

# GeoLab 1.0.0 User Manual

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Iiro Iivanainen

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## 1. The Purpose of the Software

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GeoLab is an open-source application for managing multimodal research data. The application allows the user to view grayscale 3D images, such as tomographic images, and to connect research data files to coordinates corresponding to the points in the image. The connected files may contain data tables, images or simple text. The 3D images can be viewed on XY, XZ or YZ planes.

GeoLab is licensed under the MIT License and has been originally developed for the Geological Survey of Finland. This user manual introduces the main features of the application via the general workflow.

## 2. Glossary

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Term	Description
Connector	is a point with coordinates that has a linked file and metadata associated with it. Multiple connectors may have the same coordinates.
Map	is three-dimensional intensity data that can be portrayed with two dimensional image slices.
Map file	is a file that is read as a map. It can also be a set of files such as a sequence of images.
Metadata	is a set of names and descriptions related to the sample or connector data defined within the application.
Stack	is an ordered set of image slices representing a map from a certain orientation.
Sample	is a saveable project-like body for connecting the map, the connectors as well as the metadata.

## 3. Running the Application

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GeoLab is distributed in a single folder for 32-bit Windows 7 and up. The files may be distributed in a ZIP file, in which case the compressed files need to be extracted first. After extracting the folder simply run the executable file `GroundhogApp.exe` to start the application.

## 4. Main Window Interface

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Upon starting the application the main window in Figure 1 is displayed. The main window consists of the menu bar, the container window (containing the *Map*, *Controller* and *Connectors* subwindows) and the status bar (displaying the username). Figure 10 gives more of an idea of what the main window looks like with the 3 *Map* views displayed and a single connector added.

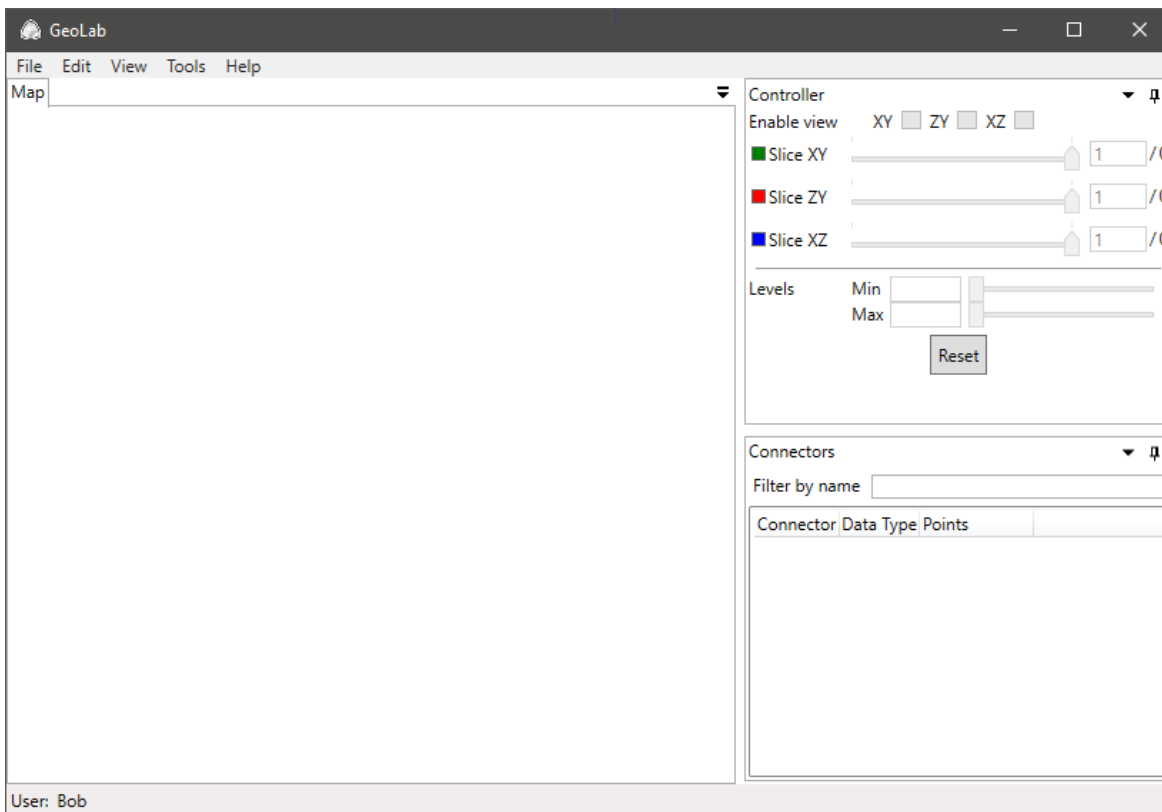


Figure 1. Main window when opening the application.

## 4.1 Menu Bar Items

The section describes the commands in the menu bar of the main window.

