MARSIS/SHARAD viewer plug-in for QGIS

Release 0.9

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CHAPTER

ONE

ABOUT THE PLUG-IN

MARSIS/SHARAD viewer is a plug-in for the QGIS software (http://www.qgis.org/). It's aim is to provide an easy way to visualize radargrams from MARSIS (http://sci.esa.int/mars-express/34826-design/?fbodylongid=1601) and SHARAD (http://mars.nasa.gov/mro/mission/instruments/sharad/) ground penetrating radars.

It is written in Python and uses the PyQtGraph (http://www.pyqtgraph.org/) library for 2D and 3D plots rendering.

The plug-in is made to work together with the MARSIS and SHARAD tracks DB as provided by EPFL-eSpace (see tracks DB documentation for details).

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CHAPTER

TWO

INSTALLATION

2.1 Install dependaces

2.1.1 GNU/Linux

Debian 8 (Jessie)

Enable backports repository

Enabling the official debian backport repository allows to install a more recent version of QGIS. You can skip this step if you are happy with the version provided in the main repository.

Add the following line to the file */etc/apt/sources.list* (root privileges required):

```
deb http://ftp.debian.org/debian wheezy-backports main
```

Run repos update (as root):

```
# apt-get update
```

More information about *Debian backports* can be found here

http://backports.debian.org/

Official **QGIS** repositories providing newer versions of the software can be added following the instruction in

http://qgis.org/en/site/forusers/alldownloads.html#debian-ubuntu

Install QGIS and dependencies

Install python and python packages:

```
# apt-get install python-numpy python-scipy python-qt4 python-pil
```

Check the available QGIS versions:

```
# apt-cache showpkg qgis
```

The output should begin like this:

```
Package: qgis
Versions:
2.14.5+dfsg-1~bpo8+1 (/var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie-...
 Description Language:
                 File: /var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language: en
                 File: /var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad

2.4.0-1+b1 (/var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie_main_bina...
 Description Language:
```

```
                 File: /var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language: en
                 File: /var/lib/apt/lists/ftp.ch.debian.org_debian_dists_jessie...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
```

To install the most recent version:

```
# apt-get install qgis=2.14.5+dfsg-1~bpo8+1
```

Take care of replacing the version with the actual version available in the repository at the installation time.

Ubuntu 16 LTS (Xenial Xerus)

Enable Ubuntu GIS repository

Enabling the Ubuntu GIS unstable repository allows to install a more recent version of QGIS. You can skip this step if you are happy with the version provided in the main repository.

Add the following line to the file */etc/apt/sources.list* (root privileges required):

```
deb http://ppa.launchpad.net/ubuntugis/ubuntugis-unstable/ubuntu xenial main
deb-src http://ppa.launchpad.net/ubuntugis/ubuntugis-unstable/ubuntu xenial main
```

Run repos update:

```
# sudo apt-get update
```

More information about *Ubuntu GIS* can be found here

http://wiki.ubuntu.com/UbuntuGIS

http://trac.osgeo.org/ubuntugis/wiki/UbuntuGISRepository

Official **QGIS** repositories providing newer versions of the software can be added following the instruction in

http://qgis.org/en/site/forusers/alldownloads.html#debian-ubuntu

Install QGIS and dependencies

Install python and python packages:

```
# apt-get install python-numpy python-scipy python-qt4 python-pil
```

Check the available QGIS versions:

```
# apt-cache showpkg qgis
```

The output should begin like this:

```
Package: qgis
Versions:
2.14.1+dfsg-3~xenial0 (/var/lib/apt/lists/ppa.launchpad.net_ubuntugis_ubuntugis-...
 Description Language:
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xen...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xen...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language: en
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xen...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
                 File: /var/lib/apt/lists/ppa.launchpad.net_ubuntugis_ubuntugis...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
```

```
                 File: /var/lib/apt/lists/ppa.launchpad.net_ubuntugis_ubuntugis...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad

2.8.6+dfsg-1build1 (/var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xenial_...
 Description Language:
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xeni...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xeni...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language: en
                 File: /var/lib/apt/lists/ch.archive.ubuntu.com_ubuntu_dists_xeni...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
                 File: /var/lib/apt/lists/ppa.launchpad.net_ubuntugis_ubuntugis-u...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
 Description Language:
                 File: /var/lib/apt/lists/ppa.launchpad.net_ubuntugis_ubuntugis-u...
                  MD5: 49f76973cc4c2bd4a16872b7a79659ad
```

