



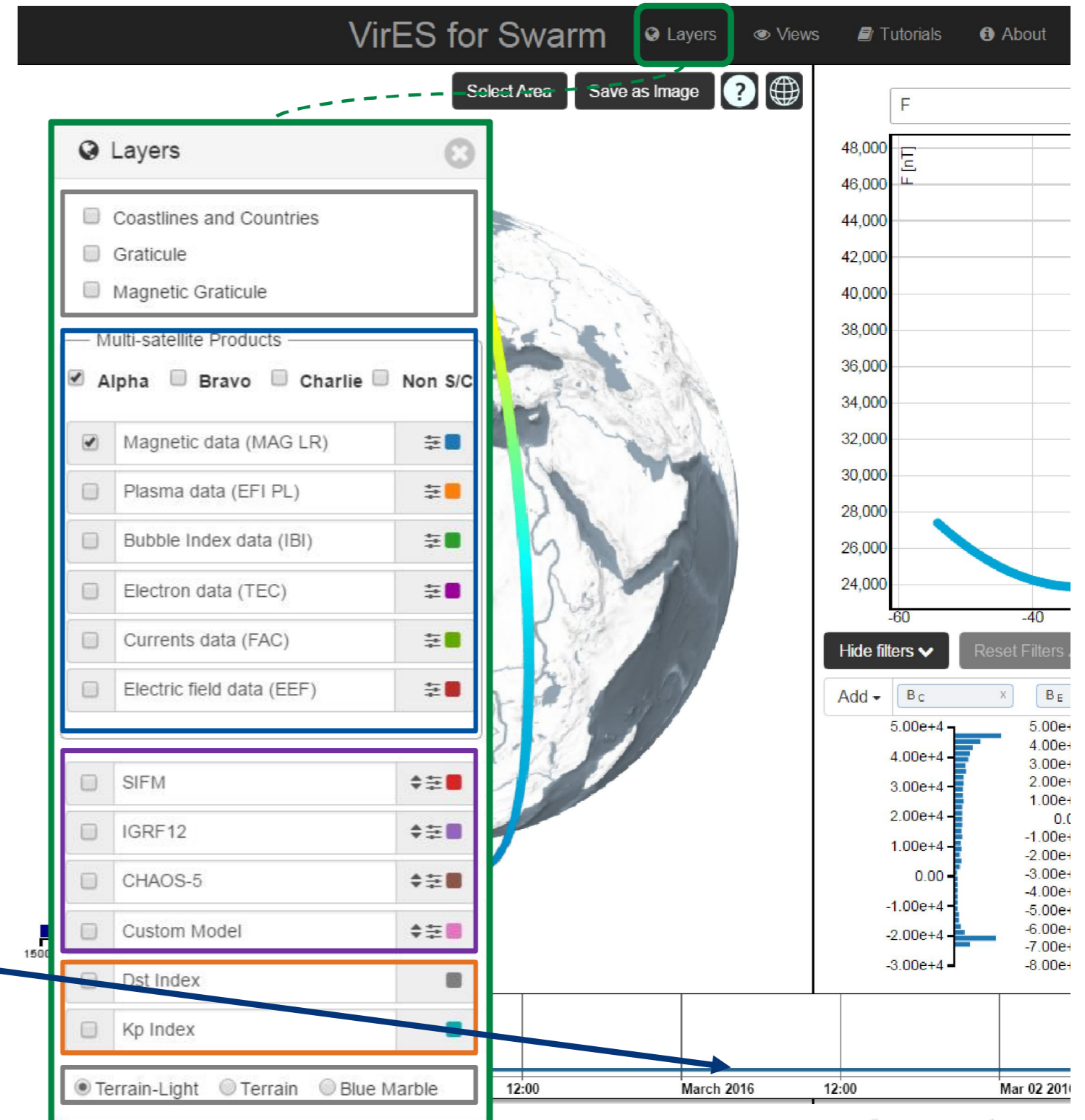
# Layers

Layers widget provides the possibility to select the specific data to be visualized. It can be activated by clicking on the "Layers" button on the dashboard.

Available layers:

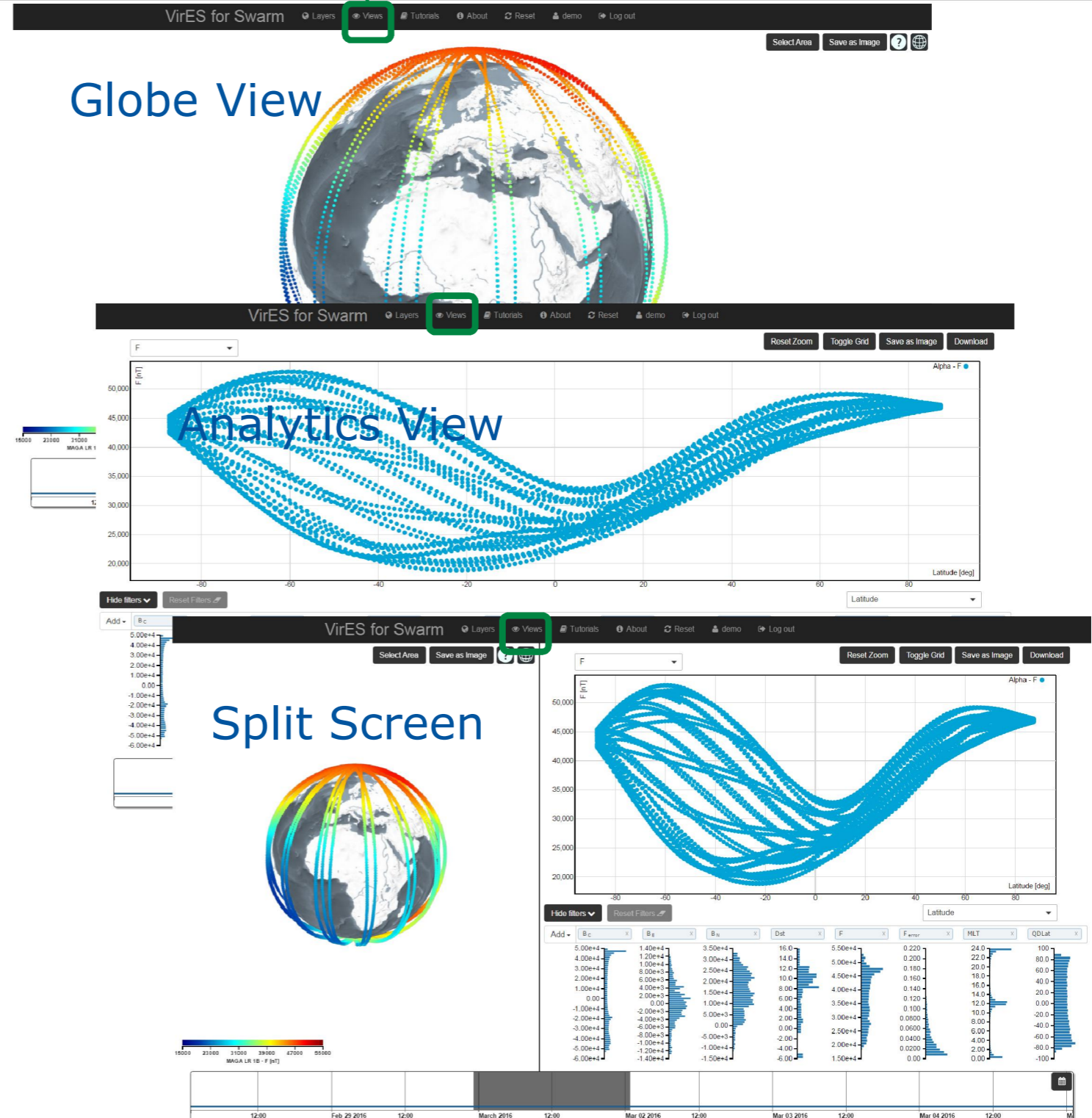
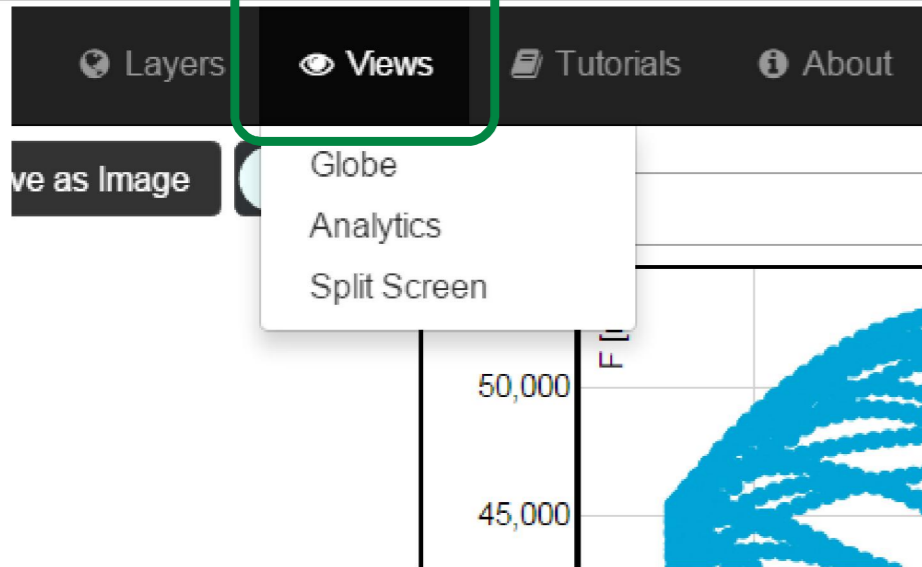
- Cartographic layers: Coastlines and Countries, Graticule, Magnetic Graticule, visualized on the map.
- Swarm products: data of the selected type and satellite are visualized on the map and in the analytic view.
- Magnetic Models: models representations are visualized on the map.
- Kp and Dst indices are visualized in the analytic view.
- Raster textures are visualized on the map.

In case of Swarm products, magnetic models, Kp and Dst indices, once the layer is activated, the data availability is shown in the time bar.





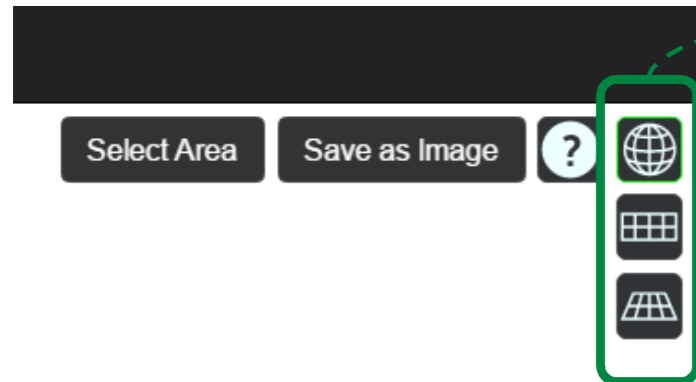
# Views



It is possible to change the active view by clicking on the “Views” button on the dashboard. The available views are:

- Globe View: world map
- Analytics View: scatter plot and histograms
- Split Screen: combination of world map and scatter plot.