The **File** menu contains the following commands:

Command	Shortcut	Description
<i>New</i>	Ctrl+N	Opens a new sample.
<i>Open</i>	Ctrl+O	Opens a saved sample file.
<i>Save</i>	Ctrl+S	Saves the current sample.
<i>Save As</i>	Ctrl+Shift+S	Saves the current sample as a new file.
<i>Exit</i>	Ctrl+Q	Closes the application.

The **Edit** menu contains the following commands:

Command	Shortcut	Description
<i>Add/Change Map</i>	Ctrl+M	Selects a new map file.
<i>Add Connector data</i>	Ctrl+D	Adds a new connector.
<i>User Preferences</i>	Ctrl+U	Opens a dialog for editing the user preferences.

The **View** menu contains the following commands:

Command	Shortcut	Description
<i>Axis Colour Coding</i>	F1	Toggles the coordinate line overlays in the <i>Map</i> view.
<i>Attached Data Points</i>	F2	Toggles the selectable connectors in the <i>Map</i> view.
<i>Sample Metadata</i>	F3	Displays the editable sample metadata.

The **Tools** menu contains the following commands:

Command	Shortcut	Description
<i>Edit Connectors</i>	Ctrl+E	Toggles the mode where the user can add a connector to the position clicked in the <i>Map</i> view.
<i>Create ZY-stack</i>	None	Creates a stack required for viewing the ZY plane.
<i>Create XZ-stack</i>	None	Creates a stack required for viewing the XZ plane.

The **Help** menu contains the following commands:

Command	Shortcut	Description
<i>View Help</i>	F4	Opens the user manual.
<i>About</i>	F5	Displays the current version, the copyright and the authors of the application.

## 4.2 Repositioning Subwindows

Within the main window the user may reposition the subwindows by dragging them from the header and docking them to a new position. A subwindow can also be left undocked as a separate floating window.

The docking tool (see Figure 2) is shown in the main window while dragging a subwindow. A subwindow can be placed above, below, to the left, to the right or in the same place relative to the subwindow below or the container window.



Figure 2. The docking tool.

When multiple subwindows share the same space they act as tabs and only one can be viewed at a time (see Figure 3).

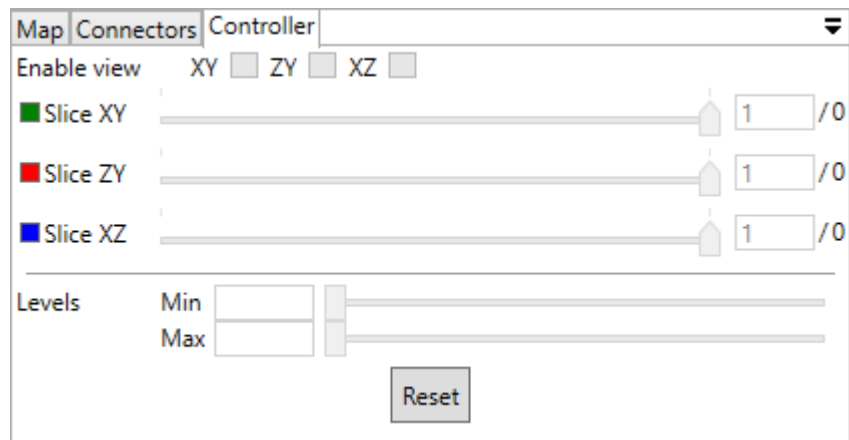


Figure 3. Subwindows as tabs.

## 5. Reading Map Files

In order to view the three dimensional intensity data a map file needs to be added. A map can be read from *Edit* → *Add/Change map*. It is possible to change the map file at any time.

### 5.1 Reading Image Sequence Files

An image sequence is a stack of image files. The read images may be in PNG or TIFF formats. When reading an image sequence the user has to select a file belonging to the stack. **The files should have sequential names** (e.g. `image000`, `image001` ...) as GeoLab will read them in the natural order based on naming.

The application will attempt to parse the common name for the images as specified in the field *File template*. The user may also input the template manually (see Figure 4).

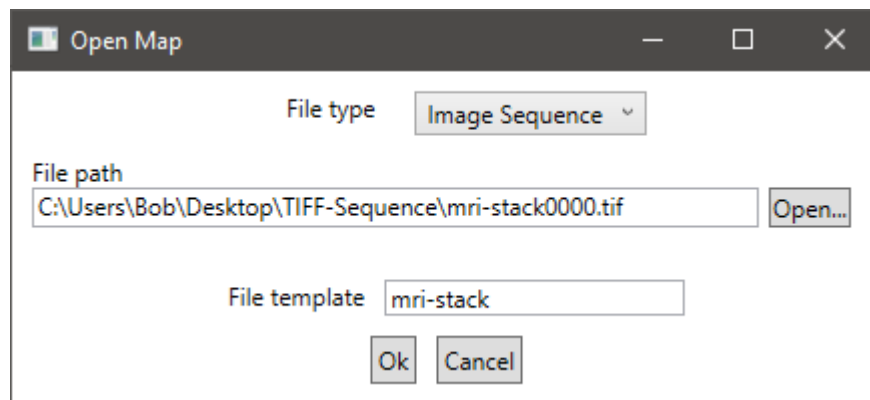


Figure 4. Reading an image sequence.

