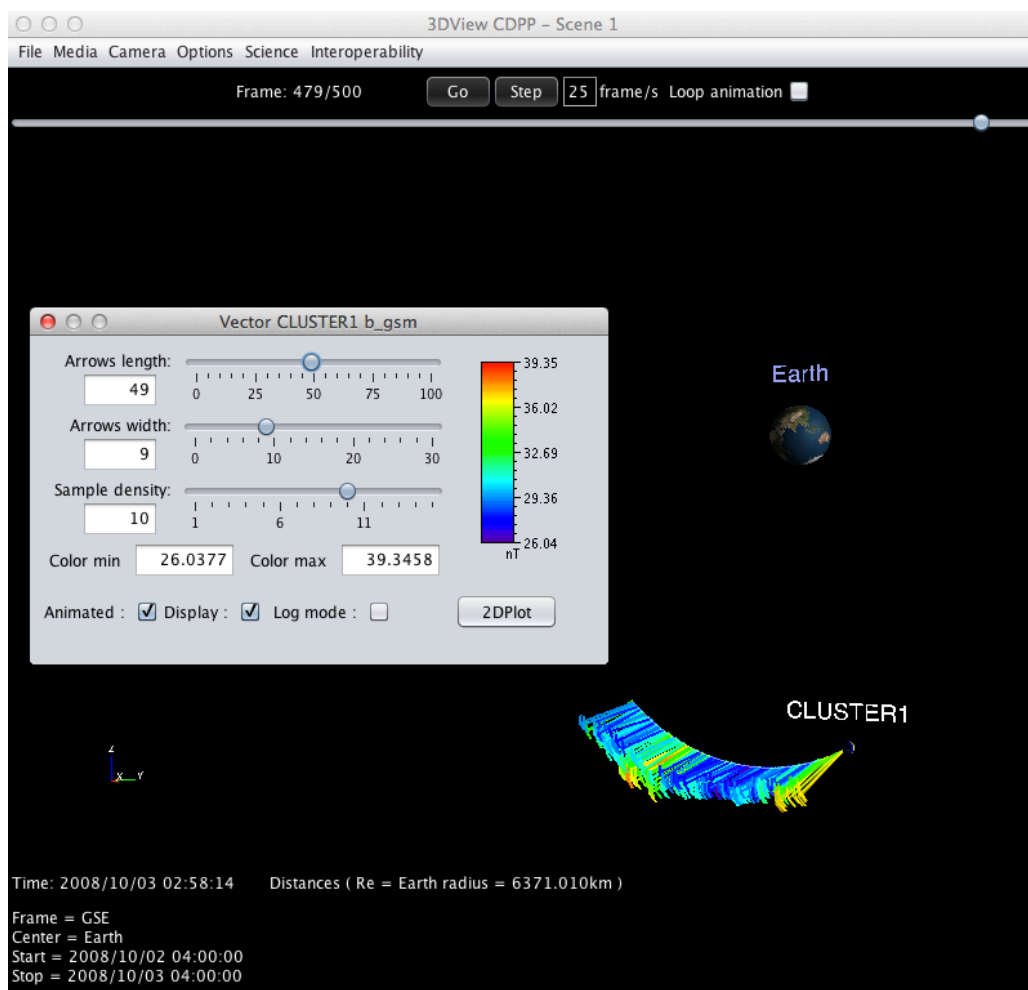


## 3DView 2.0 Tutorial

- Now, select from AMDA the observed magnetic field vector along the trajectory of CLUSTER1

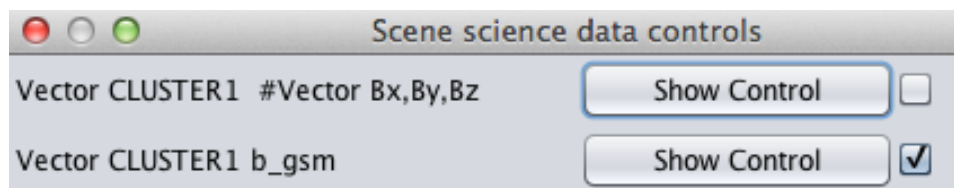
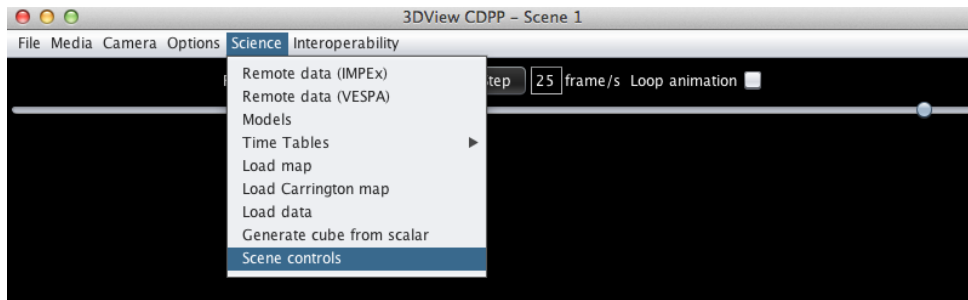


- Click on **Add selected data to the 3Dscene**



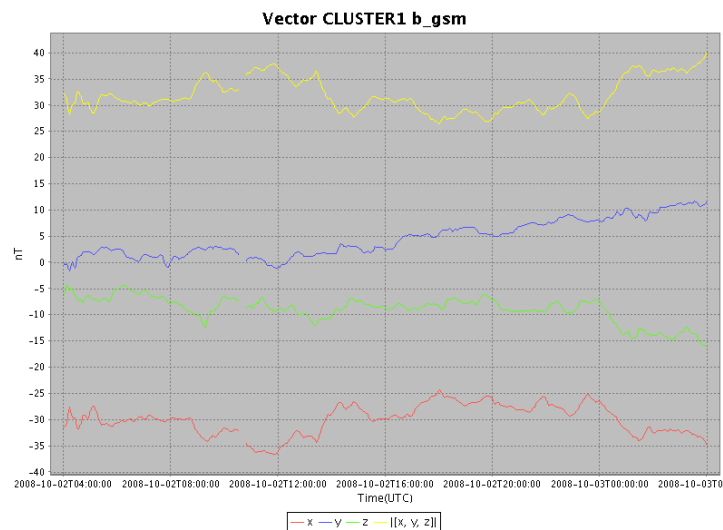
## 3DView 2.0 Tutorial

- Now, it is possible to select which vector is displayed on the scene with the **Science/Scene controls** menu

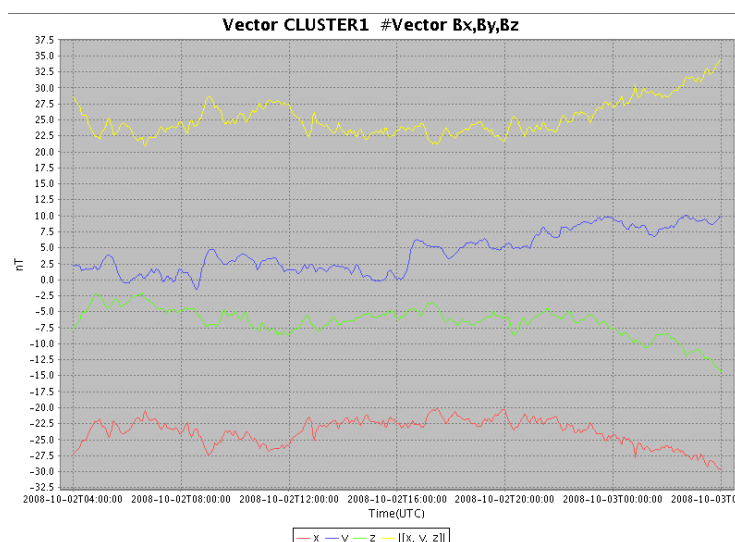


We will use the 2DPlot capability to compare simulations and observations in 2D.

- In the control box of *b\_gsm*, click on **2DPlot**



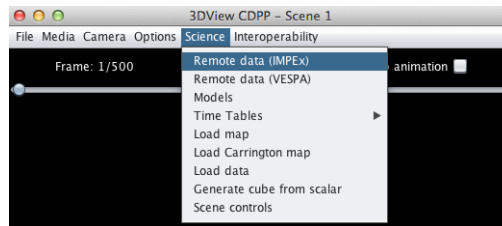
- In the control box of *#Vector Bx,By,Bz* click on **2DPlot**



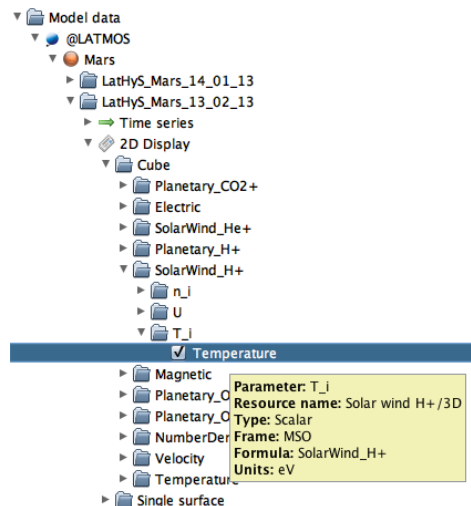
## 2.3 Select and display a parameter from a 3D Cube from LATMOS

In this use case, we select a standard parameter from a Cube provided by LATMOS and add it to the 3D scene. A Cut on every axis, with its control box is displayed in the 3D scene.

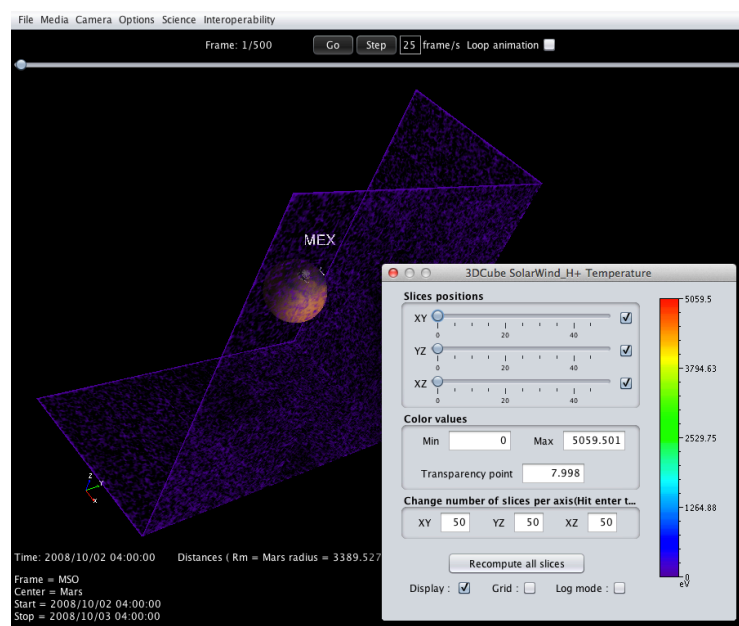
- With the “Manage Scene” window, create a scene with:
  - Start: 2008/10/02 04:00:00
  - End: 2008/10/03 04:00:00
  - Spacecraft: MEX, Coordinate System: MSO
- Select the Science/Remote data (IMPEX) menu:



- This opens the hierarchy of IMPEX data. Select the following parameter, in a Cube from LATMOS:

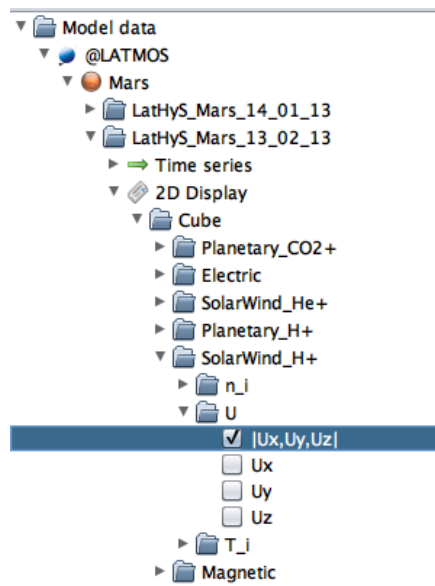


- Then click on *add to the 3D scene*. The following figure is displayed with its control box.

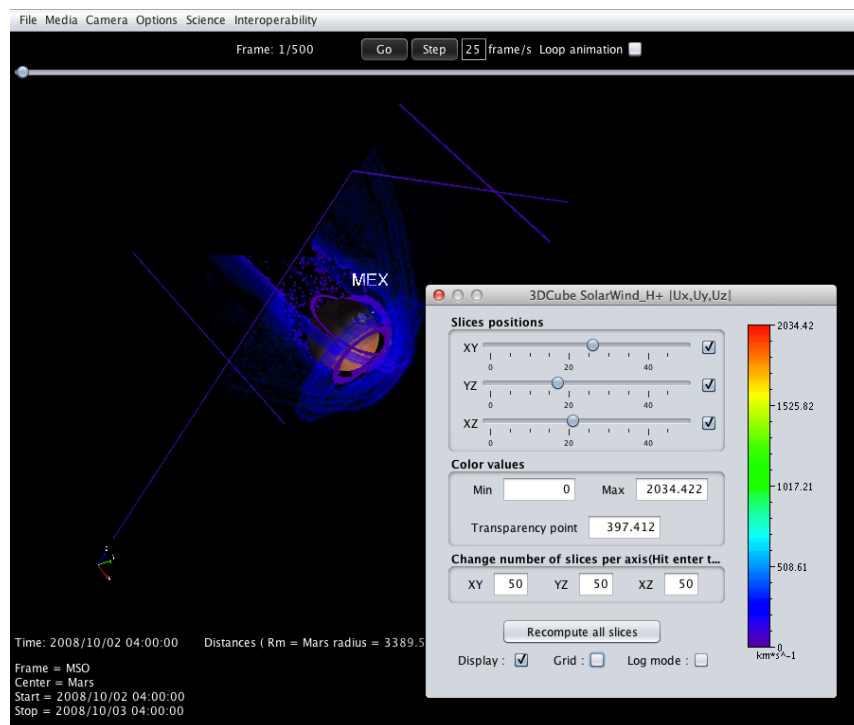


## 3DView 2.0 Tutorial

- Now select the module of a parameter of type “vector”:

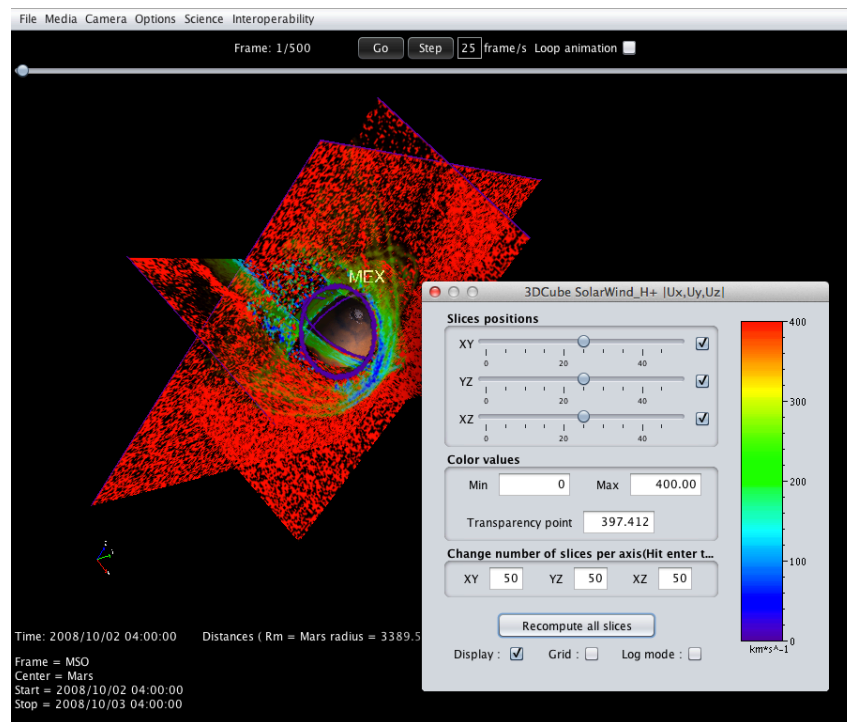


- Then click on *add to the 3D scene*. The following figure is displayed with its control box.

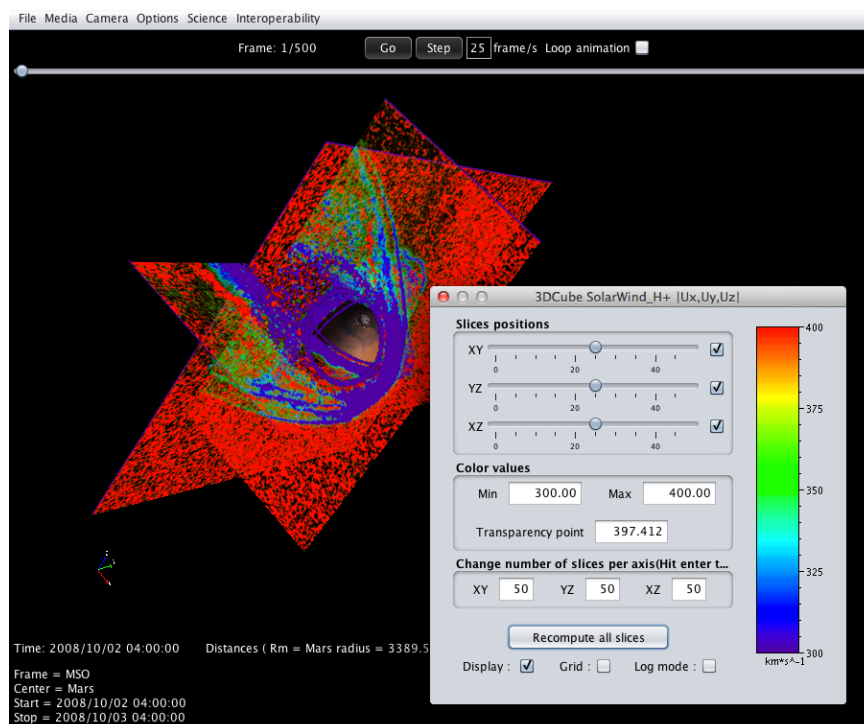


- Use the cursors to change the position of cuts displayed on each axis (slices positions), directly on the 3D scene.
- Set Max = 400 and click on « Recompute all slices ». The cube values that are greater than Max are displayed in red, and the colour bar is updated.

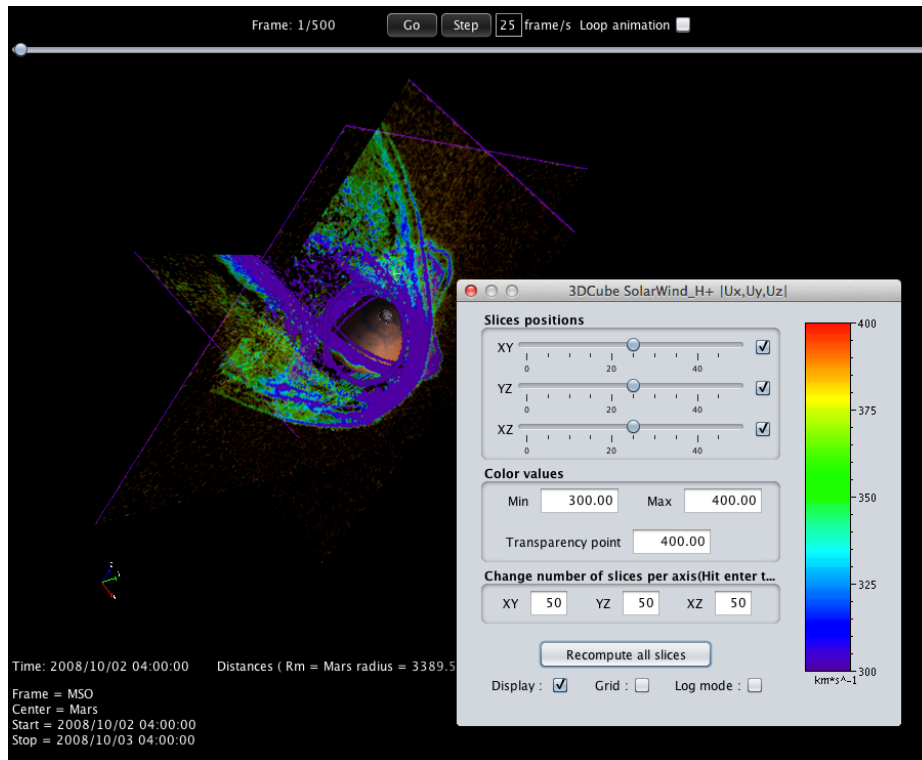
## 3DView 2.0 Tutorial



- Set Min = 300 and click on « Recompute all slices ». The cube values that are lower than Min are now transparent.



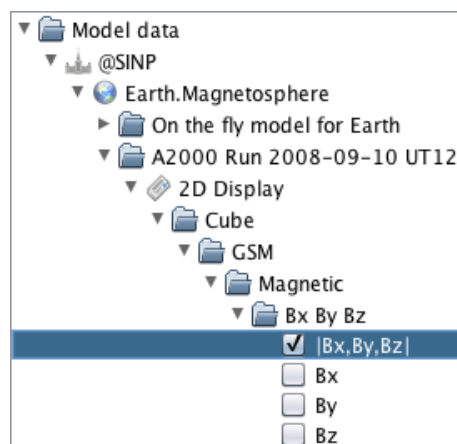
- Set Transparency point = 400 and click on « Recompute all slices ». Values that are close to Mean are transparent. For example, this value corresponding to Max, are values in red are now transparent.



### 2.4 Select and display a parameter from a 3D Cube from SINP

In this use case, we select a standard parameter from a Cube provided by SINP and add it to the 3D scene. A Cut on every axis, with a control box is displayed in the 3D scene.

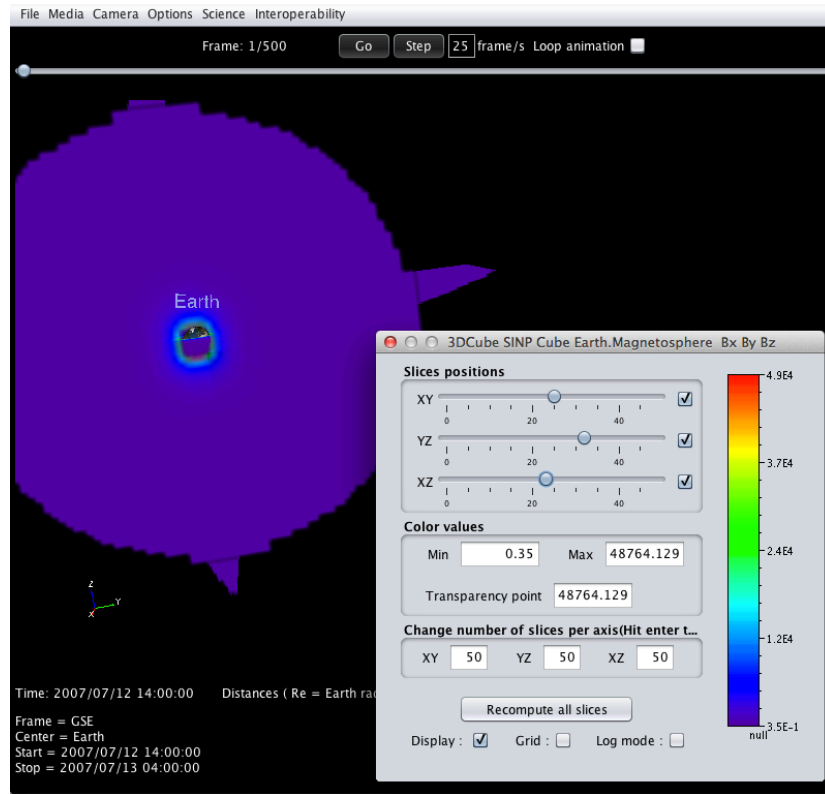
- Select the Science/Remote data (IMPEX) menu, to open the hierarchy of IMPEX data. Select the following parameter, in a Cube from SINP:



- Then click on *add to the 3D scene*. The following figure is displayed with its control box.

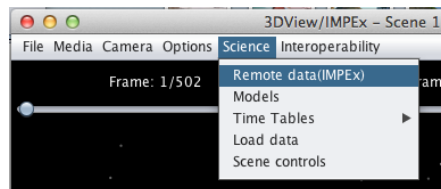


## 3DView 2.0 Tutorial

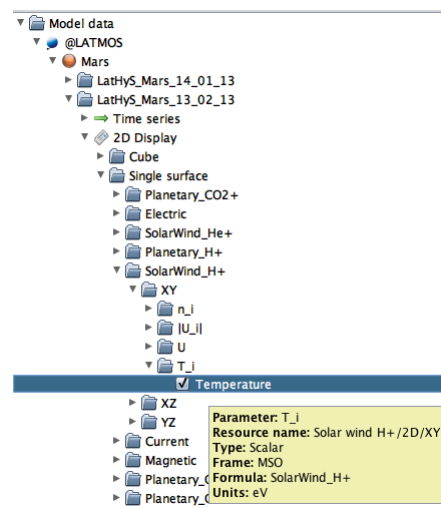


### 2.5 Select and display a 2D Cut

- With the “Manage Scene” window, create a scene with:
  - Start: 2008/10/02 04:00:00
  - End: 2008/10/03 04:00:00
  - Spacecraft: MEX, Coordinate System: MSO
- Select the Science/Remote data (IMPEX) menu:

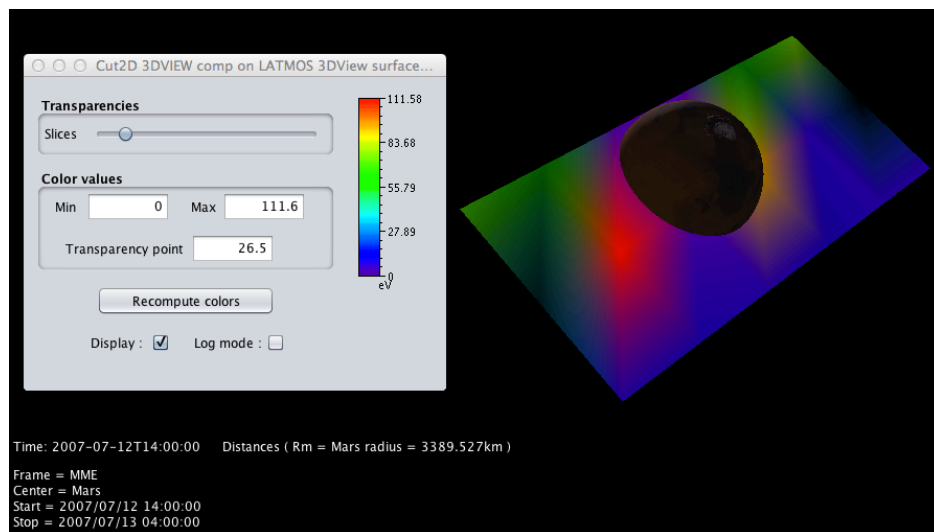


- Select the following parameter, a 2D Cut from LATMOS:

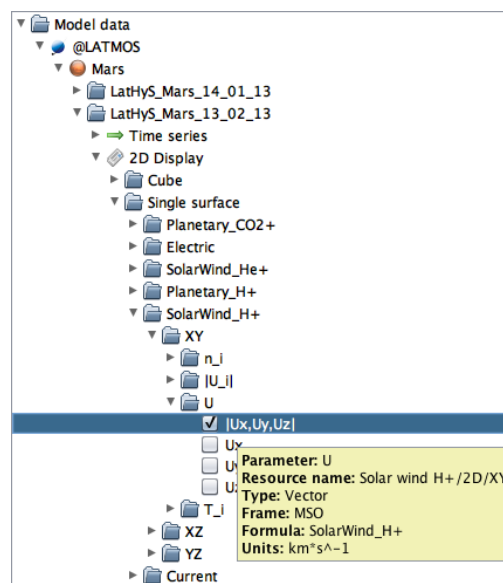


## 3DView 2.0 Tutorial

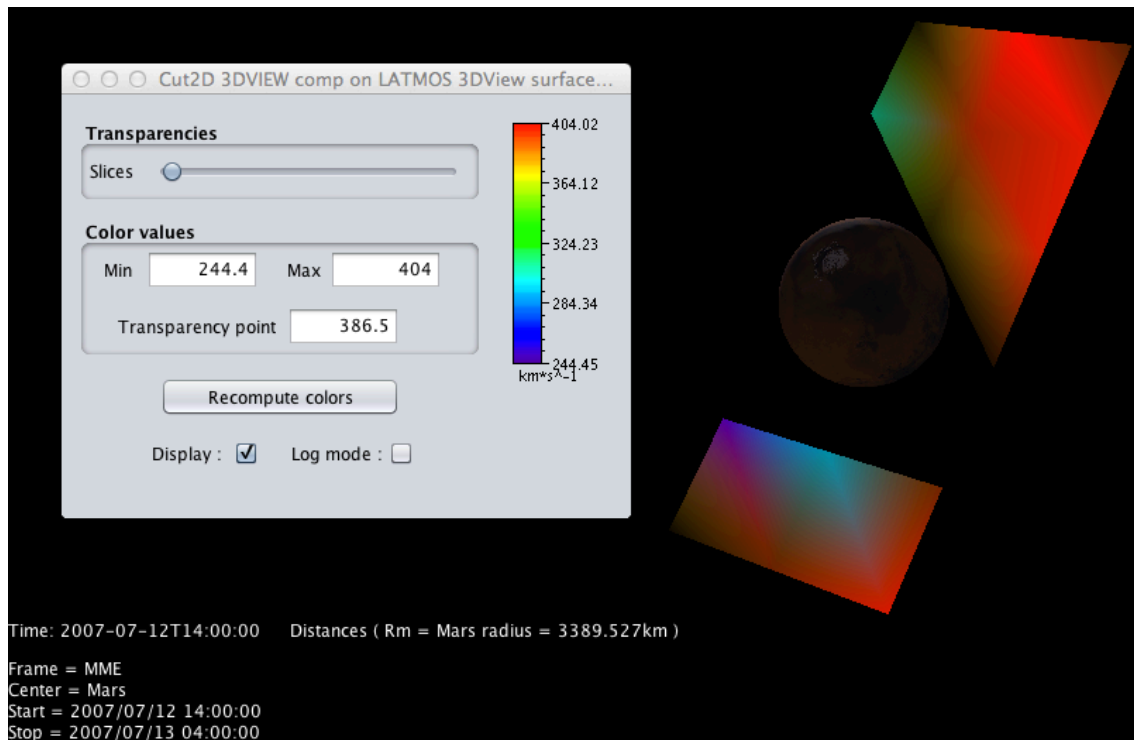
- Then click on *add to the 3D scene*. The Cut and a control box are displayed in the 3D scene.