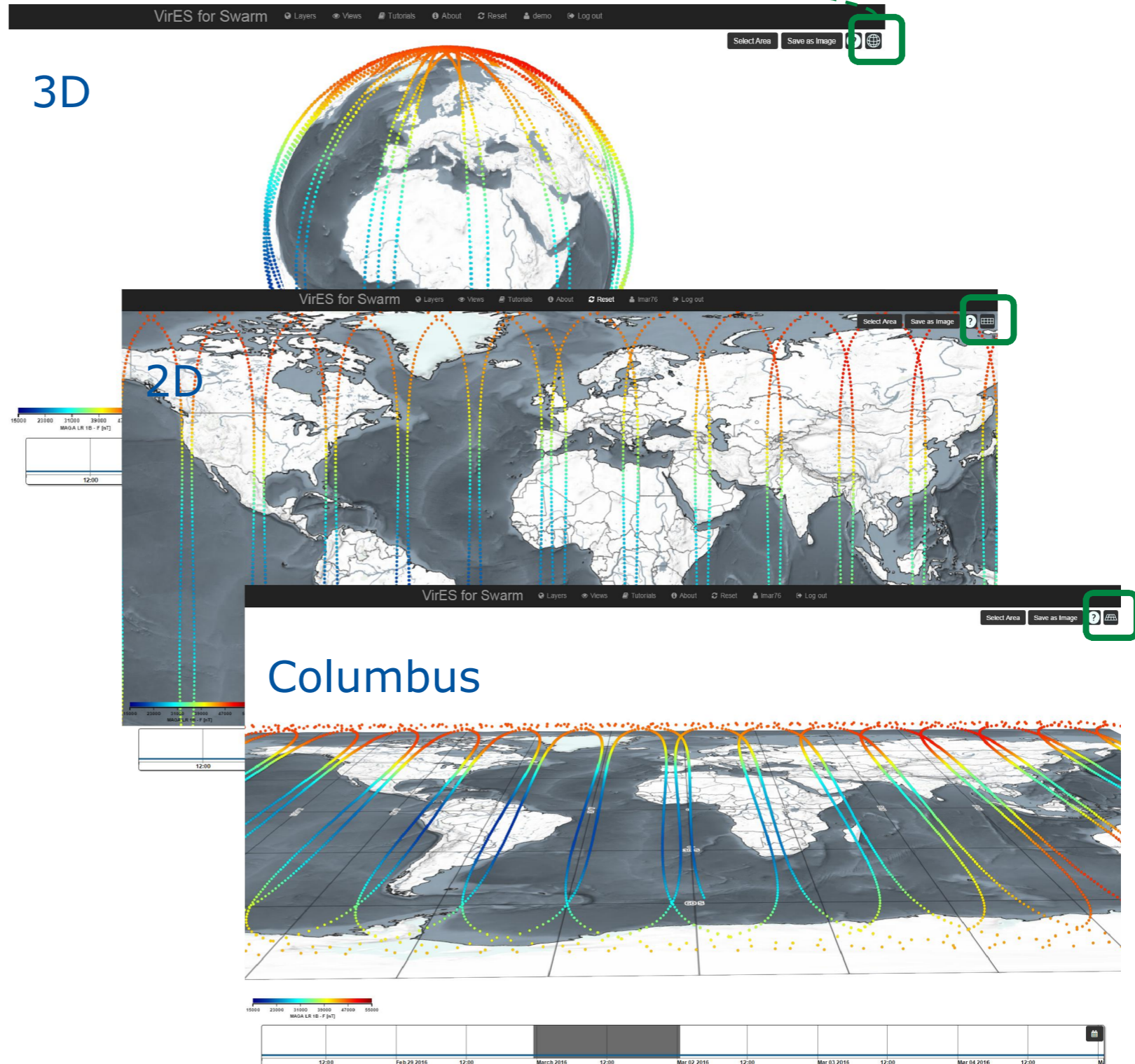
# View Projections



In the Globe View, the map projection can be changed between:

- Globe View (3D)
- Cartesian Grid (2D)
- Columbus View

The "Save as Image" button allows to save the map into a file.





# Product parameters and settings

VirES for Swarm

Layers

Select Area

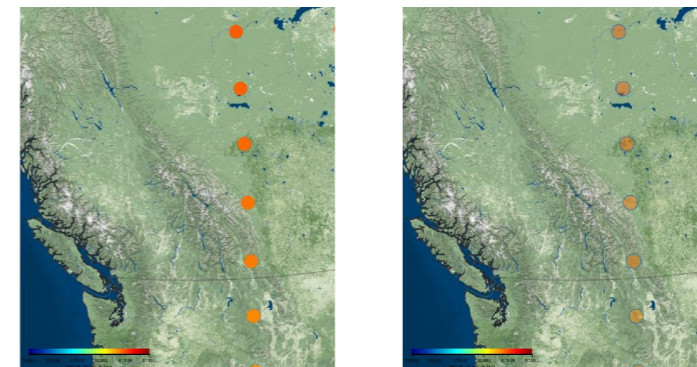
Save as Image

The screenshot shows the 'Layers' panel on the left with 'Magnetic data (MAG LR)' checked. A green dashed line connects this layer to the 'MAGA LR 1B Settings' dialog. The dialog shows 'Satellite' set to 'Alpha', 'Parameter' set to 'Magnetic field intensity', and 'Style' set to 'jet'. A color scale bar is visible with values 15000, 23000, 31000, 39000, 47000, and 55000 nT. Below the scale are input boxes for '15000' and '55000'. The 'Opacity' is controlled by a slider, 'Outlines' is unchecked, and 'Legend' is checked.

Settings widget can be activated clicking on the button near the product's name.

Available settings:

- Satellite: select between satellite Alpha, Bravo, Charlie or Not spacecraft specific data (currently used to select FAC combined products).
  - Parameter to be visualized on the map. It depends on the product type (e.g. "Magnetic field intensity" for Magnetic data, "Plasma density" for plasma data).
  - Colours style and scale range of the parameter visualized on the map.
  - Opacity: opacity of the plot over the map
  - Outlines: activate/deactivate outlines.
  - Legend: activate/deactivate legend.
- E.g.: change the opacity and outlines:

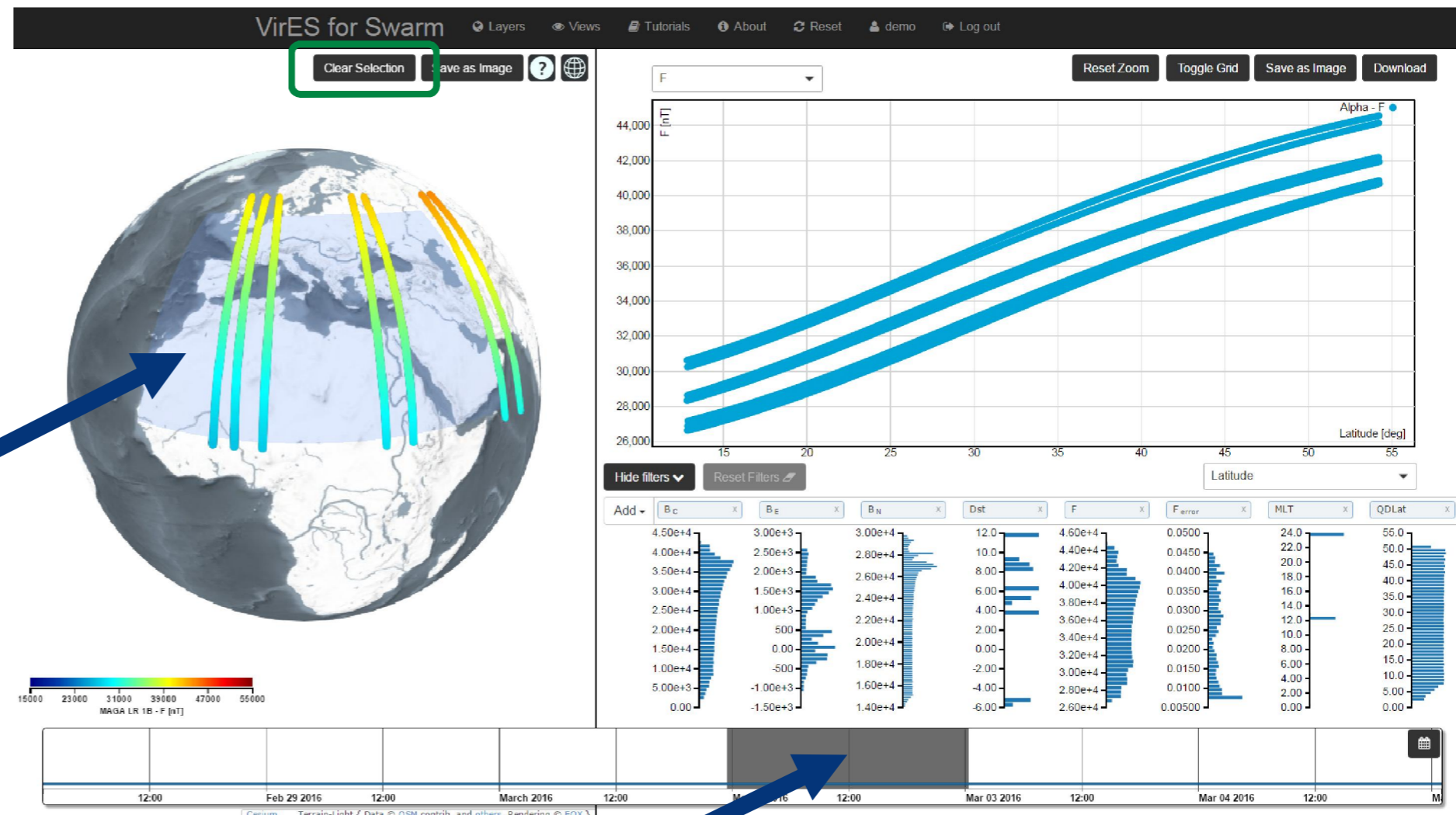


# Spatial and Temporal Data Selection



It is possible to select a specific area of interest by clicking on the "Select Area" button and drawing a rectangle on the map.

The area can be de-selected with the "Clear Selection" button.

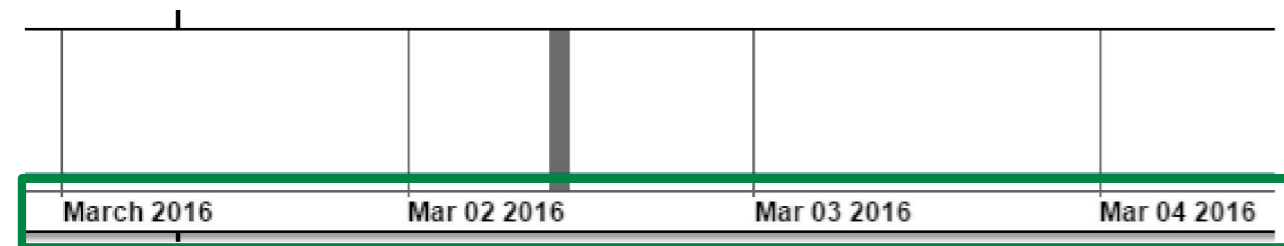


It is possible to select the desired time-span by clicking and dragging an area on the time slider.