### 5.2 Reading a Multiframe TIFF File

In order to read a multiframe TIFF the user simply needs to select the *File type 3D Tiff* and then select the file (see Figure 5).

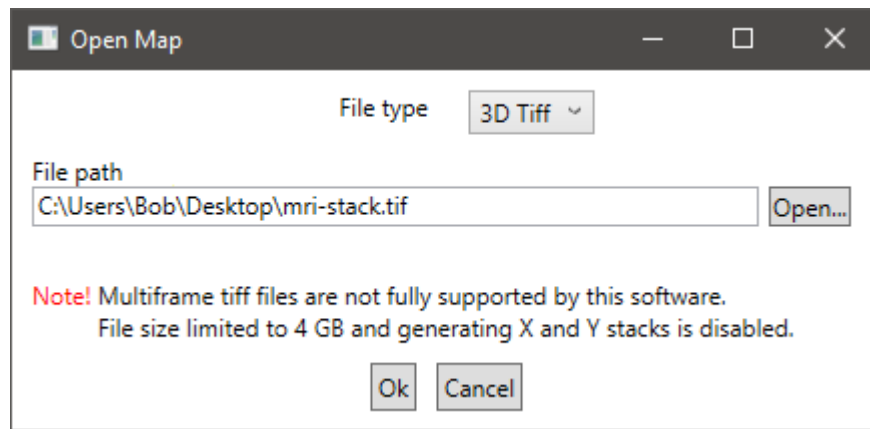


Figure 5. Reading a Multiframe TIFF file.

**NOTE:** The support for multiframe TIFF in GeoLab is limited as follows:

- When using a multiframe TIFF there is no support for stack generation.
- Files are limited to the maximum size of 4 GB.

### 5.3 Reading a Raw File

Raw files require the user to input the specific format of the file. These include the data type (*8-bit Integer*, *16-bit Integer* or *32-bit floating point*), the horizontal and vertical pixel count of each image, the image count and the endianness. **If the dimensions and the data type are set correctly the *Requested* and *File size* byte amounts should be equal** (see Figure 6). Wrong settings will display the image incorrectly.

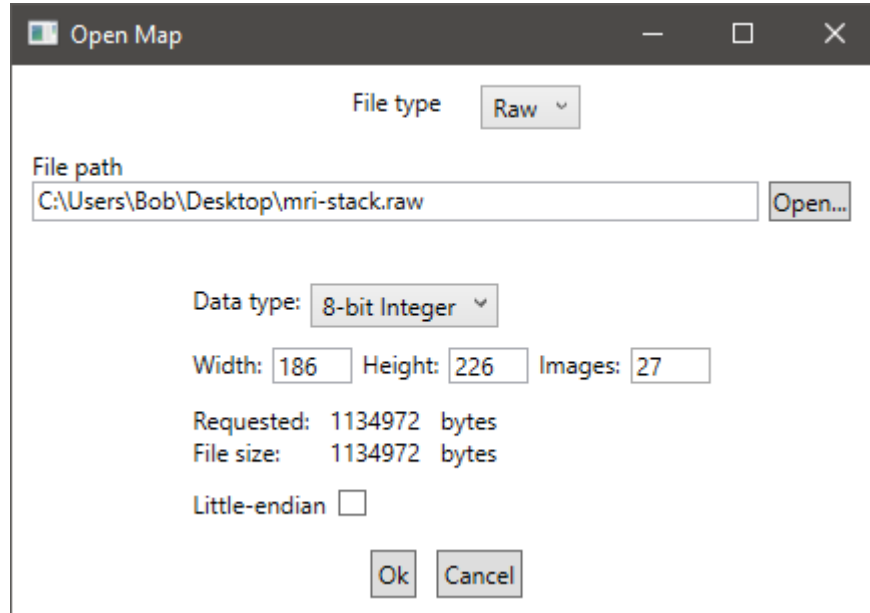


Figure 6. Reading a raw file.

## 6. Generating Stacks for Viewing XZ and YZ Planes

By default GeoLab can only display the map file from the original XY plane. In order to enable the XZ and ZY axis views the user must generate XZ and ZY stacks from the original map file.

The stacks can be created from **Tools** → **Create ZY-stack / Create XZ-stack**. The application will attempt to create a folder called `XStack` or `YStack` in the location of the original map file. The user may select this or create another location for the generated stack.

The user cannot cancel the stack generation but they can otherwise continue using the application while the process is underway. The larger the original map file is the longer the stack generation will take. After the stack is generated successfully the *Enable view* checkbox in the *Controller* (see Figure 1) will be enabled for the corresponding stack (see Figure 7).