- Now select the module of a "vector" parameter:

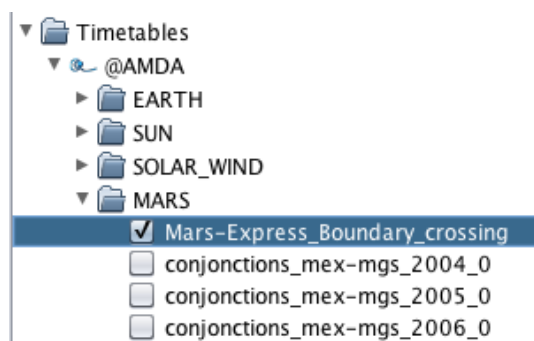


- Then click on *add to the 3D scene*. The Cut and a control box are displayed in the 3D scene.

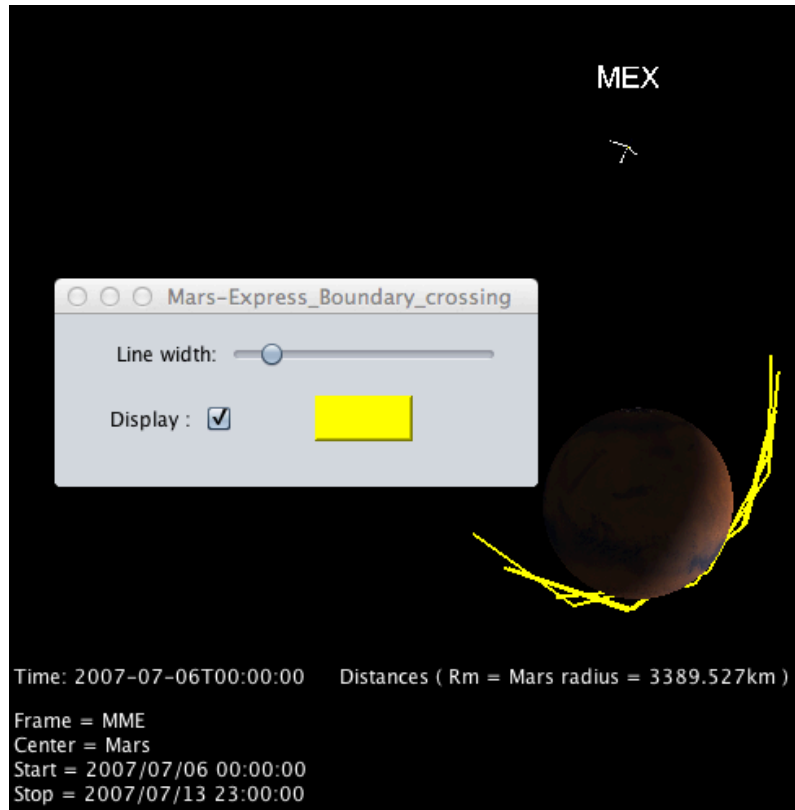


### 2.6 Select and display a Time Table

- Create a scene with MEX from 2007-07-06T00:00:00 to 2007-07-13T23:00:00.
- Select the Science/Remote data (IMPEX) menu to open the hierarchy of IMPEX data.
- Select the following time table and add it to the 3D scene



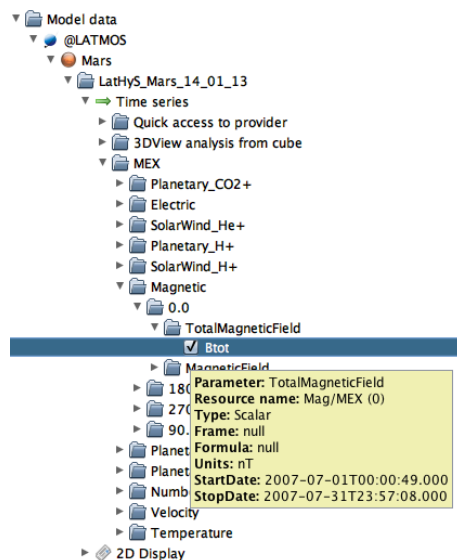
- The trajectory is highlighted from the position of MEX, and a control box is displayed



- Click on the color associated with the zone to change it. The cursor may be used to change the depth of the highlighted zone
- The list of Time Tables displayed in the 3D scene can be displayed via the **Science/Scene controls** menu

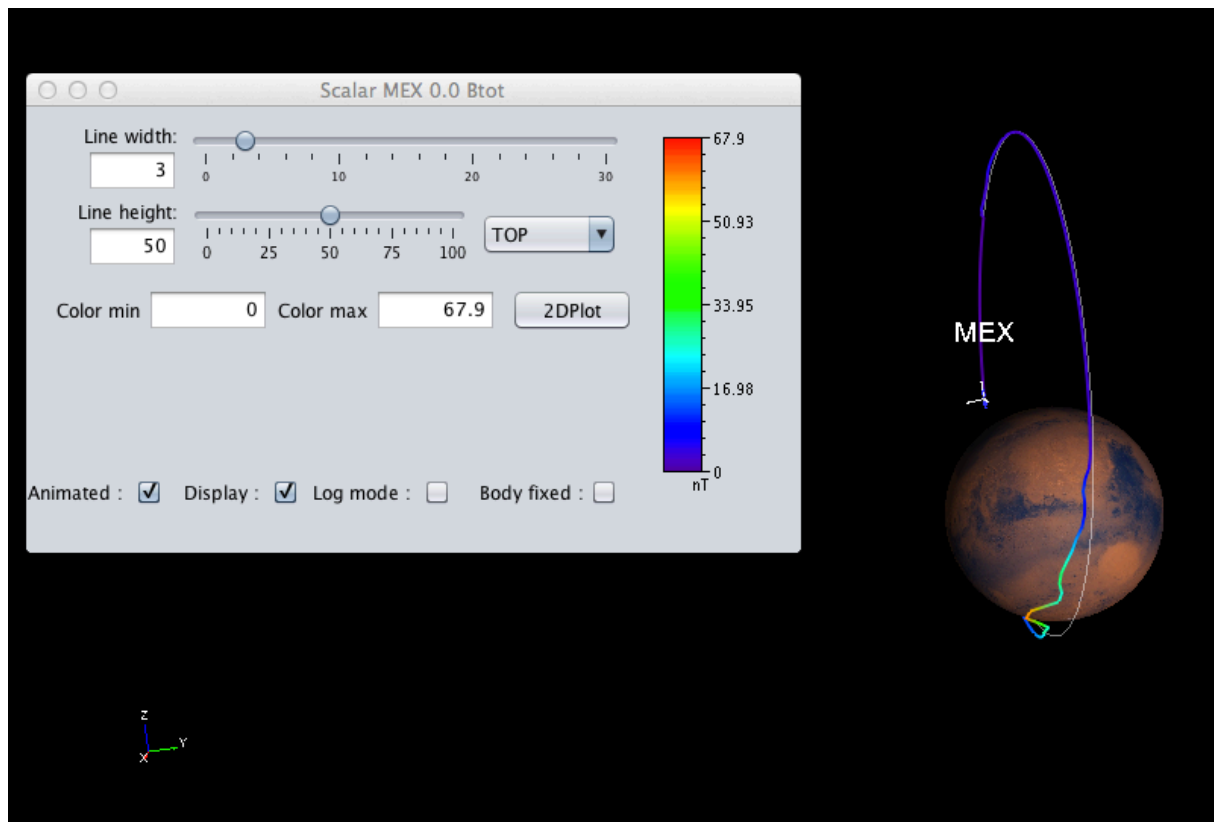
## 2.7 Select and Display Time Series

- Create a scene with MEX from 2007-07-12T14:00:00 to 2007-07-13T04:00:00 and move the cursor to the middle
- In the Science/Remote data (IMPEX) menu, select a scalar parameter

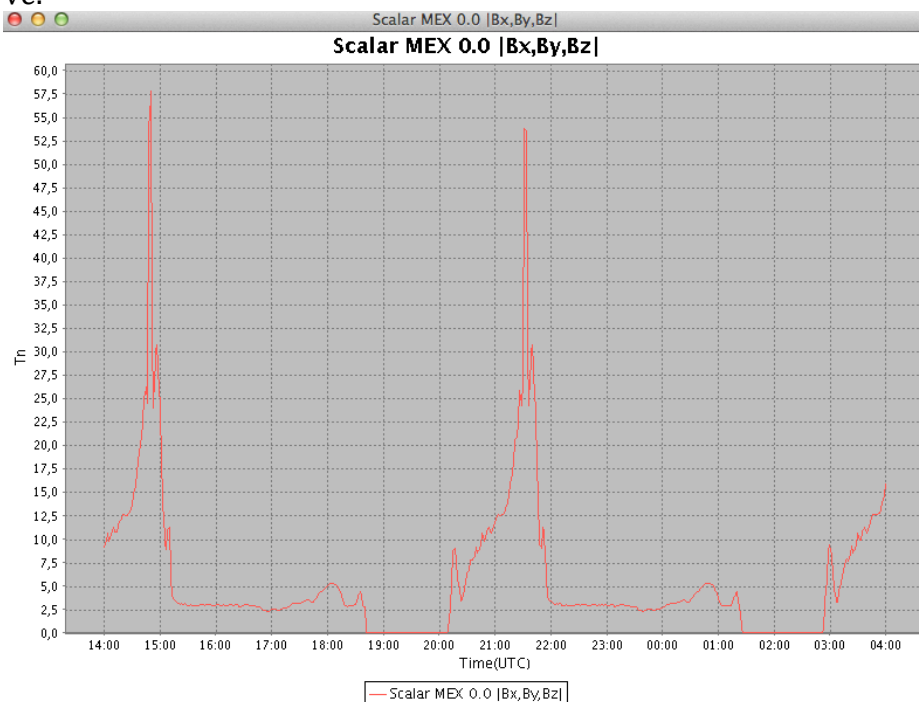


## 3DView 2.0 Tutorial

- Add it to the 3D scene. The parameter is displayed as a curve above the trajectory of the S/C

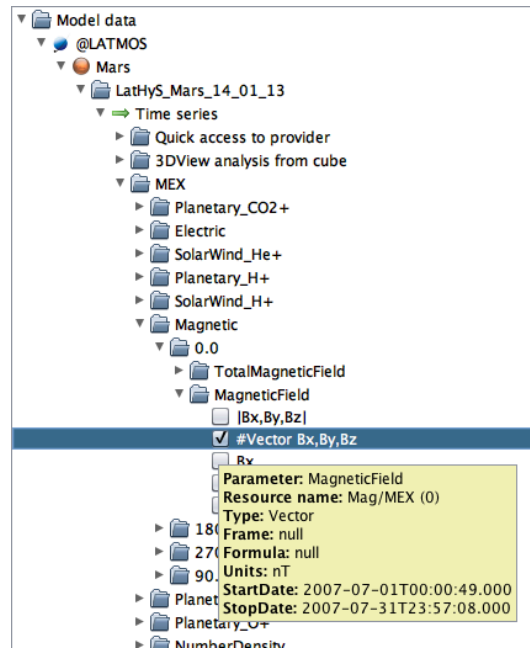


- Click on **2DPlot**. A window is opened, with the scalar parameter displayed as one curve.

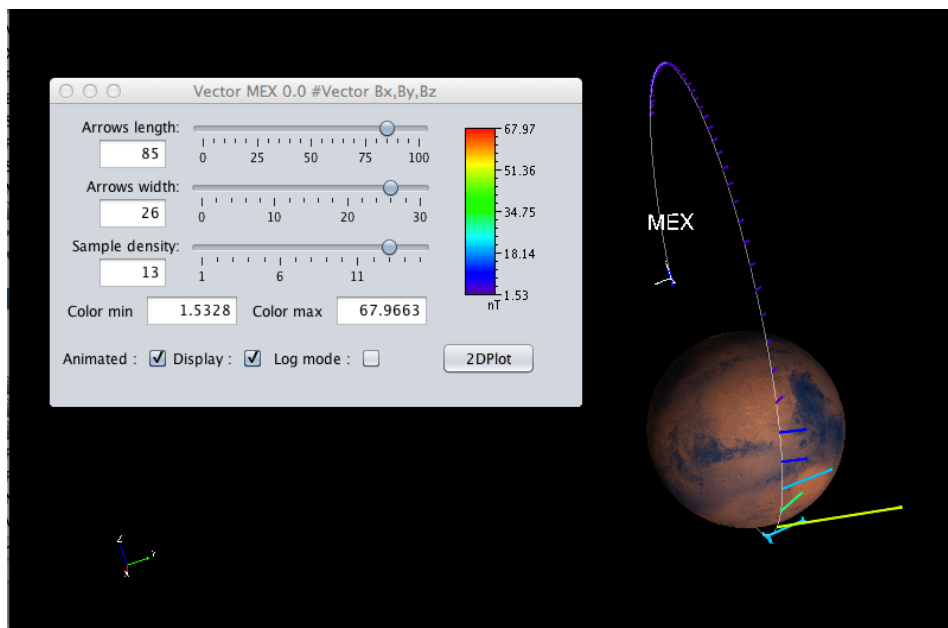


- Now, select a vector, and add it to the 3D scene

## 3DView 2.0 Tutorial

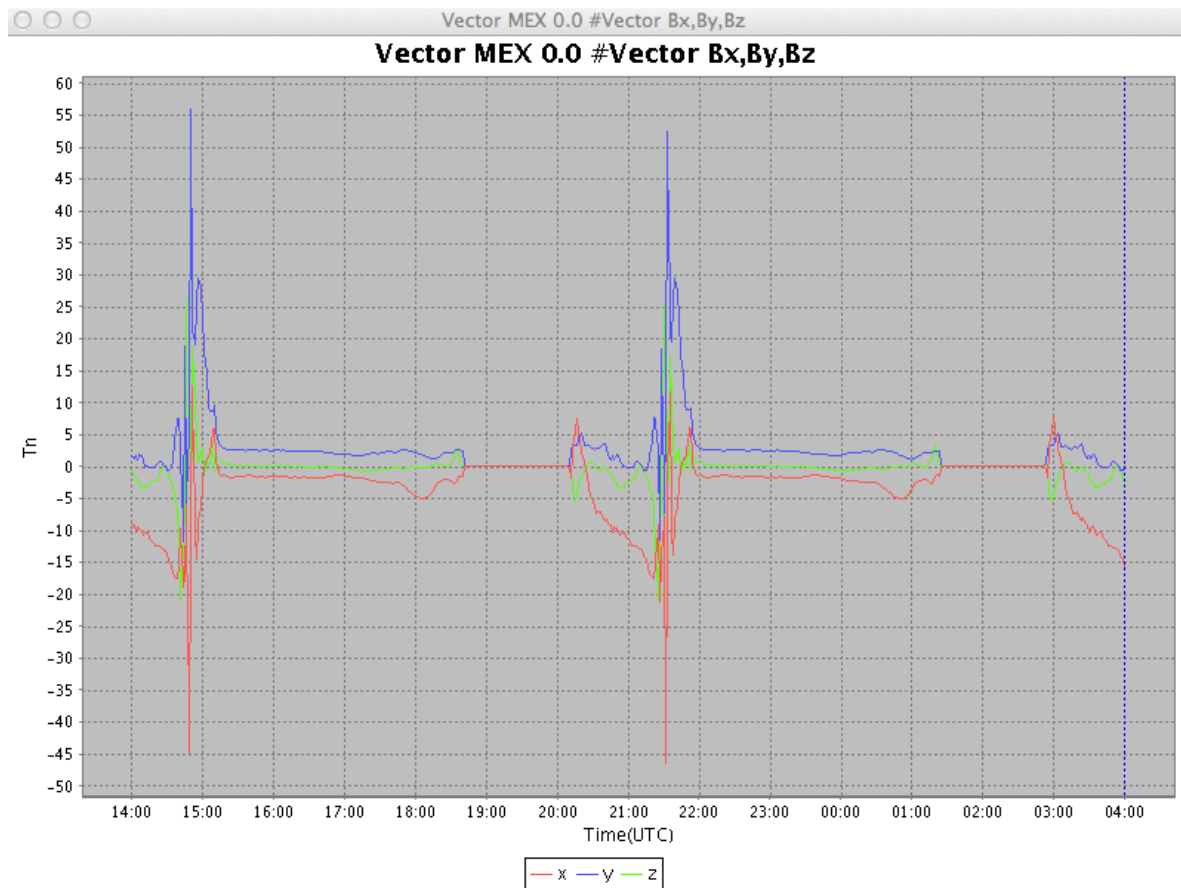


- The vector time series is displayed along the S/C trajectory

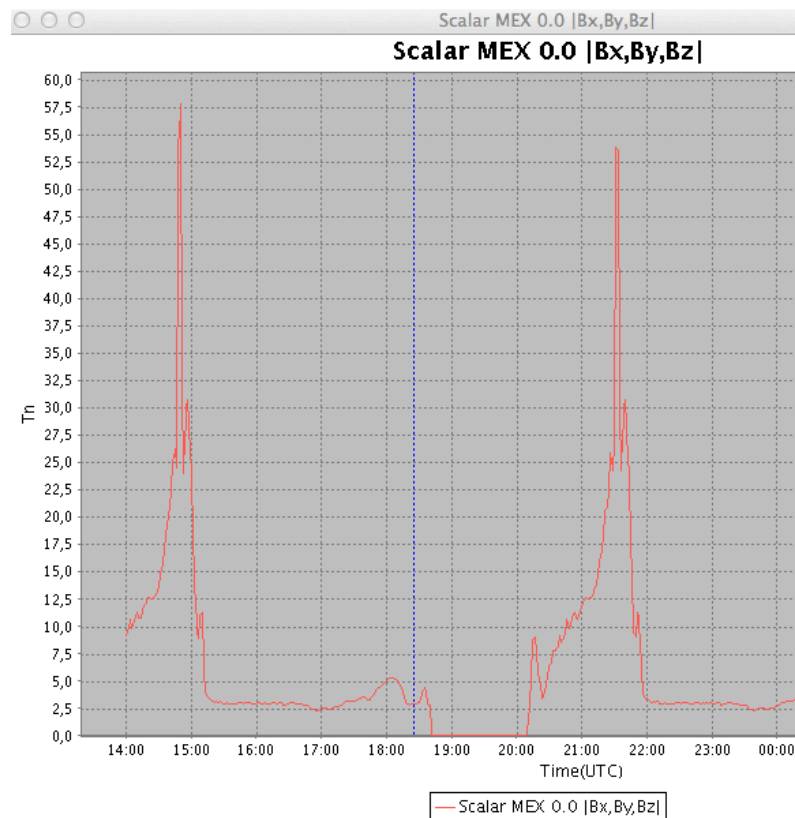


- Click on **2DPlot**. A Window containing the plot of 3 parameters x/y/z displayed as 3 curves of different colors is displayed

## 3DView 2.0 Tutorial



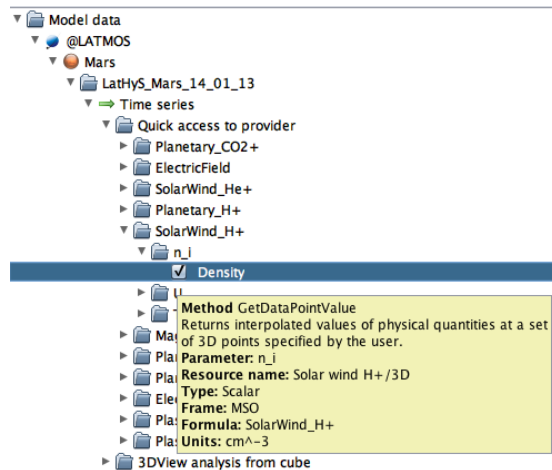
- During animation ("Go" in the 3D scene), a vertical cursor follows, in the 2D plot, the cursor of the 3D scene



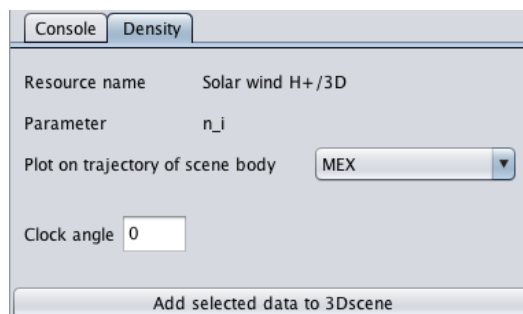
## 2.8 Interpolation of a physical quantity at a set of 3D points

In this example, the interpolation of a physical quantity (scalar or vector) is done with the `getDataPointValue` method of LATMOS at a set of 3D points defined by the user.

- With the **File/Manage scene** menu, create a scene with MEX from 2007-07-12T14:00:00 to 2007-07-13T04:00:00 and move the cursor to the middle
- In the Science/Remote data (IMPEX) menu, select



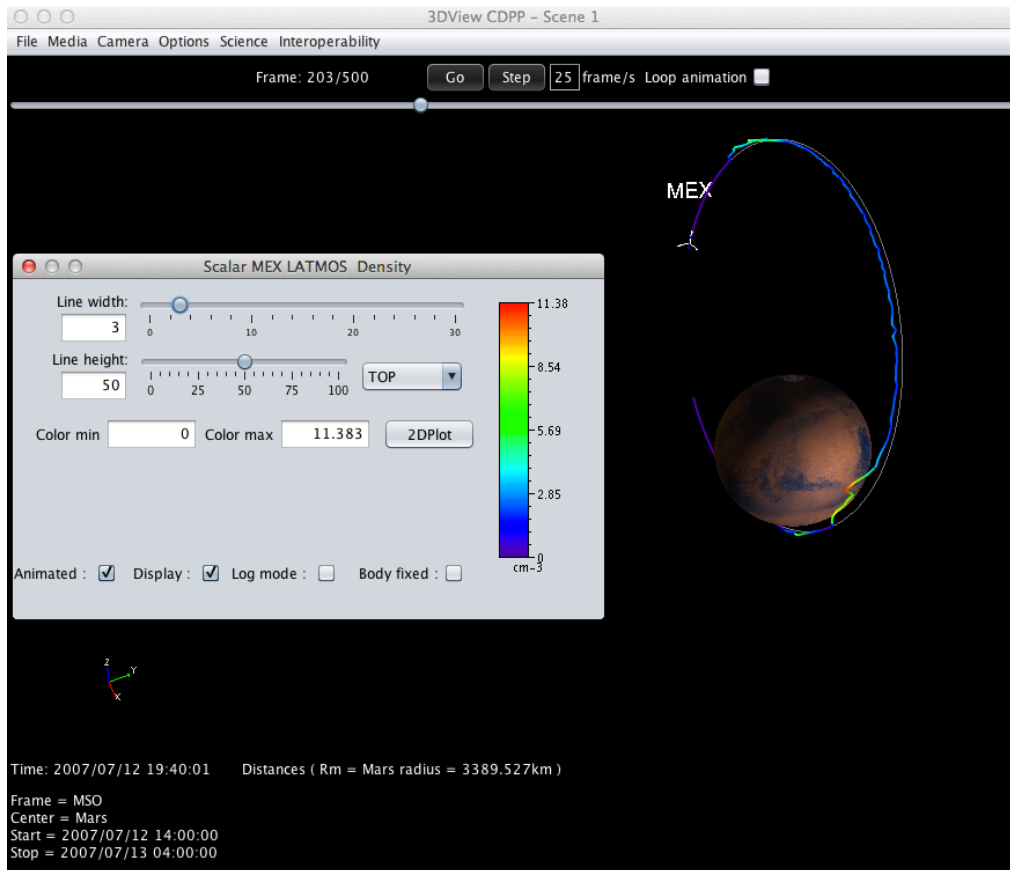
- In the panel on the right part, there is a tab containing the “Clock Angle” and the spacecraft for which we want data. When you unselect the parameter, the tab disappears



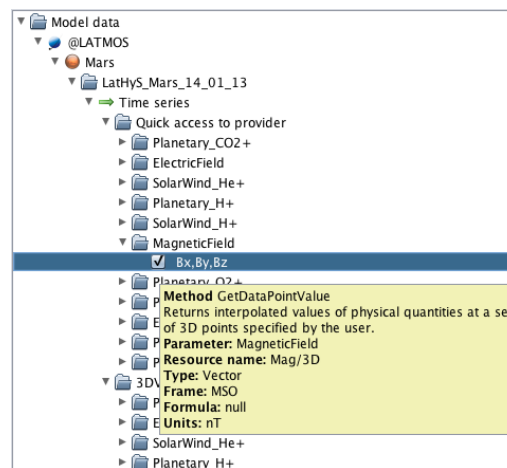
- Click on **Add selected data to 3D scene**. When you unselect **Animated**, a curve is displayed above the spacecraft’s trajectory, with the associated control box



## 3DView 2.0 Tutorial

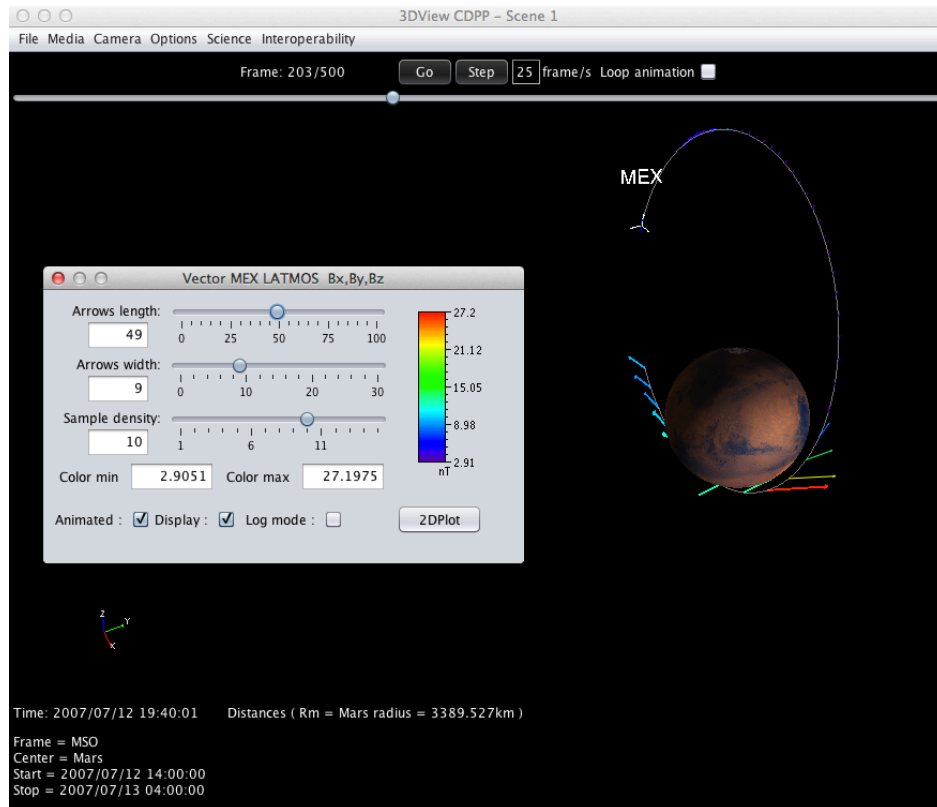


- Now, in the **Science/Remote data (IMPEX)** menu, select a vector



- In the panel on the right part, there is a tab containing the “Clock Angle” and the spacecraft for which we want data.
- Click on **Add selected data to 3D scene**. When you unselect **Animated**, a set of vectors is displayed above the spacecraft’s trajectory, with the associated control box

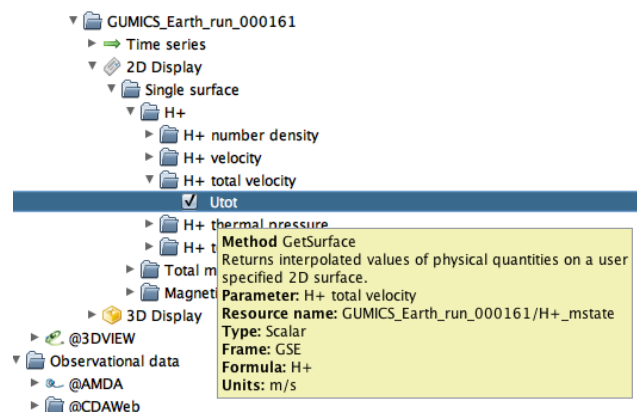
## 3DView 2.0 Tutorial



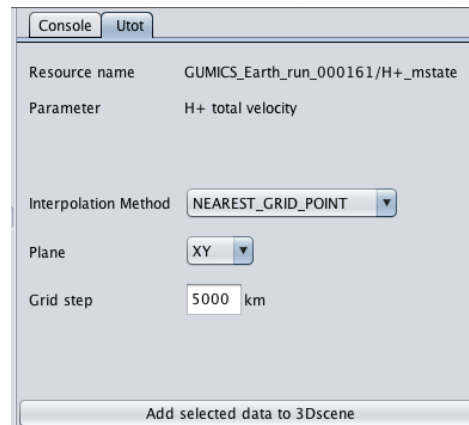
### 2.9 Interpolation of a physical quantity on a 2D surface

In this example, the interpolation of a physical quantity (scalar or vector) is done with the *getSurface* method of FMI on a 2D surface defined by the user.