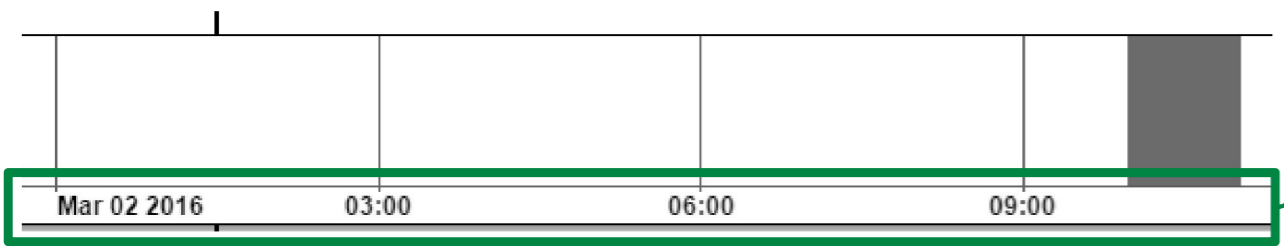
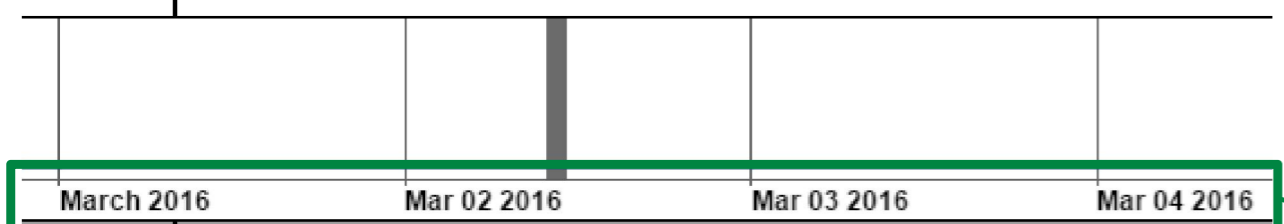
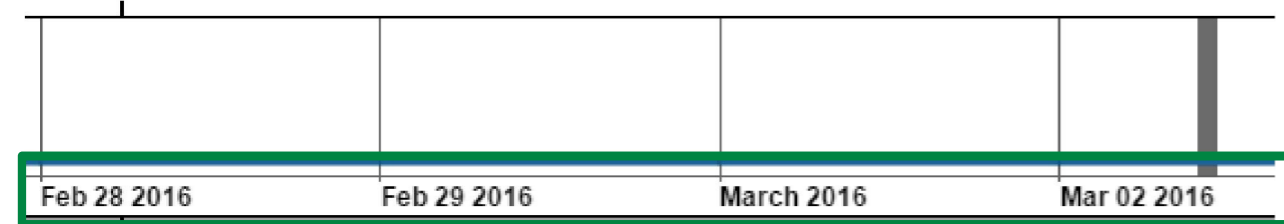
The line visualized over the time slider represents the data availability and depends on the selected layer.

Plot and histograms are automatically updated according to the spatial and temporal selections.

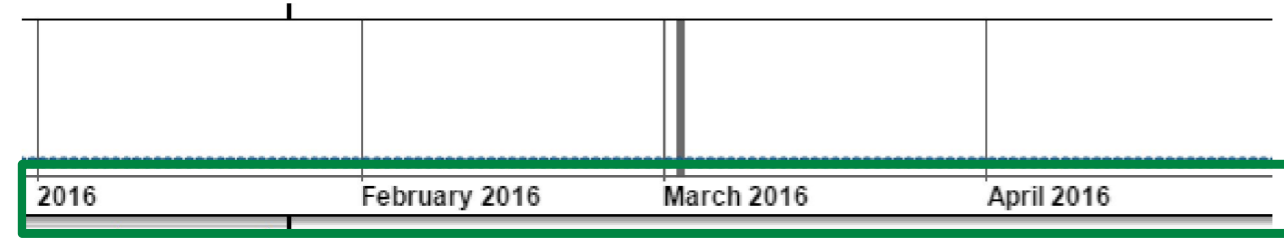
# Time Slider: date selection



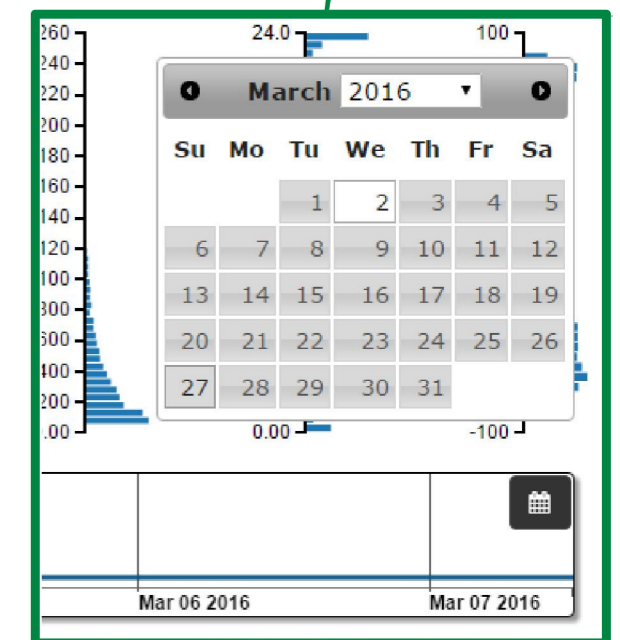
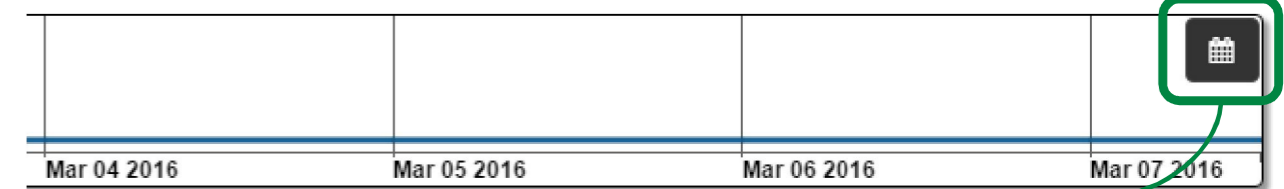
Left button + drag  
left/right: change  
date



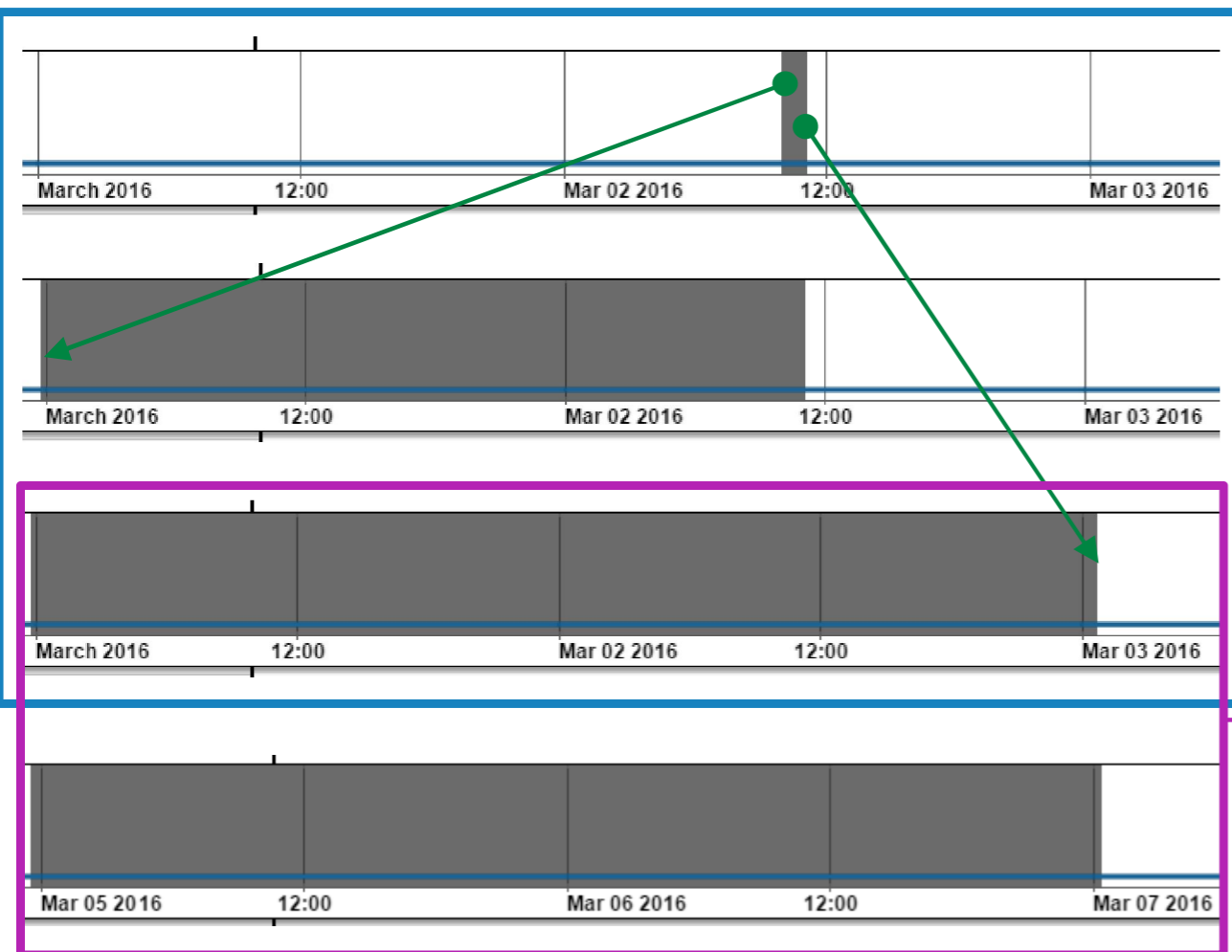
Wheel mouse: zoom  
in/out time scale



Jump to date: click the  
button on the top right  
corner of the time slider to  
easily select the date