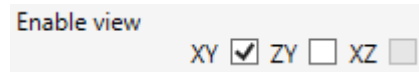


Figure 7. Enabled XY and ZY planes.

**NOTE:**

- When using a multiframe TIFF map file there is no support for stack generation.
- When using a raw map file the stack generation can take longer compared to image sequences.

## 7. Viewing the Map Via Slices

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GeoLab allows for viewing the original map and the created stacks slice by slice in each orientation (see Figure 8). The display of the slice view can be enabled or disabled from the *Enable view* checkboxes of the *Controller*. The viewed slice of the stack can be changed from the corresponding slider (*Slice XY*, *Slice ZY*, *Slice XZ*) by specifying the number of the slice.

The grayscale of the displayed slices (pixel minimum and maximum values) can be tuned or even inverted from the *Controller* (see Figure 8). The maximum value is based on the bit depth of the original map. By enabling axis colours from **View** → **Axis Colour Coding** an overlay will be added on the images displaying the selected coordinates of the other two axes as lines. The colors used for each axis can be changed in the **Edit** → **User Preferences** (see Chapter 11).

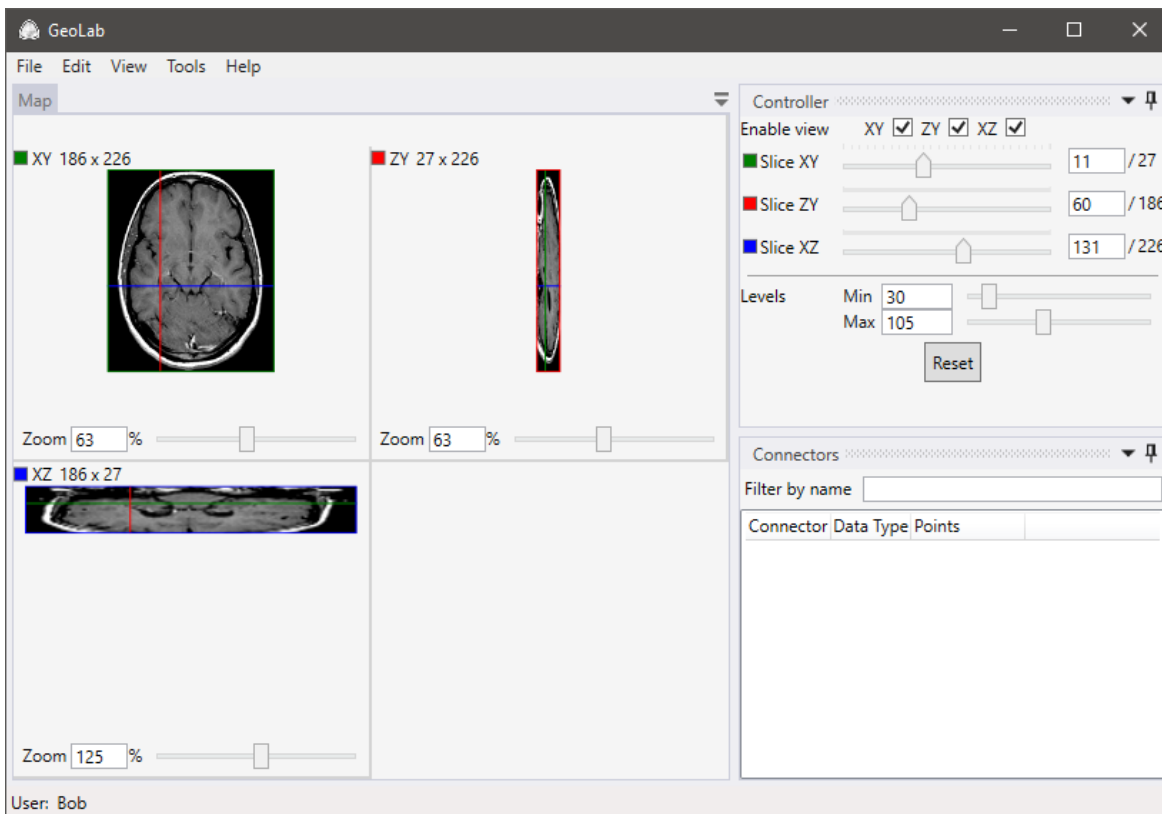


Figure 8. Viewing slices.

**NOTE:**

- Different map data types might require the grayscale to be tuned to appropriate minimum and maximum values in order for the images to look correct.

## 8. Using Connectors

GeoLab allows the user attach a file on the computer and metadata related to it with coordinates corresponding to the map. The linked file can be an image, a spreadsheet or plain text. Connectors can also be added before the map has been read and outside the map coordinates.

The supported image formats include `bmp`, `gif`, `ico`, `jpg` or `jpeg`, `png`, `tif` or `tiff`.

The supported spreadsheet formats include `csv`, `xlsx`, `xlsb`, `xls`.