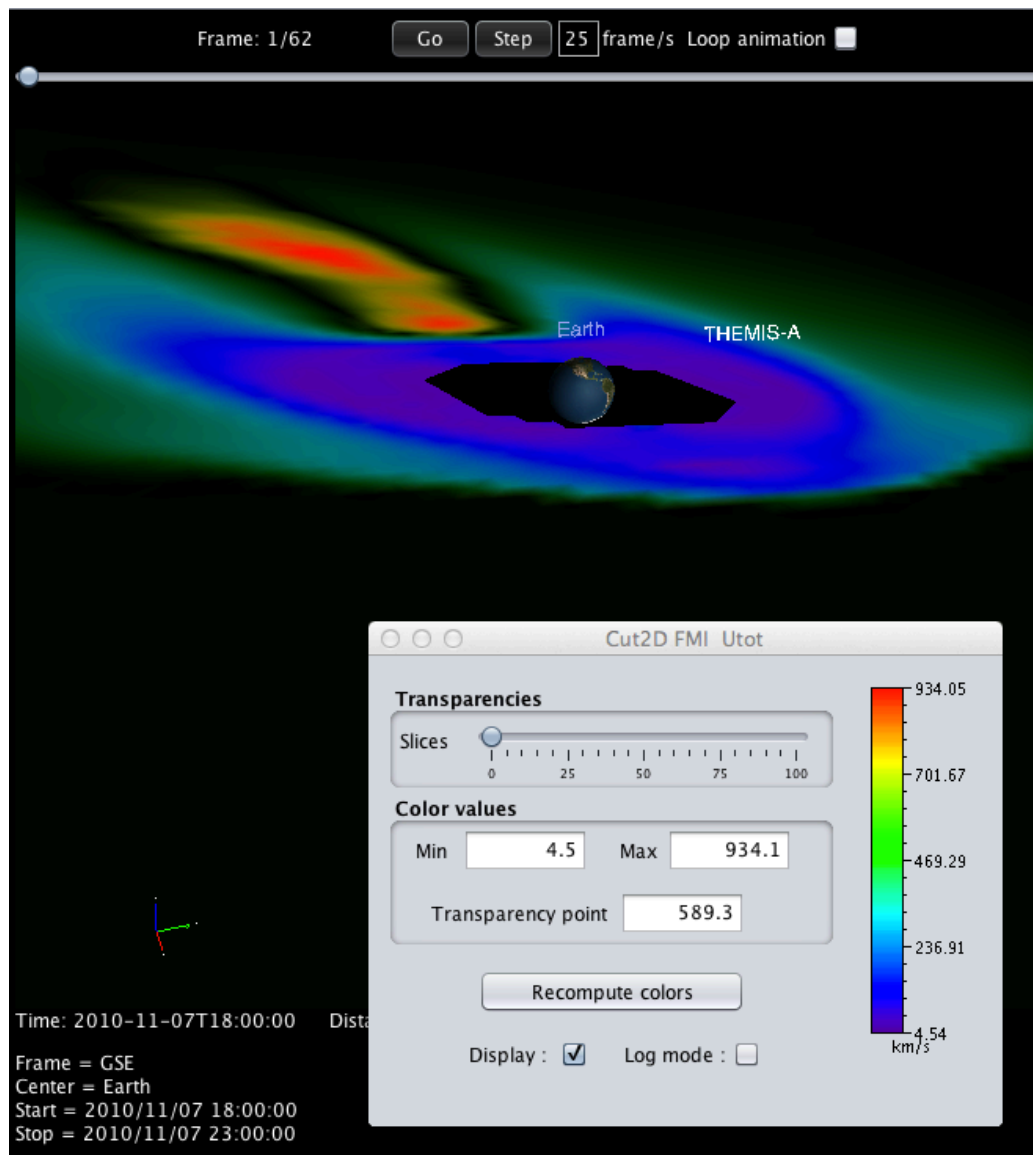
- With the **File/Manage scene** menu, create a scene in GSE coordinates with Themis A from 2010-11-07T18:00:00 to 2010-11-07T23:00:00 and move the cursor to the middle.
- In the **Science/Remote data (IMPEX)** menu, select *Model data/@FMI/Earth*, then



- In the panel on the right part, there is a tab containing the interpolation method, the plane name, and the grid step. When you unselect the parameter, the tab disappears



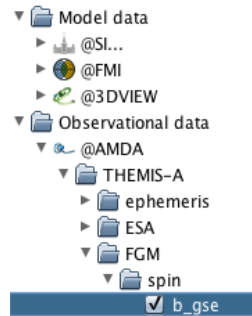
- Select 5000 for the step, plane XY and NEAREST\_GRID\_POINT as interpolation method. Please note that a too small step may infer a calculate time greater than 30 seconds and generate a time out error from the FMI server. Click on **Add selected data to 3D scene**
- A 2D Cut is displayed with its control box



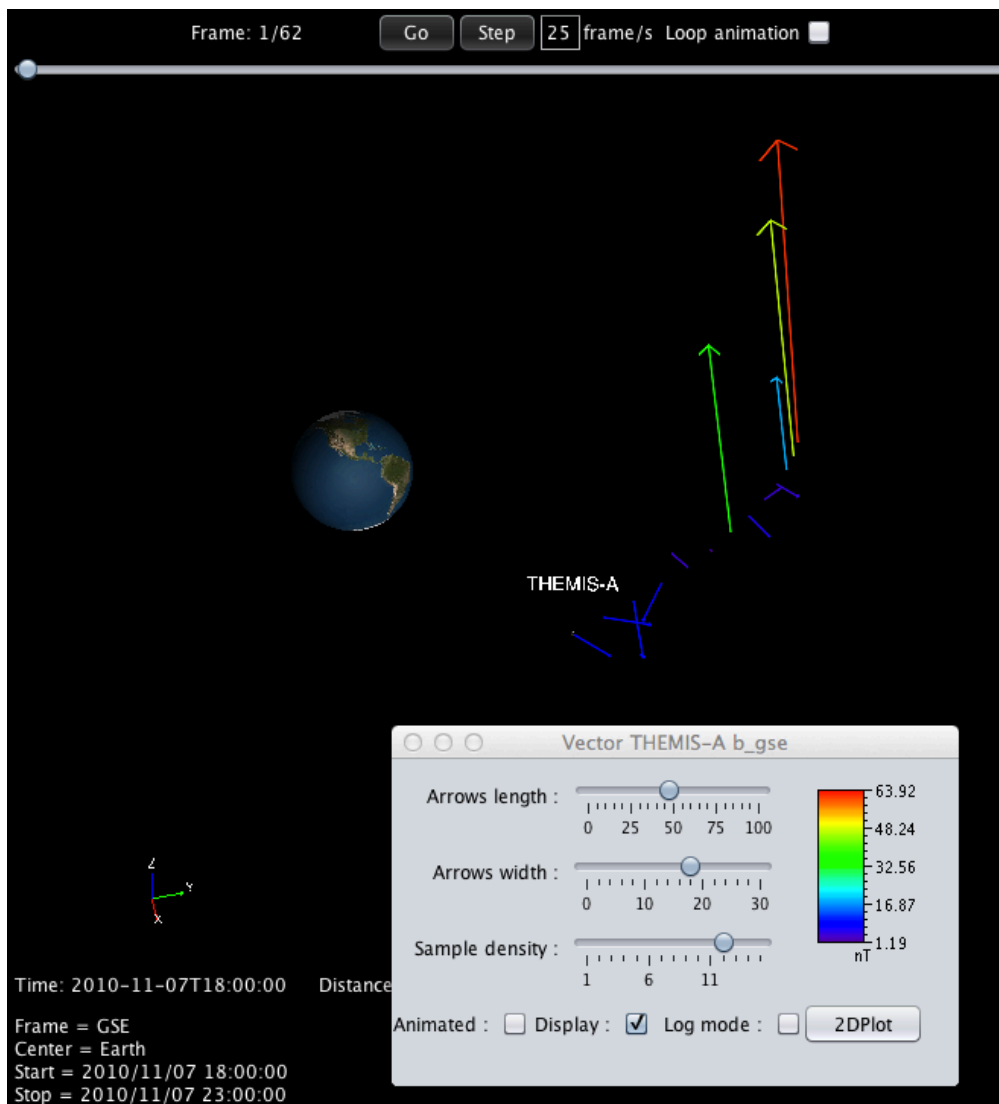
## 2.10 Get and Display a parameter from AMDA

In this example, the interpolation of a physical quantity (vector) along the trajectory of a spacecraft is done. The physical quantity is uploaded with the *getParameter* method of AMDA.

- With the **File/Manage scene** menu, create a scene in GSE coordinates with Themis A from 2010-11-07T18:00:00 to 2010-11-07T23:00:00 and move the cursor to the middle.
- In the **Science/Remote data (IMPEX)** menu, select



- Click on **Add selected data to 3D scene**

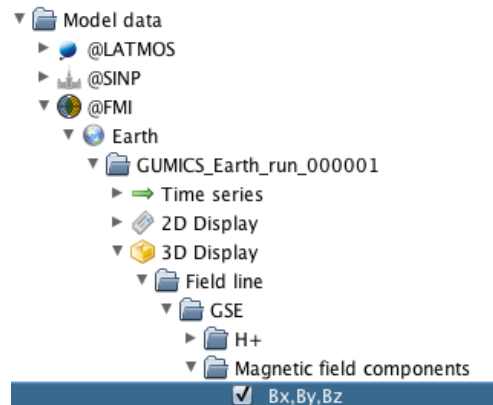


- When you unselect **Animated** the physical quantity is displayed in the form of a set of arrows along the trajectory of the spacecraft, with its associated control box.

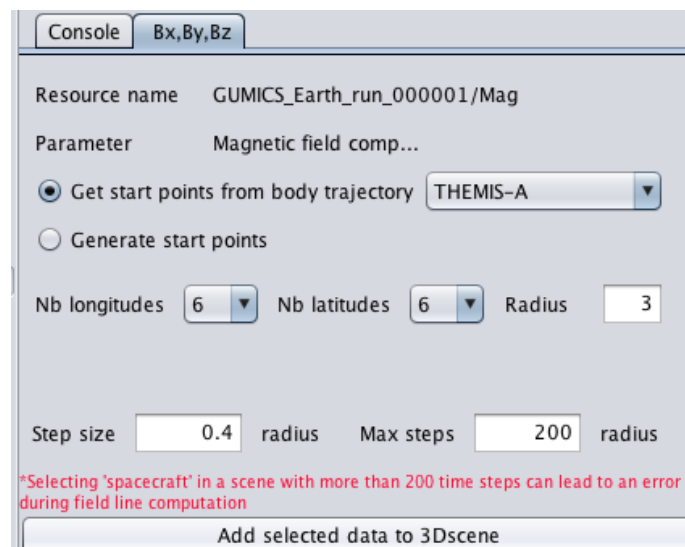
### 2.11 Display Magnetic Field Lines from a GUMICS run of FMI

In this example, the magnetic field lines are calculated with the *getFieldLine* method of FMI.

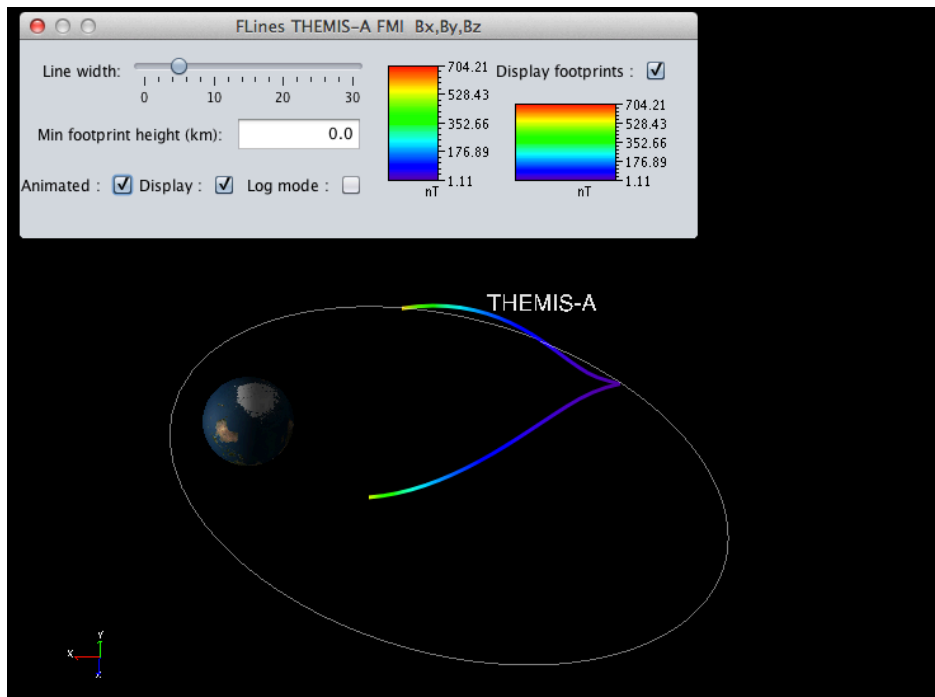
- With the **File/Manage scene** menu, create a scene in GSE coordinates with Themis A from 2010-03-27T00:00:00 to 2010-03-28T00:00:00 and a step of 500 seconds.
- In the **Science/Remote data (IMPEX)** menu, select the components of a magnetic field



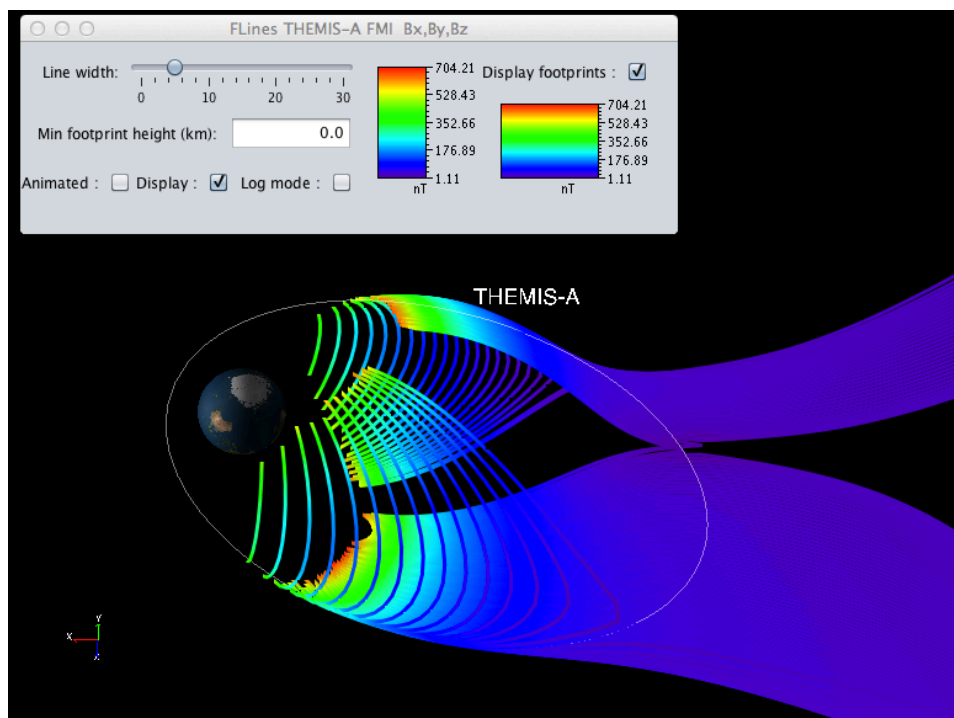
- A window called **Bx,By,Bz** is displayed in the right panel.



- Select the **Get start points from body trajectory** option with THEMIS-A as spacecraft and click on **Add selected data to 3Dscene**. A single line, corresponding to THEMIS-A is displayed.



- Unselect **Animated** option to display the set of field lines

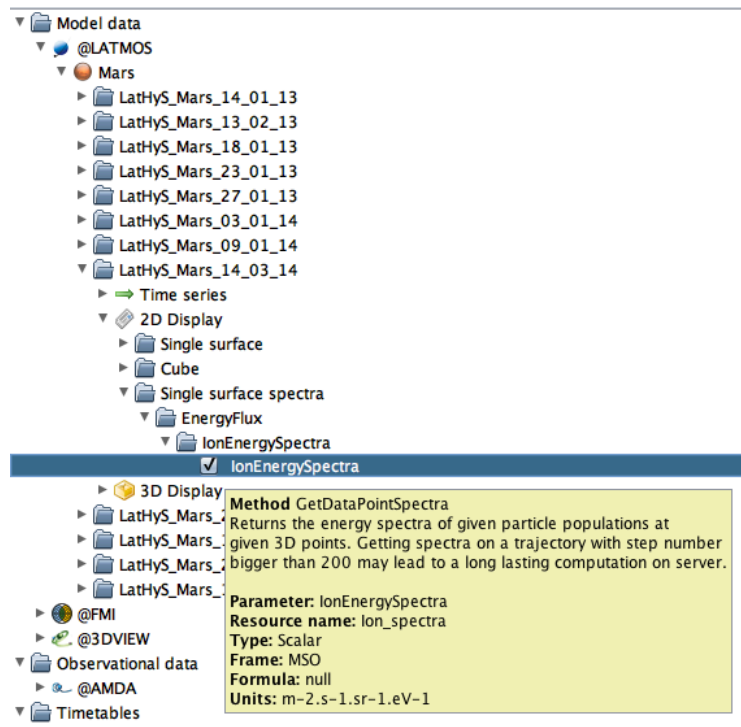


### 2.12 Display an Energy spectrum of LATMOS

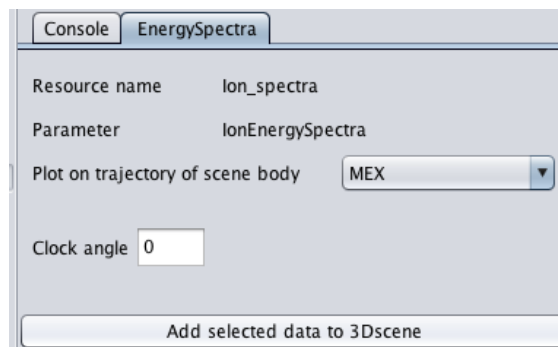
In this example, the energy spectrum of given particle populations at given points in 3D is displayed, using the *getDataPointSpectra* method of LATMOS.

- With the **File/Manage scene** menu, create a scene in MSO coordinates with MEX from 2010-03-27T00:00:00 to 2010-03-28T01:00:00 and a step of 7 seconds.

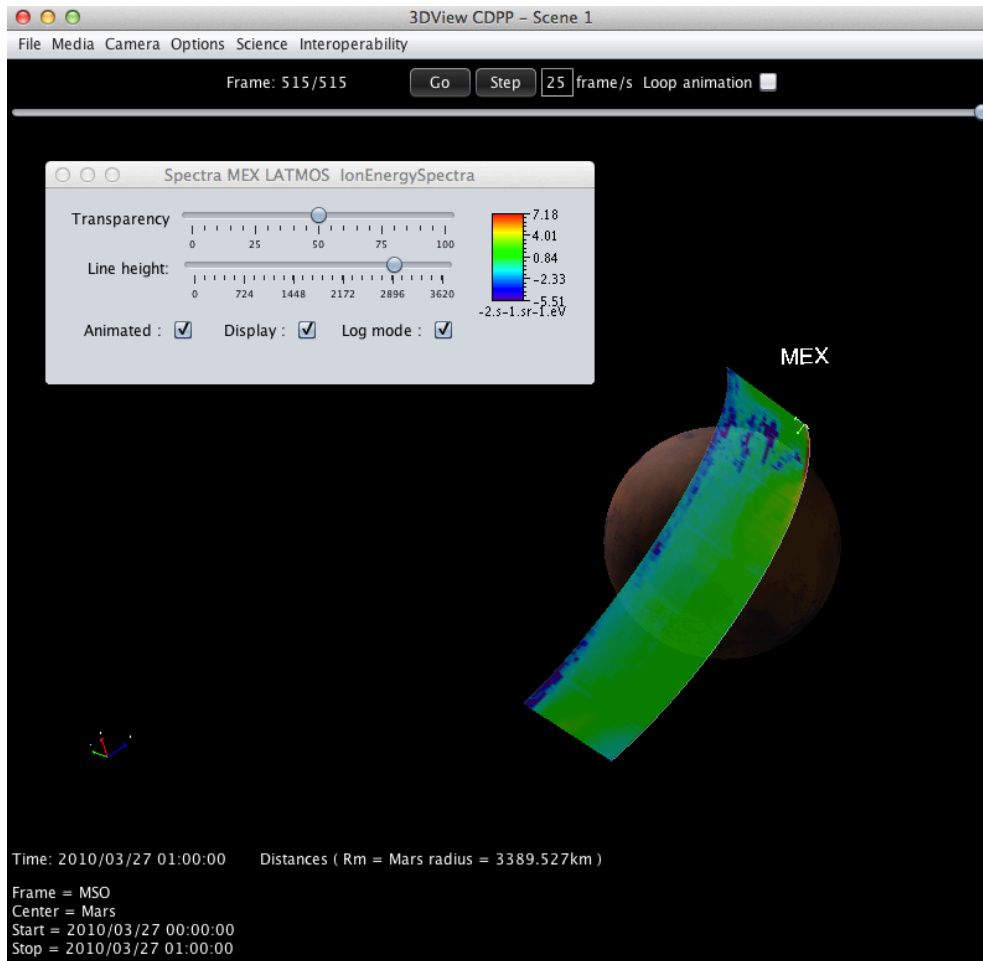
- In the **Science/Remote data (IMPEX)** menu, select a spectrum



- When **IonEnergyspectra** is selected, a dialog box is displayed in the right panel.



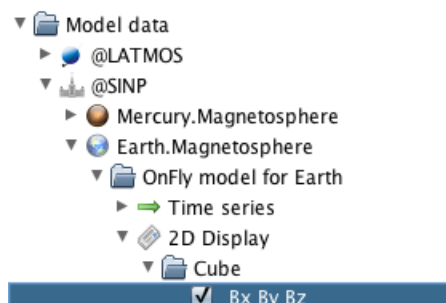
- Select MEX, and click on **Add selected data to 3Dscene**, to display the spectrum, with the control box. Since there are a lot of calculations, this may take a long time (between one and two minutes).



### 2.13 Display the magnetic field calculated in a 3D Cube

In this example, we use the *calculateCube* method of SINP. This method returns the magnetic field calculated by the *Paraboloid Model*, in grid points of a cube with chosen boundaries inside the planetary magnetosphere at a given time and sampling.

- With the **File/Manage scene** menu, create a scene in GSM coordinates with the Earth as central body.
- In the **Science/Remote data (IMPEX)** menu, select a Cube



- The following dialog box is displayed in the right panel



## 3DView 2.0 Tutorial

Console Bx By Bz

Resource name OnFly model for Earth

Parameter Bx By Bz

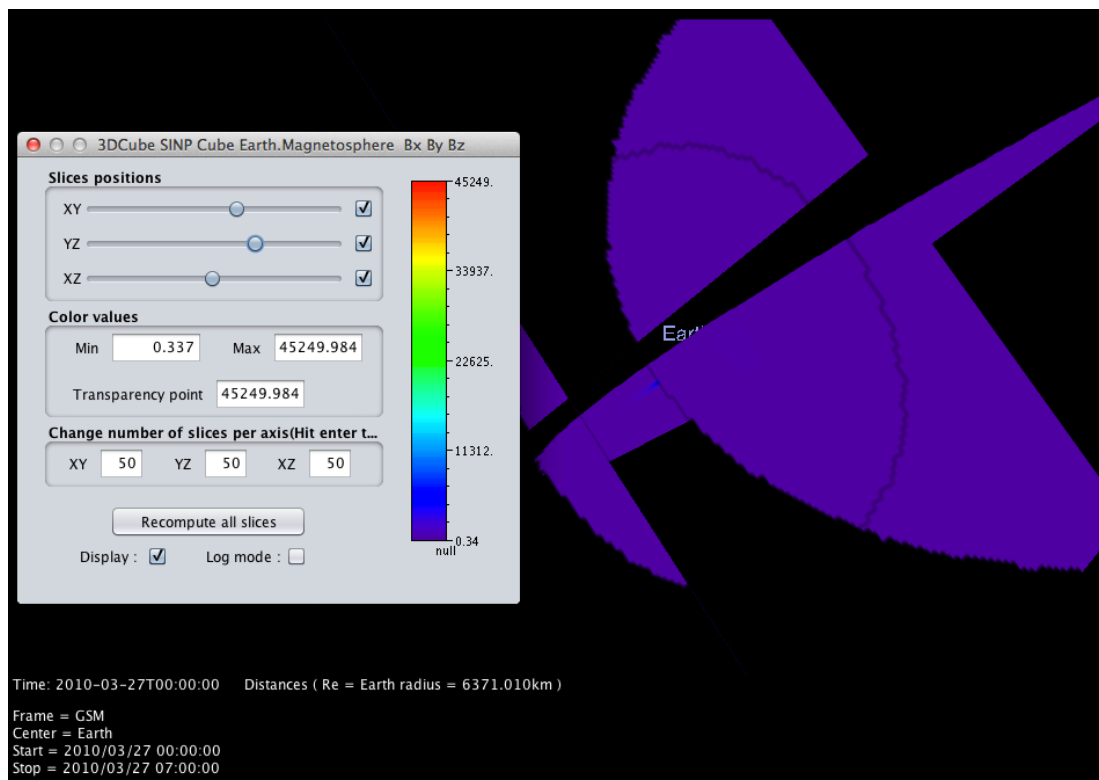
**Parameters**

SWDensity	4	cm <sup>-3</sup>	plot	plot IMF
SWSpeed	300	km/s	plot	IMF Bx -1 nT
DST	-30	nT	plot	IMF By 4 nT
AL	-150	nT	plot	IMF Bz 1 nT

Use dynamic values ☐

Add selected data to 3Dscene

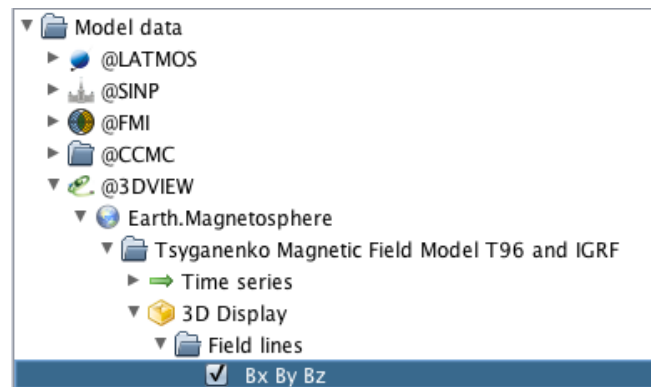
- Click on **Add selected data to 3Dscene**.



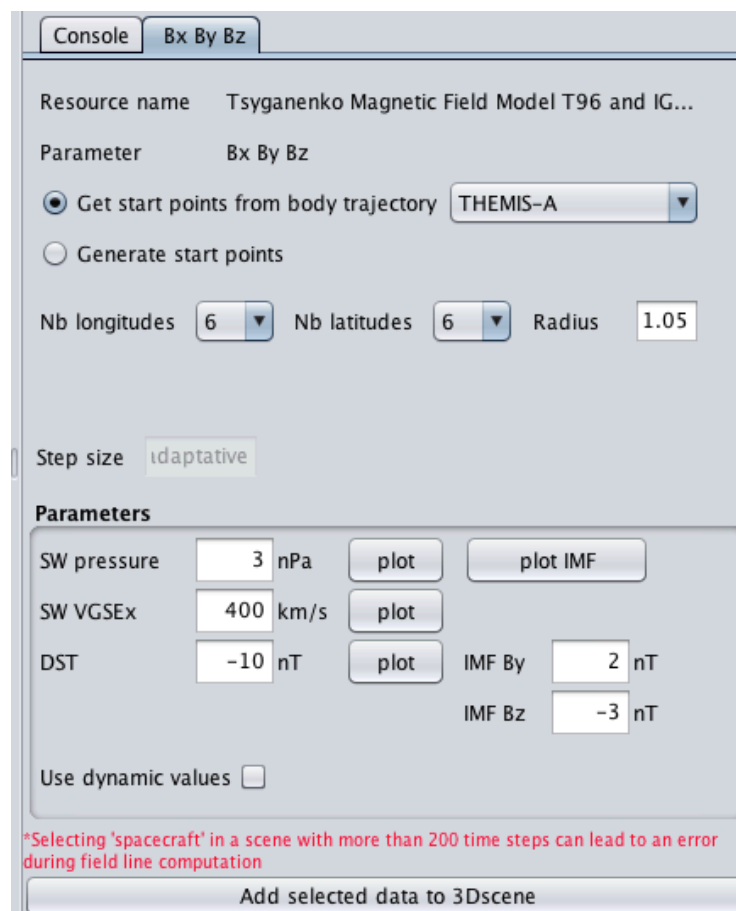
## 2.14 Display magnetic field lines calculated with Tsyganenko T96

In this example, we use the **Tsyganenko Magnetic Field Model T96** implemented on the 3DView server.

