



UgCS Mapper

version 2021 (3.19)

User Manual

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Installation and System Requirements

- Microsoft Windows 10 x86_64
- macOS: 10.13 x86_64

Useful links

- Detailed information on UgCS various application scenarios
[mapper-how-to](#)
- Visit UgCS YouTube channel with various tutorials, webinars and videos
youtube.com/user/ugcstv

Overview

UgCS Mapper is a standalone, desktop applications and must be installed with it's own installation package. This software designed to create offline 2D maps in minutes. In-field assembled map provides certainty for UAV surveyors that acquired images quality and density is sufficient. This information is crucial to decide whether the flight should be repeated before leaving surveying area.

UgCS mapper can compile orthophoto from prerecorded set of images or live video stream.

Another feasible value of UgCS Mapper is for drone missions, that has to be flown in places with insufficient quality of publicly available map. Shortly after the first flight a more detailed map of the surrounding can be created for more precise planning. UgCS installation is not required, but still useful for UgCS Mapper. If UgCS installed (and licensed) UgCS Mapper uses Geoserver and Videoserver processes.

The following camera profiles are included in installation package, the usage of these cameras will not require calibration:

Vendor/Model	Focal Length	Resolution
Canon/Canon IXUS 220HS	4.3 mm	4000x3000
Canon/Canon PowerShot S110	5.2 mm	4000x3000
DJI/FC2204	5 mm	4000x2250
DJI/XT2	8 mm	4000x3000
Agrowing SONY ILCE-QX1	25 mm	3610x2220
Agrowing SONY ILCE-7RM2	any	3610x2220
Agrowing SONY UMC-R10C	any	3610x2220
senseFly/S.O.D.A	10.2 mm	5472x3648
DJI/FC300S	3.6 mm	4000x3000
DJI/FC220	4.7 mm	4000x2250
DJI/FC220	4.7 mm	4000x3000

DJI/FC6310S	8.8 mm	5472x3078
DJI/FC330	3.6 mm	4000x2250
DJI/FC2403	4.5 mm	4056x3040
DJI/FC2204	4.4 mm	4000x2250
DJI/FC330	3.6 mm	4000x2250
DJI/FC350Z	4.1 mm	4000x2250
DJI/FC6310	8.8 mm	5472x3078

Launching UgCS Mapper

1. Download UgCS Mapper installer from ugcs.com/mapper.
2. Install UgCS mapper.
3. After installation the UgCS Mapper icon will be located on the desktop (Windows).



