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PP	Restricted to other programme participants (including the Commission Service)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
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Author (s)	Laurent BEIGBEDER

Abstract:

After the generic access of VESPA databases in 3DView, a more specific integration of APIS maps has been made.

Using specific map products containing localisation data, we have been able to project maps on planets such as Jupiter, Saturn or Uranus.

This is a JRA work (WP11) that has been delivered for VA use.

The software associated with the deliverable is developed by Laurent Beigbeder and it is available on test server <http://37.205.41.166:8080/3DVH2020/> until March 31th, then it will be available on IRAP server (<http://3dview.cdpp.eu/>).

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1 Generic surface mapping in 3DView

The use of planets maps in 3DView has been improved. A list of predefined maps with its descriptions and user custom ones can be added from a common GUI accessed through the *Science/load map* menu.

1.1 Predefined maps included in 3DView

When a scene is displayed, user can choose different maps with the load map menu:

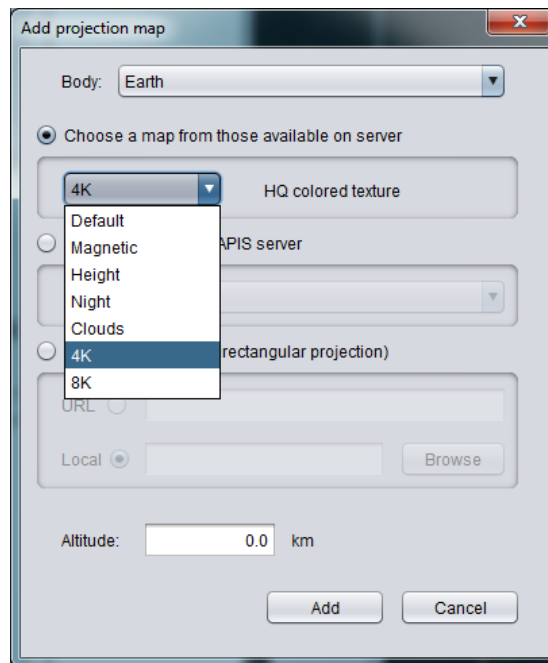


Figure 1 : Predefined map selection

Each map is described on server in an easily editable text file. Each line contains the following data: body naif id, map name, altitude from surface (km), description, type, relative path from texture directory. Here is the available list:

```
10;Default;0;Standard colored texture;MERCATOR;10_texture.jpg
199;Default;0;Standard colored texture;MERCATOR;199_texture.jpg
299;Default;0;Standard colored texture;MERCATOR;299_texture.jpg
399;Default;0;Standard colored texture;MERCATOR;399_texture.jpg
399;Magnetic;0;Custal magnetic anomalies;MERCATOR;399_Magnetic_texture.jpg
399;Height;0;Height map;MERCATOR;399_Custom_texture.jpg
399;Night;0;Night city map 1024x512;MERCATOR;399_earthlights1k.jpg
399;Clouds;300;Cloud map 1024x512;MERCATOR;399_earthcloudmap.png
399;4K;0;HQ colored texture;MERCATOR;e43_color2_sh_4k.jpg
399;8K;0;UHQ colored texture;MERCATOR;e43_color2_sh_8k.jpg
499;Default;0;Standard colored texture;MERCATOR;499_texture.jpg
```

```
499;Crustal Morschhauser;180;Morschhauser map at  
180km;MERCATOR;499_morschhauser_180.jpg  
499;Crustal Connerney;400;Connerney J.E.P. et al.(2005) Proc. Nati. Acad. Sci  
USA, 102, No. 42, 14970-14975.;MERCATOR;499_Magnetic_texture.jpg  
499;Labeled map;0;From http://www.karmalimbo.com/aro. Good GC required (3K  
map);MERCATOR;499_mars-map-mid.jpg  
499;Crustal Cain;200;Generated from Cain. Br -341 to 645  
nT;MERCATOR;499_cain_br_200.jpg  
599;Default;0;Standard colored texture;MERCATOR;599_texture.jpg  
599;Labeled map;0;From http://www.karmalimbo.com/aro. Good GC required (4K  
map);MERCATOR;599_jupiter-map.jpg  
699;Default;0;Standard colored texture;MERCATOR;699_texture.jpg  
799;Default;0;Standard colored texture;MERCATOR;799_texture.jpg  
899;Default;0;Standard colored texture;MERCATOR;899_texture.jpg  
999;Default;0;Standard colored texture;MERCATOR;999_texture.jpg
```

For the moment, the only available type is MERCATOR but it could be extend in the future if some new standard projection map type is identified.