# Time window update

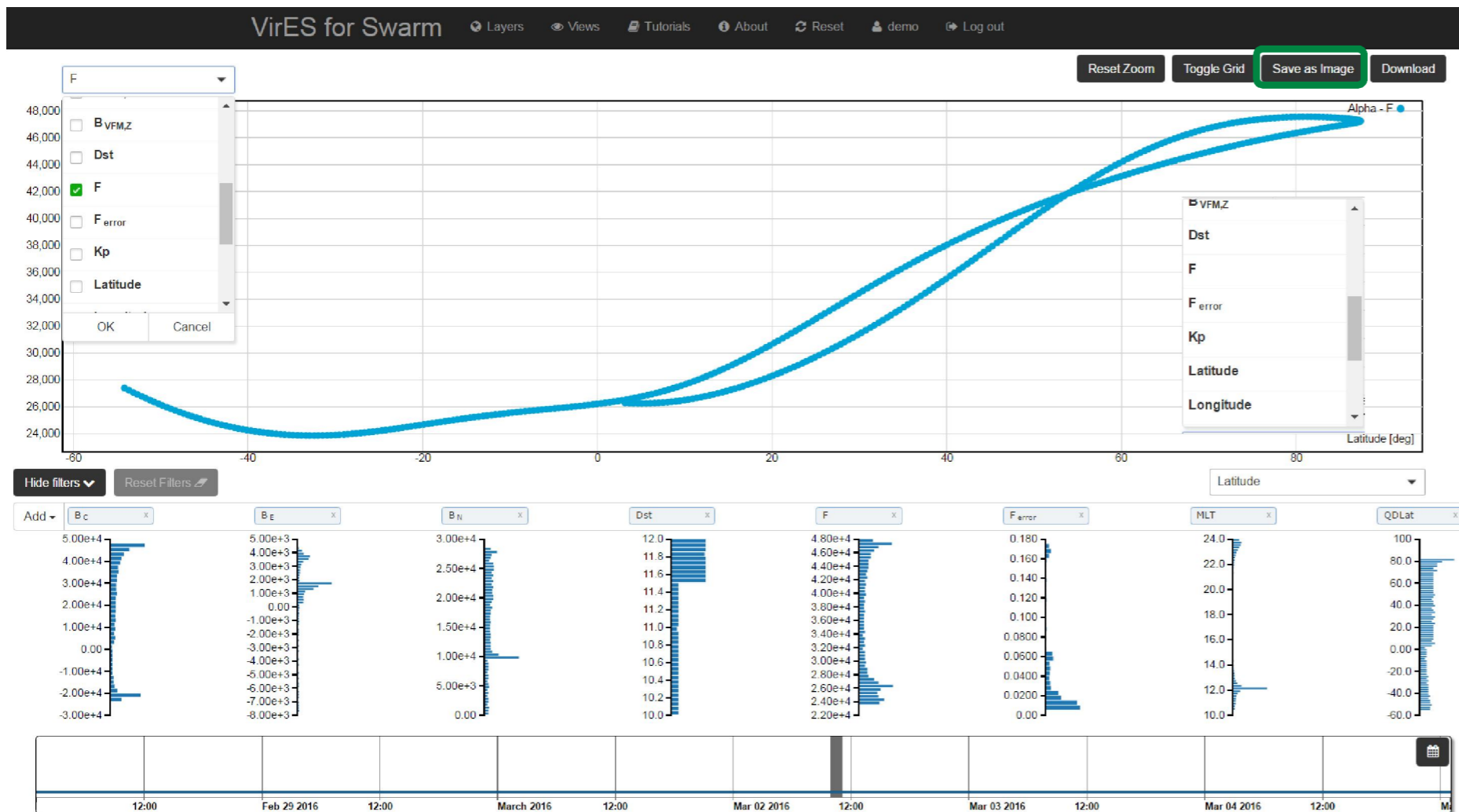


Click and drag the time window borders to increase/decrease size

Click and drag the time window to move it leaving its size unchanged



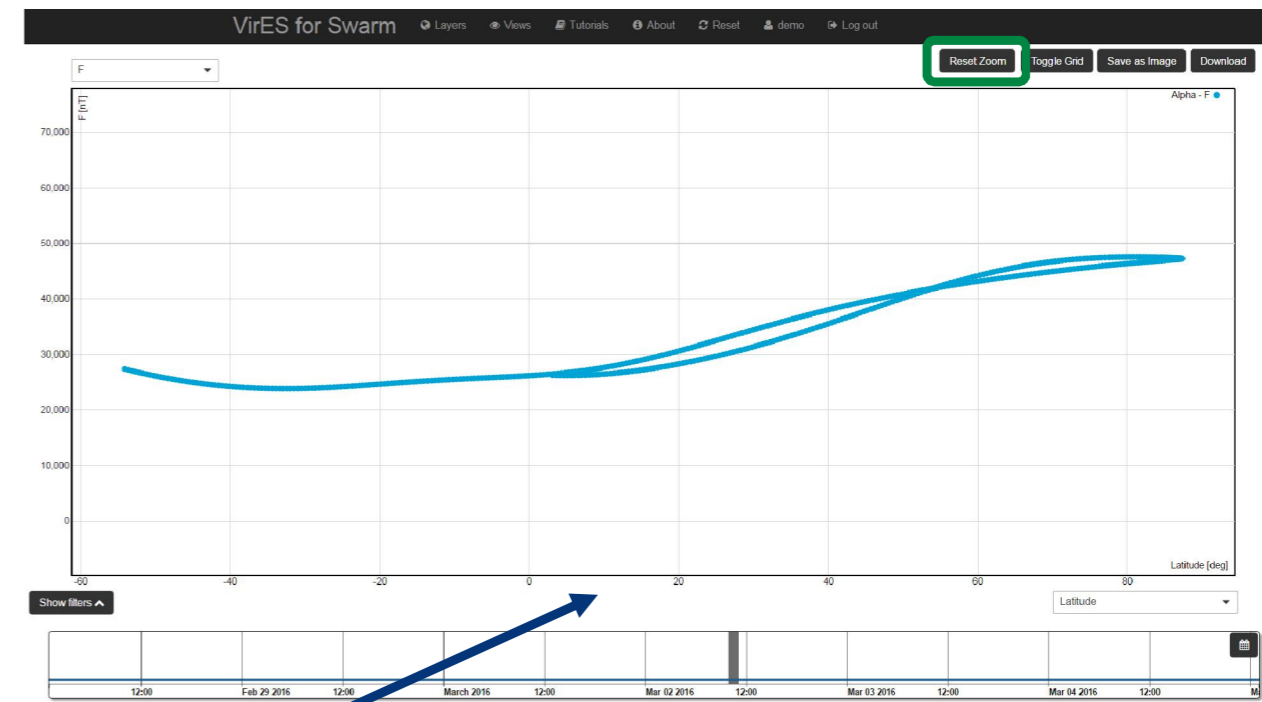
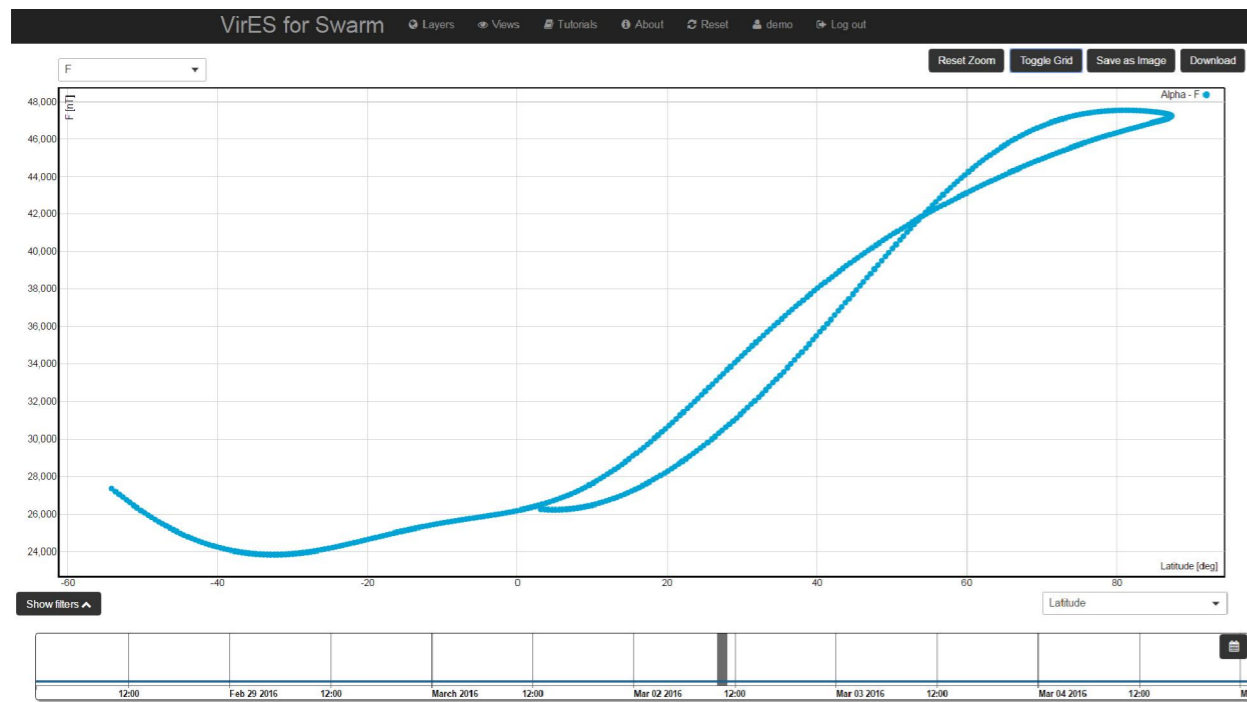
# Analytics View: parameters selection



Scatter Plot can be customized selecting the parameters to be represented on the X-axis and Y-axis

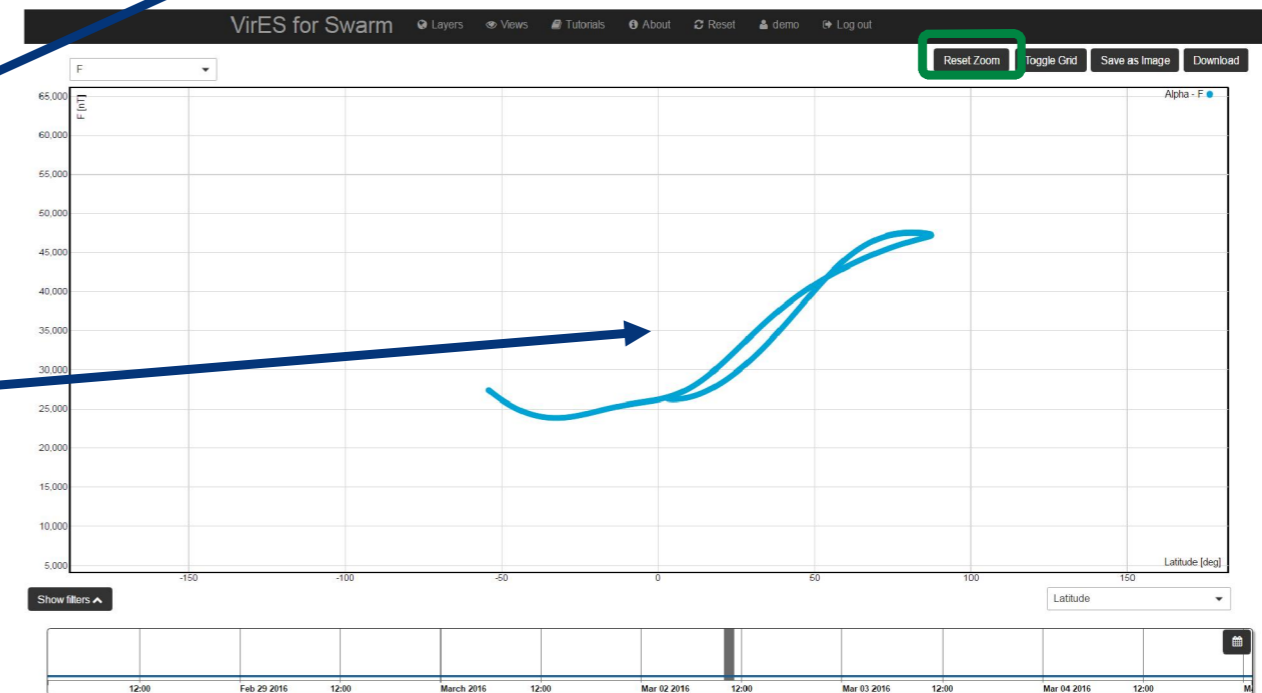
The "Save as Image" button can be used to save the plot into a file.