- With the **File/Manage scene** menu, create a scene in GSM coordinates with Themis-A from 2010-03-26T00:00:00 to 2010-03-27T00:00:00 with a step of 300 seconds.
- In the **Science/Remote data (IMPEX)** menu, select

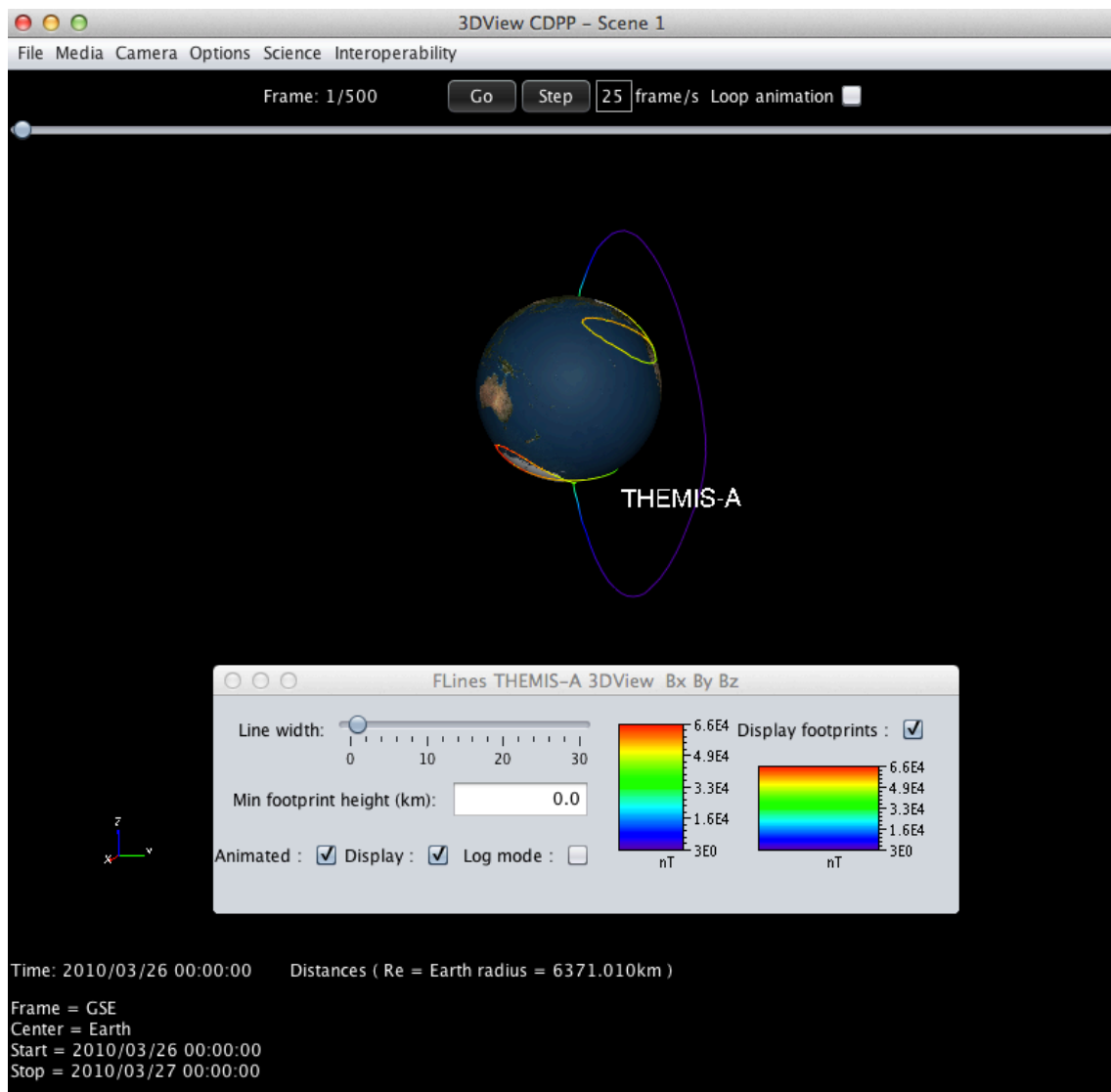


- The following dialog box is displayed in the right panel



## 3DView 2.0 Tutorial

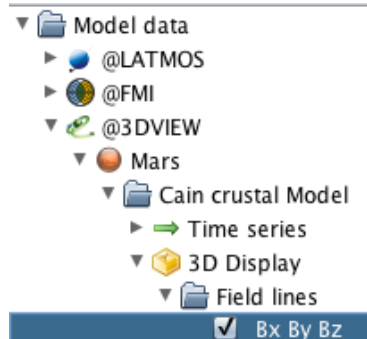
- Select the option named **Get start points from body trajectory** with THEMIS-A and click on **Add selected data to 3Dscene**



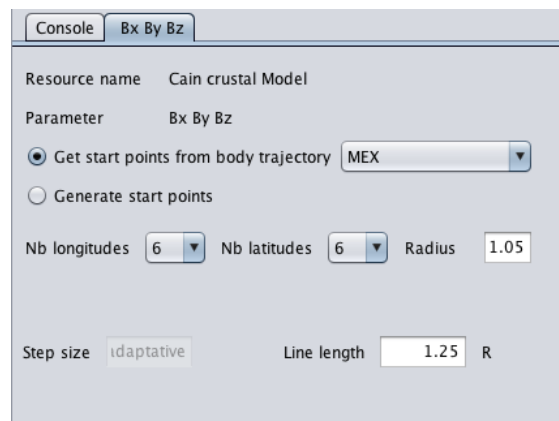
## 2.15 Display magnetic field lines calculated with Cain Crustal Model

In this example, we use the **Cain Crustal Model**, implemented on the 3DView server.

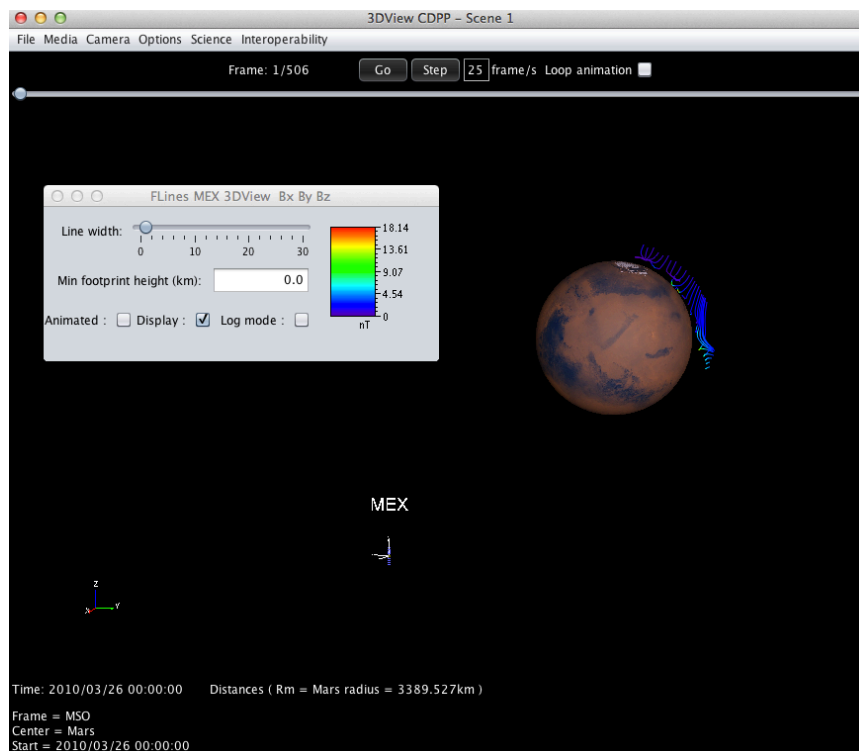
- With the **File/Manage scene** menu, create a scene in MSO coordinates with MEX from 2010-03-26T00:00:00 to 2010-03-26T08:00:00.
- In the **Science/Remote data (IMPEX)** menu, select



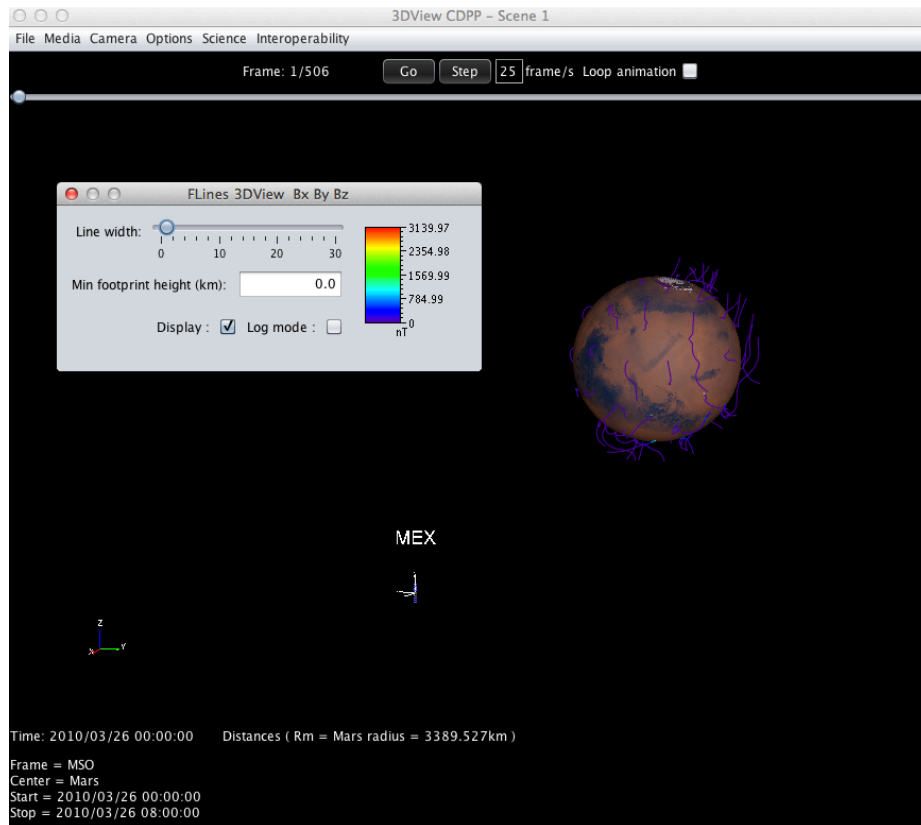
- The following dialog box is displayed in the right panel



- Select the option named **Get start points from body trajectory** with MEX and click on **Add selected data to 3Dscene**.



## 3DView 2.0 Tutorial

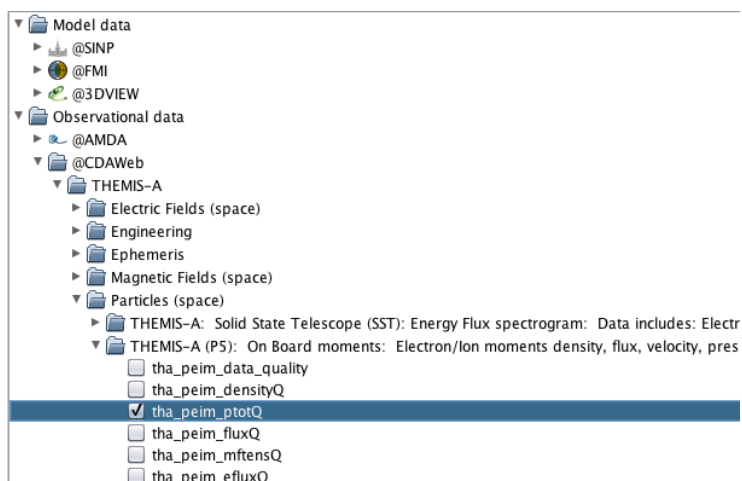


- Select the option named **Generate start points** and click on **Add selected data to 3Dscene**.

### 2.16 Display observational data from CDAWeb

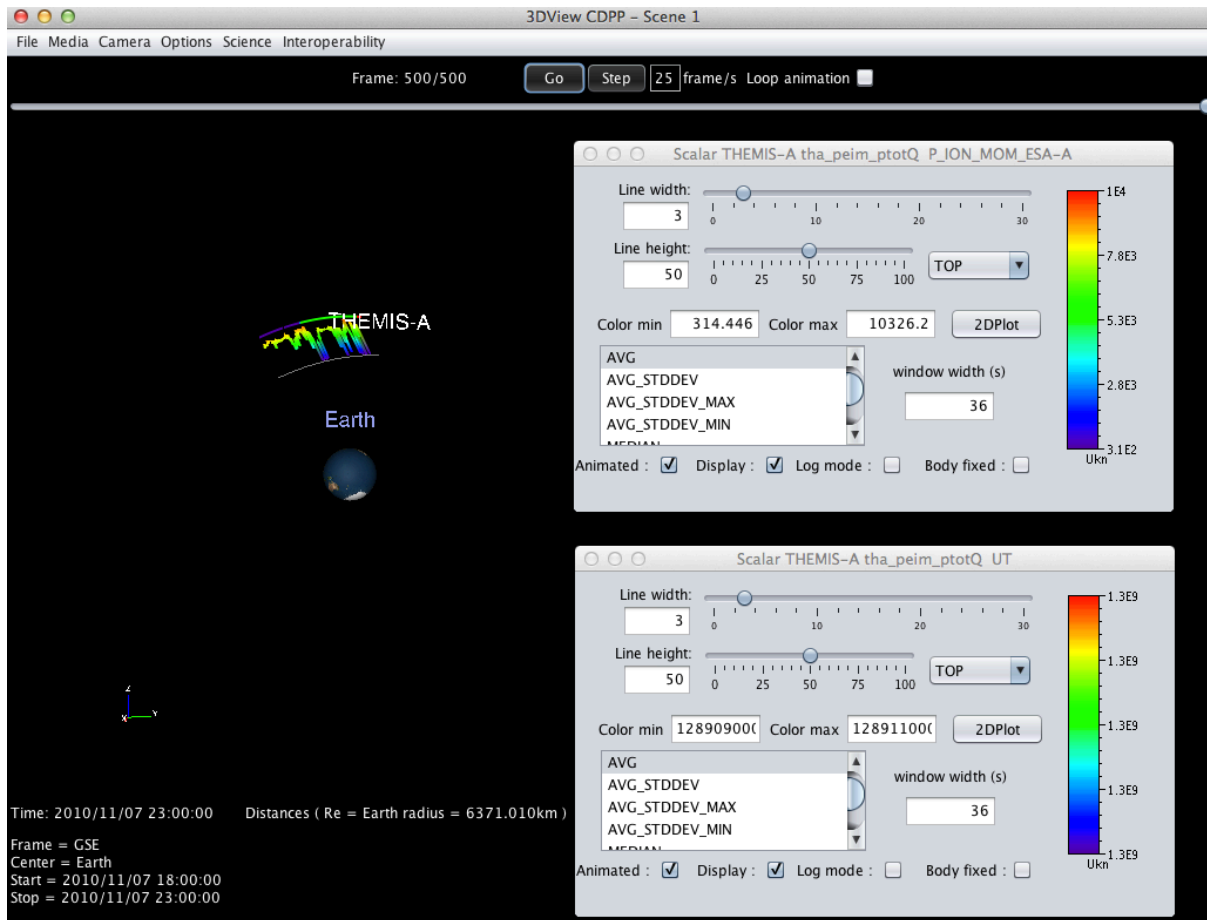
In this example, we show how to display observational data from the CDAWeb.

- With the **File/Manage scene** menu, create a scene in GSE coordinates with THEMIS-A from 2010-11-07T18:00:00 to 2010-11-07T23:00:00.
- In the **Science/Remote data (IMPEX)** menu, select



## 3DView 2.0 Tutorial

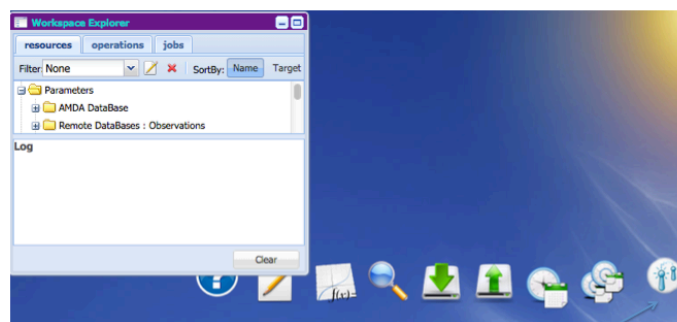
- Then click on **Add selected data to 3D scene**. Two physical quantities are displayed with their control box.



### 2.17 Display observational data from AMDA using SAMP

- With the **File/Manage scene** menu, create a scene in GSE coordinates with THEMIS-A from 2010-03-27T00:00:00 to 2010-03-27T07:00:00.
- In a browser, enter <http://amda.cdpp.eu> to start AMDA
- Follow these steps to start a SAMP Hub and open a SAMP connexion

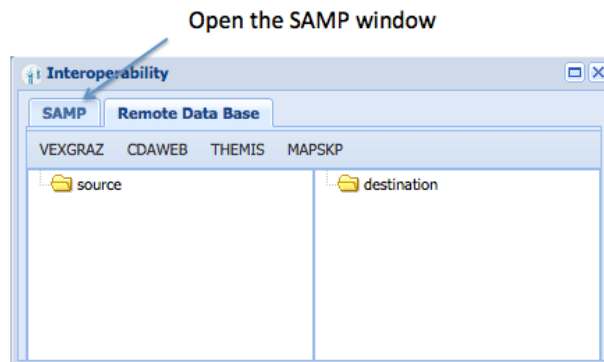
#### ○ Step 1



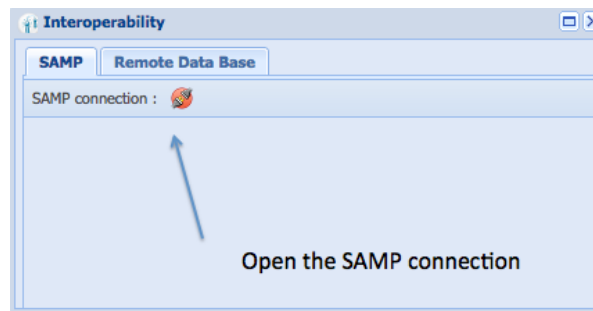
Click here to open  
the interoperability window

## 3DView 2.0 Tutorial

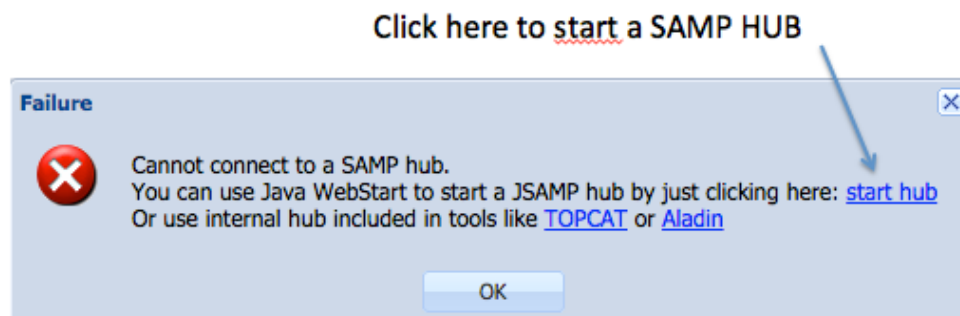
### ○ Step 2



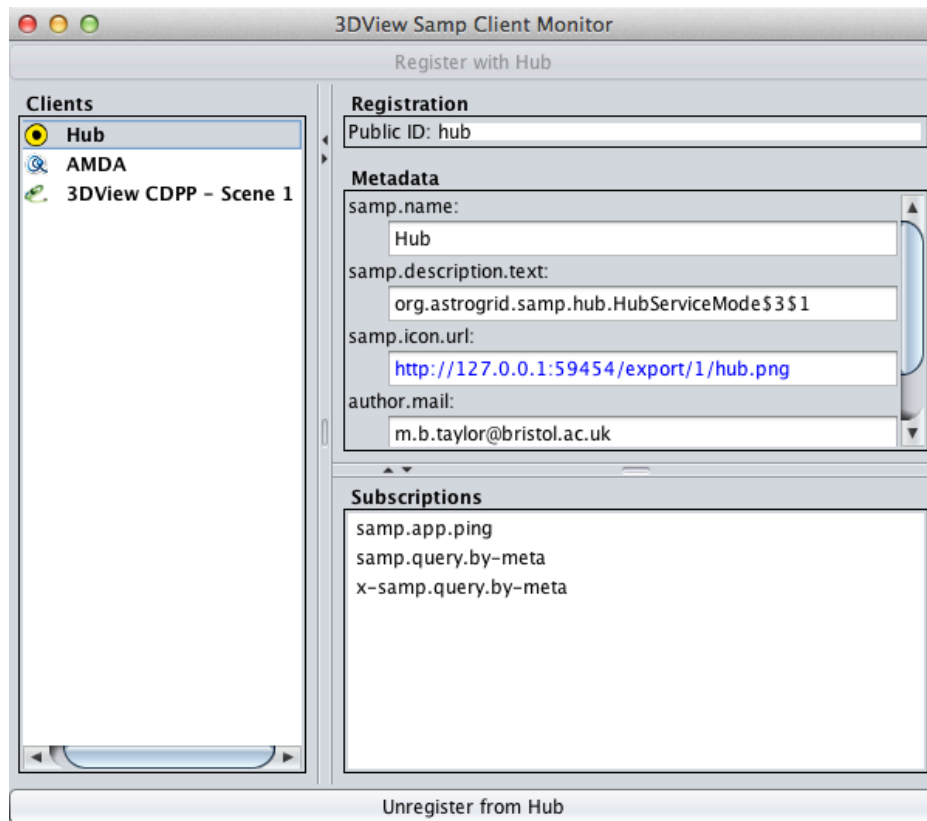
### ○ Step 3



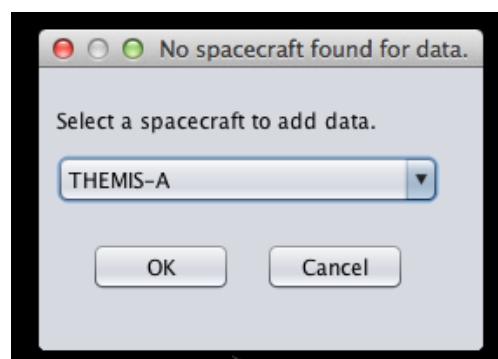
### ○ Step 4



- Back in **3DView**, select **Interoperability/SAMP**, and then click on **Register Hub**. AMDA and 3DView are displayed in the list of connected clients.



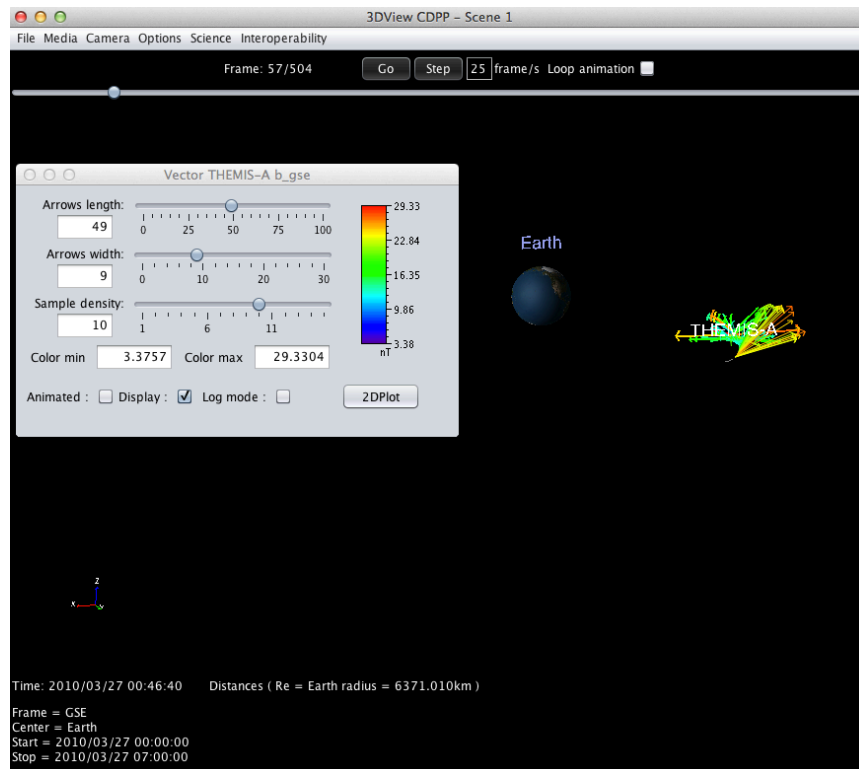
- Back in **AMDA**
  - Open the plot Manager, drag and drop Themis-A/FGM/low/B\_gse from the Workspace Explorer
  - Select the period 2010-03-27T01:00:00 2010-03-27T05:00:00
  - Select **VOTable** as file format and click on **Download**
  - In the **Download** window, click on **Send via SAMP to 3DView**
- A **Download** pop-up window is displayed by 3DView. You have to select the spacecraft on which trajectory the exchanged data will be displayed.



- Data are displayed in the 3D scene, with the associated control box.

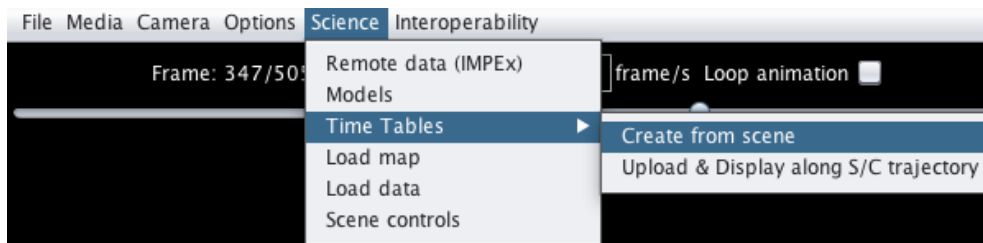


## 3DView 2.0 Tutorial

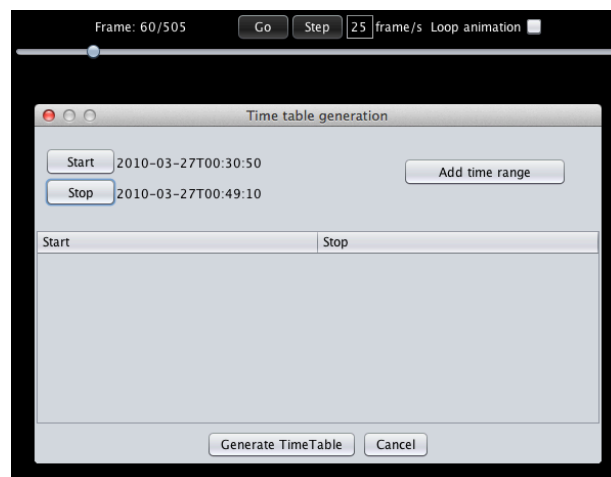


### 2.18 Create a Time Table from the animation bar

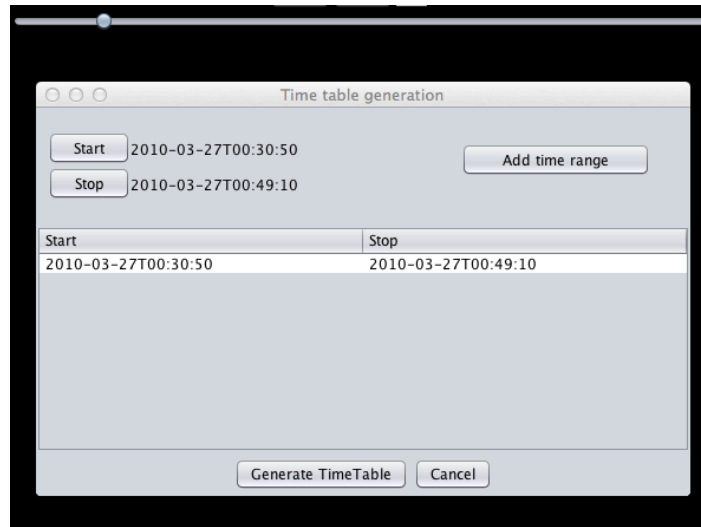
- With the **File/Manage scene** menu, create a scene in GSE coordinates with THEMIS-A from 2010-03-27T00:00:00 to 2010-03-27T07:00:00.
- Then select the following menu



- In the animation bar, select the time with the animation button and create an interval with the *Start* and *Stop* buttons.



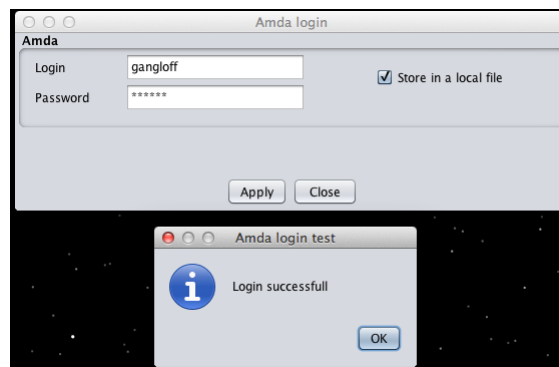
- Click on Add time range to append the selected time interval to the list.



- Repeat this operation for several time intervals, and then click on **Generate Time Table**. The Time Table will be saved in a file with the *xml* extension.

### 2.19 Access to private Time Tables from AMDA

- With the **File/Manage scene** menu, create a scene in GSE coordinates with THEMIS-A from 2010-03-27T00:00:00 to 2010-03-27T07:00:00.
- Select **Interoperability/AMDA login**. Enter your AMDA user ID, with your password. Select the **Store in a local file** option to save the ID and password. This way, they are saved for further 3DView sessions. Then click on **Apply**.