**NOTE:**

- The file is read as plain text by default if the file extension doesn't match the supported image and spreadsheet formats.

### 8.1 Adding a Connector

A connector can be added from **Edit** → **Add Connector data** (see Figure 9). By default the current coordinates chosen in the sliders are suggested as the position for the new connector. Alternatively the user can select the suggested point by clicking the displayed map image after toggling the *Edit Mode* from **Tools** → **Edit Connectors**.



When the file is selected its name is suggested as the connector name in the *Attached data name* field. The user may also give a brief description of the connector which is then saved as connector metadata. The *Copy to sample folder* option will copy the file to the location of the saved sample file under the folder [Sample file name]\_AttachedData.

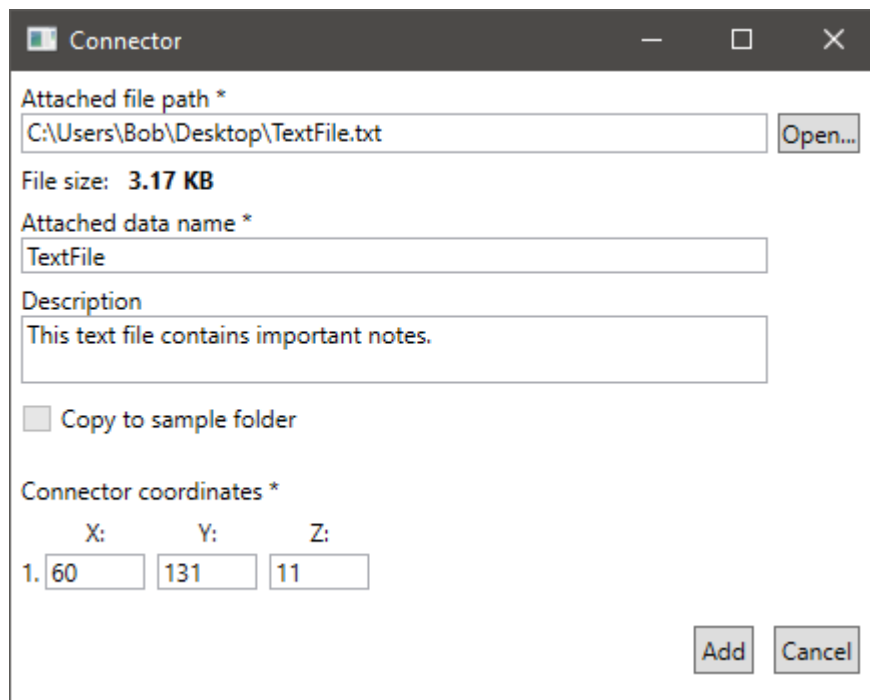


Figure 9. Adding a connector.

**NOTE:**

- The *Copy to sample folder* feature is disabled until the sample has been saved on the disk.

## 8.2 Managing Connectors

The connectors are listed in the *Connectors* subwindow (see Figure 10). By right-clicking the connector a context menu will appear with the following options:

Command	Description
<i>Go to</i>	Selects the slices in the <i>Controller</i> that correspond to the connector location (if the coordinates exist on the map).
<i>Display</i>	Displays the linked data file in the application.
<i>Open File</i>	Opens the linked data file.
<i>Open Folder</i>	Opens the file location of the linked data file.
<i>Delete selected</i>	Deletes the connector from the sample (doesn't delete the file on the disk).
<i>Metadata</i>	Displays the metadata of the connector.

When adding a new connector the sliders in the *Controller* are marked with a clickable note with a number of connectors that have been placed on that slice (see Figure 10).

The connectors can also be viewed and selected from the map view by enabling **View** → **Attached Data Points** (see Section 4.1). The color of the marking can be customized in the **Edit** → **User Preferences** (see Chapter 11).