# Analytics View: zoom



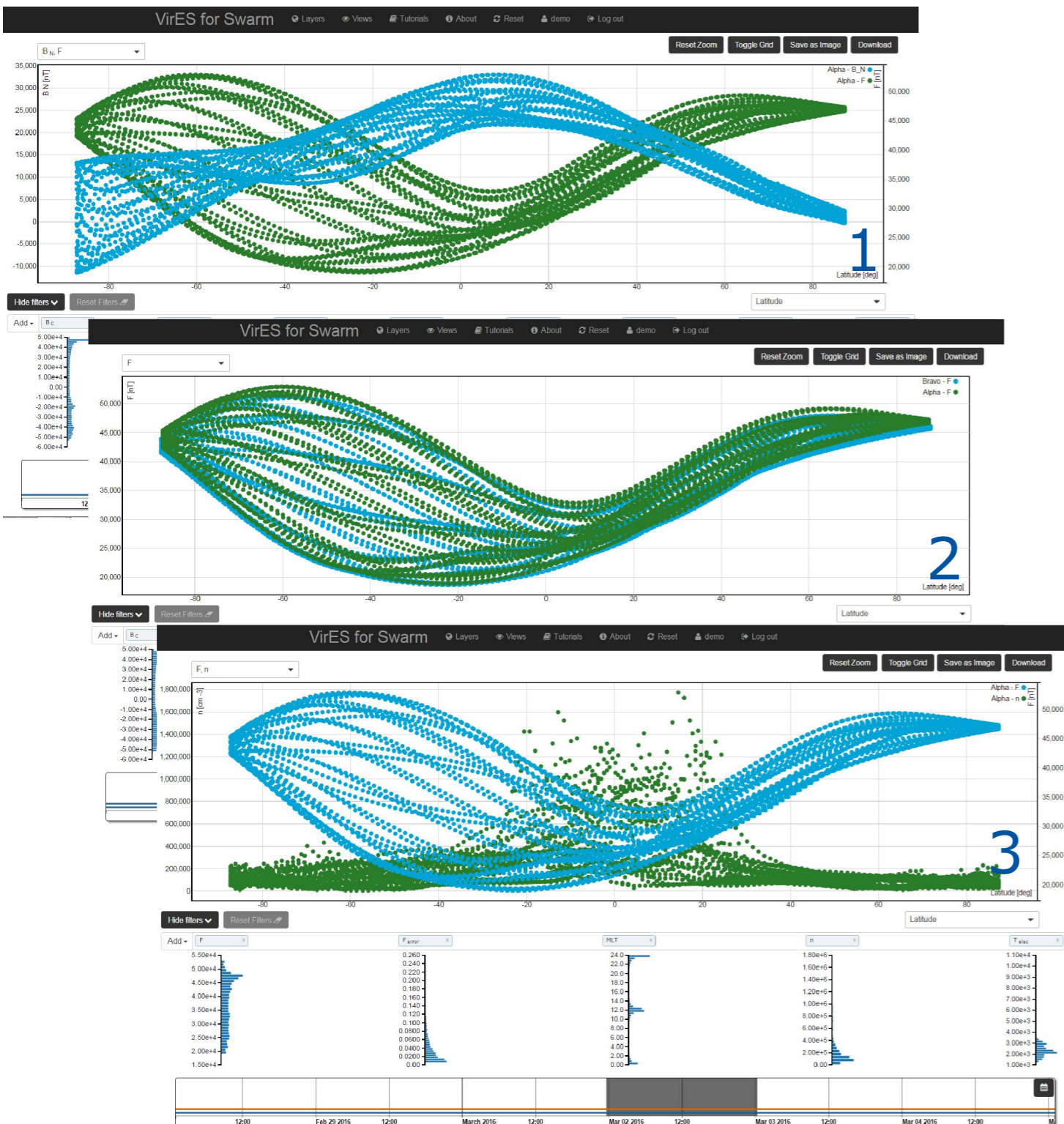
## Changing the zoom level:

- Mouse pointer over one axes + mouse wheel: change zoom level on a single axes
- Mouse pointer on the scatter plot + mouse wheel: change zoom level on both axis
- Reset Zoom button: resume the original plot





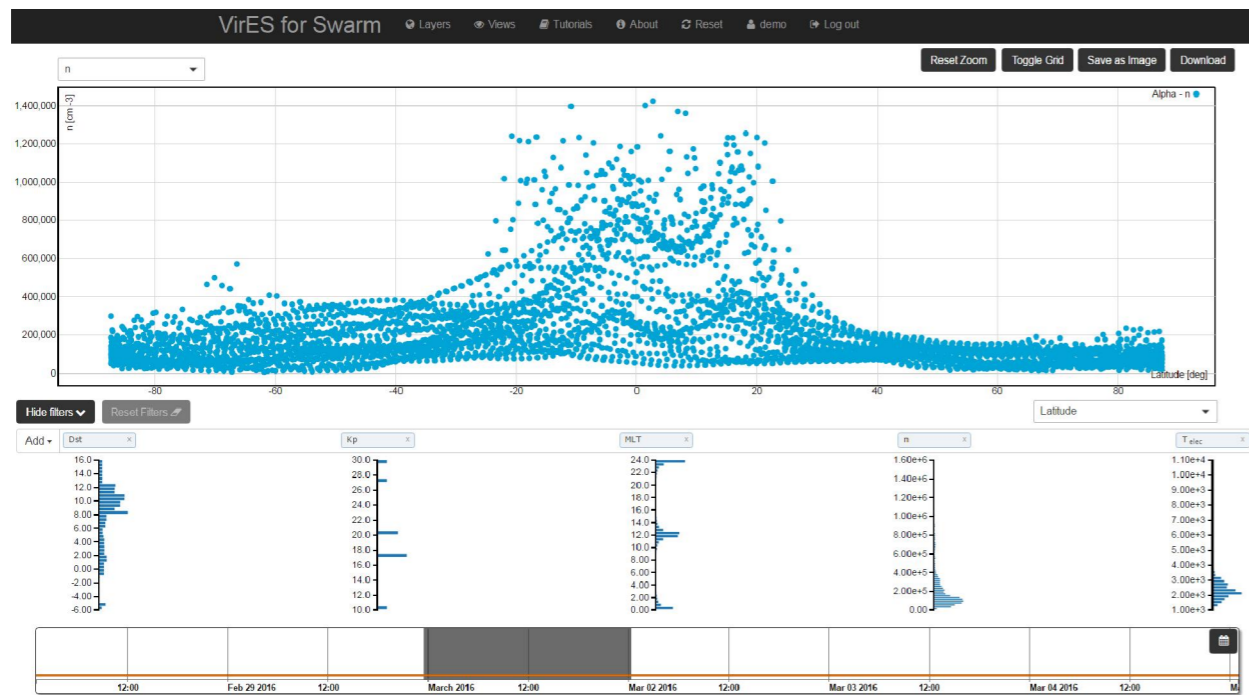
# Data over-plotting



Selecting different combinations of layers and/or spacecrafts it is possible to visualize more parameters in the same plot. E.g.:

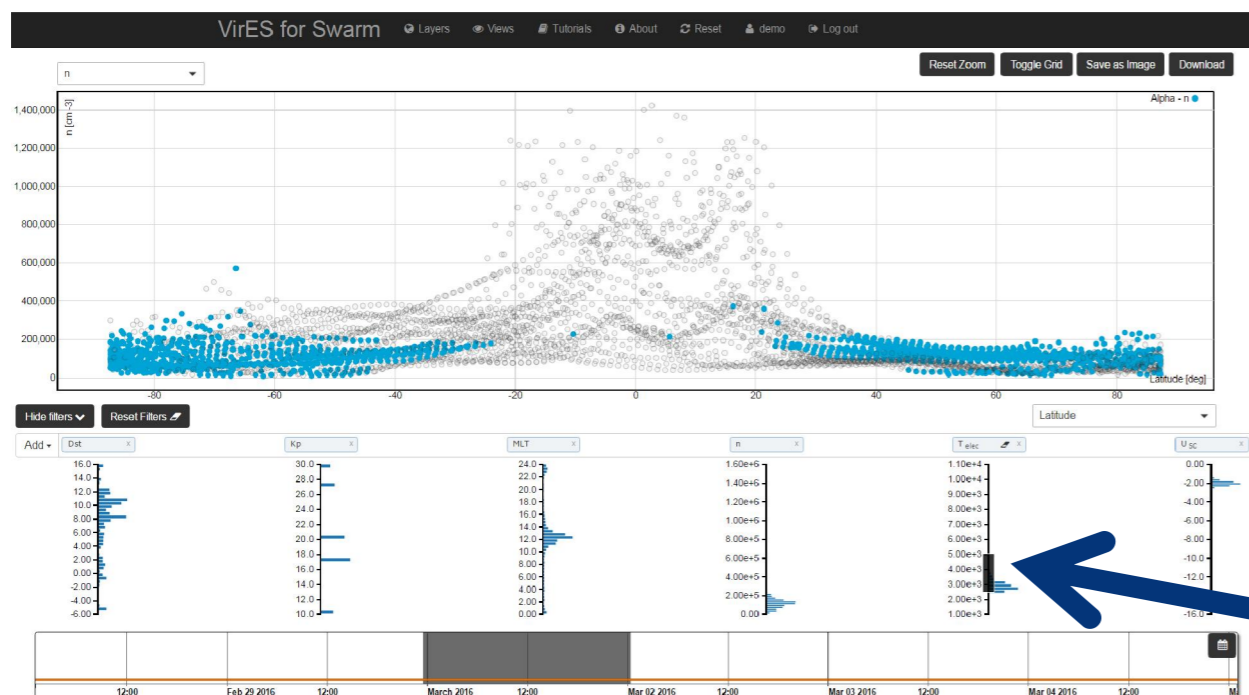
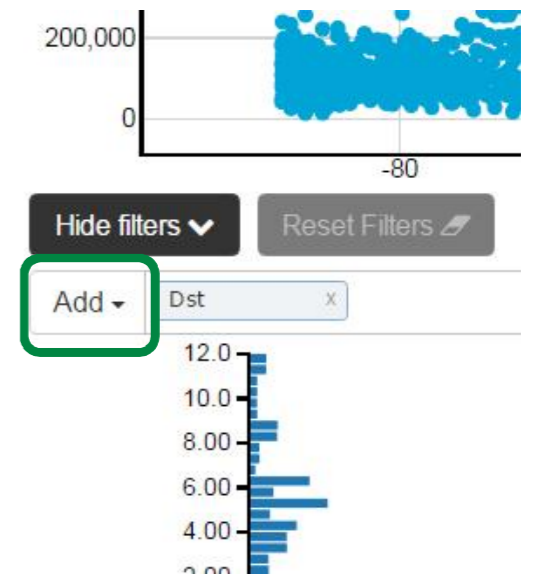
1. Same product, same spacecraft, different parameters
2. Same product, different spacecrafts, same parameters
3. Different products, different parameters, same spacecraft

# Data Filtering



It is possible to filter data according to a specific parameter by clicking and dragging with the mouse over the desired histogram.

If the parameter is not present in the histograms list, it can be added clicking on the "Add" button.