To install the most recent version:

```
# apt-get install qgis=2.14.1+dfsg-3~xenial0
```

Take care of replacing the version with the actual version available in the repository at the installation time.

CentOS 7

Enable required repositories

2.1.2 Apple OSX

Download and install QGIS

Download and install *QGIS* from https://www.qgis.org/en/site/forusers/download.html#mac or directly from http://www.kyngchaos.com/software/qgis

Download and install depdendances

From http://www.kyngchaos.com/software/python install the following packages:

- NumPy
- PIL

2.1.3 Microsoft Windows

Download and install QGIS

Download and install the *QGIS standalone installer* of your choice from

http://www.qgis.org/en/site/forusers/download.html

The package contains all the libriaries required.

2.2 Install MARSIS/SHARAD plugin

2.2.1 Download MARSIS/SHARAD viewer

You can alternatively do one of the following

- Download the latest release version (or any other version at your choice) from

https://github.com/eSpaceEPFL/marsissharadviewer/releases

and uncompress the archive.

- Get the development version from

https://github.com/eSpaceEPFL/marsissharadviewer

by clicking on the green button *'clone or download'*.

Uncompress the archive if you downloaded the *zip* file.

Cloning the repository requires you have Git installed on your machine.

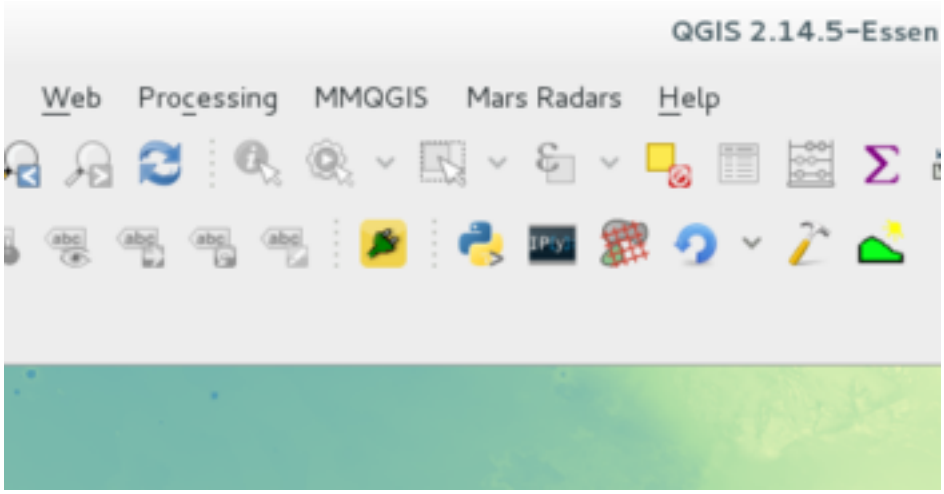
2.2.2 Installing the plug-in

Copy the folder *marsissharadviewer* containing the plug-in files in the QGIS plug-ins folder.

Location of the QGIS plug-ins folder

Operating system	Folder location
GNU/Linux	/home/*{username}*/.qgis2/python/plugins
OSX	/Users/*{username}*/.qgis2/python/plugins
Windows	C:\users\{*username*}\.qgis2\python\plugins

Lunch QGIS, the *'Mars Radars'* menu should appear in the menu bar as show in the figure below.