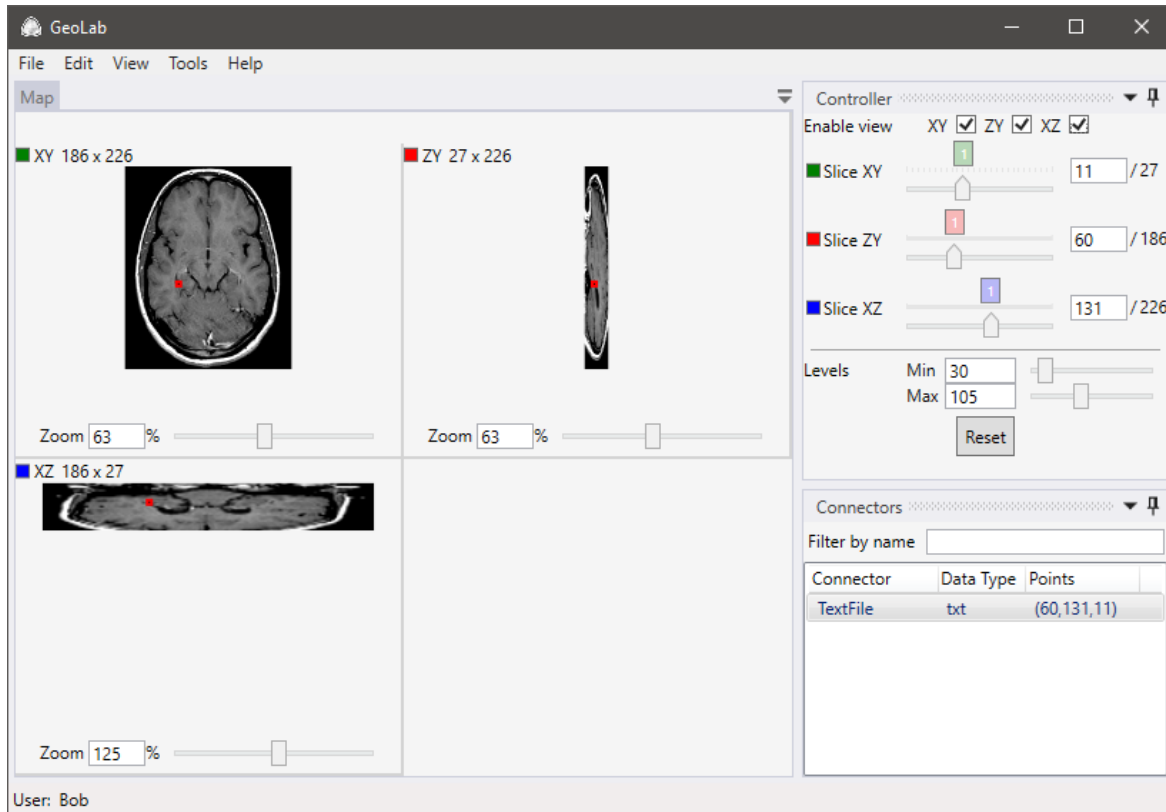


Figure 10. Viewing attached data.

### 8.3 Viewing Linked Files

The contents of the linked file can be viewed from the *Connectors* list by double-clicking the connector (see Figure 10) or selecting Display from the context menu (see Section 8.2). This will open a new subwindow displaying the contents of the file as shown in Figures 11, 12 and 13. If the contents have been edited in another software, the displayed file can be refreshed by opening the *Options* bottom slide menu and pressing *Reload File*. If the file has been deleted from the disk the user will be shown an error message when viewing or reloading the file.

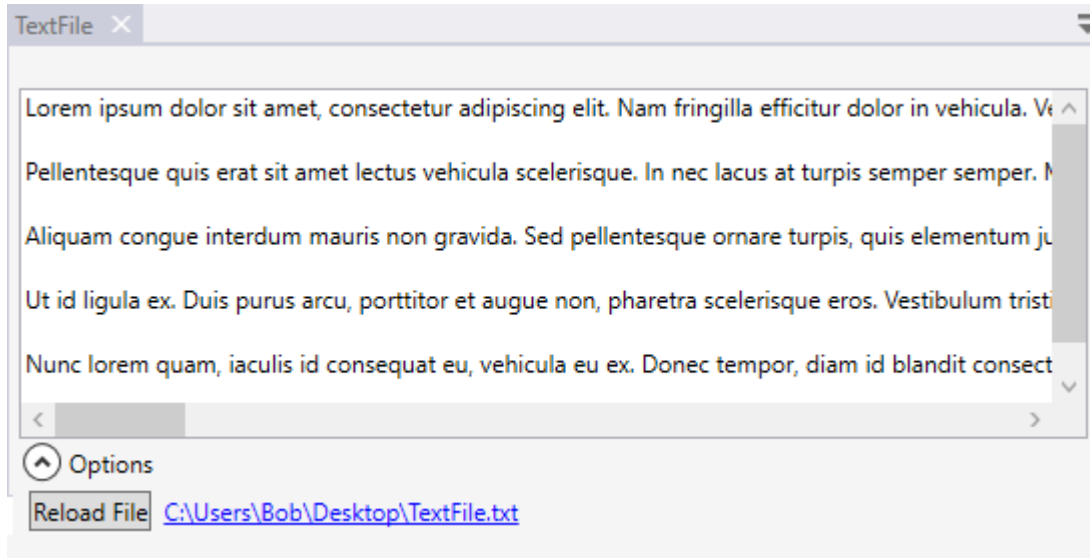


Figure 11. Displaying a text file.

## 8.4 Handling Spreadsheets

When viewing spreadsheets the rows can be sorted by the value of each column. If the first row of the spreadsheet is dedicated for the headers the checkbox *First row as headers* in the *Options* menu should be ticked . When using Excel spreadsheets the sheet of the workbook can also be changed from the *Options* menu with the drop-down menu (see Figure 12).