1.2 User custom maps loading

If user has his own map in a Mercator format (equirectangular is the right projection name as latitudes are in constant scale: https://en.wikipedia.org/wiki/Equirectangular_projection).

Longitude 0 must be at the center of the map.

User can upload a map from a local file system or giving a URL (i.e.

<https://upload.wikimedia.org/wikipedia/commons/e/ea/Equirectangular-projection.jpg>).

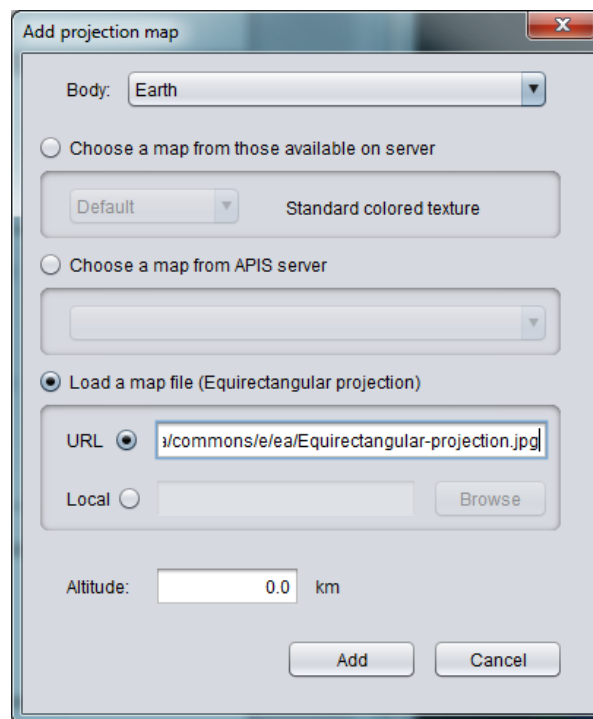


Figure 2 : adding a distant map from URL

1.3 Generic properties of maps

Each map can be added to scene with an altitude parameter. If altitude is set to 0, map will replace current one and no other option will be available afterwards. If altitude is more than 0, a new semi-transparent sphere will be added to center planet. A control box allows then to modify altitude and transparency of the map.