CHAPTER

THREE

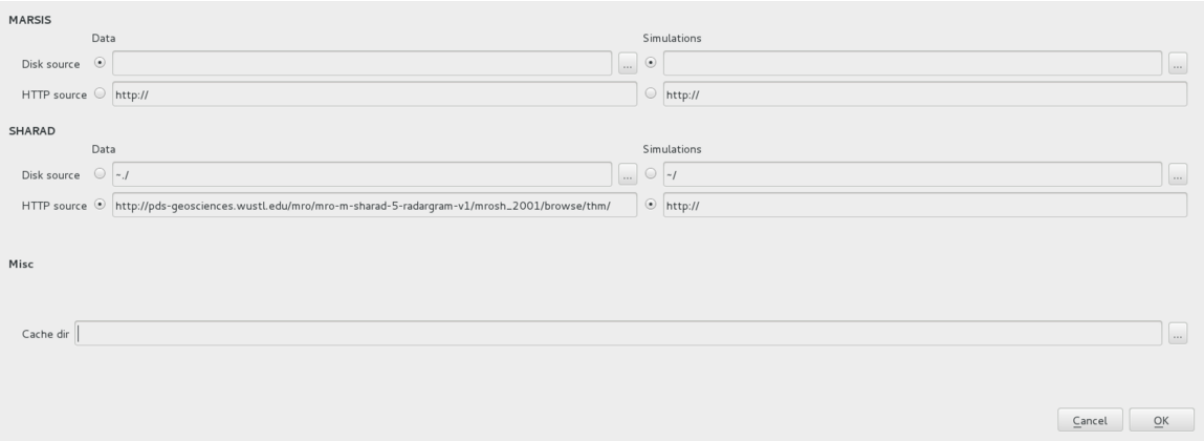
USING THE PLUG-IN

3.1 Set plug-in preferences

Open the *Mars radars->Settings* dialog from the meu bar.

The dialog (see figore below) allows to set the radargram source and the plug-in cache directory.

This information must be provided before using the plug-in



Radargrams (and possibly clutter simulations) can be fetched both from the disk and from a web server via *http* protocol.

Default server for the *SHARAD* radargrams

(*http://pds-geosciences.wustl.edu/mro/mro-m-sharad-5-radargram-v1/mrosh_2001/browse/thm/*)

is alredy set.

Regarding *MARSIS* data, since an official repository is not yet available, local copy of the data must be set up.