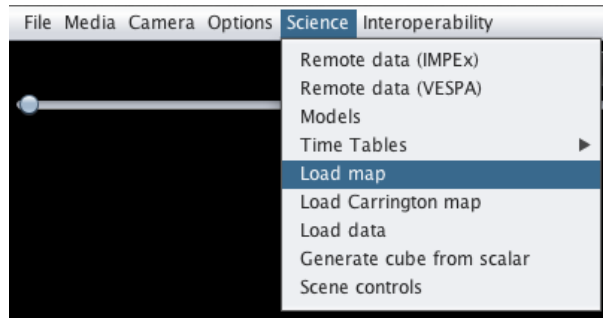


- The **Science/Remote data (IMPEX)** menu now displays the list of user owned Time Tables in the *Timetables/Private* directory.

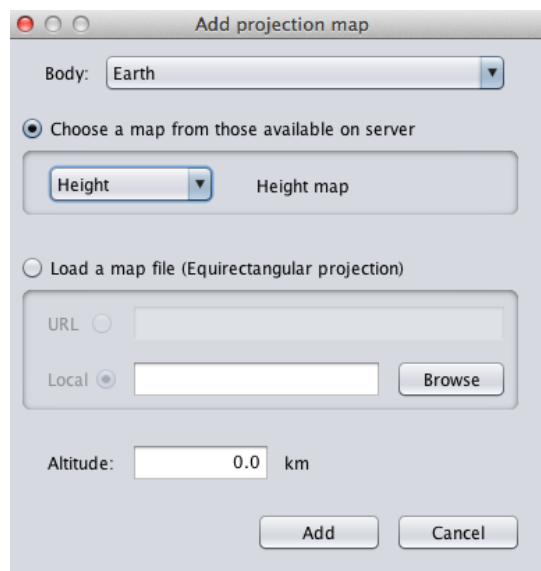
## 2.20 Add a Map on or above a Central Body

### 2.20.1 Add a predefined map

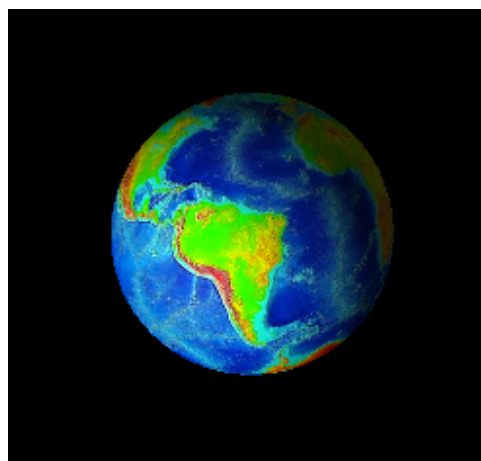
- With the **File/Manage scene** menu, create a scene with the EARTH as central body, in 2014.
- Then select



- The following window is displayed. Select **Choose an map from those available on server** and *Height*



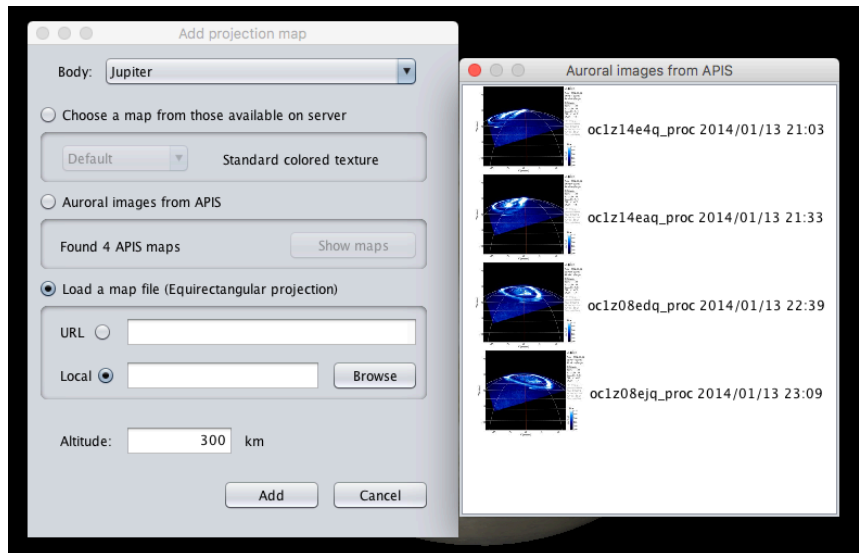
- The *Height* map is displayed on the Earth



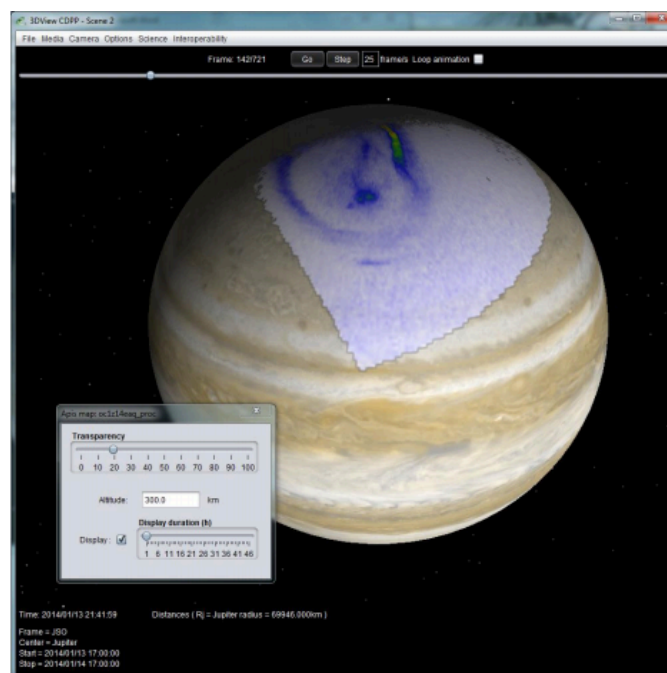
### 2.20.2 Add a map from APIS

The APIS auroral image database (<http://apis.obspm.fr/>) available through EPN-TAP can be used to add specific maps on planets such as Jupiter or Saturn.

- To be able to find available data on APIS, choose a scene 2014/01/13 19:00:00 to 2014/01/14 01:00:00 with Jupiter center.
- Open the Science/load map menu and select Auroral images from APIS.



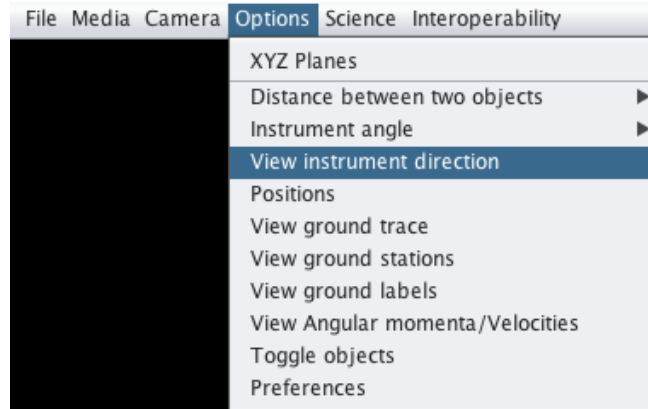
- Clicking the add button loads the maps in the scene and show them according to their timestamp. The image list on the right in Figure 7 allows the user to set scene time by clicking on the desired one.



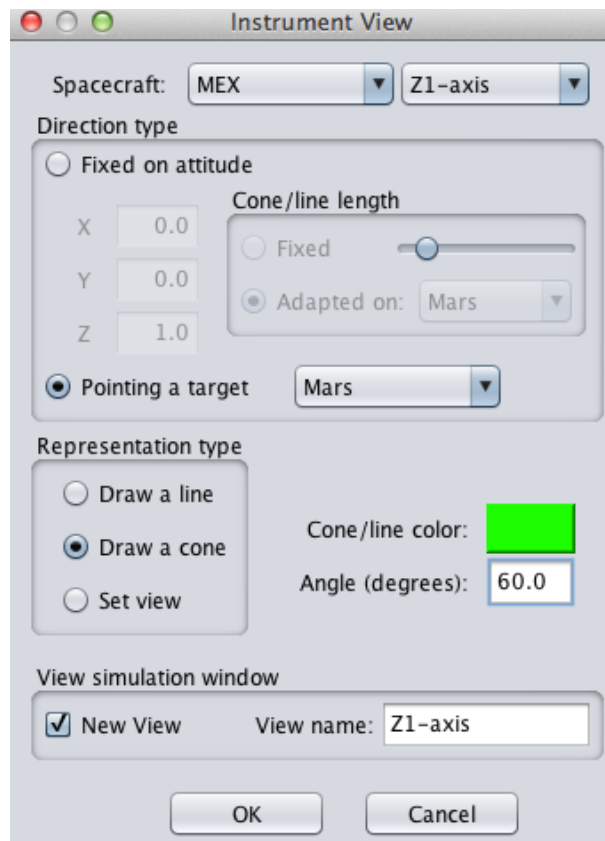
With some graphic cards, at low altitudes, the aurora can be interlaced with planet surface.

## 2.21 Display a cone view a target in a pop-up window

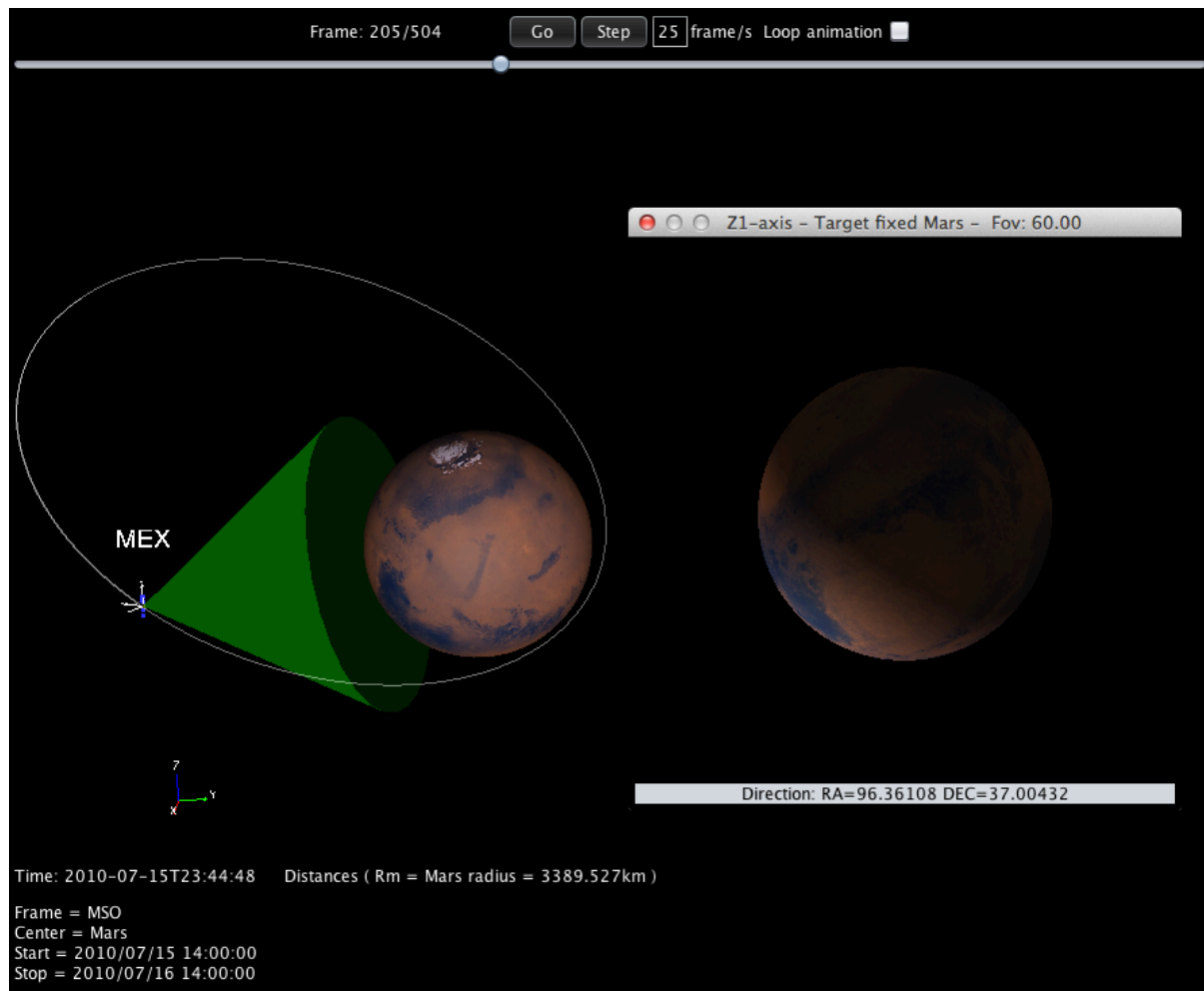
- With the **File/Manage scene** menu, create a scene with MEX and MSO as coordinate system from 2010-07-15T14:00:00 to 2010-07-16T14:00:00
- Then select



- Select **Pointing a target** option with *Mars*, **New View** in *View Simulation window*, and an angle of 60.0 degrees.



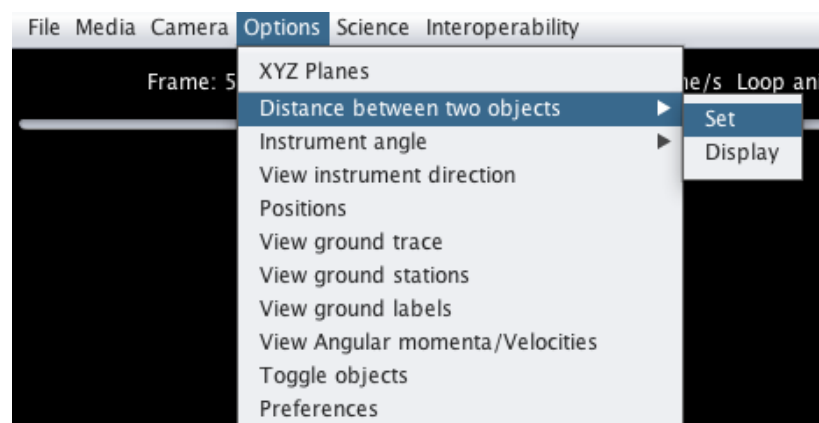
- A Cone is displayed in the main window, and a new window containing a view of Mars (60°) from MEX.



- Now, if you select *set view* and an angle of  $60.0^\circ$  in the *Instrument view* window, a view of Mars ( $60^\circ$ ) from MEX is displayed in the main window..

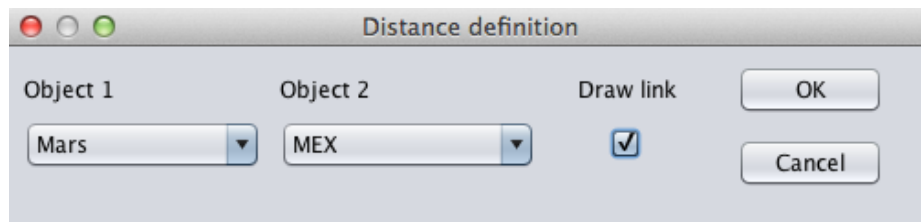
### 2.22 Display the distance between two bodies

- With the **File/Manage scene** menu, create a scene with MEX and MSO as coordinate system from 2010-07-15T14:00:00 to 2010-07-16T14:00:00. Select *Phobos* and *Deimos* as Natural bodies.
- Then select

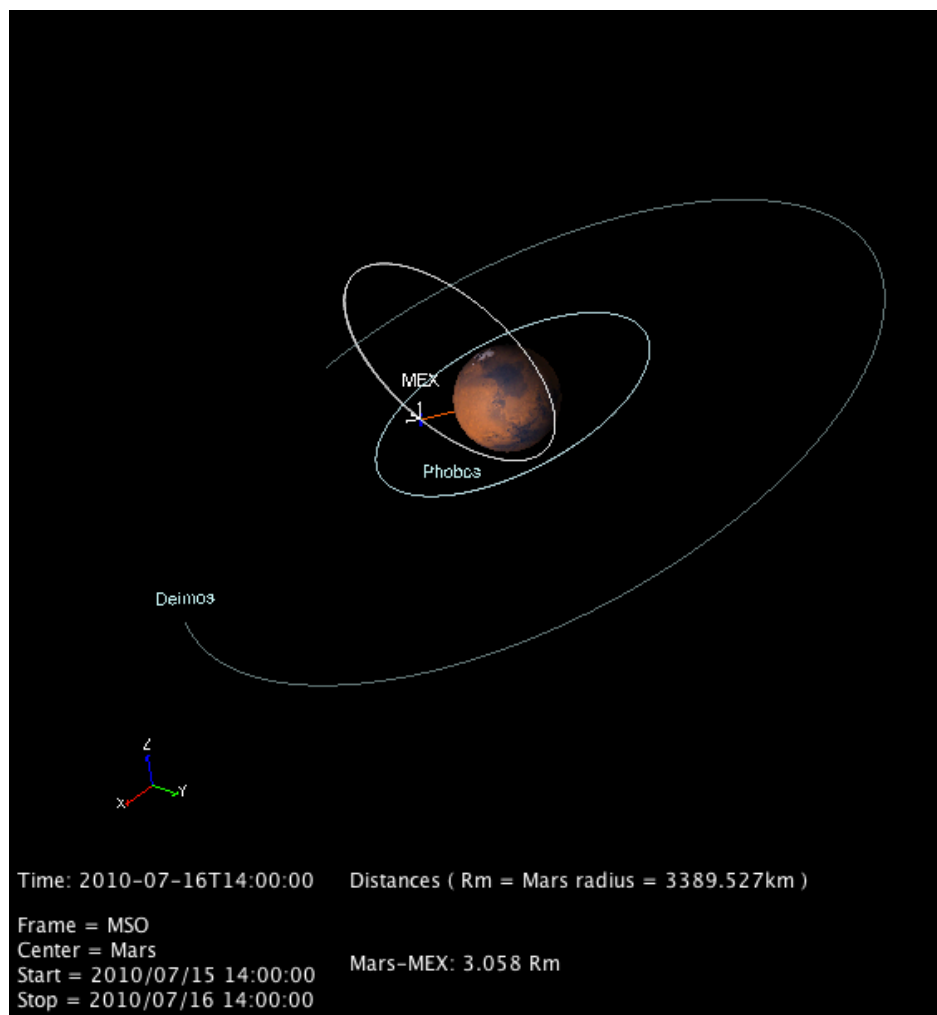


## 3DView 2.0 Tutorial

- This opens a pop-up window. Select Mars as Object#1, MEX as Object#2, and select *Draw link*



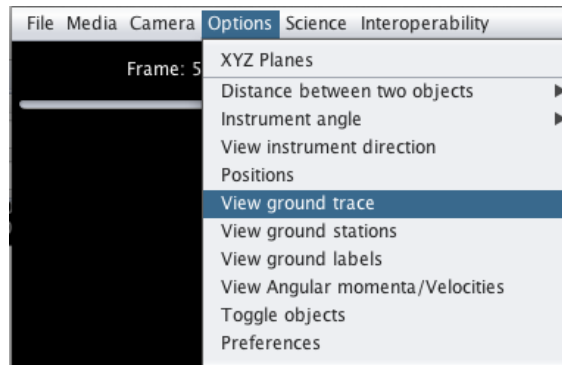
- A link between Mars and MEX is displayed as well as the distance.



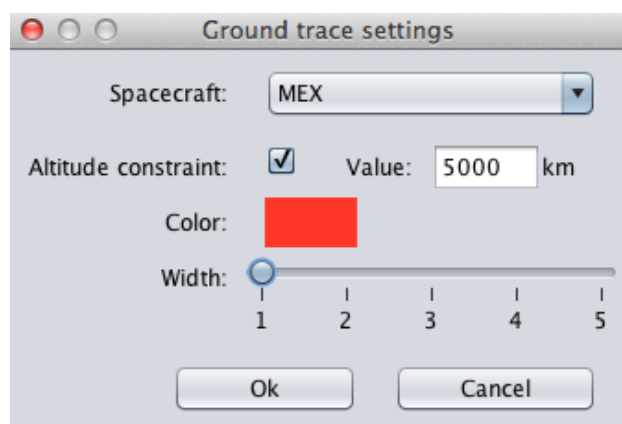
### 2.23 Display a ground trace

- With the **File/Manage scene** menu, create a scene with MEX and MSO as coordinate system from 2010-07-15T14:00:00 to 2010-07-16T14:00:00. Select *Phobos* and *Deimos* as Natural bodies.
- Then select

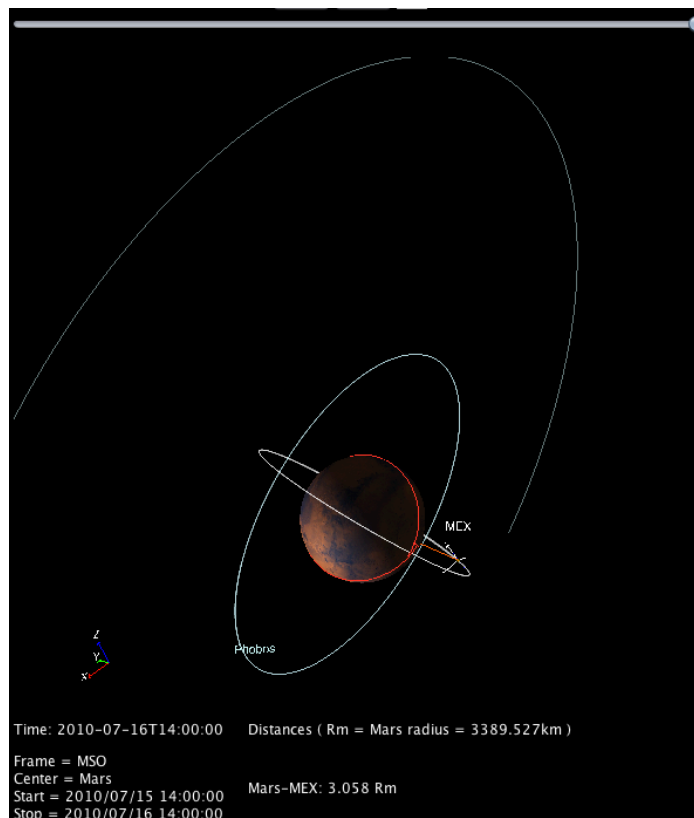
## 3DView 2.0 Tutorial



- Select an altitude constraint of 5000 km



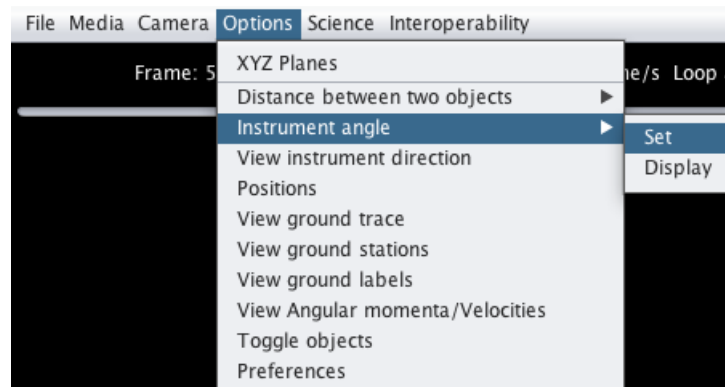
- The ground trace is displayed with the chosen colour.



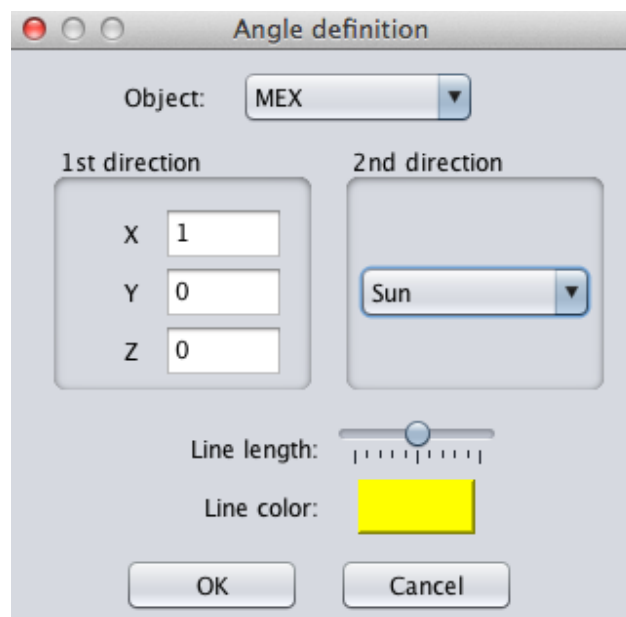


## 2.24 Display the angle between an instrument and a body

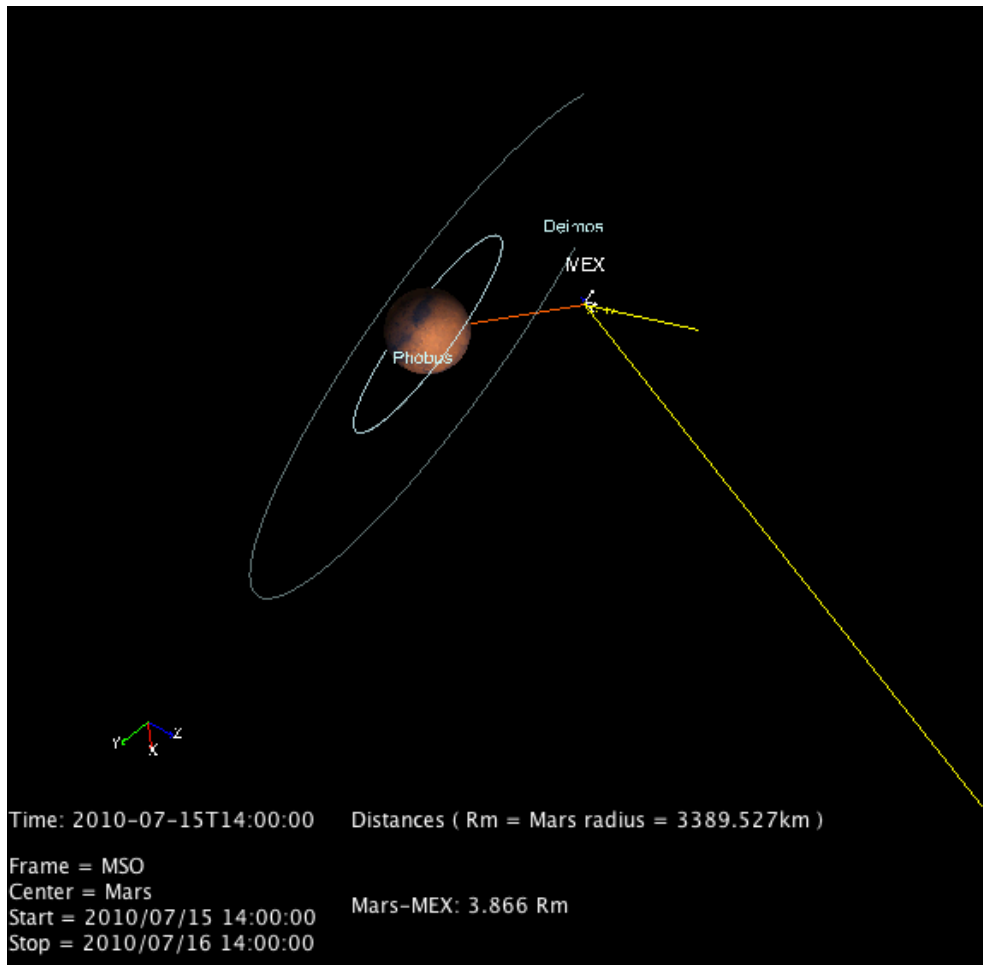
- With the **File/Manage scene** menu, create a scene with MEX and MSO as coordinate system from 2010-07-15T14:00:00 to 2010-07-16T14:00:00. Select *Phobos* and *Deimos* as Natural bodies.
- Then select



- Select X=1 Y=0 Z=0 *Sun* as second direction and yellow as colour

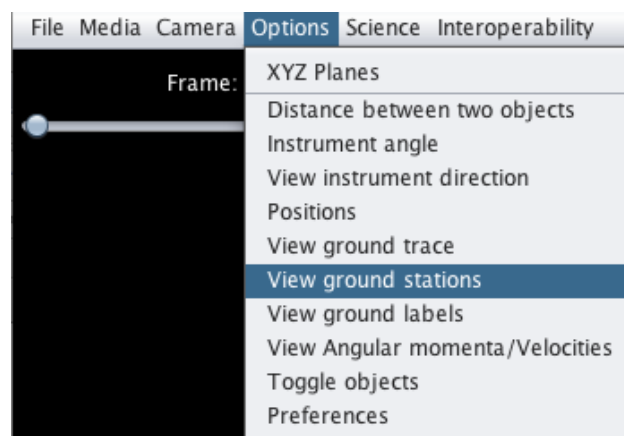


- The angle between MEX and the Sun is displayed in yellow



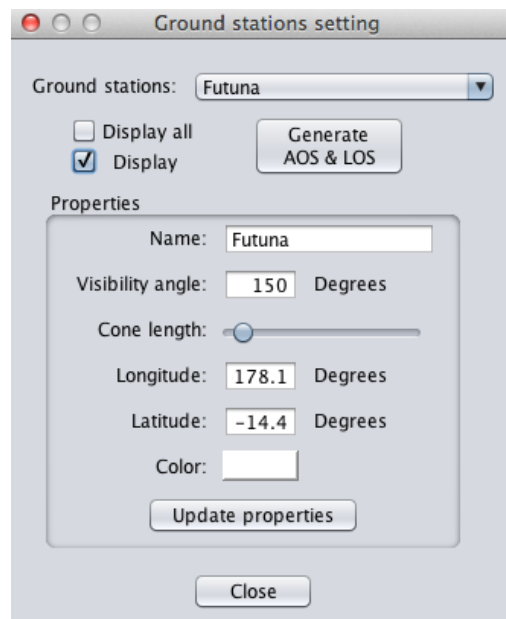
## 2.25 Display ground stations

- With the **File/Manage scene** menu, create a scene with SVOM and the EARTH as central body from 2013-01-01T14:00:00 to 2013-01-03T14:00:00.
- Then select

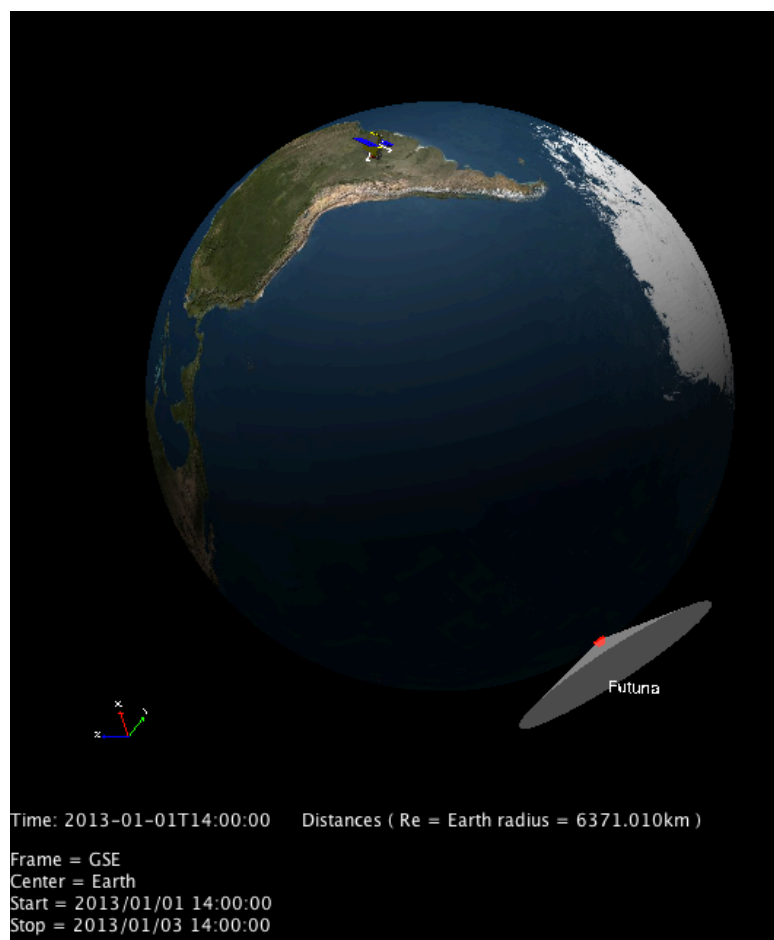


- Select *Futuna* as ground station and *Display*

## 3DView 2.0 Tutorial

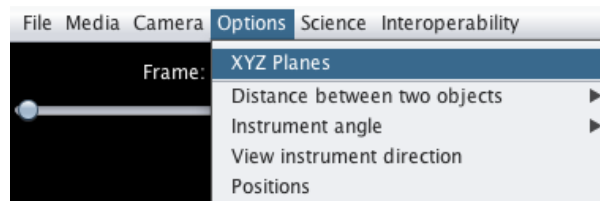


- A cone associated with the Futuna ground station is displayed.