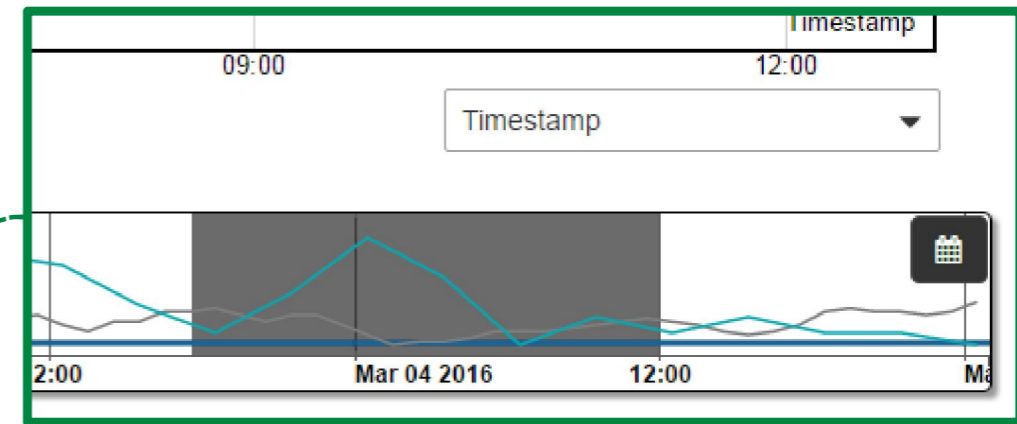
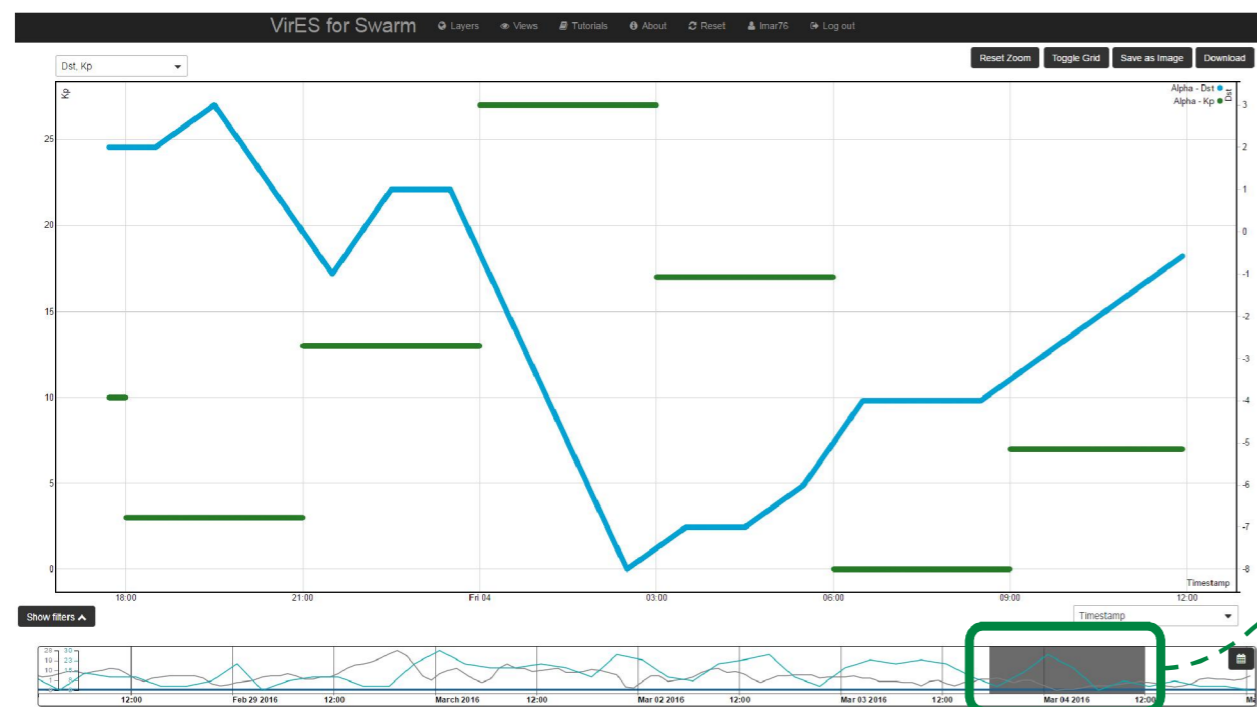
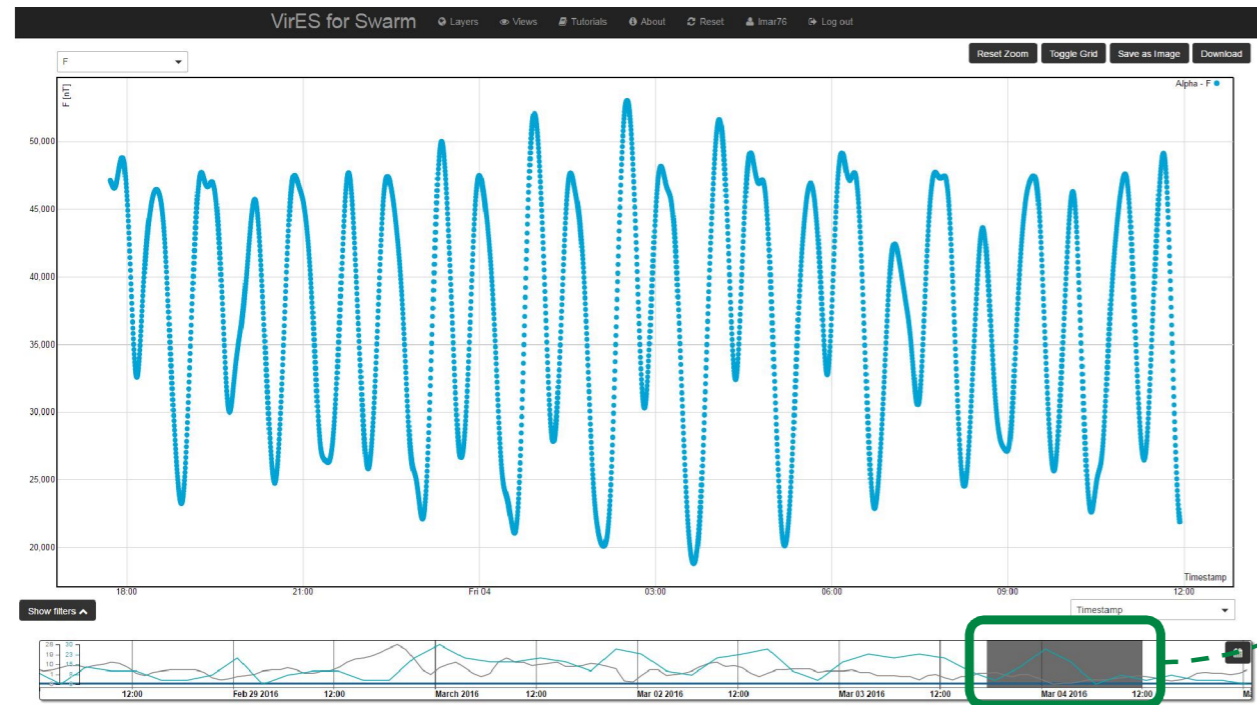
Original data visualization can be resumed clicking on the "Reset Filters" button.

Histograms can be hidden by clicking on the "Hide Filters" button.

E.g.:  $2.5 \text{ e}3 \text{ K} \leq \text{Telec} \leq 5 \text{ e}3 \text{ K}$



# Kp and Dst Visualization



Kp and Dst indices are visualized on the time bar. These representation can be used to select a time window having particular Kp and Dst values.

# Data Download



VirES for Swarm Layers Views Tutorials About Reset Imariani Log out

Select Area Save as Image ? F Reset Zoom Toggle Grid Save as Image **Download**

The screenshot shows the VirES for Swarm web interface. On the left, a globe displays the Swarm satellite orbits. A color scale at the bottom left indicates the magnetic field strength (MAGA LR 1B - F [nT]) from 15000 to 55000. The main plot shows the magnetic field strength (F [nT]) on the y-axis (ranging from 40,000 to 48,000) against time on the x-axis (from Feb 29 2016 to Mar 04 2016). A blue line represents the magnetic field strength, and a dashed green line represents the Alpha-F component. A 'Download Manager' dialog box is open, showing filters for the date (02.03.2016), products (MAGA LR 1B), and file format (CDF - Common data format). A 'Process & create link' button is visible in the dialog box. A text box explains that the Download Manager allows the user to download the selected product and can be activated by clicking on the 'Download' button.

Download Manager

Filters

Date (  specify time ) 02.03.2016 ... 02.03.2016 ...

Products

- o MAGA LR 1B

Custom download parameters

Latitude Longitude Timestamp Radius

File format CDF - Common data format

F [nT]

Alpha-F

F<sub>error</sub> x MLT x

15000 23000 31000 39000 47000 55000  
MAGA LR 1B - F [nT]

12:00 Feb 29 2016 12:00 March 2016 12:00 Mar 02 2016 12:00 Mar 03 2016 12:00 Mar 04 2016 12:00 M

The Download Manager allows the user to download the selected product.

It can be activated by clicking on the "Download" button.



# Download Manager: settings



Download Manager

**Filters**

Date (  specify time ) 02.03.2016 ... 02.03.2016 ...

**Products**      **Models**

MAGA LR 1B       IGRF12

EFIA PL 1B

Custom download parameters

Latitude    Longitude    Timestamp    Radius

File format: CDF - Common data format

Process & create link

**Filters** section reports, by default, the currently selected start and stop dates (it can be modified), the selected area of interest (if any) and any selected filter on the histograms.

**Products/Models** section reports the currently selected products and models.

**Custom download parameters** section allows the user to select a specific subset of the parameters to be included in the output product.

**File format** allows the user to select the output file format: CDF (default) or CSV.

**Process & create link** button allows the user to start the creation of the selected product file. Once the file is ready to be download, a download button appears.

# Download Manager: filters

Download Manager

**Filters**

Date	<input checked="" type="checkbox"/> specify time	02.03.2016	02.03.2016	<input type="button" value="−"/>
Time (hh:mm:ss.fff)		10:00:00.000	11:00:00.000	<input type="button" value="−"/>
F <sub>res</sub> IGRF12		-21.77	-13.61	<input type="button" value="−"/>
Longitude		15.77	51.39	<input type="button" value="−"/>
Latitude		29.25	48.02	<input type="button" value="−"/>

**Products**  
◦ MAGA LR 1B  
◦ EFIA PL 1B

**Models**  
◦ IGRF12

Custom download parameters

Latitude Longitude Timestamp Radius

File format: CDF - Common data format

Start and stop dates are initially set to the start and stop dates of the selected time window.

It is possible to specify the start and stop time selecting the "specify time" checkbox.

Any filter applied on the histograms is reported indicating the parameter and the minimum and maximum values.

If an area of interest is selected, the latitude and longitude information is reported

With the exception of dates, it is possible to remove the filters clicking on the red button.

# Download Manager: custom download parameters



**Download Manager**

**Filters**

Date ( <input checked="" type="checkbox"/> specify time )	02.03.2016	02.03.2016	<input type="checkbox"/>
Time (hh:mm:ss.fff)	10:00:00.000	11:00:00.000	<input type="checkbox"/>
F <sub>res</sub> IGRF12	-21.77	-13.61	<input type="checkbox"/>
Longitude	15.77	51.39	<input type="checkbox"/>
Latitude	29.25	48.02	<input type="checkbox"/>

**Products**  
◦ MAGA LR 1B  
◦ EFIA PL 1B

**Models**  
◦ IGRF12

Custom download parameters

Latitude Longitude Timestamp Radius F x F<sub>res</sub> IGRF12 x T<sub>elec</sub> x n x |

File format: CDF - Common data format

[Process & create link](#)

The product's content can be customised by selecting the "Custom download parameters" checkbox and adding the desired parameters from the list. In this way, only the selected parameters will be included in the output product.



# Download Manager: product preparation and download



The screenshot shows the 'Download Manager' interface. At the top, there's a title bar with a download icon and the text 'Download Manager'. Below it, a 'Download links' section contains a table with one entry: '2017-03-15T10:44:14'. This entry has a green progress bar labeled 'Ready', a 'Process details' button with a dropdown arrow, and a 'Download' button with a download icon. Below the links is a 'Filters' section with several input fields: 'Date (specify time)' with two date pickers set to '02.03.2016'; 'Time (hh:mm:ss.fff)' with two time pickers set to '10:00:00.000' and '11:00:00.000'; 'F<sub>res</sub> IGRF12' with two value pickers set to '-21.77' and '-13.61'; 'Longitude' with two value pickers set to '15.77' and '51.39'; and 'Latitude' with two value pickers set to '29.25' and '48.02'. Each filter field has a red minus button to its right. Below filters are 'Products' (MAGA LR 1B, EFIA PL 1B) and 'Models' (IGRF12) sections. A 'Custom download parameters' checkbox is checked. At the bottom, there's a 'File format' dropdown set to 'CDF - Common data format' and a large blue 'Process & create link' button.

After having customized the date and time ranges, the area of interest, the filtering parameters and the output parameters, the product can be processed by clicking on the "Process & create link" button.

The download link appears with a progress indicator. Once the product is ready, it can be downloaded by clicking on the "Download" button.