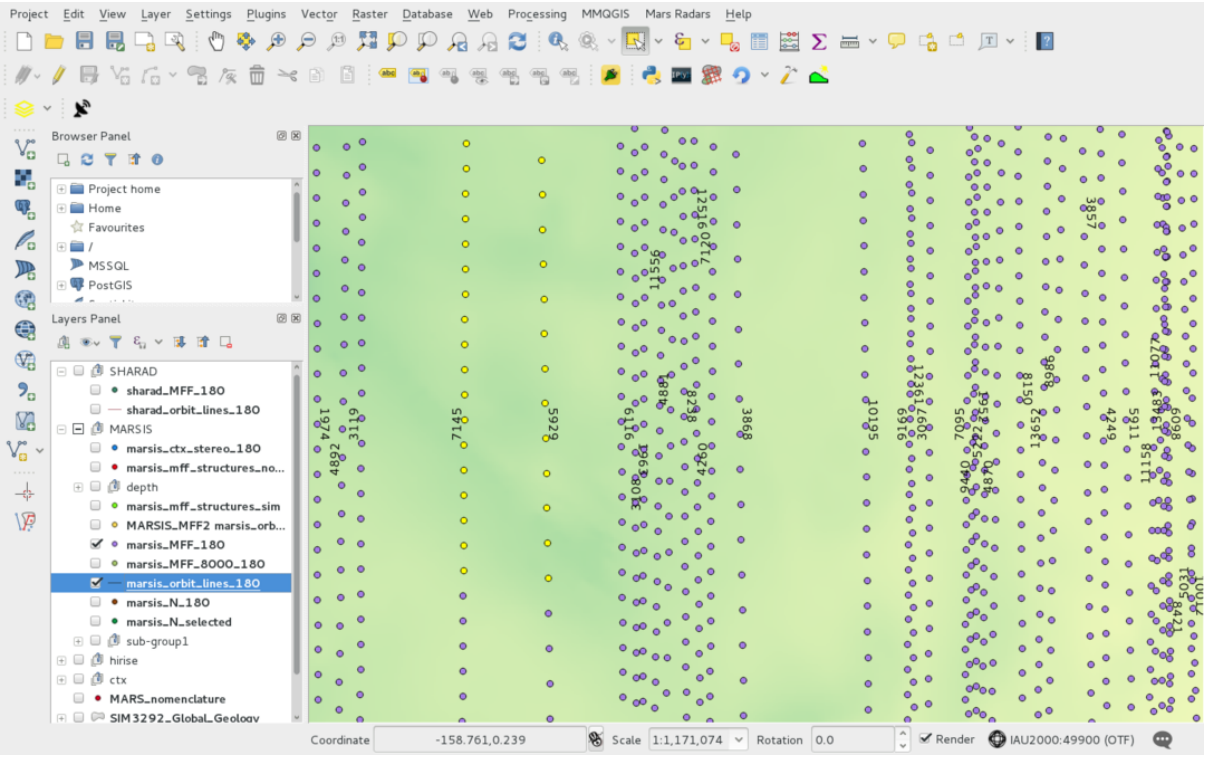
3.2 Orbits selection

The MARSIS/SHARAD viewer will show data on the basis of the selected features on the QGIS map.

Features can be selected with any selection tool provided by QGIS. A multiple layer selection plug-in (http://plugins.qgis.org/plugins/MultipleLayerSelection/) can be usefull.

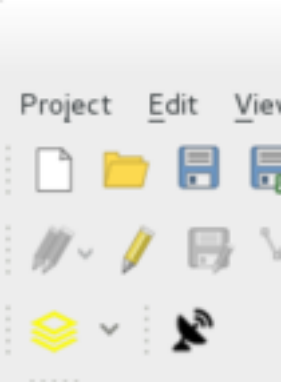
Layers containing MARSIS and SHARAD tracks feaures must have their name starting with *marsis_* and *sharad_* respectively in order to be correctly recognised

The image below shows a QGIS map with selected features on two MARSIS tracks.



3.3 Running the plugin

Once the features of interest are selected, the plug-in can be started using either the *Mars radars->MARSIS/SHARAD Viewer* menu or by pressing the plug-in launch button (see figure below).



The viewer will open and show the radargrams belonging to the selected orbits.