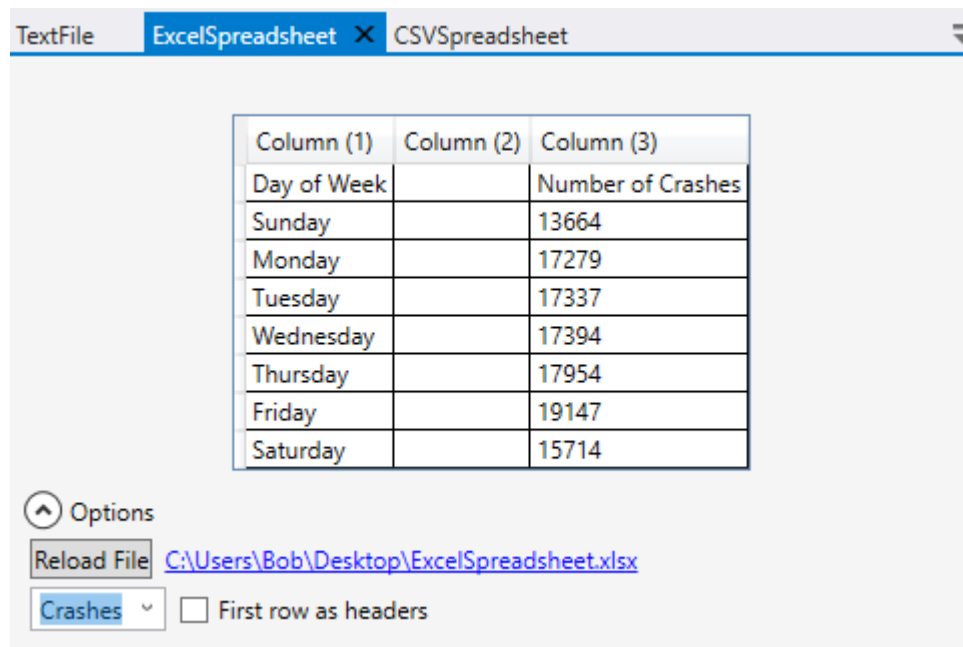


Figure 12. Excel file with "Crashes" workbook selected.

When using the comma separated value ( `CSV` ) format the application will try to automatically detect the separator. The user can also select the separator manually. After inputting the separator the spreadsheet needs to be reloaded (see Figure 13).

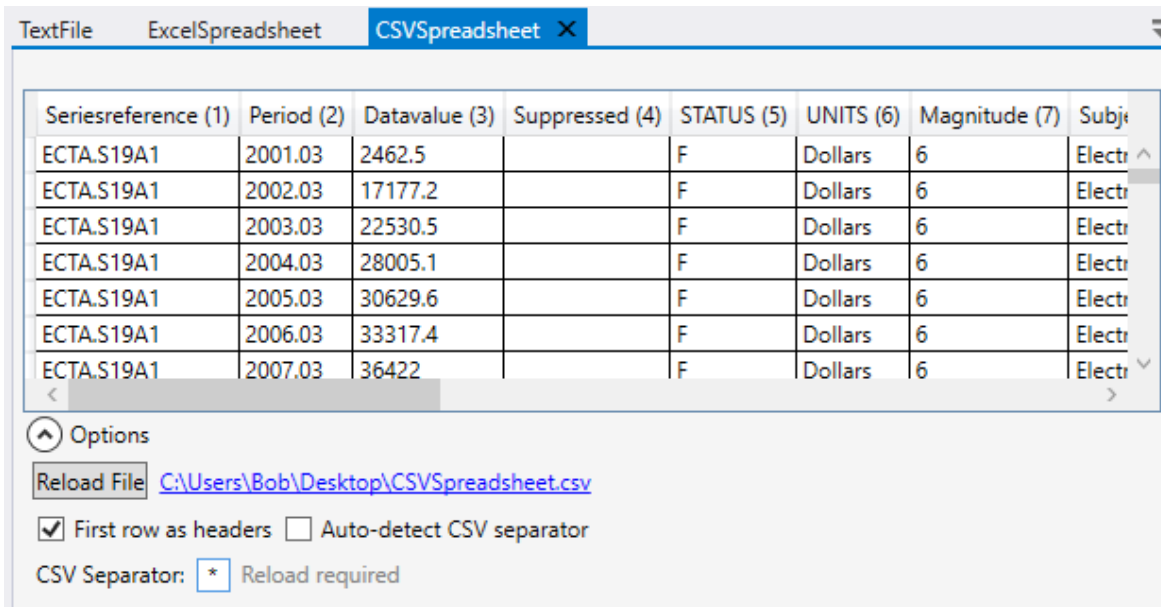


Figure 13. CSV with separator manually selected.

## 9. Saving the Sample

The sample can be saved as a `json` file from **File** → **Save / Save As**. This will save all the links to the map, the created stacks and the linked data relative to the `json` file. It is advised that the user stores all the files in a tidy folder structure to make the transfer of the sample between computers easier. The metadata is also saved to the `json` file.