# View of magnetic field models: SIFM, IGRF12, CHAOS-5



**Layers**

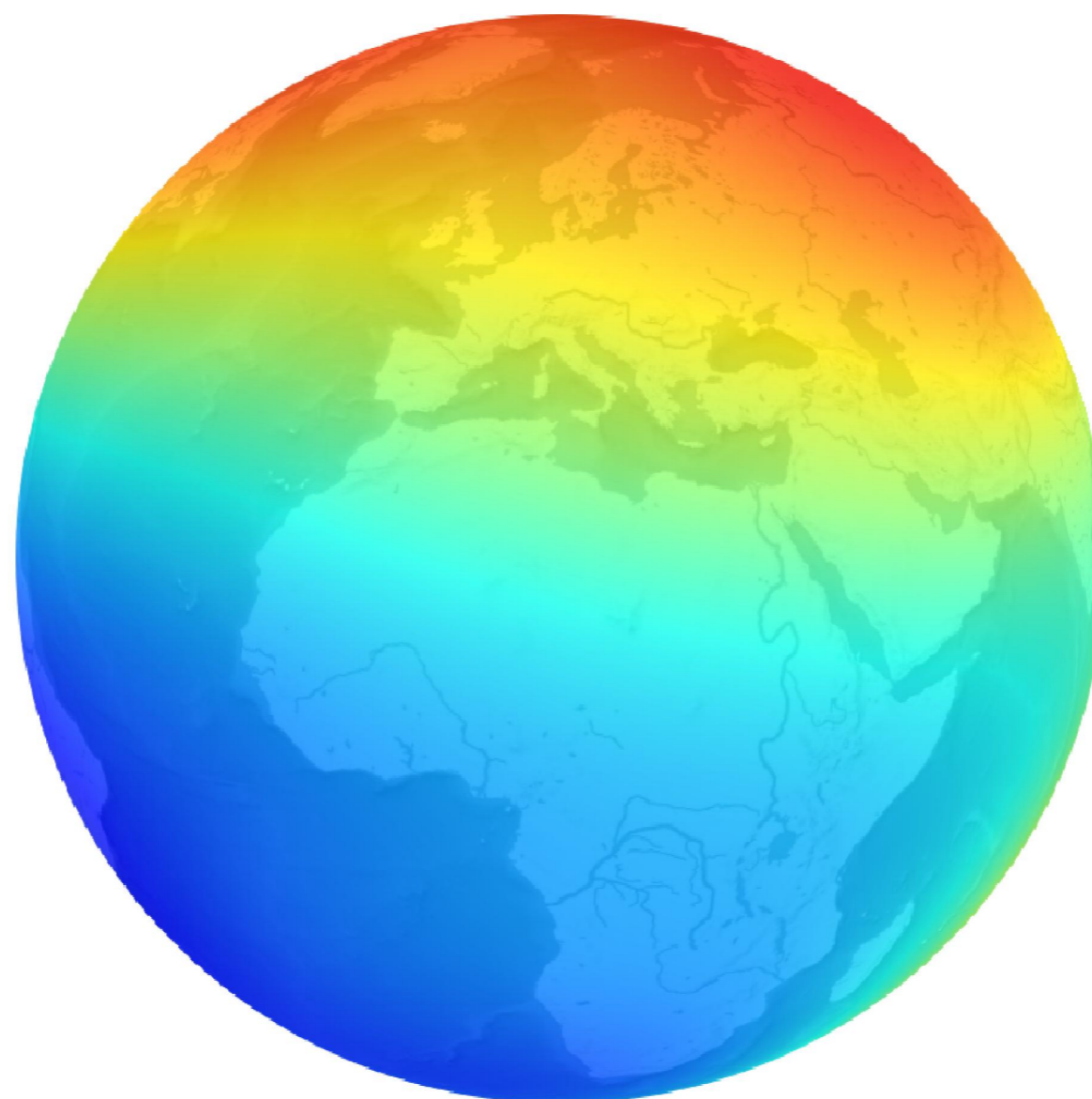
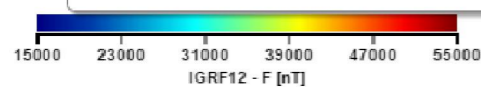
- Coastlines and Countries
- Graticule
- Magnetic Graticule

Multi-satellite Products

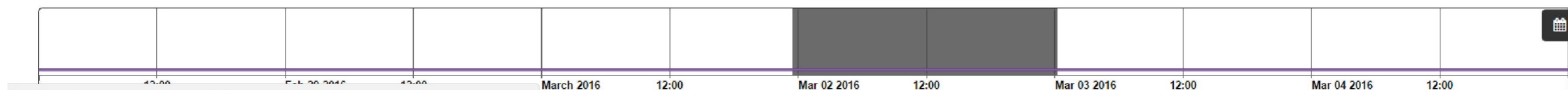
- Alpha  Bravo  Charlie
- Magnetic data (MAG LR)
- Plasma data (EFI PL)
- Bubble Index data (IBI)
- Electron data (TEC)
- Currents data (FAC)
- Electric field data (EEF)

- SIFM
- IGRF12
- CHAOS-5
- Custom Model
- Dst Index
- Kp Index

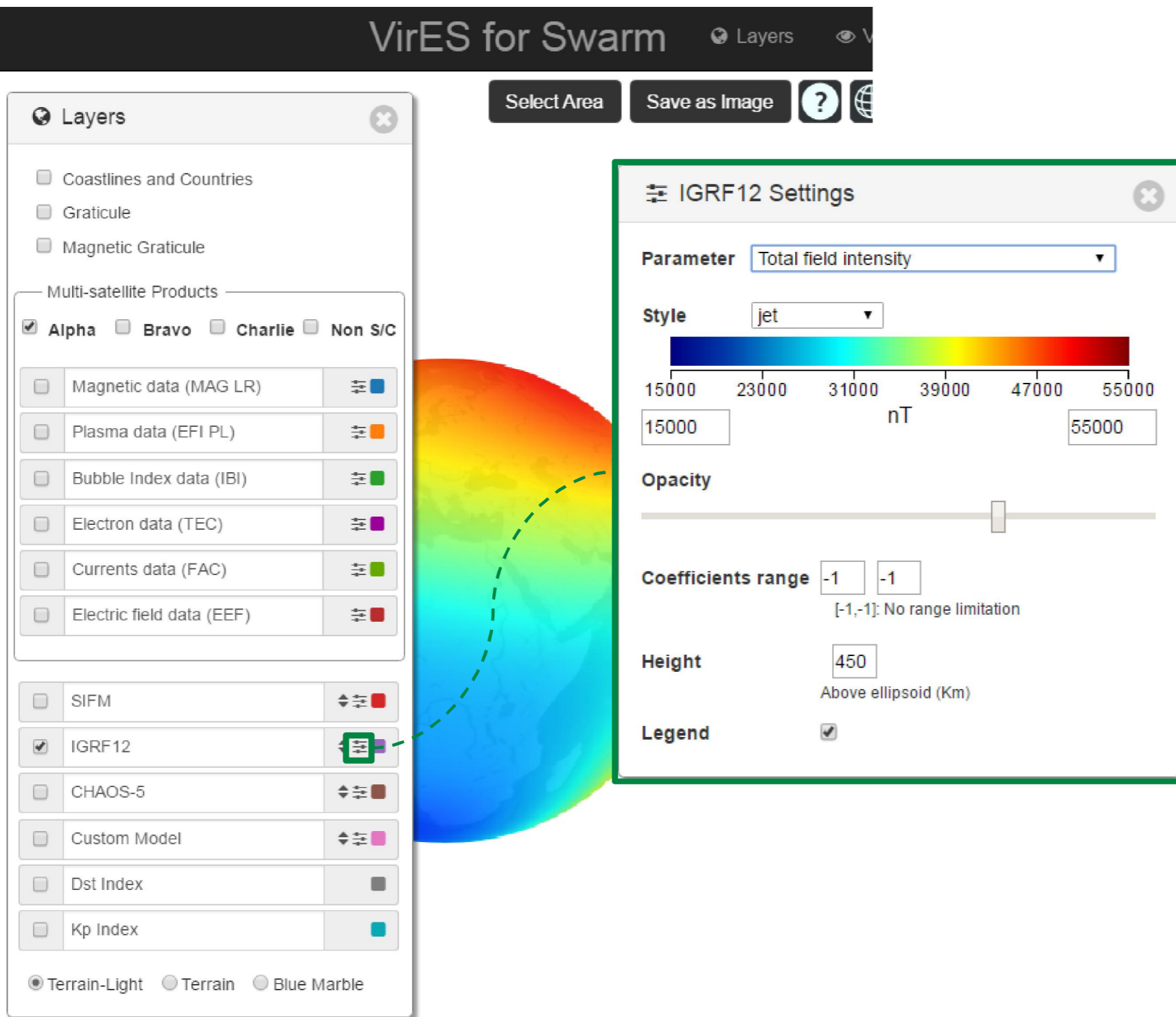
Terrain-Light  Terrain  Blue Marble



Three predefined models: SIFM, IGRF12, CHAOS-5



Creazione di una connessione protetta in corso...



The screenshot shows the 'VirES for Swarm' interface. On the left is the 'Layers' panel with various data layers. The 'IGRF12' layer is selected and highlighted with a green box. To the right, the 'IGRF12 Settings' dialog is open, showing the following configuration:

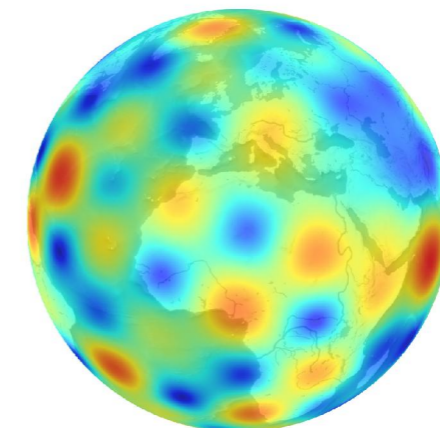
- Parameter: Total field intensity
- Style: jet
- Scale range: 15000 to 55000 nT
- Opacity: slider set to approximately 50%
- Coefficients range: [-1, -1] (No range limitation)
- Height: 450 (Above ellipsoid (Km))
- Legend: checked

Settings widget can be activated clicking on the button near the model's name.