3.3.1 Single radargram viewer

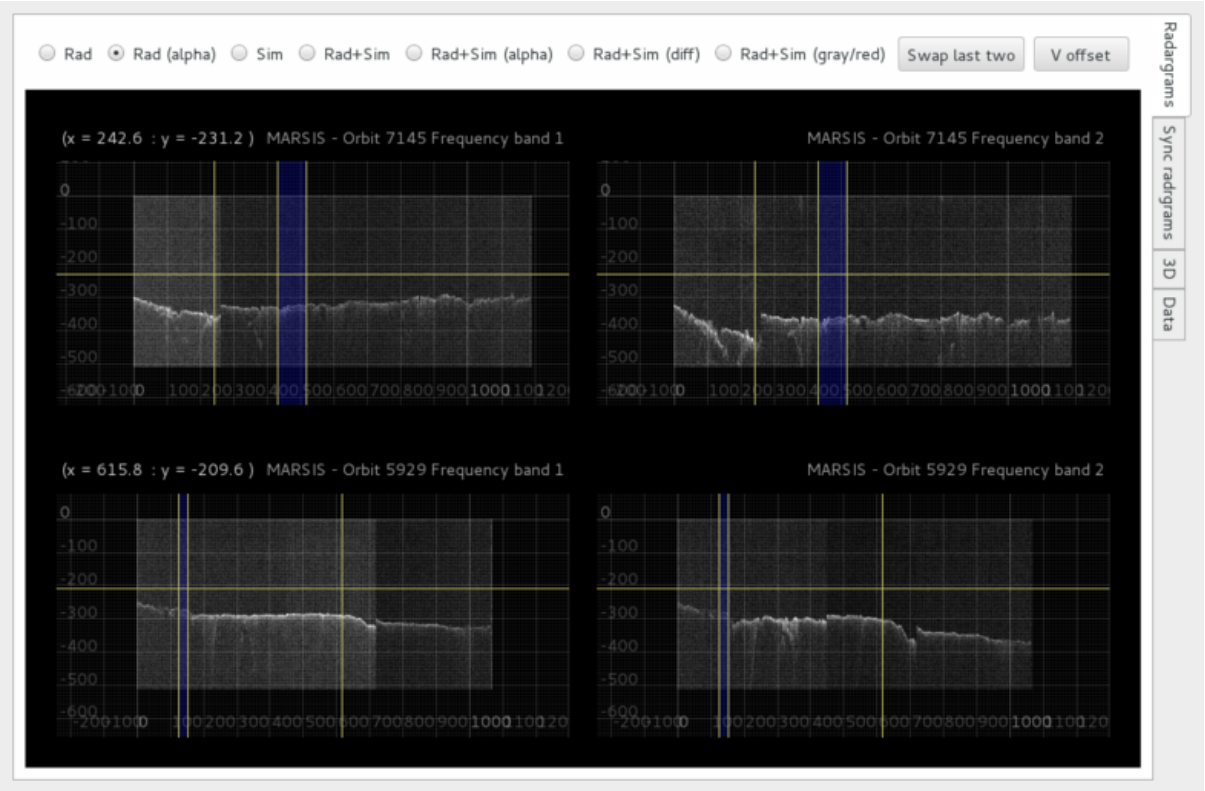
The *Single radargram* is the default view provided by the plug in.

Radargrams belonging to the selected orbits will be shown, one orbit per row. For MARSIS data one radargrams per frequency band will be shown.

The section of the radargram highlighted with a blue band is the region corresponding to the selected features on the map. Plots can be zoomed and panned. For each plot, a vertical and an horizontal marker line are available.

Radio buttons at the top of the viewer allows to select among only radargrams, only clutter simulation and superposed view, using different look up table preset. The *swap last two* button toggle between the views corresponding to the last two selected radio buttons.

In case of MARSIS data, the plots of the different frequencies are synchronised.



Adjusting the selection

Moving the highlight selection will cause the features selection on the QGIS map to change accordingly. (*It is suggested to use this functionality with a small subset of orbits for a good responsiveness of the system*)

Subsurfaces depth measurement

The *subsurfaces depth measurement tool* allows to select subsurfaces and measure their depth with respect to the planet surface saving data on QGIS layers.

On each plot, the tool can be access by right-clicking on the mouse/touch-pad and positioning the mouse pointer on *Dpeth measurement* on the context menu. The following option are available:

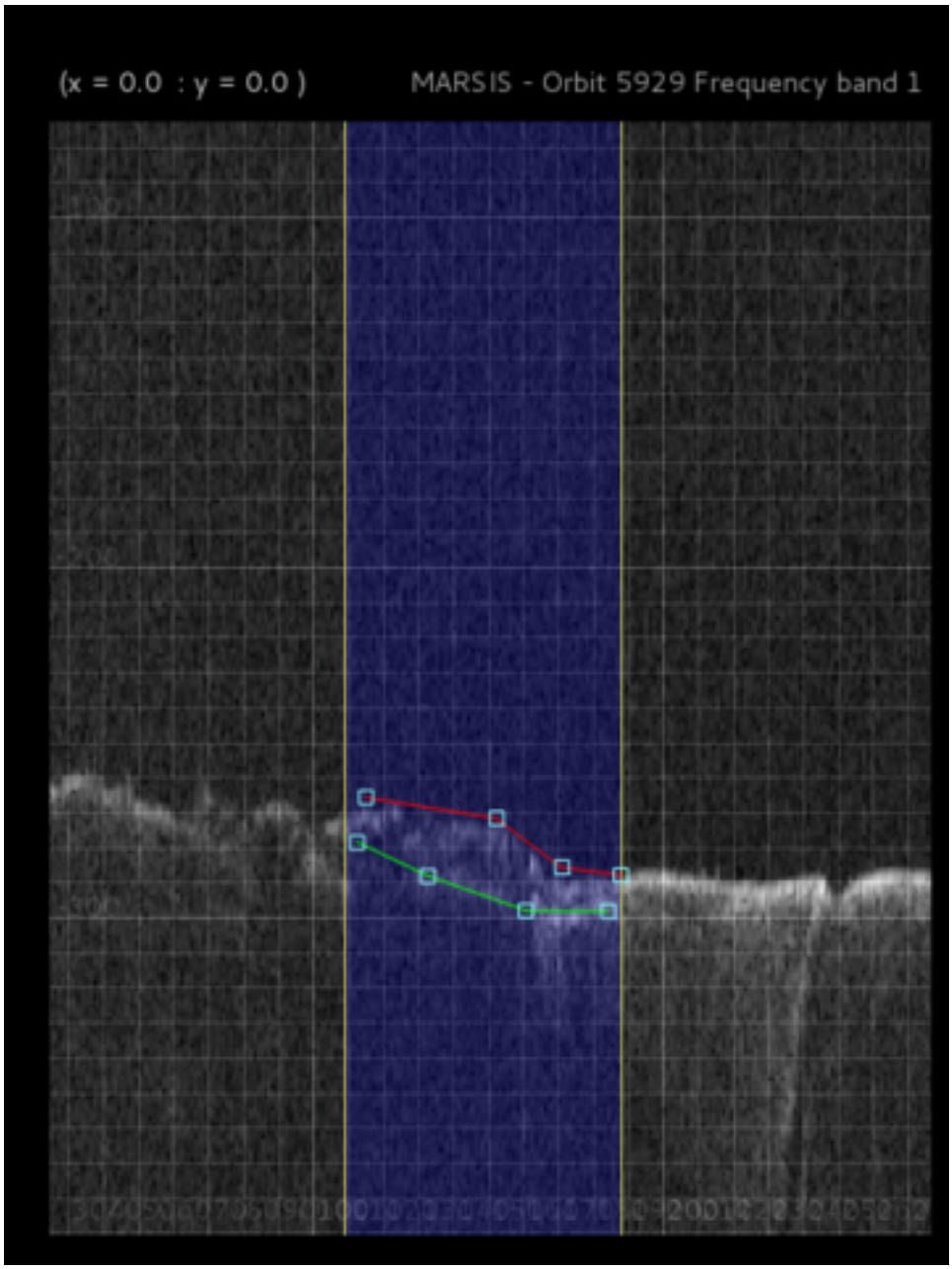
- Add surface line
- Add subsurface line
- Measure...
- Load lines from selected layer

Add surface line add a line to be used to draw the surface. New *handles* can be added to the line clicking on it, to split the line in segments. The line and each handle can be moved to match the surface. Only one *surface line* can be added to the plot.

Add subsurface line add a line to be used to draw a subsurface. The *subsurface lines* act as the *surface line*. An arbitrary number of *subsurface lines* can be added to the plot.

Measure... compute the subsurfaces depth. Computed data (in pixels and time), together with the position of the line's handles, are stored in a new memory layer automatically added to the QGIS map. Since memory layers are not automatically saved by QGIS, a copy of the layer in *SQLite* format is saved in the *cache directory* selected in the *settings dialog*.

Load lines from selected layer load surface and subsurface lines from a proper selected layer. The user must select the correct layer to load data from **before** using the command.



3.3.2 Synchronised viewer

The *synchronised view* acts as the default view except the radargrams belonging to different orbits are aligned by latitude and linked when zooming and panning. The aim of the view is to help to inspect structures in close, quasi-parallel radargrams.