### NOTE:

- Before the sample has been saved the linked files (including linked data, the map and created stacks) are stored as absolute paths.
- After the sample has been saved the linked files belonging to the same drive as the sample are stored with relative paths.
- Files located on a different drive from the sample are still stored with absolute paths.

## 10. Viewing and Editing Metadata

GeoLab stores automatically some metadata related to the sample and each connector created. The user is free to add, edit and remove metadata as they please.

**The sample metadata** can be accessed from **View** → **Sample Metadata**. When saving the sample the application will record the user who created the sample and the datetimes for the creation and latest edit (see Figure 14).

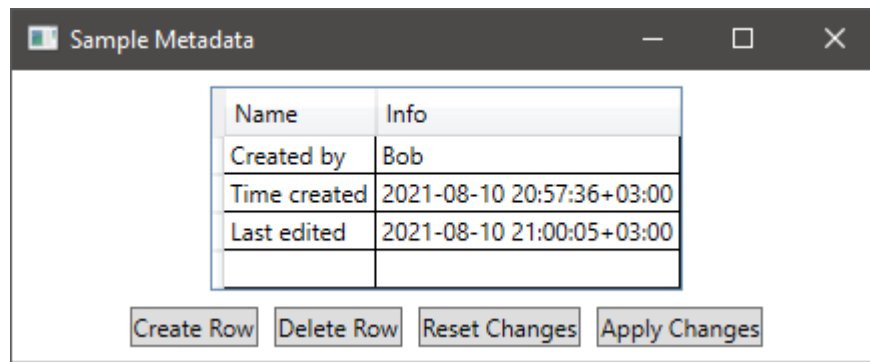


Figure 14. Default sample metadata.

The **connector metadata** can be accessed by right-clicking the connector from the list in *Connectors* (see Figure 10) and selecting *Metadata*. By default the description, the user who added the connector and the datetime for creation are recorded (see Figure 15).

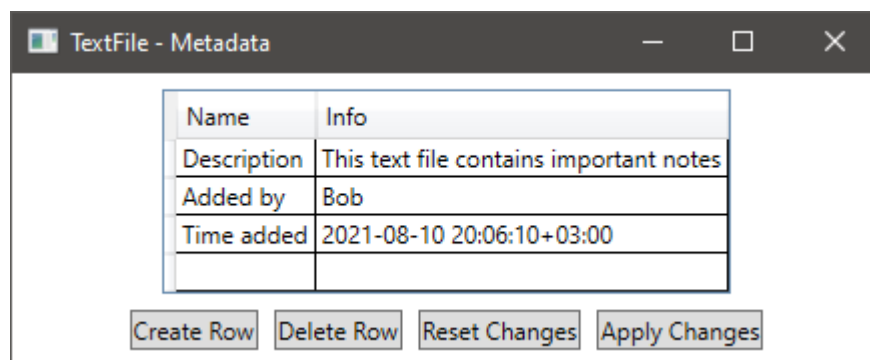


Figure 15. Default connector metadata.

## 11. Editing User Preferences

The color coding as well as the username recorded in the metadata can be customized from **Edit** → **User Preferences** (see Figure 16). Each value can also be reset to the default value. When resetting the username, the current Windows username will be set.

*Axis Color Coding* selects the colors for the three main axes used in the *Controller* and *Map*. *Attached Data Color* selects the base and the highlight color for connectors used in the *Map* (see Figure 10) when the **View** → **Attached Data Points** visibility has been toggled.

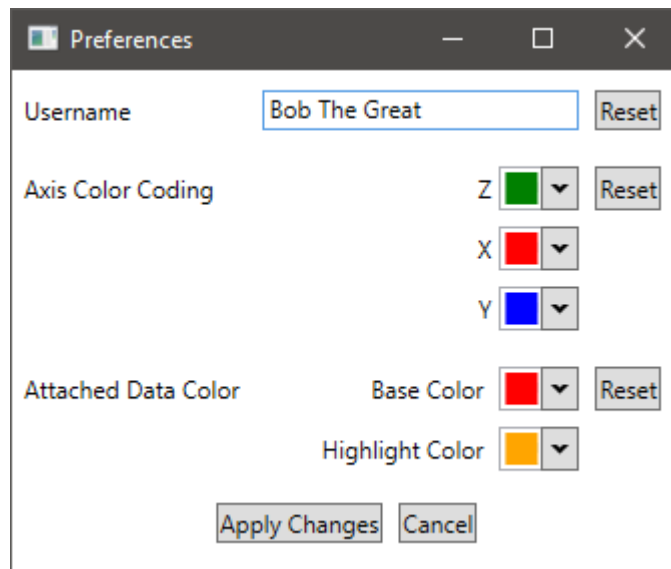


Figure 16. User preferences.

**NOTE:**

- User preferences can't be saved and start with default values when launching the application.

## 12. Contact Information

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For issues concerning the use of the application you may contact Jukka Kuva at `jukka.kuva@gtk.fi`.