Available settings:

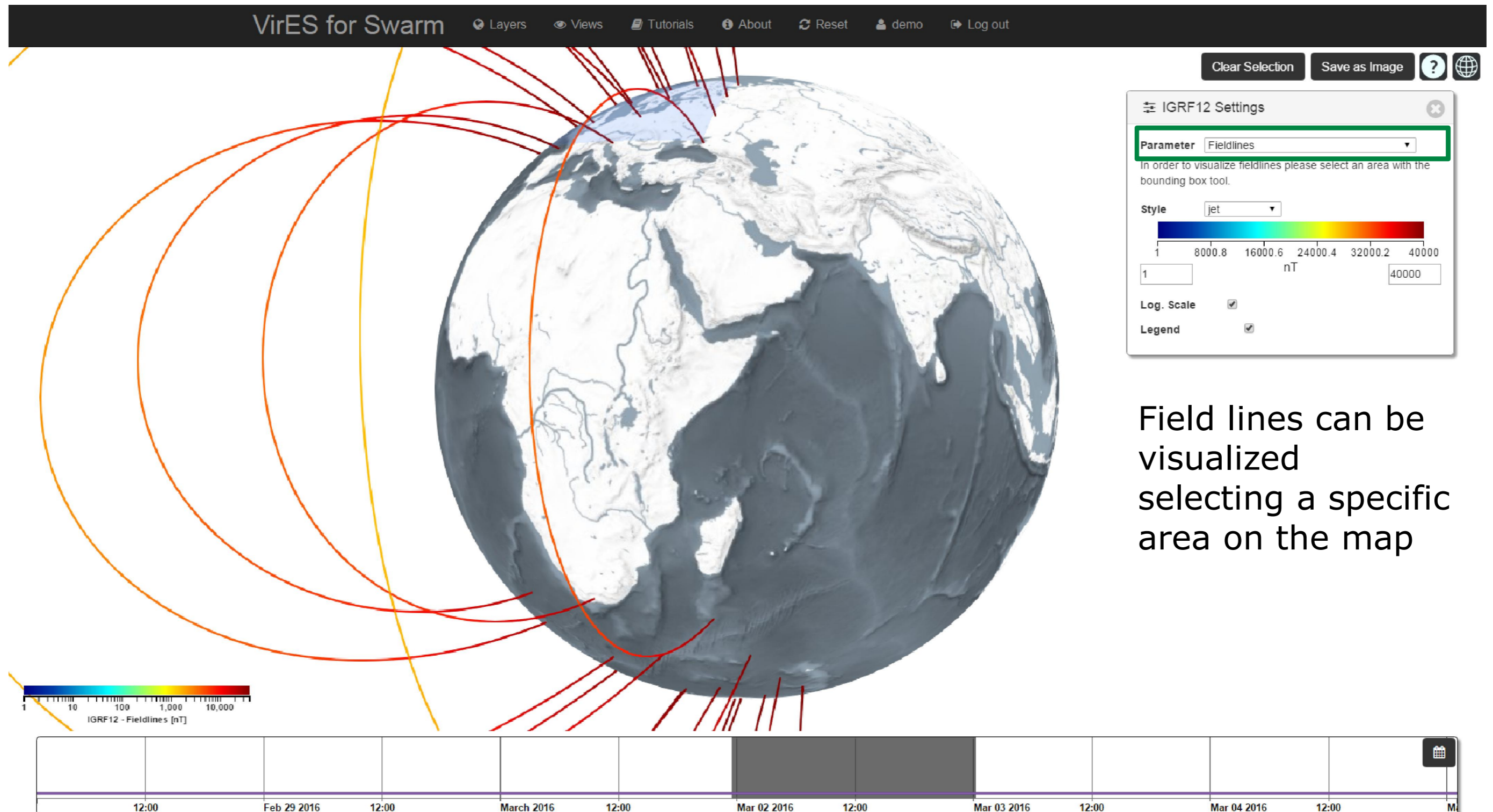
- Parameter to be visualized on the map (e.g. "Total field intensity", "Fieldlines", etc.)
- Colours style and scale range of the parameter visualized on the map.
- Opacity: opacity of the field map.
- Coefficients range of the spherical harmonics expansion.
- Height: reference height.
- Legend: activate/deactivate legend.

E.g.: coefficients range: [10, 13], height: 0 Km



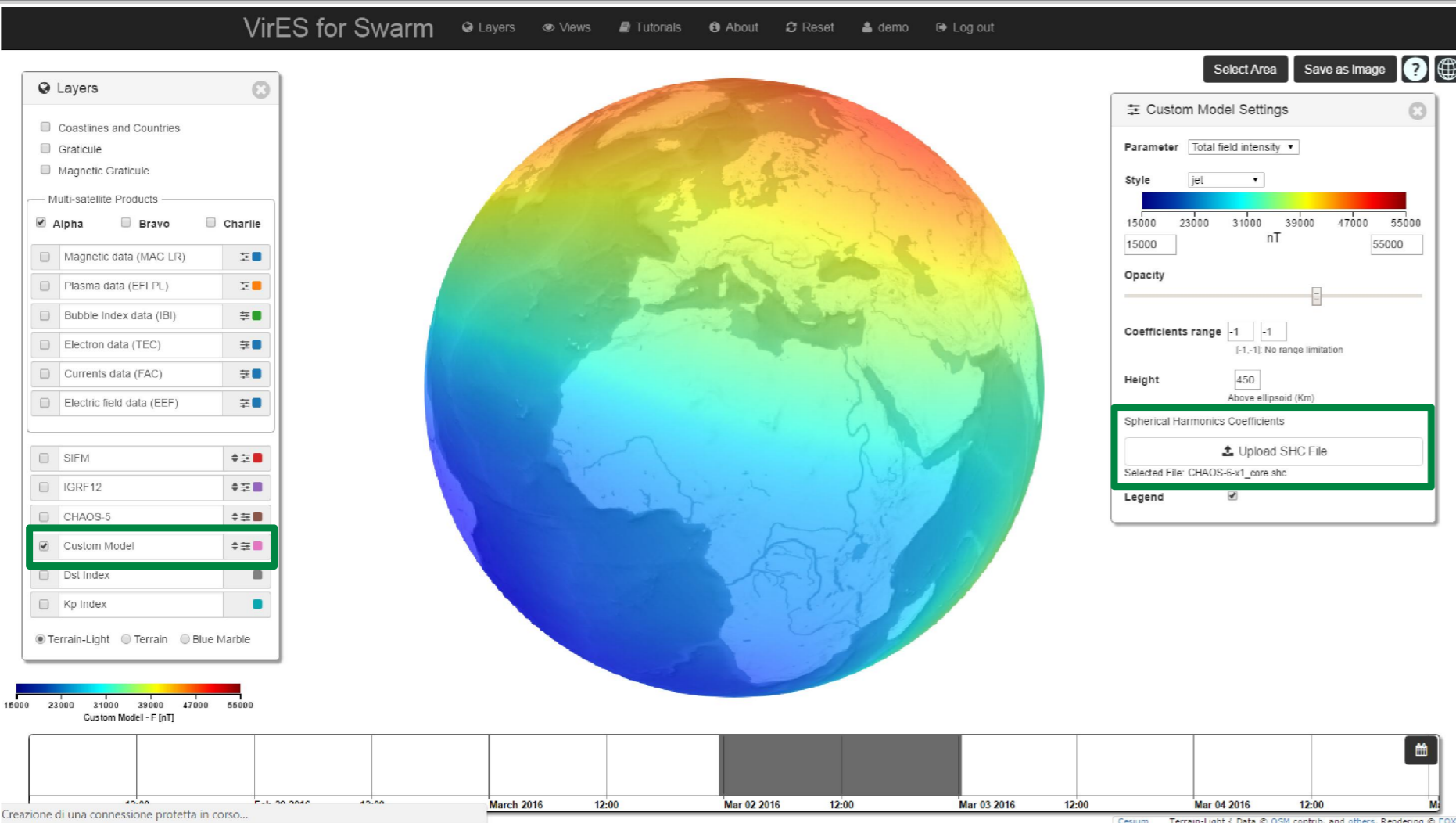


# Magnetic field lines



Field lines can be visualized selecting a specific area on the map

# Upload of custom model



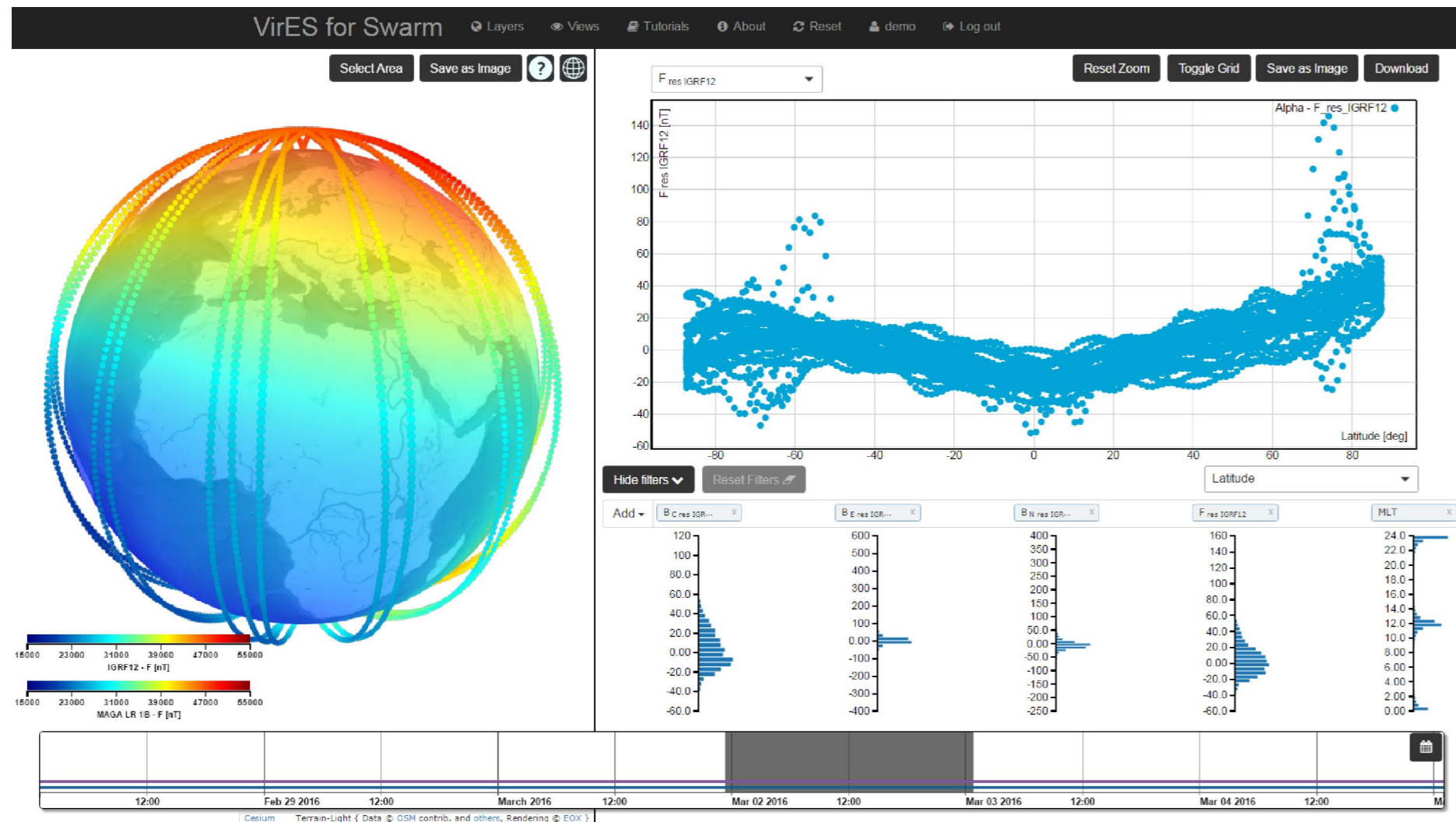
In addition to the predefined models, it is also possible to visualize a custom model by uploading a Spherical Harmonic Expansion coefficients file (SHC) [1].

In the example, CHAOS-6 SHC file has been used [2].

[1] Description of SHC file format: <http://www.spacecenter.dk/files/magnetic-models/CHAOS-5/SHC-Format-Description.pdf>

[2] CHAOS-6 SHC file: [http://www.spacecenter.dk/files/magnetic-models/CHAOS-6/CHAOS-6-x1\\_core.shc](http://www.spacecenter.dk/files/magnetic-models/CHAOS-6/CHAOS-6-x1_core.shc)

# Residual visualization and analysis



Selecting Magnetic Data and a magnetic field model it is also possible to visualize, in the analytic view, the residual between the measured parameter and the one calculated with the model.

In the example you can see the residual between the measured F and the field intensity calculated with IGRF12 model.



Thank you for your attention