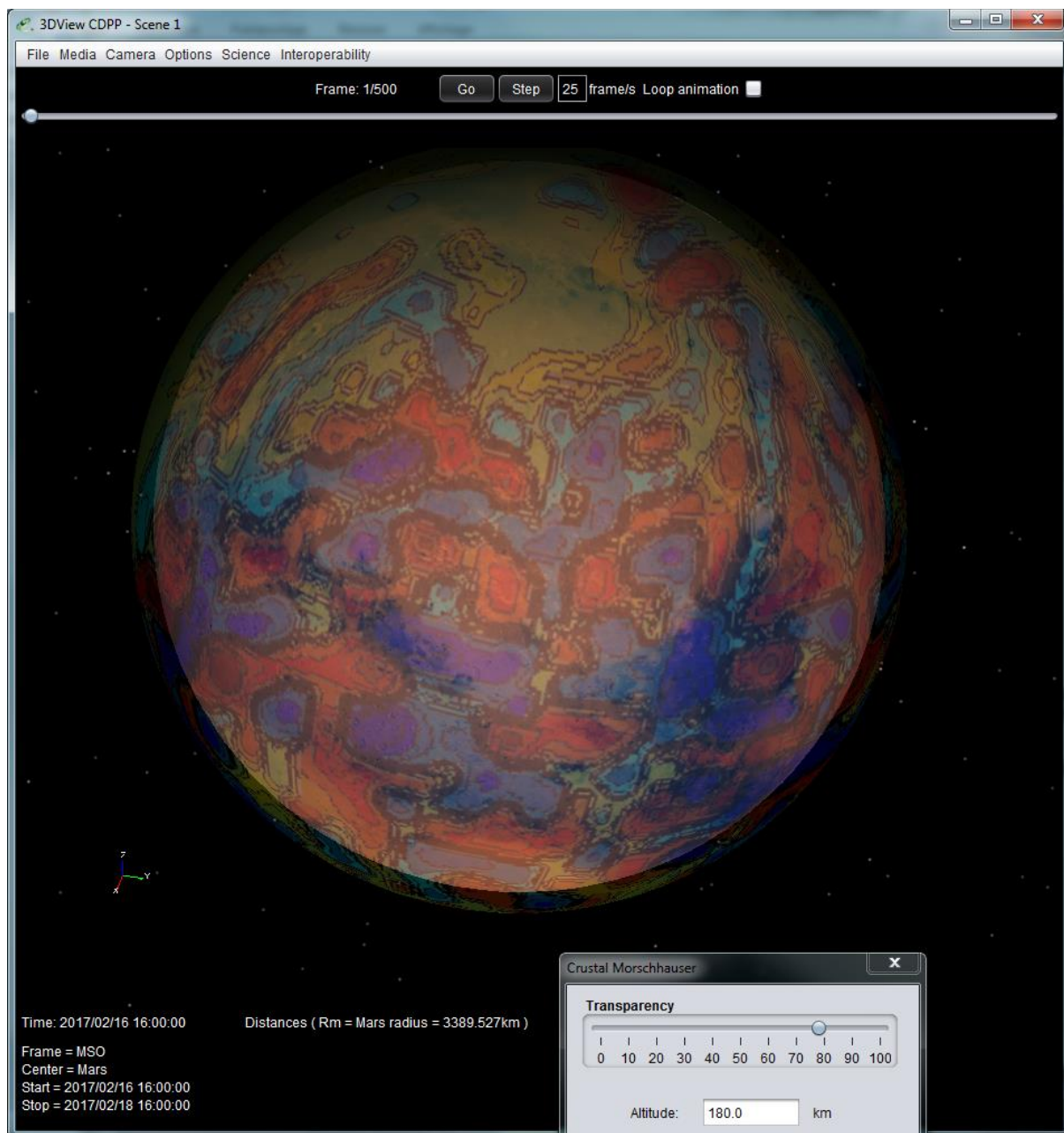


Figure 3 : Morschhauser map added to Mars at 180km from surface

2 Planetary mapping from APIS in 3DView

2.1 Presentation

After the generic access of VESPA databases in 3DView, a more specific integration has been made.

The APIS auroral image database (<http://apis.obspm.fr/>) available through EPN-TAP has been used to improve 3DView projection mapping capabilities. Using specific map products containing localisation data, we have been able to project maps on planets such as Jupiter or Saturn.

The EPN-TAP protocol allows the user to select a subset of data from an archive in a standard way, based on the IVOA (International Virtual Observatory Alliance) Table Access Protocol (TAP). The TAP mechanism is completed by an underlying Data Model and reference dictionaries.

2.2 Integration

APIS Database provides many product types but only one gives location metadata so only images with product type 'im', access format 'image/fits' and name ending with '_proc' have been processed.

As images come with a time flag, they are displayed accordingly. Images are displayed in a timerange computed from the timestamp and the display duration set by user.

To preserve map location in time, it follows planet rotation after being shifted from Earth observation reference to Sun. For that, values in FITS header giving Earth and Sun longitude and latitude were used (SUSLON, SUBELON, SUBSLAT, SUBELAT).

2.3 Example

To use this functionality in 3DView, you have to first create a scene centered on the observation planet. Once done, with *Science/load map* menu, you can load APIS maps available for this object in the scene time range. It is retrieved from an EPN-TAP request.