## 2.26 Display XYZ planes

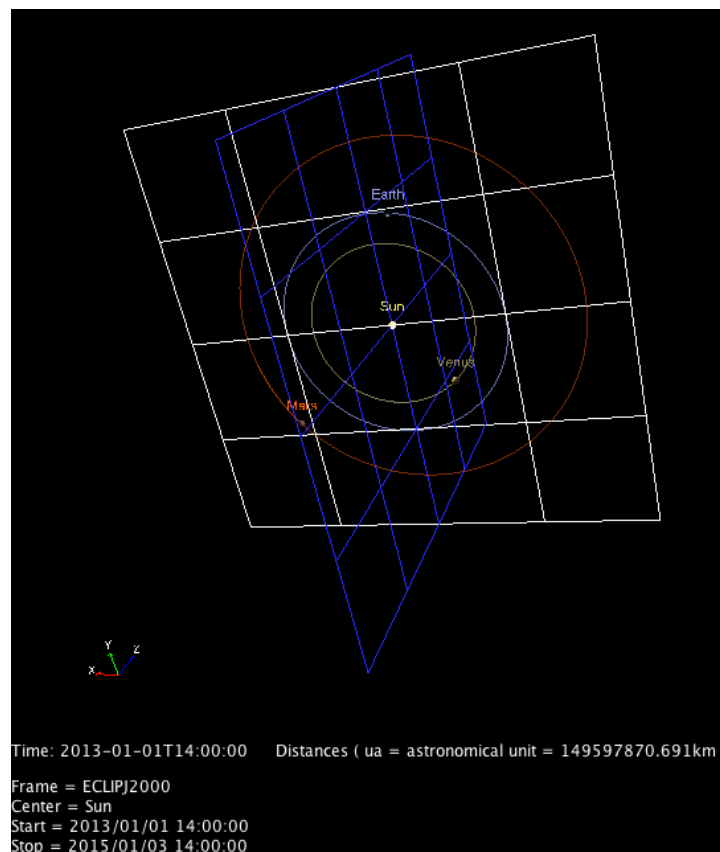
- With the **File/Manage scene** menu, create a scene with the Sun as central body and ECLIPJ2000 as coordinate system from 2013-01-01T14:00:00 to 2015-01-03T14:00:00. Add Venus, the Earth and Mars as Natural bodies.
- Then select



- Then select XY with white colour and YZ.

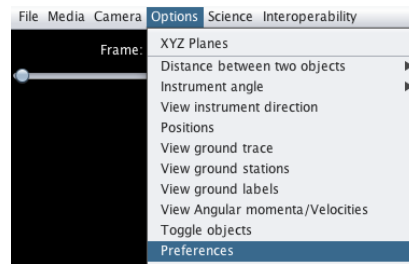


- Both planes are displayed as grids (units=AU). The white grid is aligned on the orbit of the planets

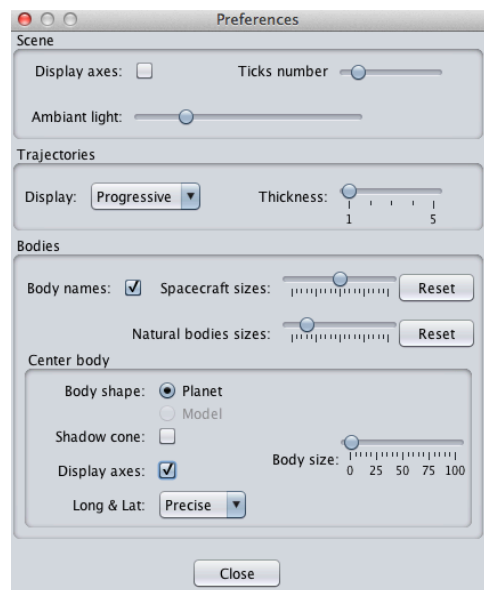


## 3DView 2.0 Tutorial

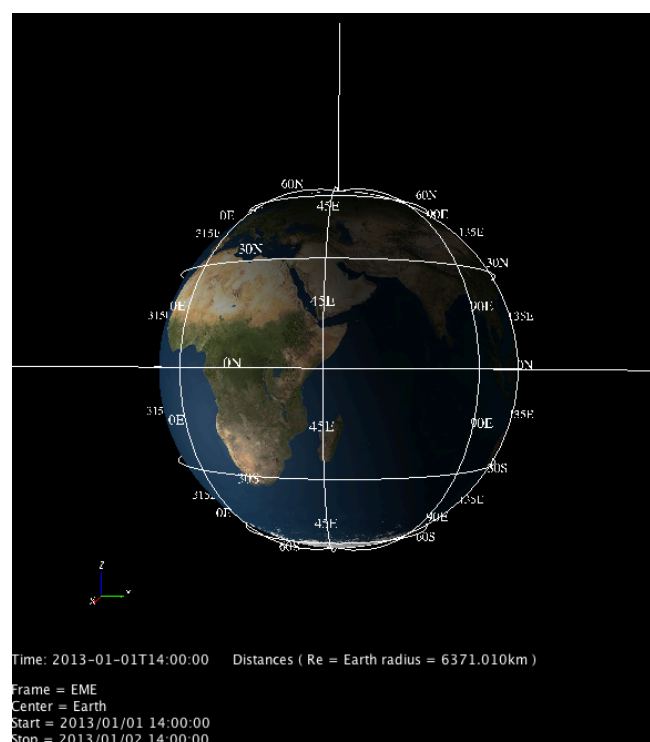
- With the **File/Manage scene** menu, create a scene with the Earth as central body and EME as coordinate system from 2013-01-01T14:00:00 to 2013-01-02T14:00:00, then select



- Select *Display axes* (in Center Body) and set **Long & Lat** to *Precise*



- Axes, longitudes and latitudes are displayed above the Earth



### 2.27 Search and display data around a Titan fly-by with VESPA

For this use case, we use 3DView and another tool called TopCat<sup>1</sup> to display data searched by 3DView among VESPA services.

We want to search for data provided by VESPA around a Titan flyby by the CASSINI spacecraft described below (source PDS):


#### Titan Flyby T-117: Measuring Titan's Atmosphere

This is Cassini's 118th flyby of Titan and the third of eleven planned for 2016. This encounter will increase the inclination of Cassini's orbit from 16 degrees to 20.6 degrees. The highest priority science is a grazing atmospheric occultation observed by Radio Science Subsystem (RSS), which will profile the thermal structure of the atmosphere, with ingress and egress latitudes of ~7S and ~30N degrees. The occultation is followed by a short-duration high northern-latitude egress-only bistatic scattering with ground track likely crossing small lakes, covering the region from about (80N, 190W) to about (70N, 240W) degrees, and capturing near-grazing scattering angle decreasing from about 80 to 75 degrees.

On approach, the Composite Infrared Spectrometer (CIRS) will view the sub-Saturn hemisphere of Titan, the Visible and Infrared Mapping Spectrometer (VIMS) will do two mapping observations and the Imaging Science Subsystem (ISS) will search for clouds across Titan's Fensal-Aztlan region.

**Sources:**

- Cassini Science Team, NASA Jet Propulsion Laboratory
- [Cassini Saturn Tour Dates](#)
- Cassini Imaging Central Laboratory for Observations (CICLOPS), "[Looking Ahead: Rev232: Jan 22 - Feb 7 2016](#)"



This natural color image shows Titan's upper atmosphere -- an active place where methane molecules are being broken apart by solar ultraviolet light and the byproducts combine to form compounds like ethane and acetylene.

[+ More Titan Information](#)

#### Titan Flyby at a Glance

**Date**  
Feb. 16, 2016

**Altitude**  
633 miles (1,018 km)

**Speed (rel. to Titan)**  
20,132 mph (9.9 km/sec)

**Details**

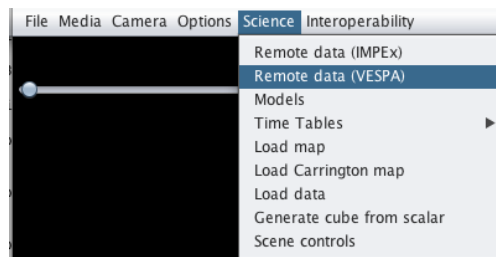
[+ Flyby FAQ](#)

[+ Titan Image Gallery](#)

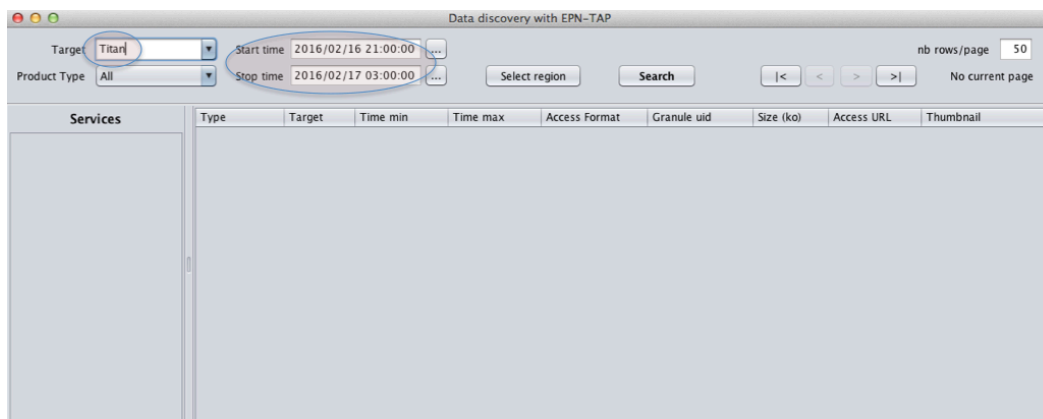
[+ Browse or Search the Latest Raw Images](#)

[+ Saturn's Moons](#)

- With the **File/Manage scene** menu, create a scene with Titan as central body, CASSINI as spacecraft and TIIS as coordinate system from 2016-02-16T21:00:00 to 2016-02-17T03:00:00. Then select the VESPA option



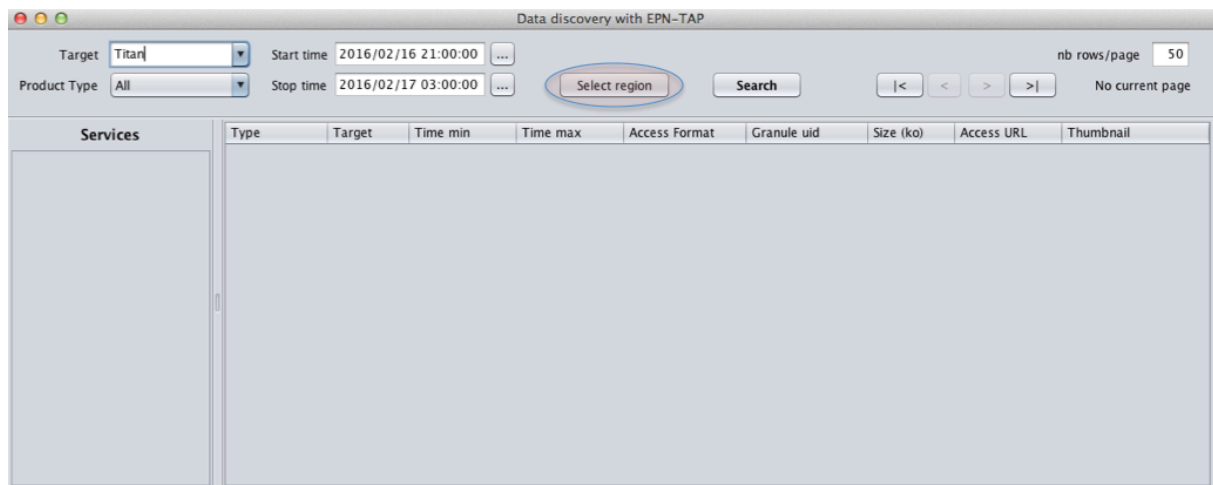
This opens the VESPA pop-up window, with *Target*, *StartTime* and *StopTime* selected from the scene.



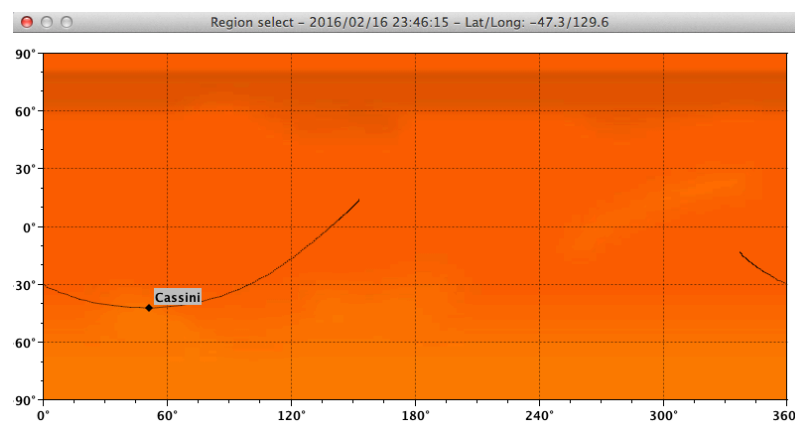
<sup>1</sup> <http://www.star.bris.ac.uk/~mbt/topcat/>

## 3DView 2.0 Tutorial

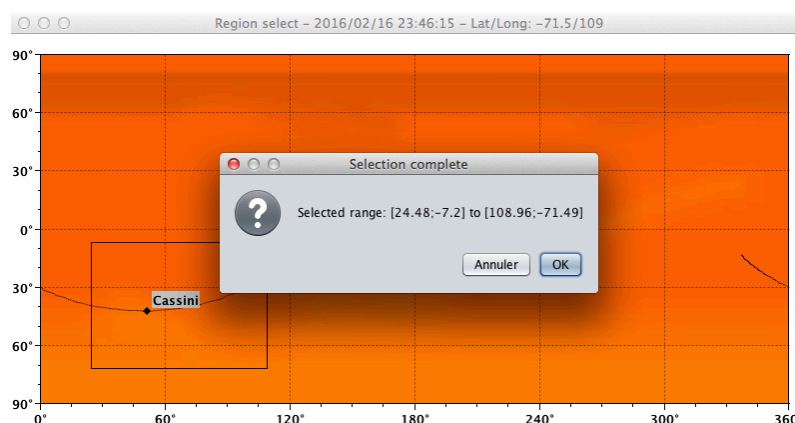
Then launch the animation and stop it at about 23:16, and click on the *Select Region* button to add a new search keyword.



The following pop-up window is opened



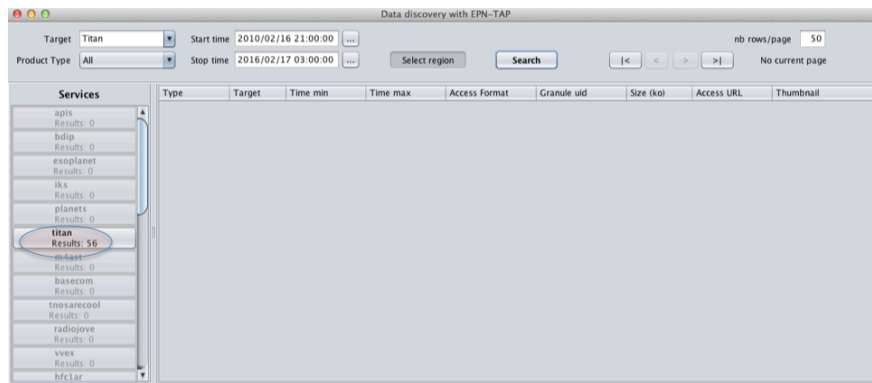
Then select a region



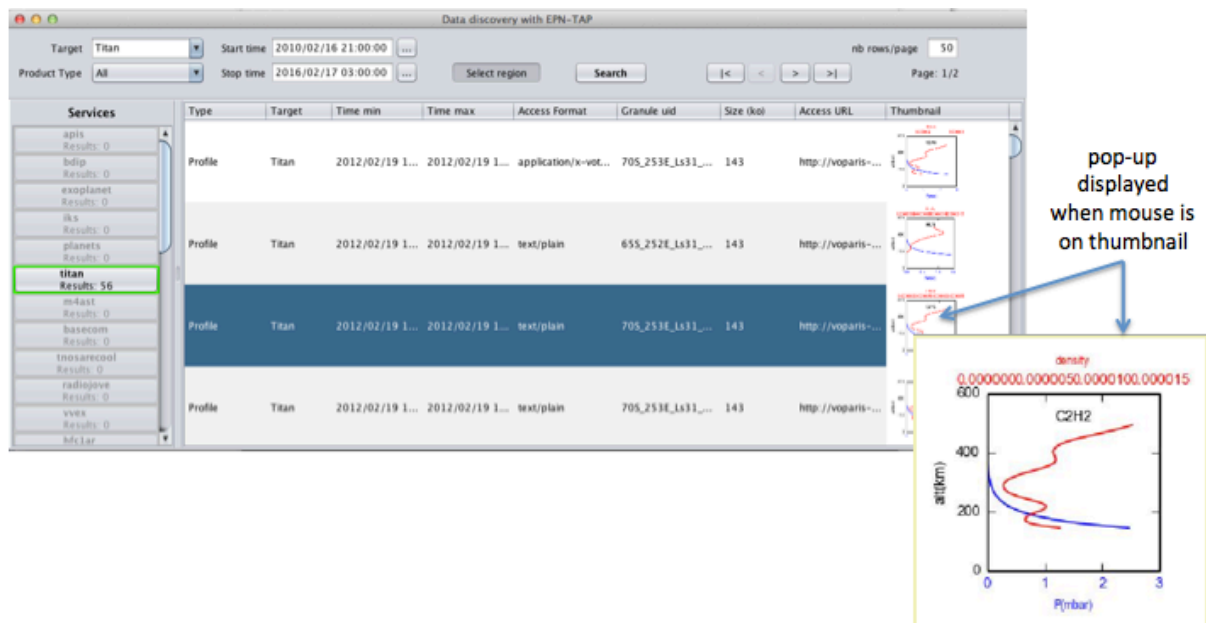
To increase the number of possible responses, change the *Start Date* to 2010-02-16T21:00:00 and click on Search

## 3DView 2.0 Tutorial

The list of services is displayed in the left part of the window. The name of each service is displayed with the corresponding number of results.



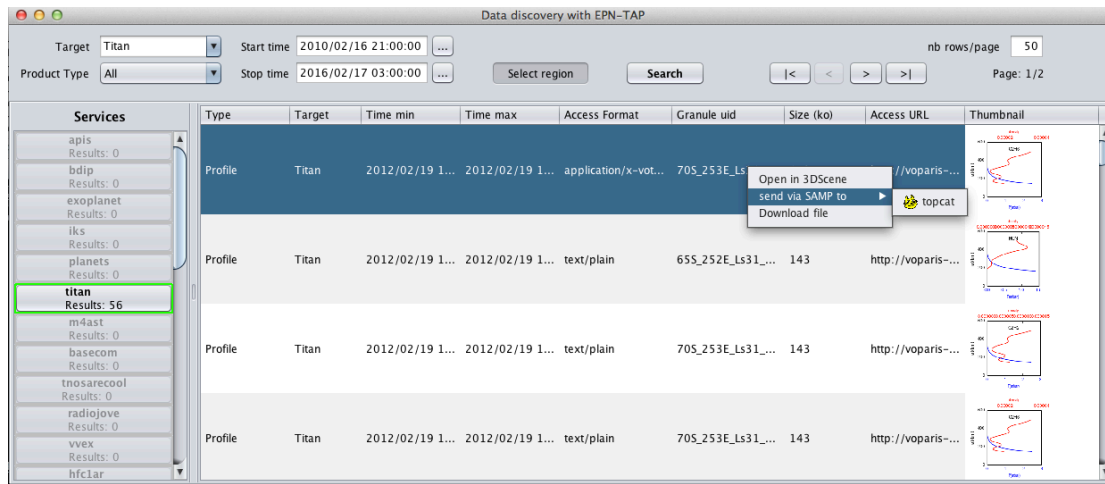
Click on *titan* to display the results of this database.



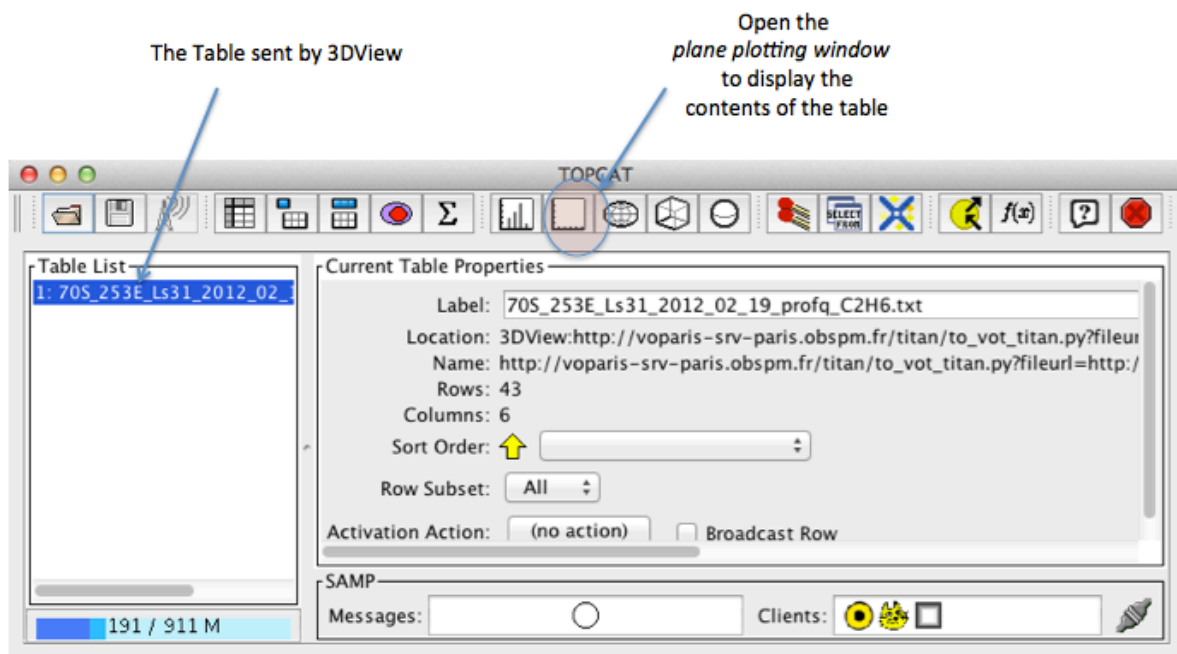
Launch TopCat. This will automatically start the SAMP HUB hosted by TopCat. Right click on a raw displays several options depending on the data format. Select *send via SAMP to topcat*. This option is available for data of mime type equal to application/x-votable+xml only.



## 3DView 2.0 Tutorial

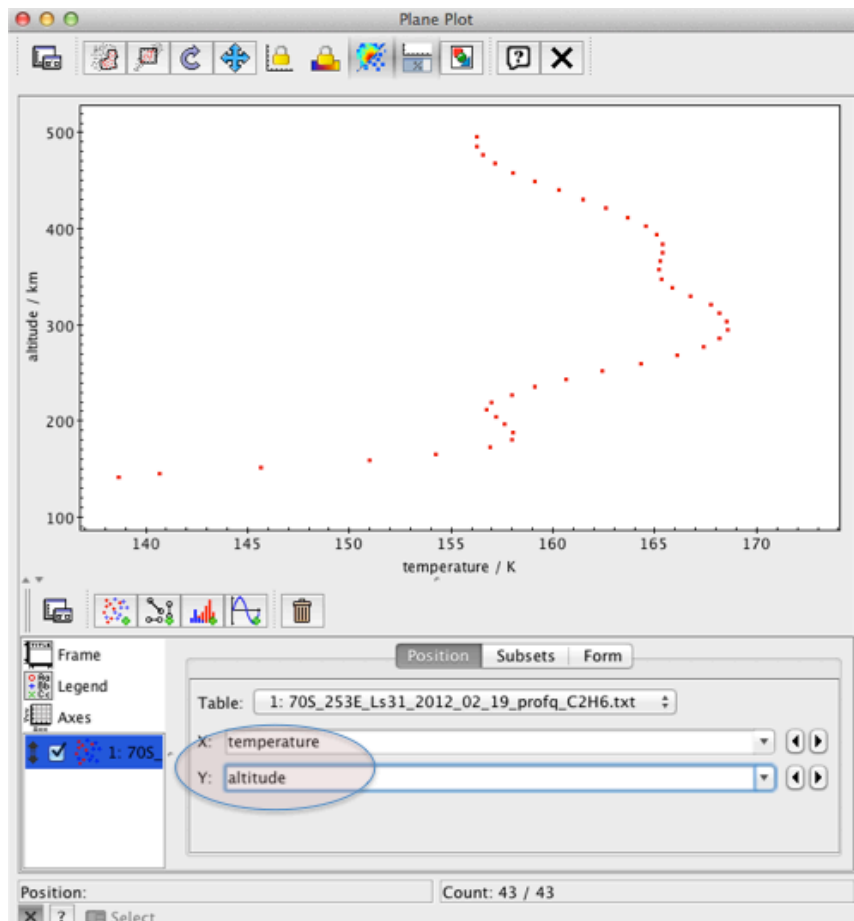


The table is loaded by TopCat, and visible in the Table List after a few seconds.



Select *temperature* on X-axis and *altitude* on Y-axis.

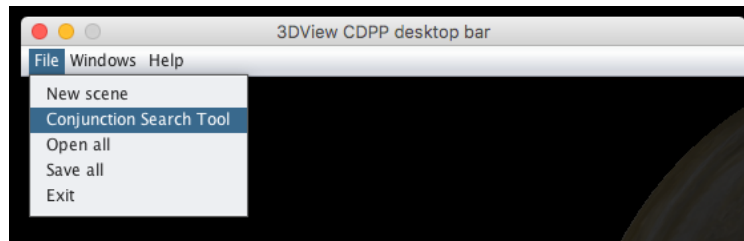
## 3DView 2.0 Tutorial



### 2.28 EISCAT Svalbard radar – Swarm conjunction in the night side

This use case is related to the Conjunction Search Tool. Its goal is i) to find favourable conjunctions between the ESR and Swarm around magnetic midnight, ii) to exploit one of the conjunctions found.