Figure 1. Shortcut on Windows desktop to run UgCS Mapper

4. Run UgCS Mapper and activate it with the license code:

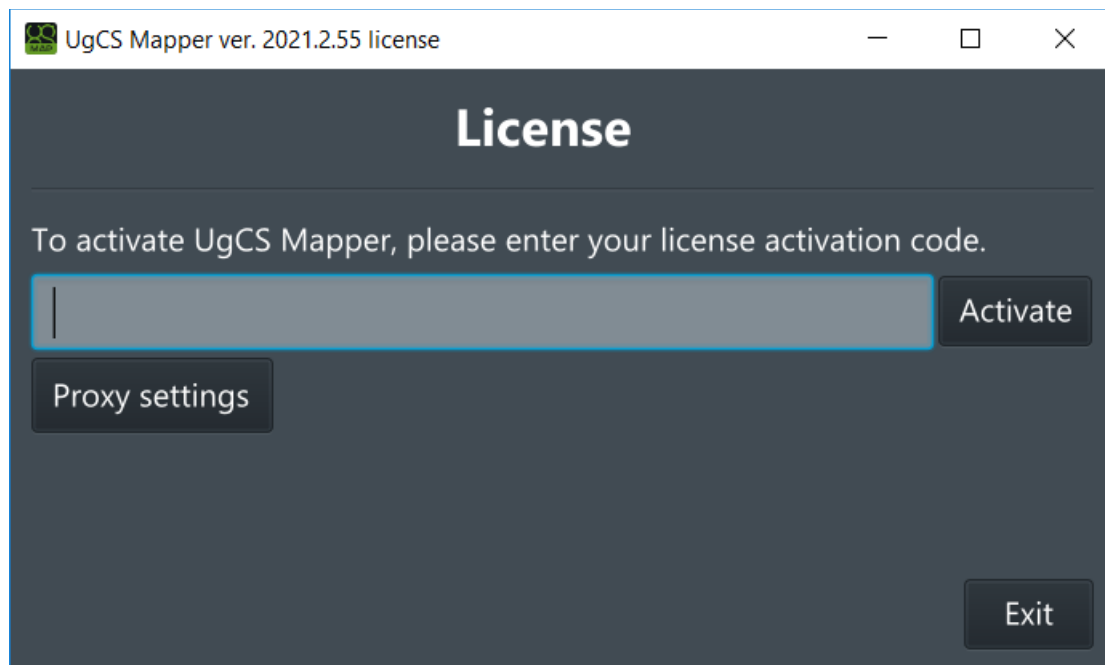


Figure 2. UgCS Mapper activation

If you launch UgCS Mapper on network behind proxy, push button “Proxy settings” and fill dialog with required parameters. For detailed information on proxy settings dialog see Image Processing > Geoservers section of this document.

Image processing

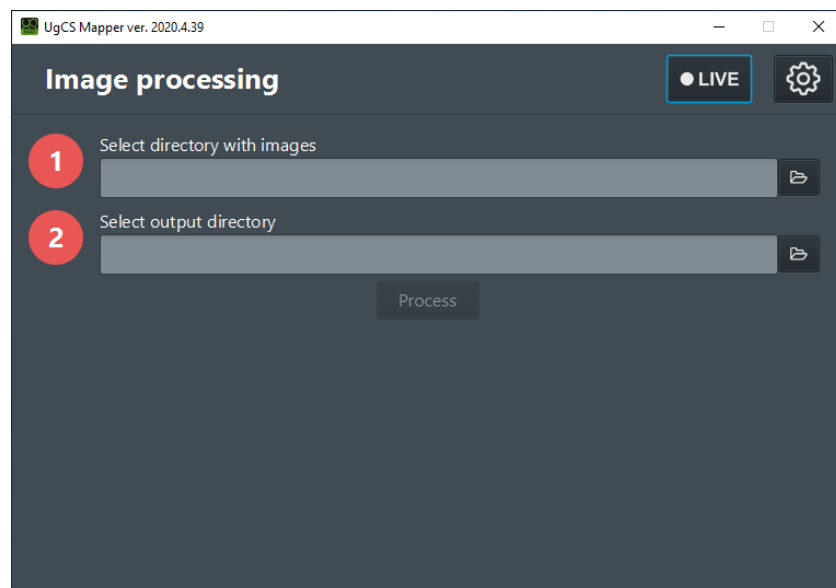


Figure 3. Window displayed when UgCS Mapper is launched

1. Images for processing should be georeferenced, e.g. EXIF data should contain GPS coordinates of the camera.
2. Select directory with images, select or create output directory and click "Process". Make sure to select the correct camera type, if the camera supports more than one mode.