For example: select a scene from 2014/01/13 19:00:00 to 2014/01/14 01:00:00 with Jupiter center:

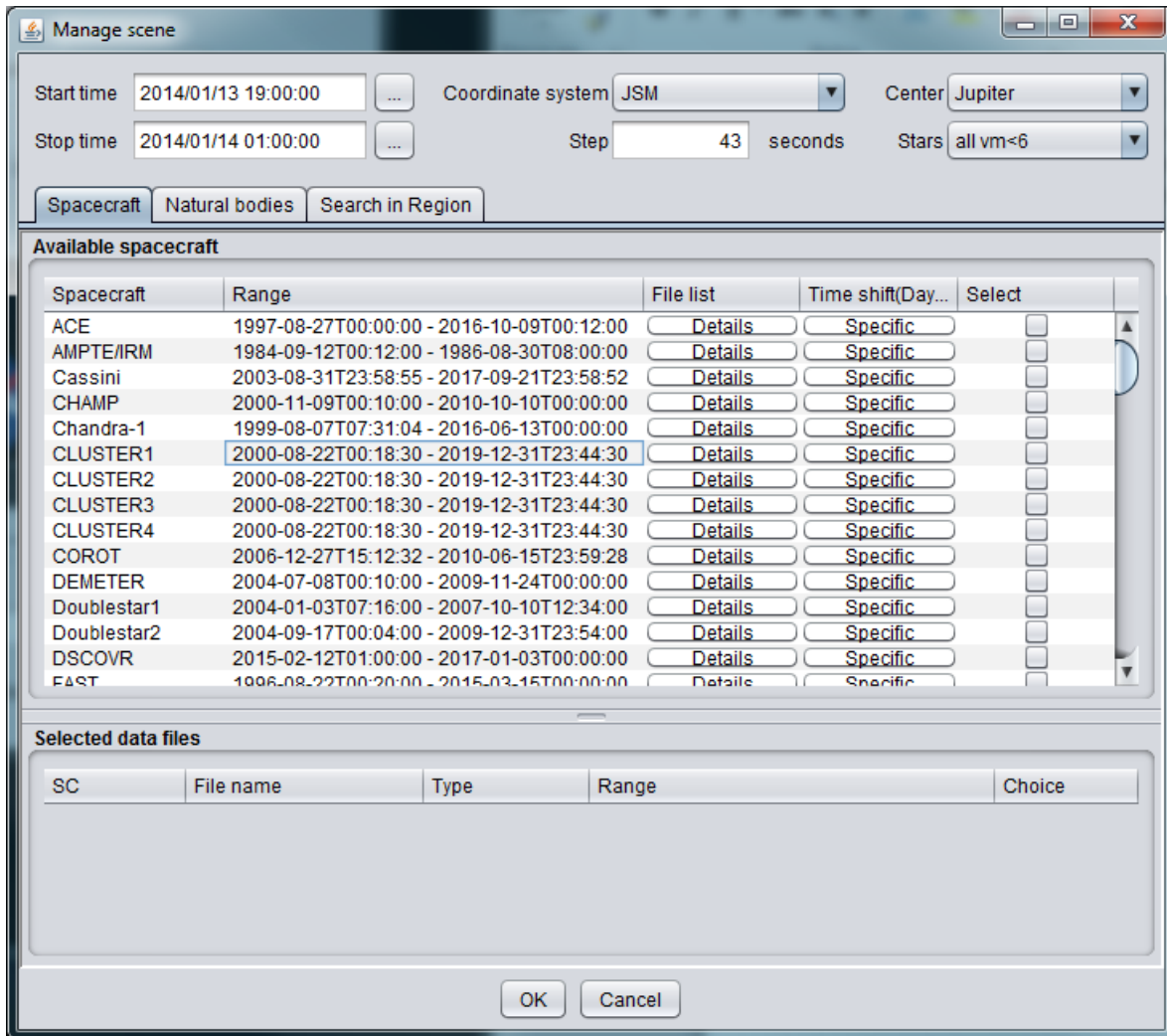


Figure 4 : Scene parameters

Scene should look like this:

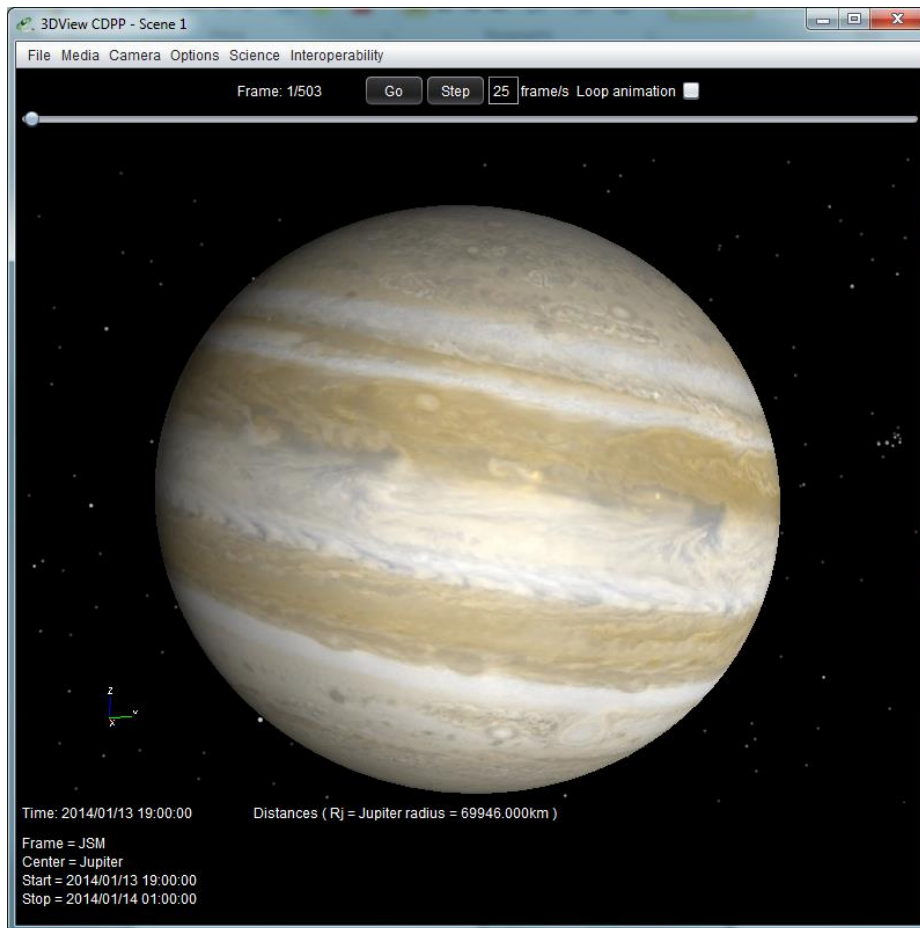


Figure 5 : Initial scene

Now open the *Science/load map* menu and select *Auroral images from APIS*.

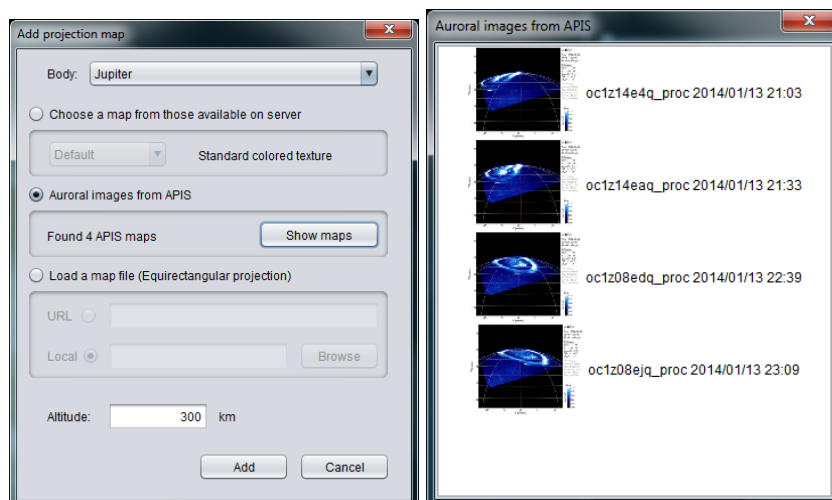


Figure 6 : APIS map loading GUI

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.