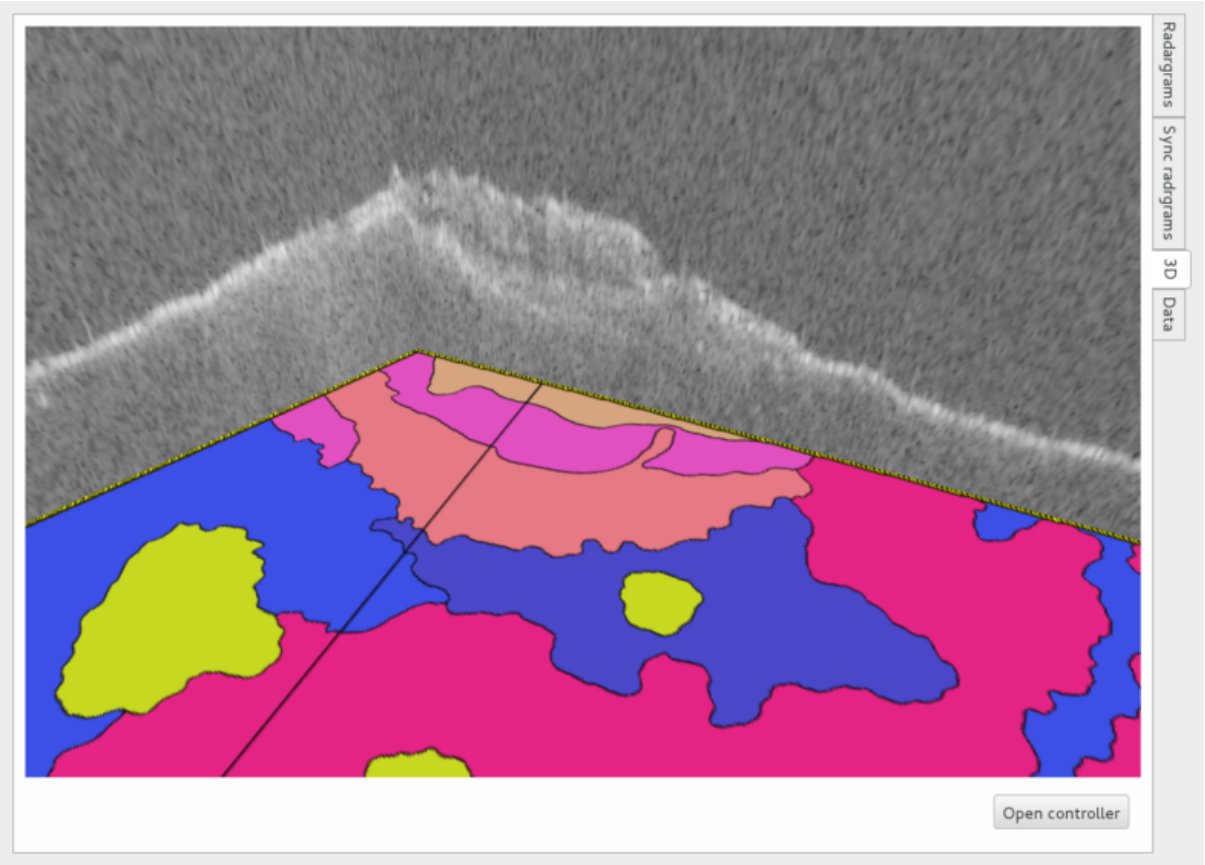
The alignment is done on the selected area (blue highlight bands) corresponding to the features selection of the QGIS map. Outside this region, the latitude alignment is not guaranteed.

Highlight region editing and subsurface selection are currently **not** available in this view.

3.3.3 3D viewer

The *3D view* shows a 3D representation of the redargrams in the space, together with the map layer selected on the QGIS map. The aim of the view is to show intersecting radargrams, especially in the polar regions.

The geographic projection is the one selected on QGIS.



Radargrams alignment

The *Open controller* button opens a dialog to toggle the visibility and adjust the vertical alignment of each radargram as well as the map layer.