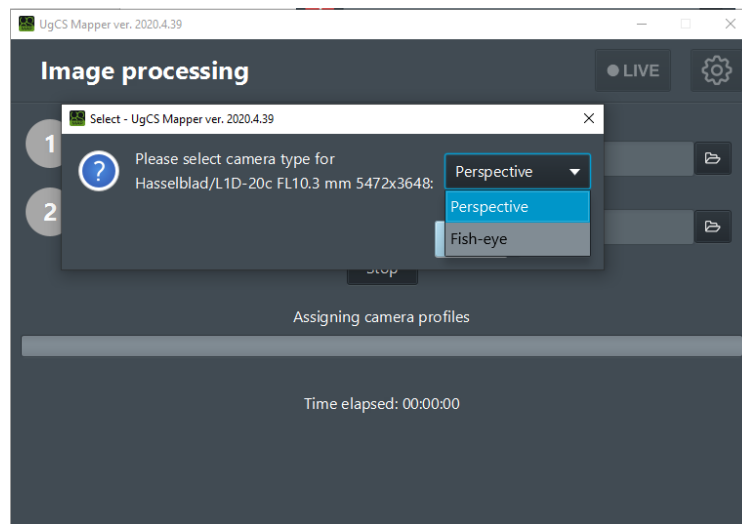


Figure 4. Camera mode

3. If the camera is not calibrated, the following window will be displayed:

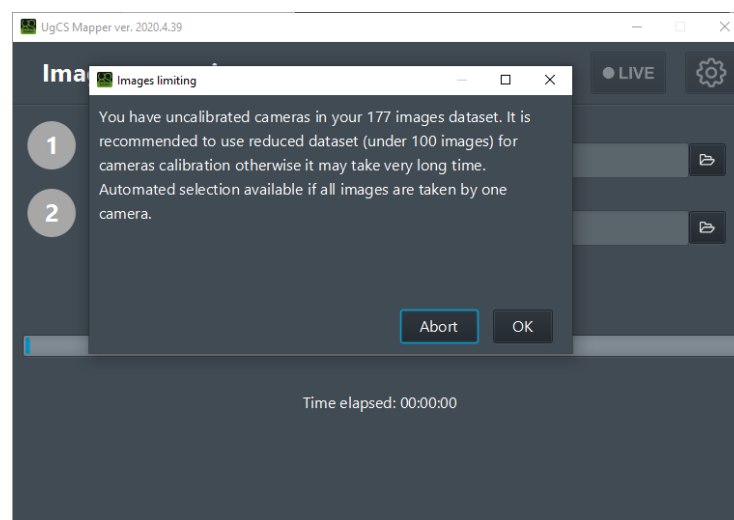


Figure 5. Camera calibration

For best calibration result, select the folder with the set of images taken nadir from same altitude on the same AGL (Above Ground Level.)

Calibration process take some time. When calibration is complete, the following window will appear:

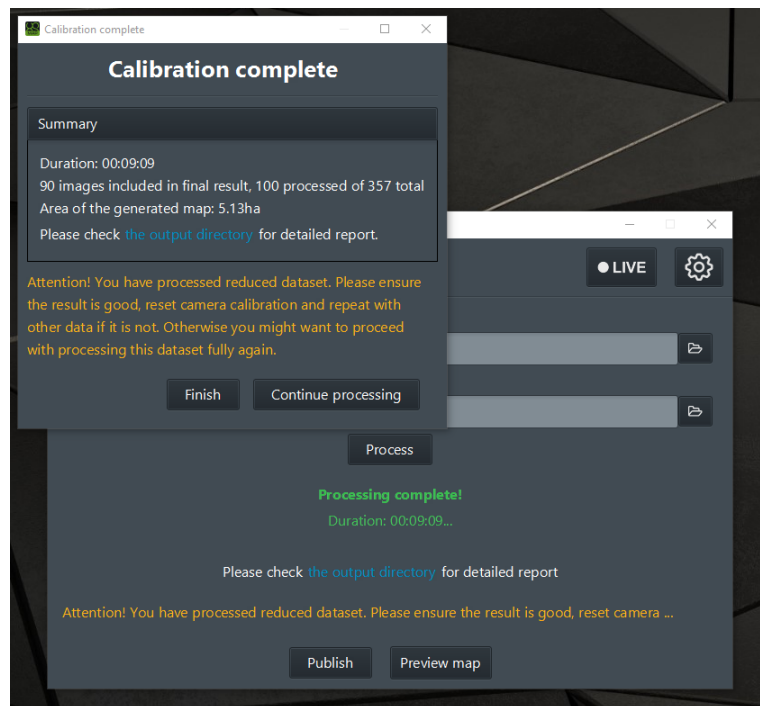


Figure 6. Calibration complete

When image processing is complete, the following window will be displayed:

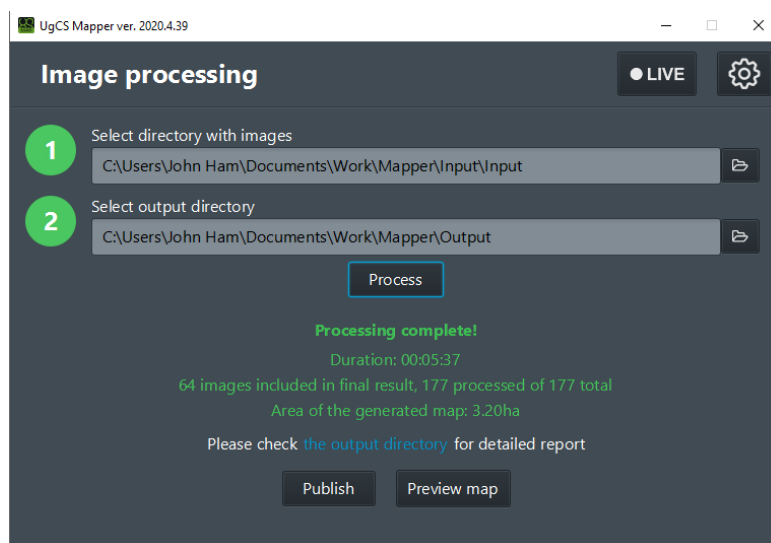


Figure 7. Camera calibration complete

4. Click the “Preview map” button and select the desired map provider (Base layer). If the processing results are satisfying – close the preview tab and click Publish.

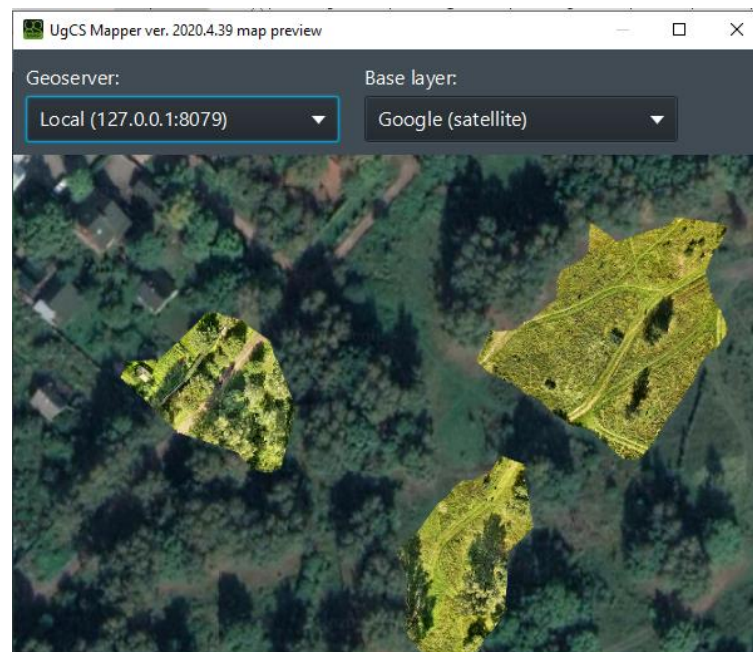


Figure 8. Preview

5. Name the map and elevation layer and select “Publish”. You can accept default name (based on source folder of images) or input new value. The UgCS Mapper will process the layers to UgCS desktop.