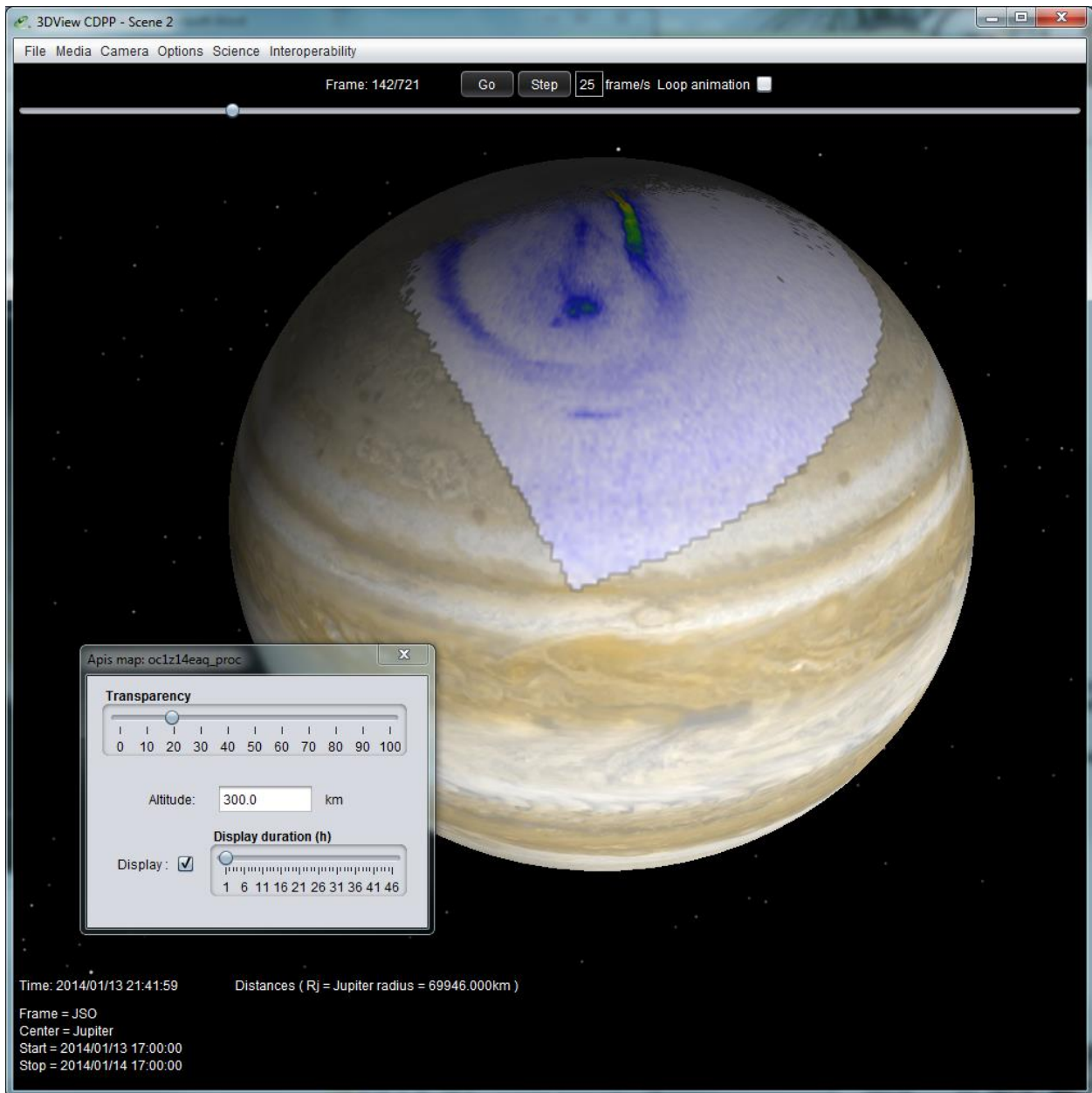


Figure 7 : Jupiter aurora and its display control box

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