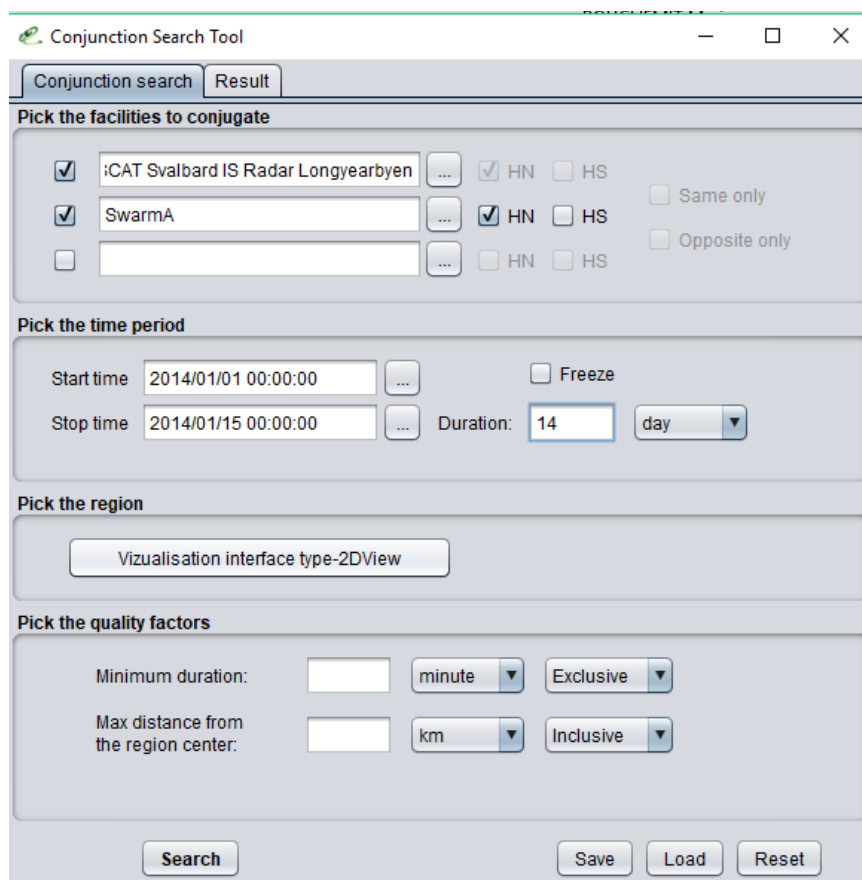
Note: this use case requires, at a later stage, the upload of a Swarm data file in 3D View. The Conjunction Search Tool is accessed through the File Menu of the desktop bar.



#### Step 1: instruments and time interval selection

*Instruments:* ESR (Ground -> IS Radars -> EISCAT) and Swarm A (Space -> Polar -> LEO -> Swarm) Hemisphere: HN

*Time interval:* 2014/01/01 00:00:00 - 2014/01/15 00:00:00 (only 2 weeks for a faster run)

A screenshot of the 'Conjunction Search Tool' window. It has two tabs: 'Conjunction search' (active) and 'Result'. The interface is divided into several sections:

- Pick the facilities to conjugate:** Two rows of facility selection. The first row has 'EISCAT Svalbard IS Radar Longyearbyen' selected with a checkbox and 'HN' selected with a radio button. The second row has 'SwarmA' selected with a checkbox and 'HN' selected with a radio button. There are also checkboxes for 'Same only' and 'Opposite only'.
- Pick the time period:** 'Start time' is '2014/01/01 00:00:00' and 'Stop time' is '2014/01/15 00:00:00'. There is a 'Freeze' checkbox and a 'Duration' field set to '14' days.
- Pick the region:** A button labeled 'Vizualisation interface type-2DView'.
- Pick the quality factors:** 'Minimum duration' is set to 'minute' with an 'Exclusive' dropdown. 'Max distance from the region center' is set to 'km' with an 'Inclusive' dropdown.

At the bottom are buttons for 'Search', 'Save', 'Load', and 'Reset'.

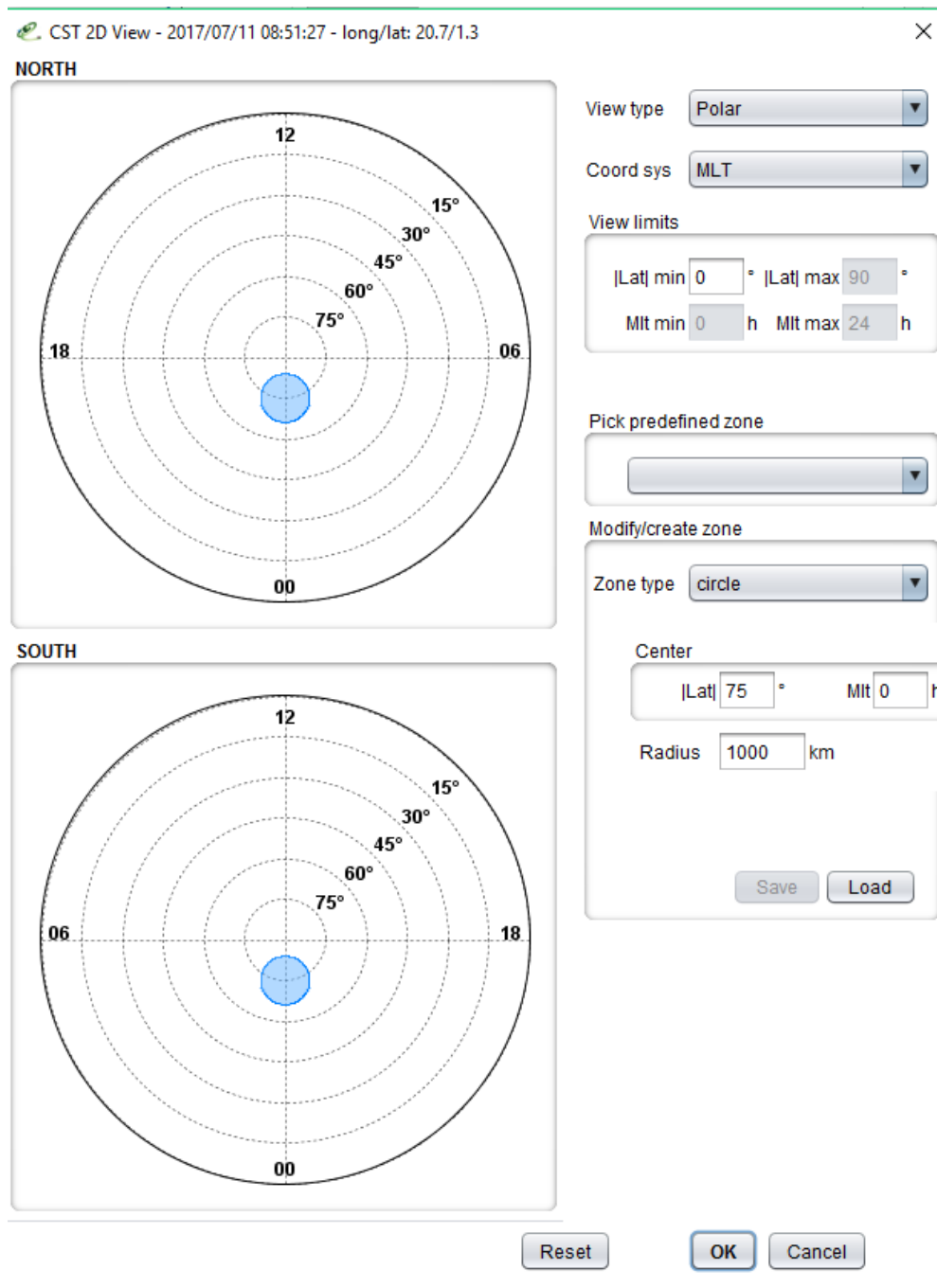
Note that

the time

interval (Start time and stop time) will automatically adjust to the common operation time of the selected instruments. To avoid this, the “Freeze” box can be ticked.

## Step 2: conjunction region

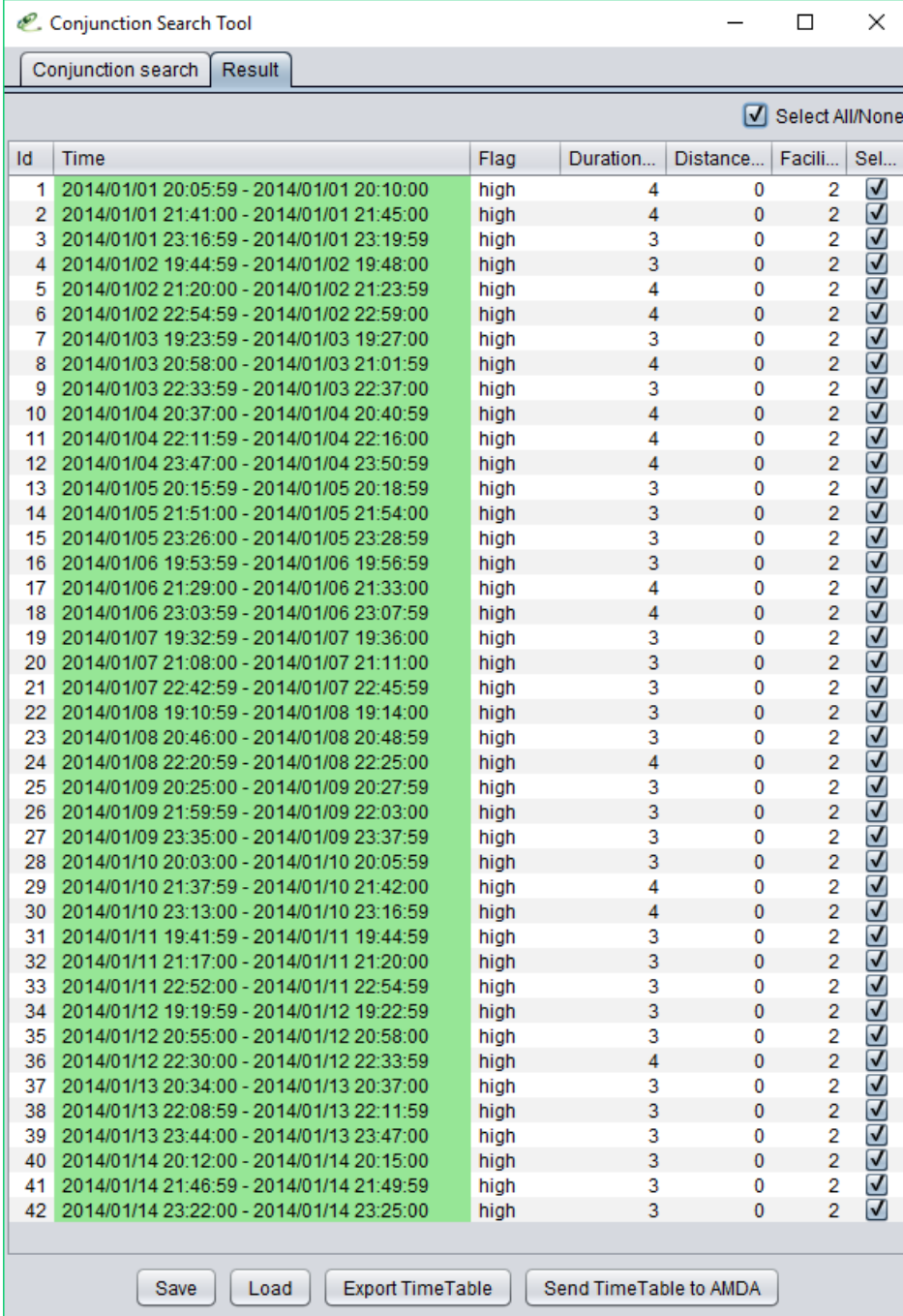
Click the Visualization interface type-2DView button. In polar view and MLT coordinate system, we set the region of conjunction as a circle centred on the ESR latitude (~75 MLAT) and at 0 MLT. Radius of the circle: 1000 km (for the time being, it is recommended not to choose too small radii).



Click OK; Then you receive the following message : Region correctly picked !

### Step 3: run and results

Here we launch the run without specifying any quality criteria (not yet quite implemented). Click the **Search** button. After a while (typically 20s), the CST returns 42 conjunctions in the *Results* tab.

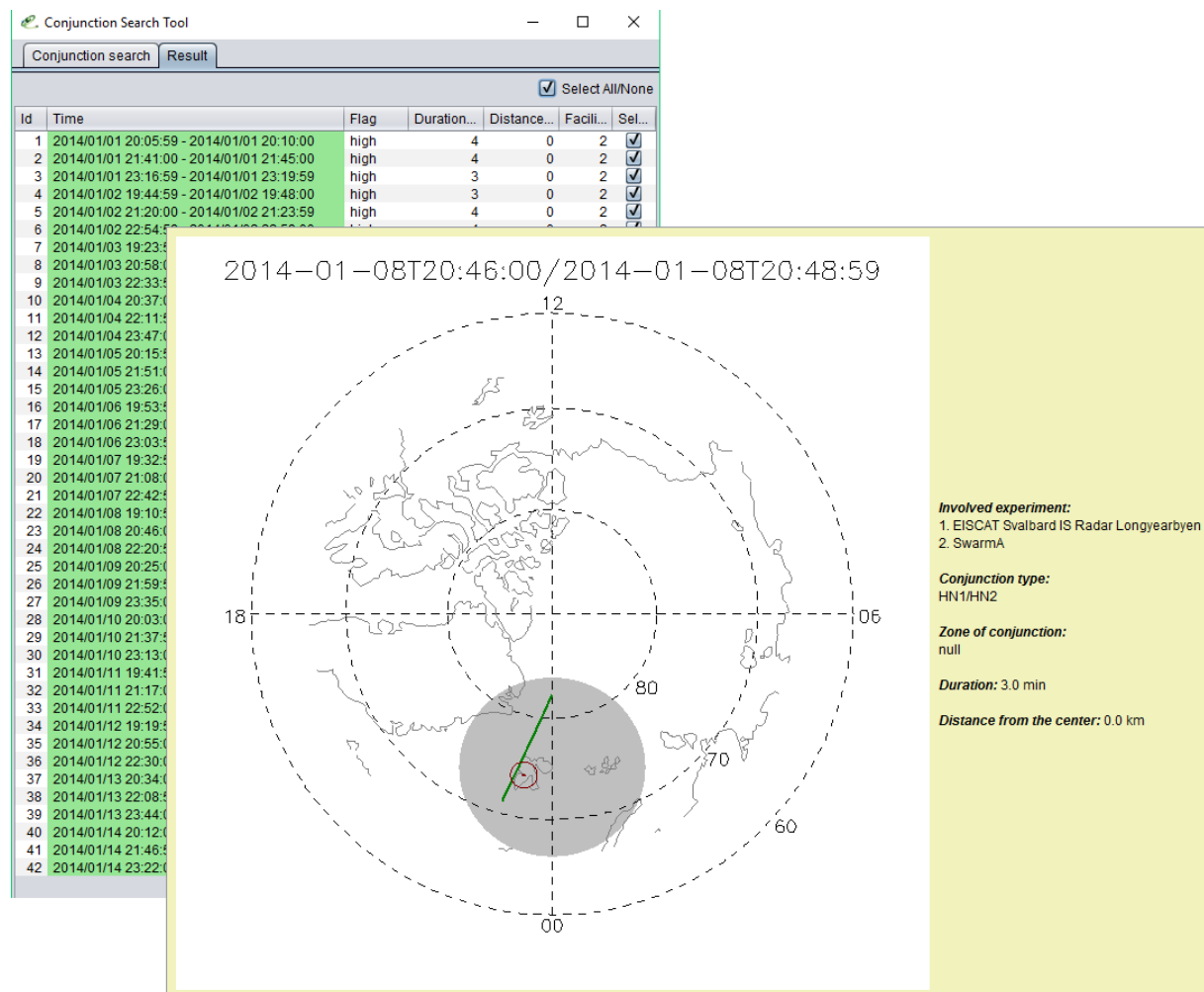


The screenshot shows the 'Conjunction Search Tool' window with the 'Result' tab selected. A table lists 42 conjunctions, each with an ID, time range, flag, duration, distance, facility count, and a selection checkbox. All flags are 'high', distances are 0, and facility counts are 2. The table is scrollable, and the bottom of the window contains buttons for 'Save', 'Load', 'Export TimeTable', and 'Send TimeTable to AMDA'.

Id	Time	Flag	Duration...	Distance...	Facili...	Sel...
1	2014/01/01 20:05:59 - 2014/01/01 20:10:00	high	4	0	2	<input checked="" type="checkbox"/>
2	2014/01/01 21:41:00 - 2014/01/01 21:45:00	high	4	0	2	<input checked="" type="checkbox"/>
3	2014/01/01 23:16:59 - 2014/01/01 23:19:59	high	3	0	2	<input checked="" type="checkbox"/>
4	2014/01/02 19:44:59 - 2014/01/02 19:48:00	high	3	0	2	<input checked="" type="checkbox"/>
5	2014/01/02 21:20:00 - 2014/01/02 21:23:59	high	4	0	2	<input checked="" type="checkbox"/>
6	2014/01/02 22:54:59 - 2014/01/02 22:59:00	high	4	0	2	<input checked="" type="checkbox"/>
7	2014/01/03 19:23:59 - 2014/01/03 19:27:00	high	3	0	2	<input checked="" type="checkbox"/>
8	2014/01/03 20:58:00 - 2014/01/03 21:01:59	high	4	0	2	<input checked="" type="checkbox"/>
9	2014/01/03 22:33:59 - 2014/01/03 22:37:00	high	3	0	2	<input checked="" type="checkbox"/>
10	2014/01/04 20:37:00 - 2014/01/04 20:40:59	high	4	0	2	<input checked="" type="checkbox"/>
11	2014/01/04 22:11:59 - 2014/01/04 22:16:00	high	4	0	2	<input checked="" type="checkbox"/>
12	2014/01/04 23:47:00 - 2014/01/04 23:50:59	high	4	0	2	<input checked="" type="checkbox"/>
13	2014/01/05 20:15:59 - 2014/01/05 20:18:59	high	3	0	2	<input checked="" type="checkbox"/>
14	2014/01/05 21:51:00 - 2014/01/05 21:54:00	high	3	0	2	<input checked="" type="checkbox"/>
15	2014/01/05 23:26:00 - 2014/01/05 23:28:59	high	3	0	2	<input checked="" type="checkbox"/>
16	2014/01/06 19:53:59 - 2014/01/06 19:56:59	high	3	0	2	<input checked="" type="checkbox"/>
17	2014/01/06 21:29:00 - 2014/01/06 21:33:00	high	4	0	2	<input checked="" type="checkbox"/>
18	2014/01/06 23:03:59 - 2014/01/06 23:07:59	high	4	0	2	<input checked="" type="checkbox"/>
19	2014/01/07 19:32:59 - 2014/01/07 19:36:00	high	3	0	2	<input checked="" type="checkbox"/>
20	2014/01/07 21:08:00 - 2014/01/07 21:11:00	high	3	0	2	<input checked="" type="checkbox"/>
21	2014/01/07 22:42:59 - 2014/01/07 22:45:59	high	3	0	2	<input checked="" type="checkbox"/>
22	2014/01/08 19:10:59 - 2014/01/08 19:14:00	high	3	0	2	<input checked="" type="checkbox"/>
23	2014/01/08 20:46:00 - 2014/01/08 20:48:59	high	3	0	2	<input checked="" type="checkbox"/>
24	2014/01/08 22:20:59 - 2014/01/08 22:25:00	high	4	0	2	<input checked="" type="checkbox"/>
25	2014/01/09 20:25:00 - 2014/01/09 20:27:59	high	3	0	2	<input checked="" type="checkbox"/>
26	2014/01/09 21:59:59 - 2014/01/09 22:03:00	high	3	0	2	<input checked="" type="checkbox"/>
27	2014/01/09 23:35:00 - 2014/01/09 23:37:59	high	3	0	2	<input checked="" type="checkbox"/>
28	2014/01/10 20:03:00 - 2014/01/10 20:05:59	high	3	0	2	<input checked="" type="checkbox"/>
29	2014/01/10 21:37:59 - 2014/01/10 21:42:00	high	4	0	2	<input checked="" type="checkbox"/>
30	2014/01/10 23:13:00 - 2014/01/10 23:16:59	high	4	0	2	<input checked="" type="checkbox"/>
31	2014/01/11 19:41:59 - 2014/01/11 19:44:59	high	3	0	2	<input checked="" type="checkbox"/>
32	2014/01/11 21:17:00 - 2014/01/11 21:20:00	high	3	0	2	<input checked="" type="checkbox"/>
33	2014/01/11 22:52:00 - 2014/01/11 22:54:59	high	3	0	2	<input checked="" type="checkbox"/>
34	2014/01/12 19:19:59 - 2014/01/12 19:22:59	high	3	0	2	<input checked="" type="checkbox"/>
35	2014/01/12 20:55:00 - 2014/01/12 20:58:00	high	3	0	2	<input checked="" type="checkbox"/>
36	2014/01/12 22:30:00 - 2014/01/12 22:33:59	high	4	0	2	<input checked="" type="checkbox"/>
37	2014/01/13 20:34:00 - 2014/01/13 20:37:00	high	3	0	2	<input checked="" type="checkbox"/>
38	2014/01/13 22:08:59 - 2014/01/13 22:11:59	high	3	0	2	<input checked="" type="checkbox"/>
39	2014/01/13 23:44:00 - 2014/01/13 23:47:00	high	3	0	2	<input checked="" type="checkbox"/>
40	2014/01/14 20:12:00 - 2014/01/14 20:15:00	high	3	0	2	<input checked="" type="checkbox"/>
41	2014/01/14 21:46:59 - 2014/01/14 21:49:59	high	3	0	2	<input checked="" type="checkbox"/>
42	2014/01/14 23:22:00 - 2014/01/14 23:25:00	high	3	0	2	<input checked="" type="checkbox"/>

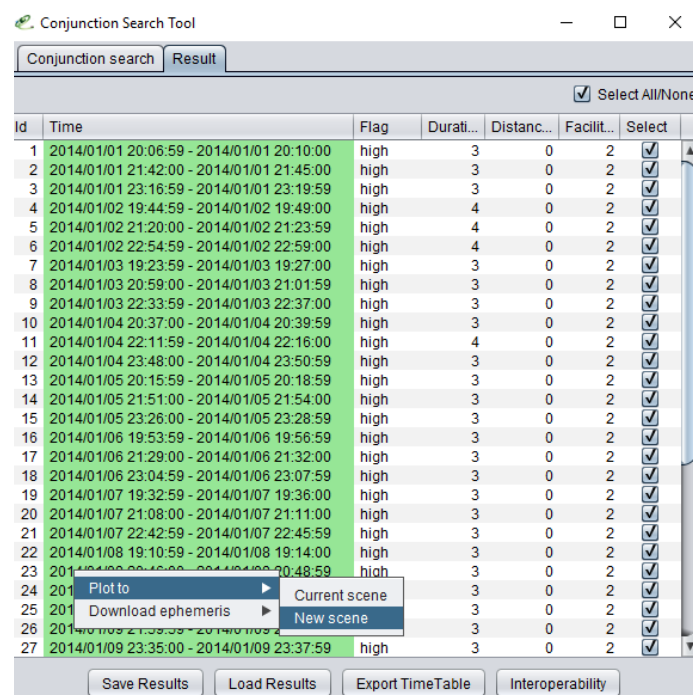
Let us choose the conjunction on January 8, between 20:46 à 20:49 (conjunction #23). By passing the mouse over the corresponding line, a picture of the conjunction appears.

## 3DView 2.0 Tutorial

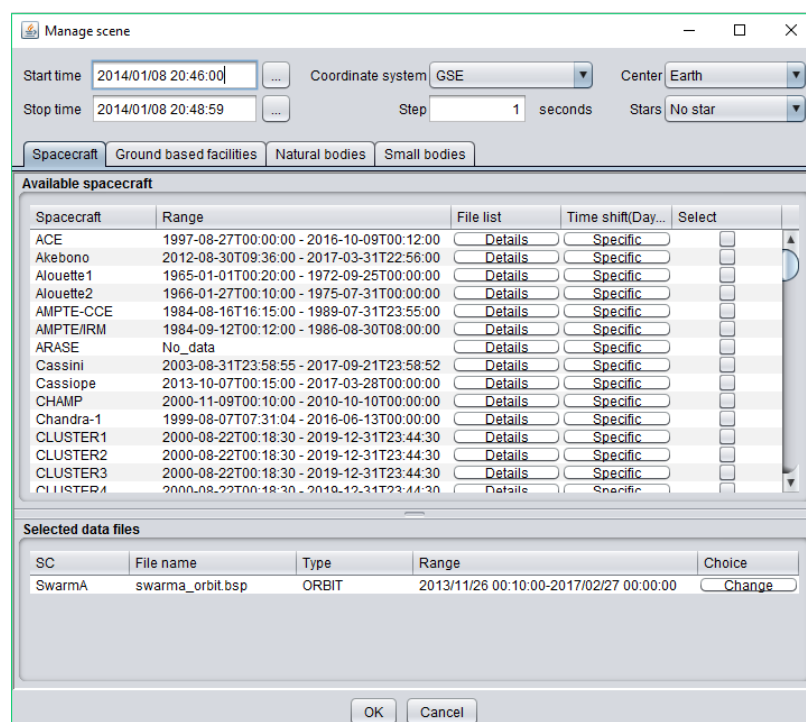


## Step 4: visualisation of the conjunction

One can then send all the necessary information (time intervals and instruments involved in the conjunction) to 3D View by right clicking on the conjunction #23 and choosing *Plot to new scene*. The option *Plot to current scene* uses an already existing 3DView scene.

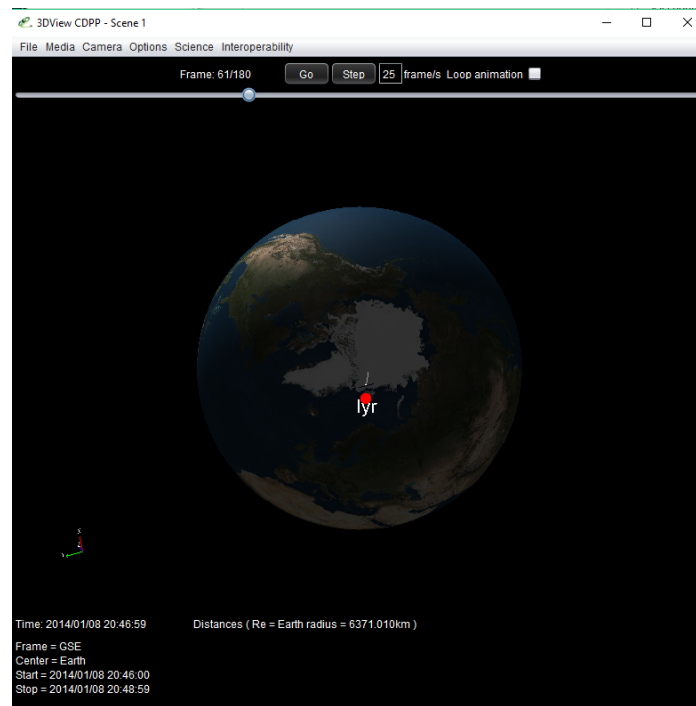


The *Manage scene* of 3D View then opens. The time interval corresponding to the conjunction #23 is prefilled; Swarm A in the *Spacecraft* and ESR in *Ground based facilities* are selected.