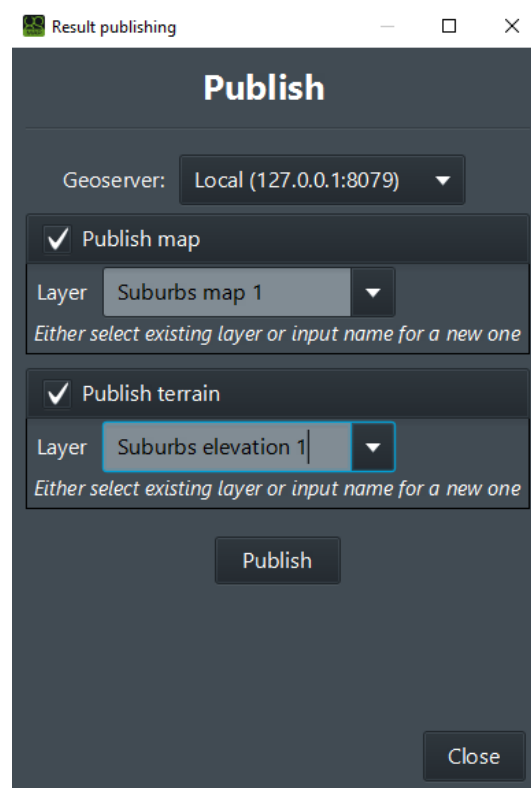


Figure 9 Publish options

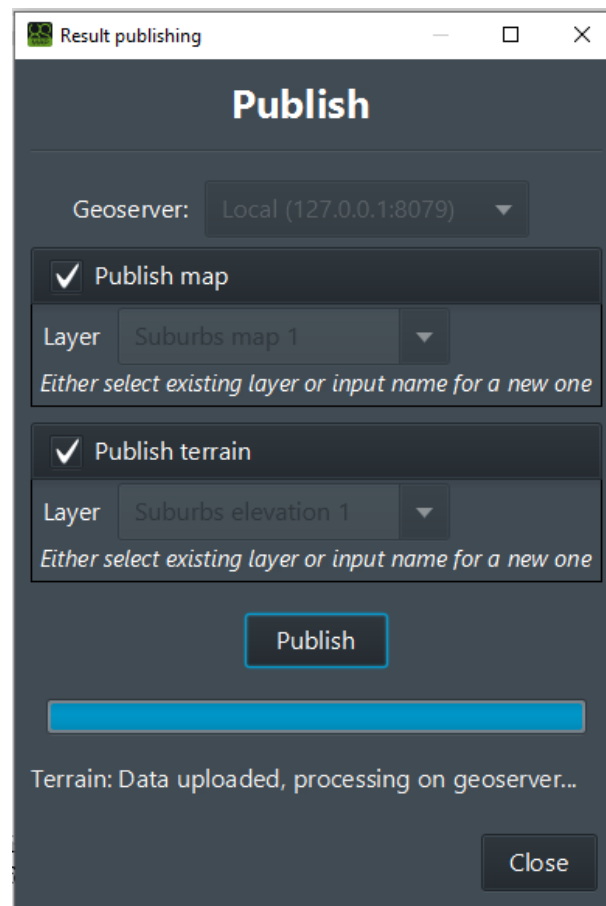


Figure 10 Publishing successfully completed

6. After processing is complete, the elevation and the map layers under the indicated name can be found in the Map options in UgCS, also the output folder will contain orthophoto.tiff with stitched map and report.html with processing report. In the root of the output directory application generates the following files:

- Geotiff
- MBTiles
- Processing report HTML
- Logs.

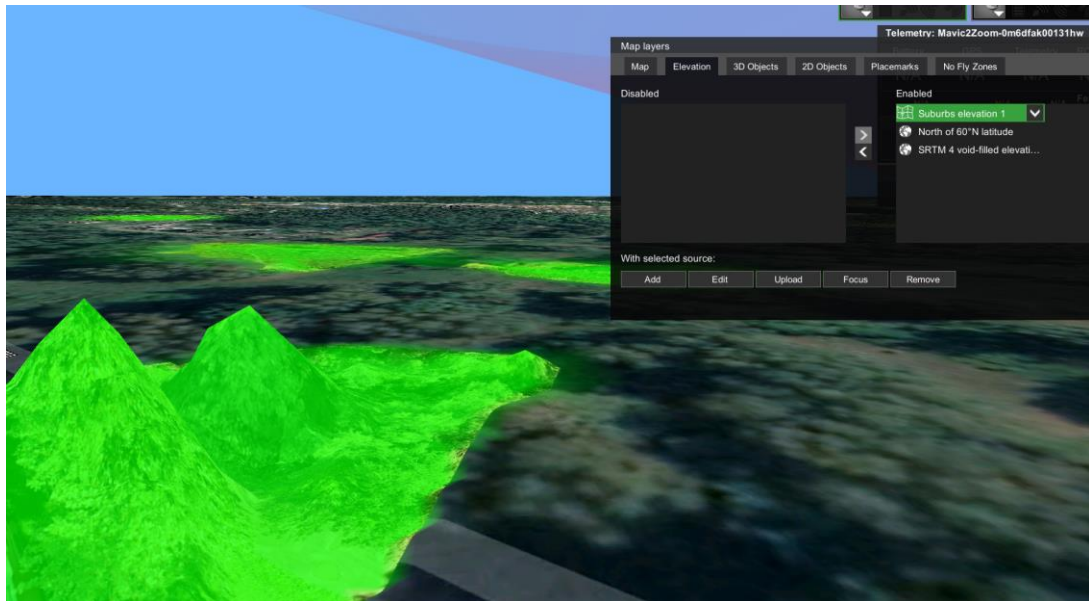


Figure 11. UgCS elevation layer tab

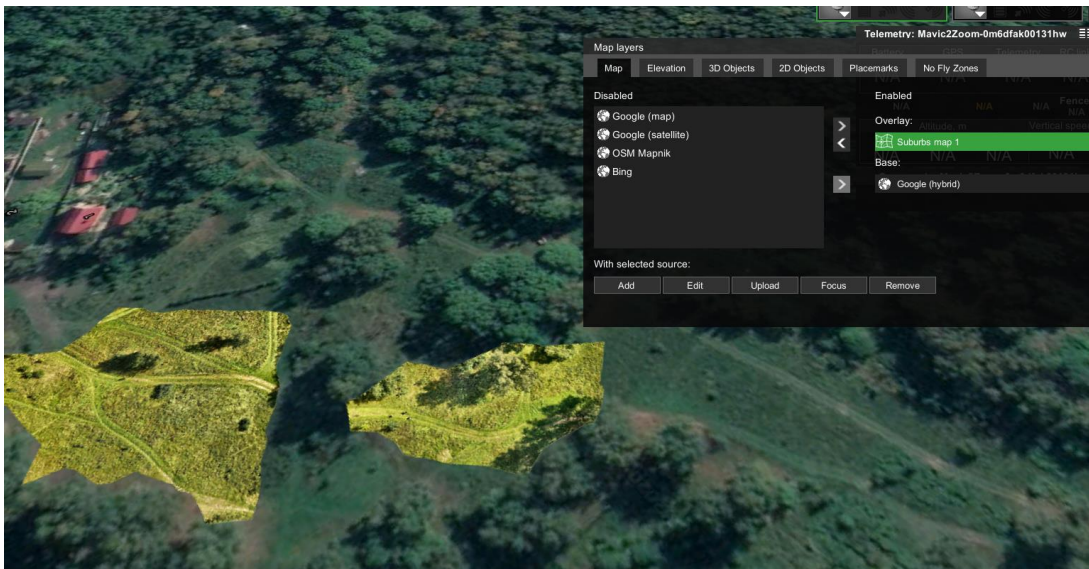
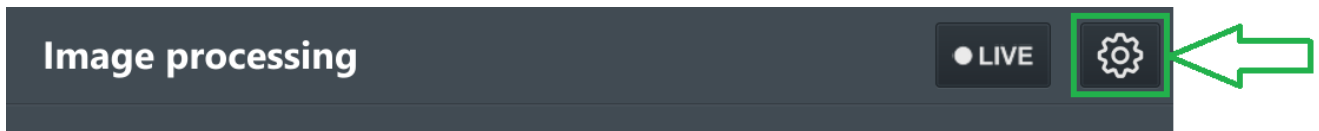