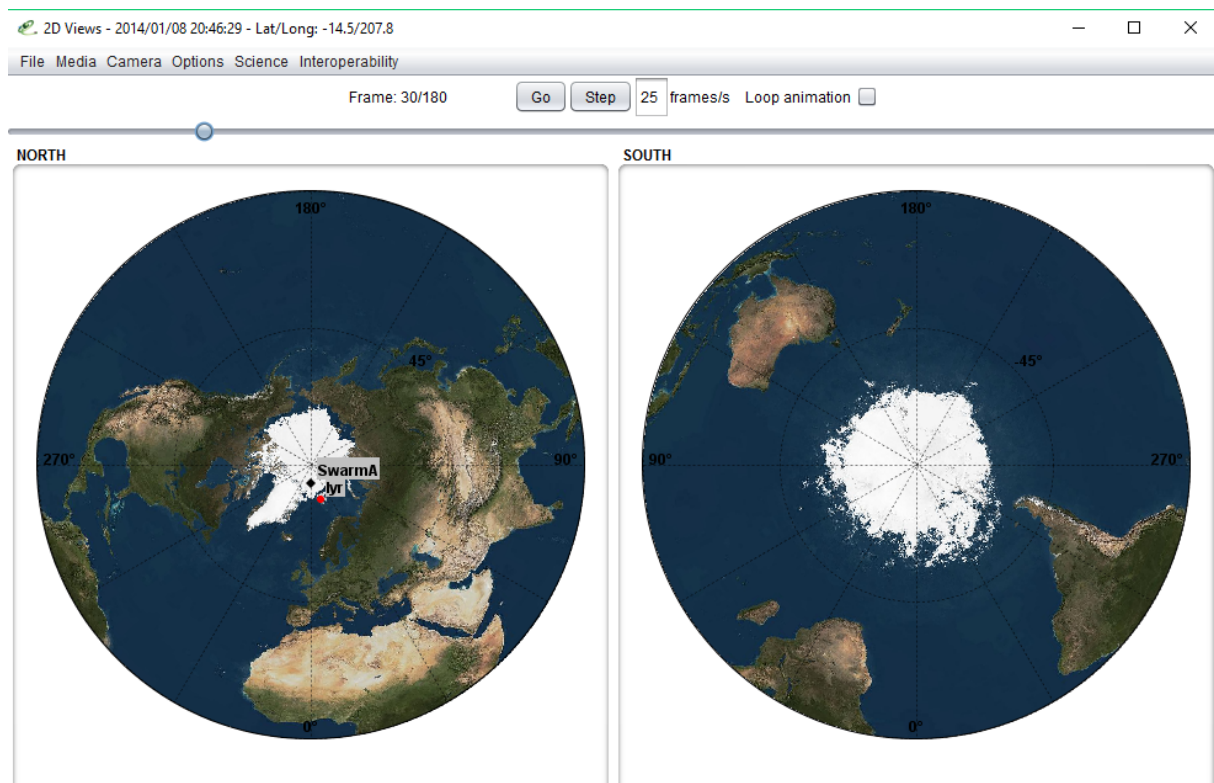


## 3DView 2.0 Tutorial

One can then visualise the conjunction in 3D:



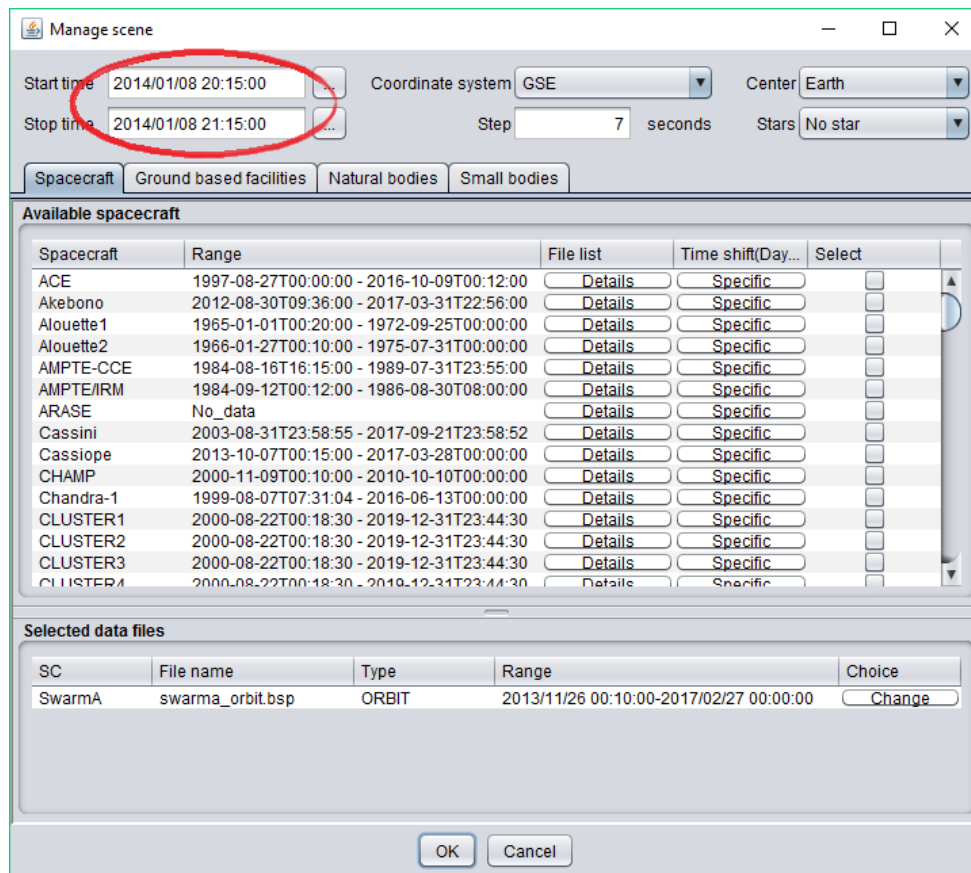
Or in 2D (*Camera* tab then *2DView*):



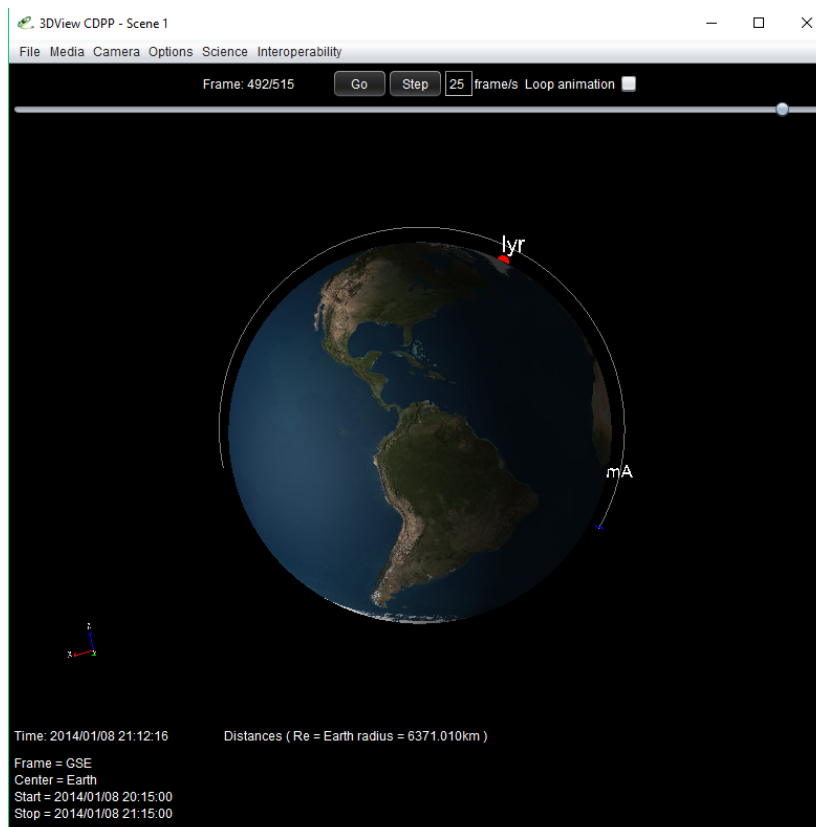


## Step 5: exploitation of the conjunction

Let us add some data to the scene to exploit scientifically our conjunction. To the end, we extend a little the time interval to 20:15 – 21:15 in the *Manage scene* window.

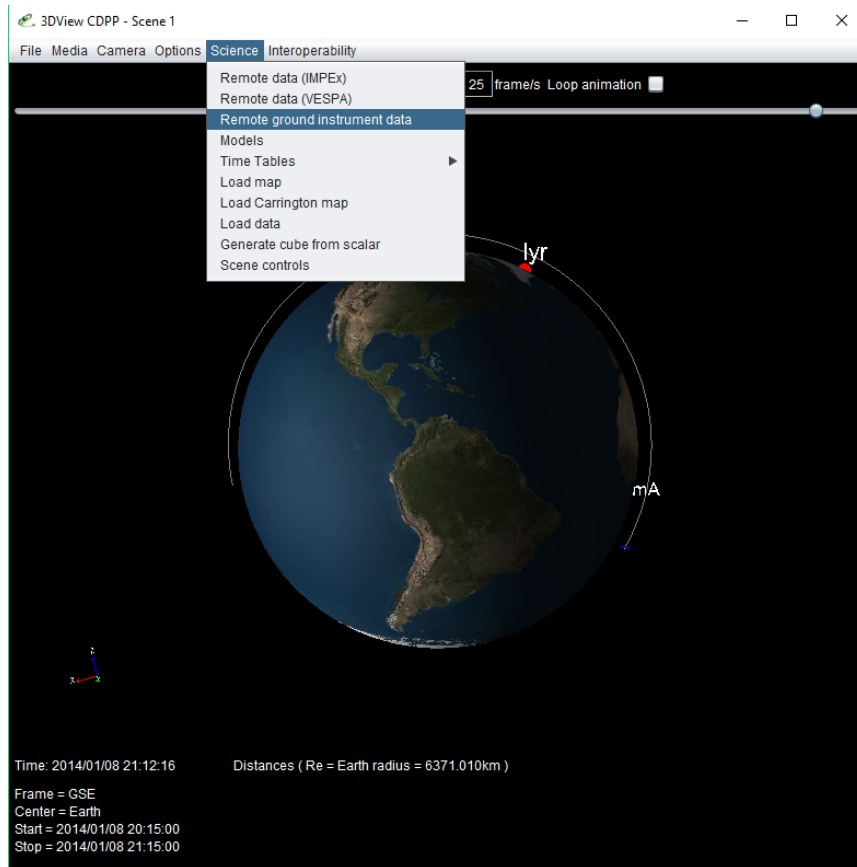


We now have about 2/3 of Swarm A orbit.

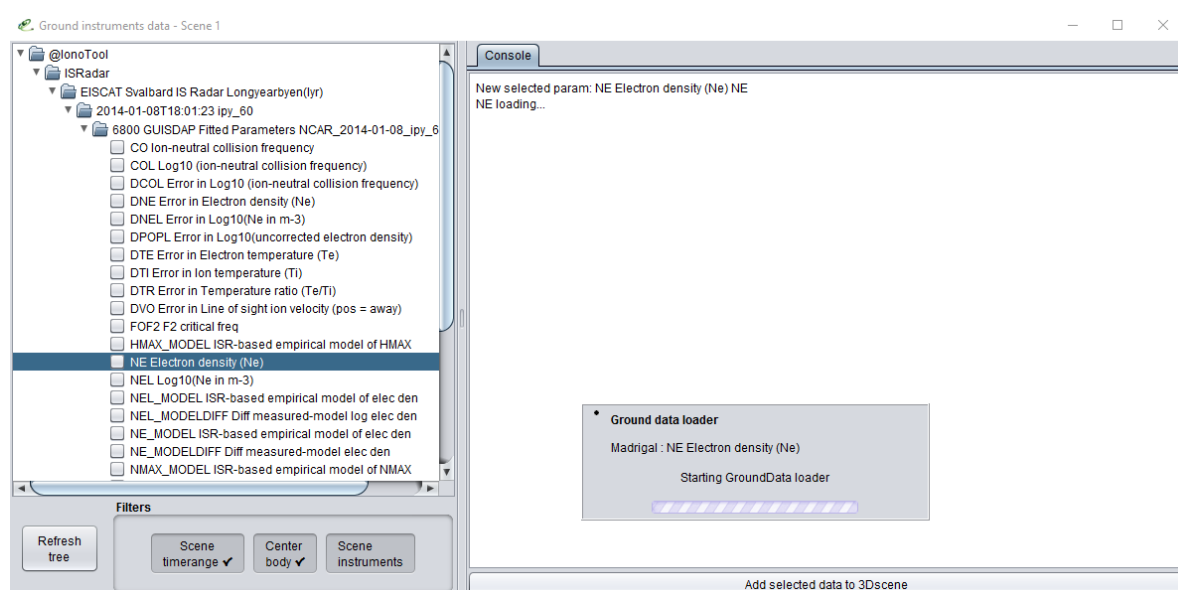


## 3DView 2.0 Tutorial

To add ESR data to the view, in *Science* tab, one has to select *Remote ground instruments data*:

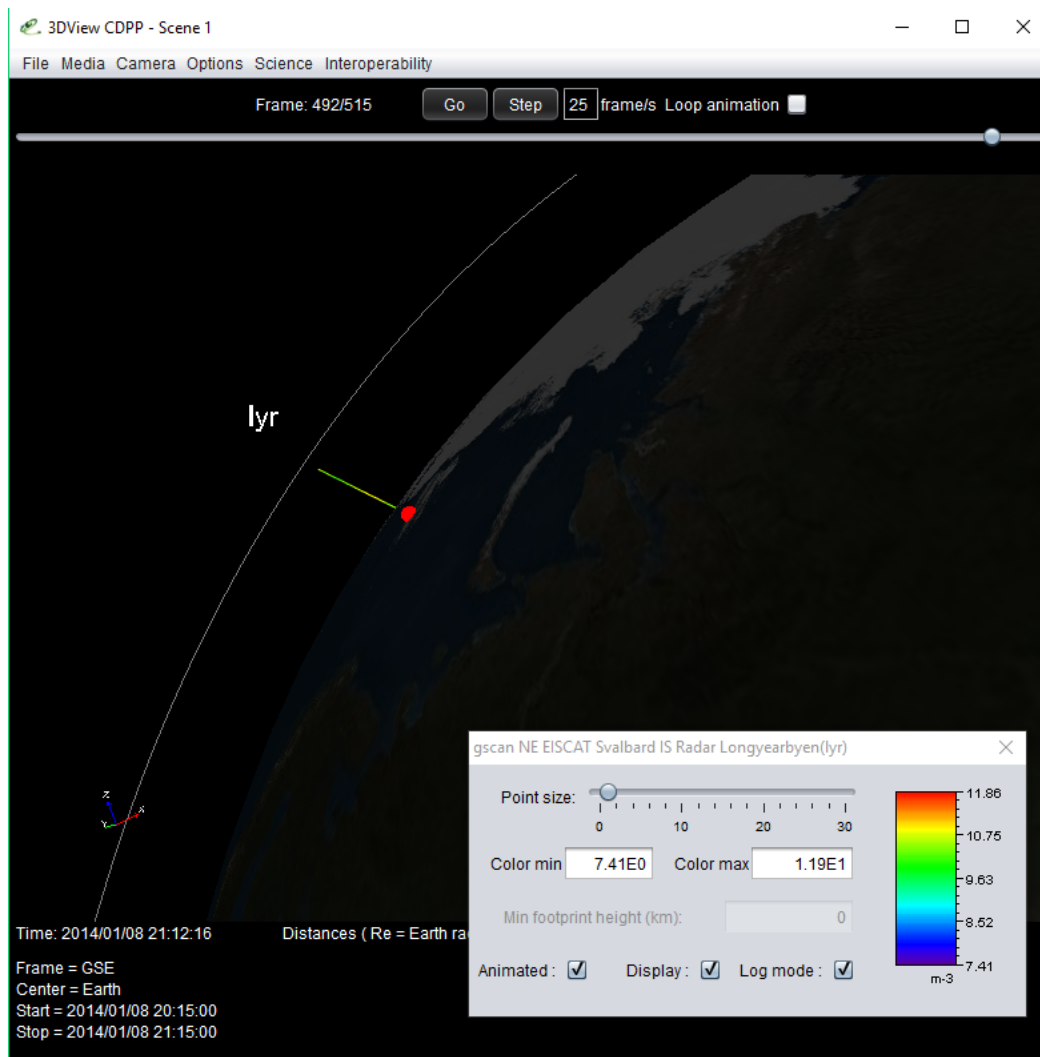


In the *@Ionotool* data tree, only ISRadars should appear, as it is the only instrument category selected in *Manage scene*. Let us click on it and then appears *EISCAT Svalbard IS Radar Longyearbyen*, the only selected ground based instrument. Clicking on it makes 3D View connect to the Madrigal database, which returns a file containing the available parameters for the day. Let us choose Ne, the electron density and send Ne to the scene by clicking on *Add selected data to 3D scene*.



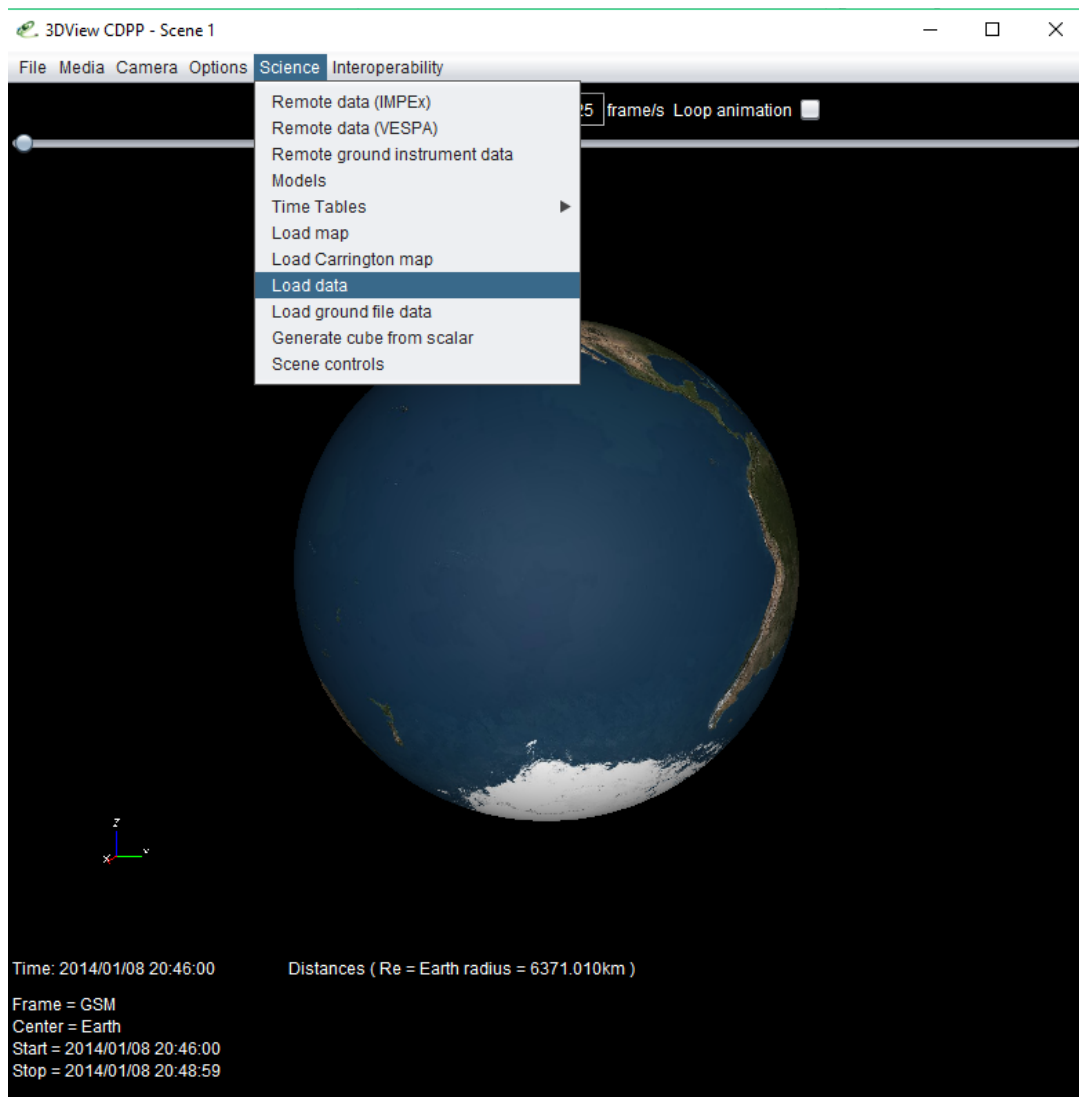
## 3DView 2.0 Tutorial

We get, on the 3D view, a coloured line that represents colour-coded Ne values along the radar beam.



Let us now add a Swarm data file. The attached file is from the Langmuir probe on Swarm A. We can upload it in *Science* and *Load data*

## 3DView 2.0 Tutorial

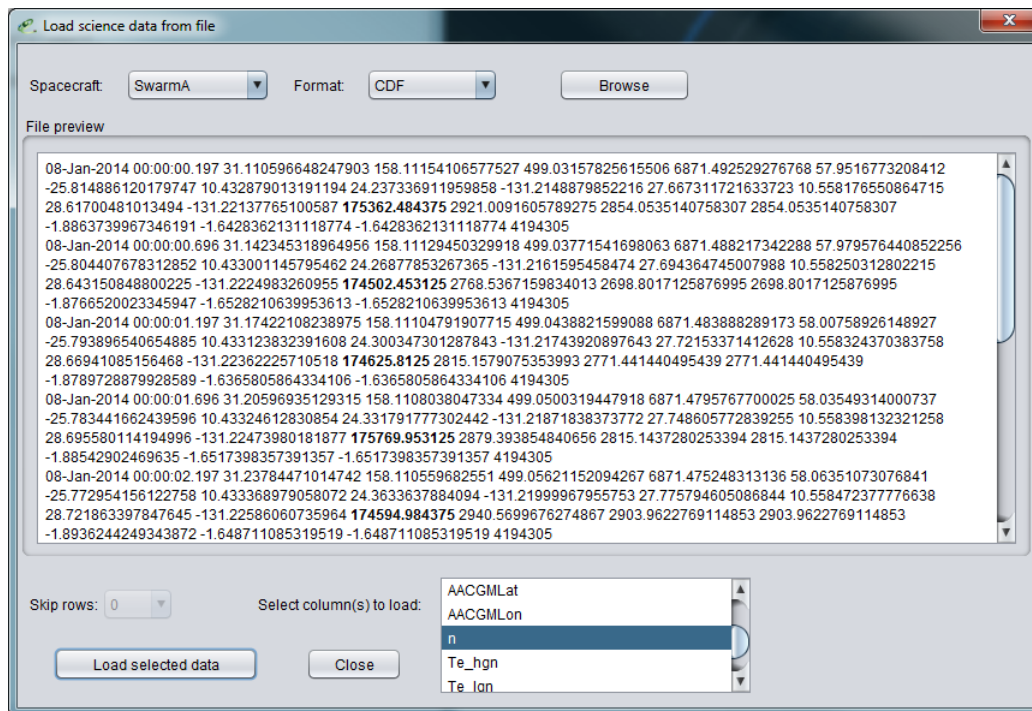


We select the file format (here .cdf) and choose one of the physical parameters contained in the file. Let us choose the electron density  $n$ .

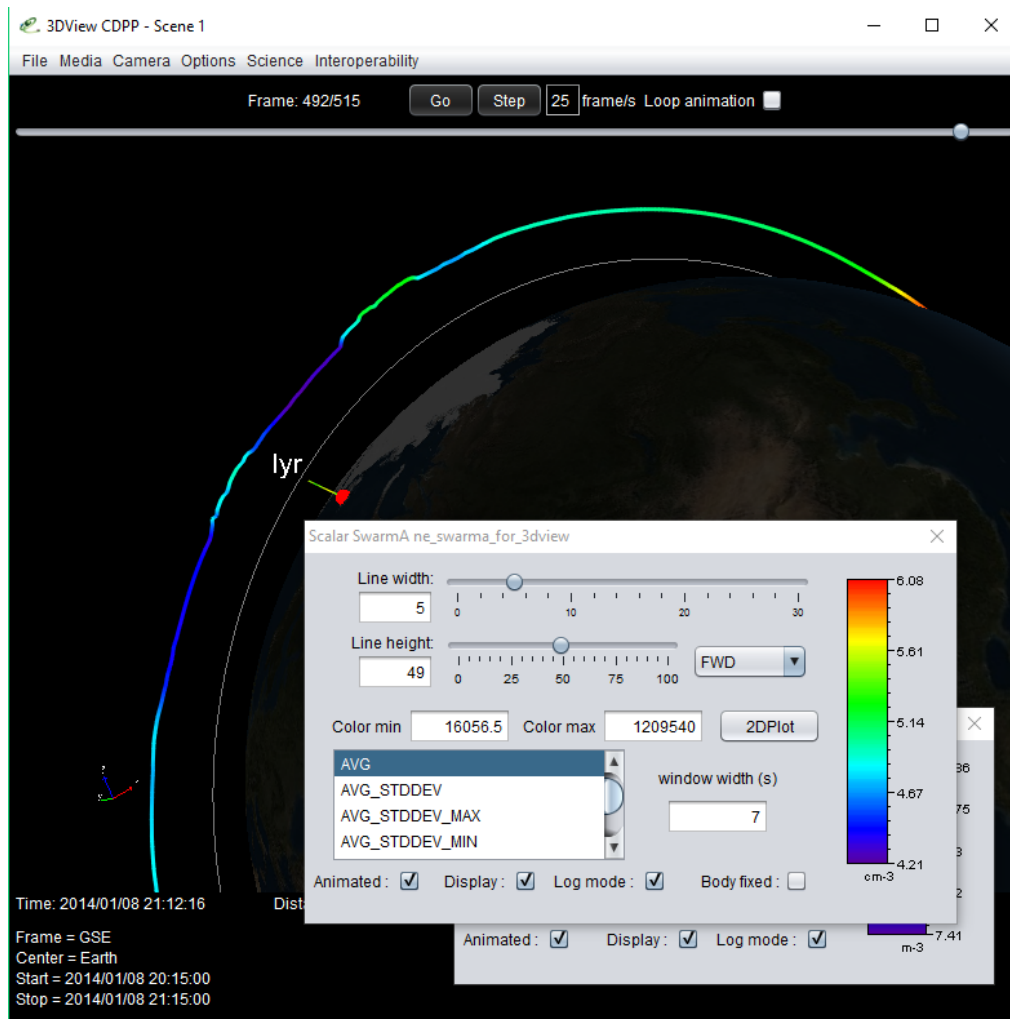
This data file can be downloaded from:

<https://nuage.irap.omp.eu/index.php/s/2L00mv4F3nsU6bq>

## 3DView 2.0 Tutorial

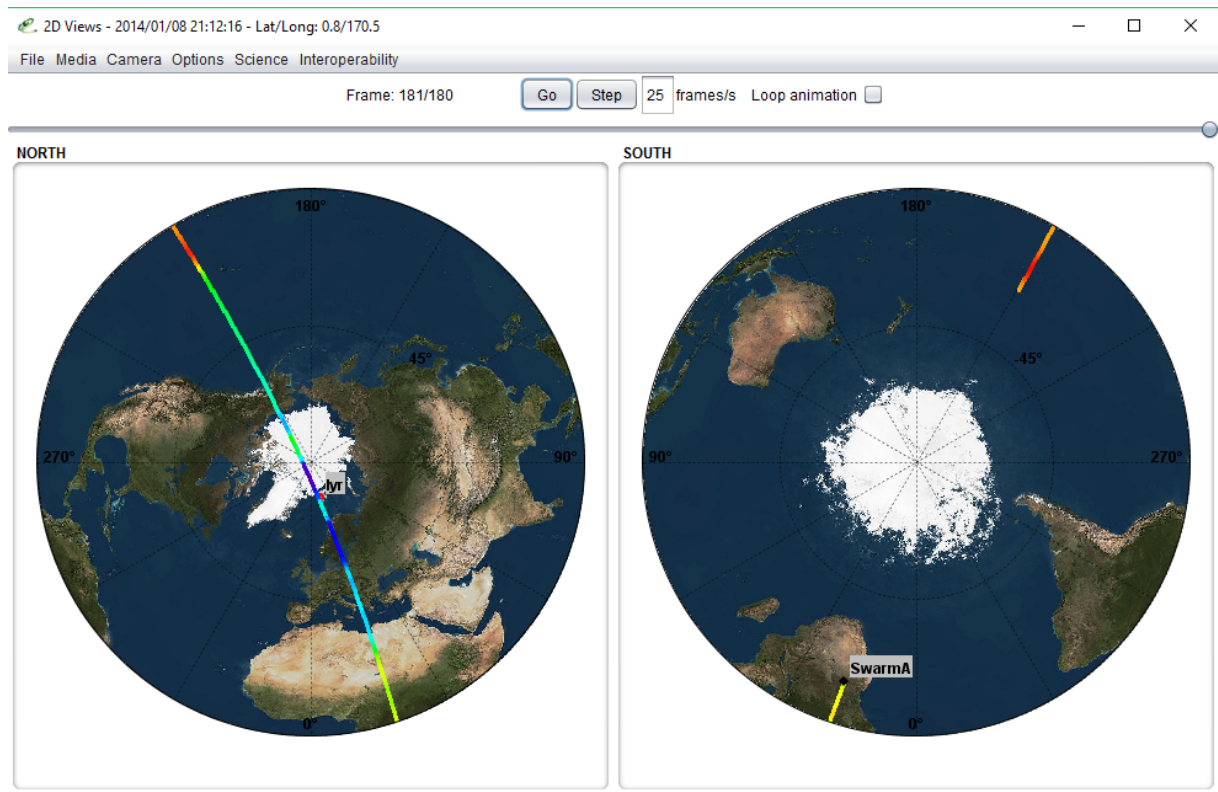


The electron density is added along Swarm A orbit:



## 3DView 2.0 Tutorial

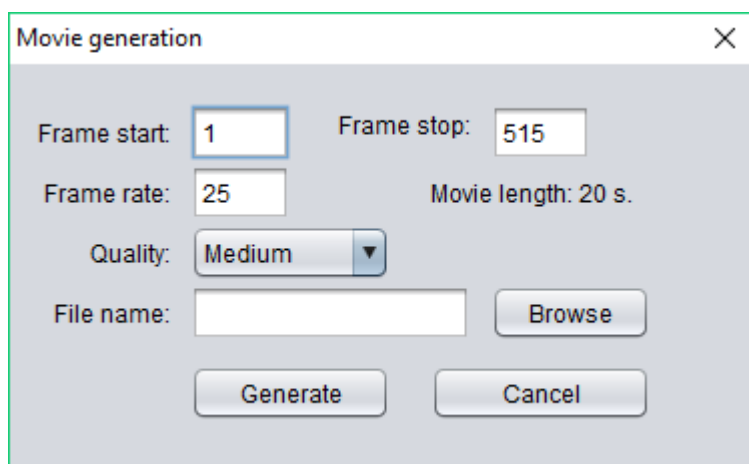
This can be viewed in 2D (*Camera* and *2DView*):



### Step 6: generating a figure or a movie

For the need of a publication or a presentation, one may want to generate a picture or a movie of the scene. To these ends, in the *Media* tab, one have the choice.

#### *Generate movie*



Please be aware that the movie will actually start where you are in the view. If you want a movie from start time to end time, then you need to position the time cursor at the beginning of the time interval or set *Frame start* at 1 in the *Movie generation* window.