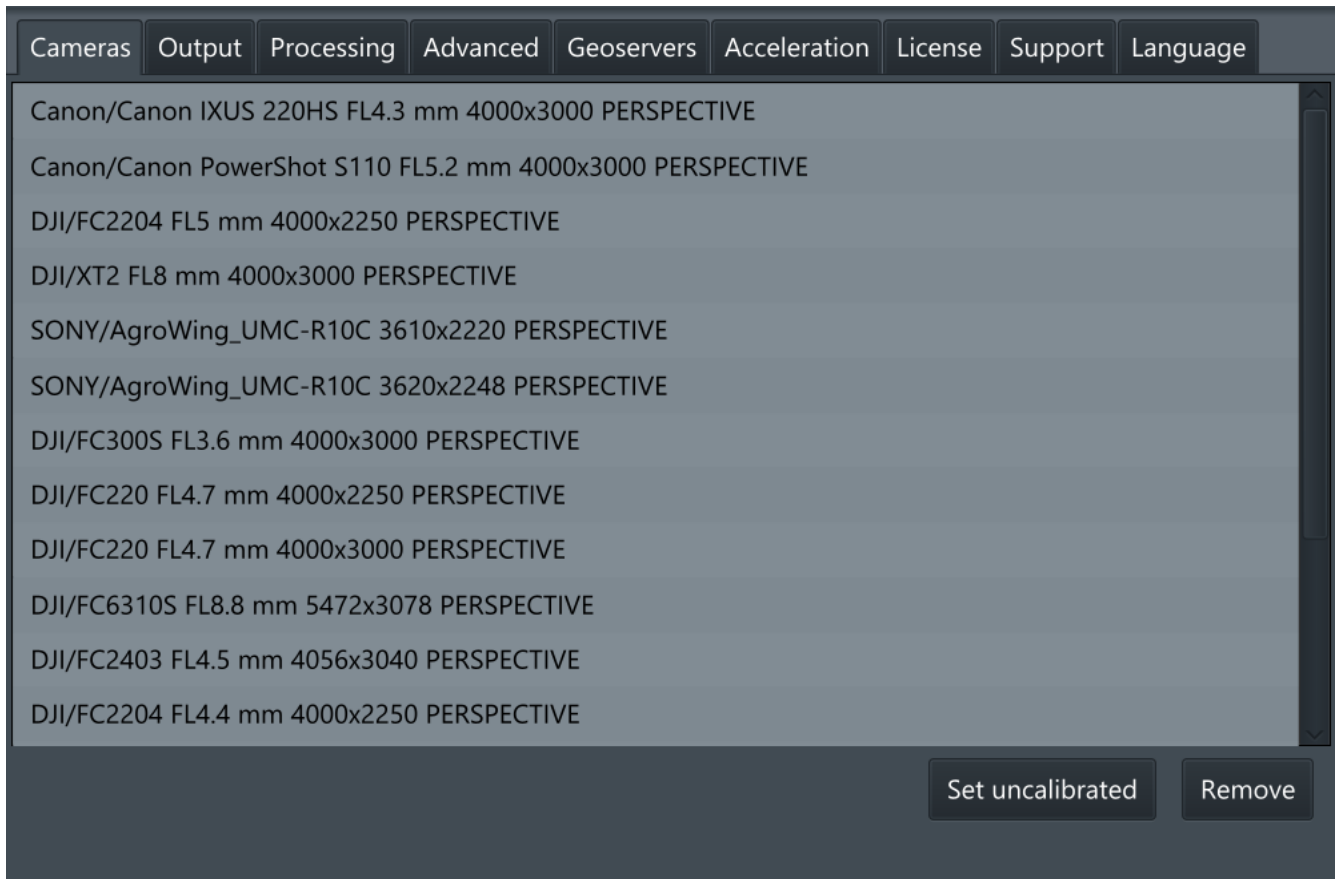
Figure 12. UgCS map layer tab

Advanced options and settings

Click the “gear” button to open settings menu.

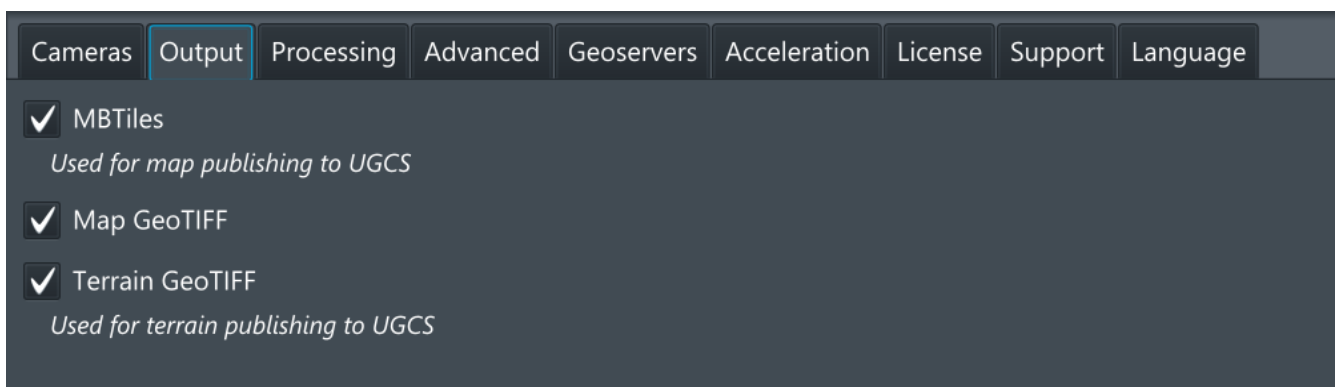


Cameras



Cameras – The location of the calibrated cameras and preinstalled camera profiles, can be highlighted by right-clicking and clicking “Set uncalibrated” button to reset calibration settings.

Output

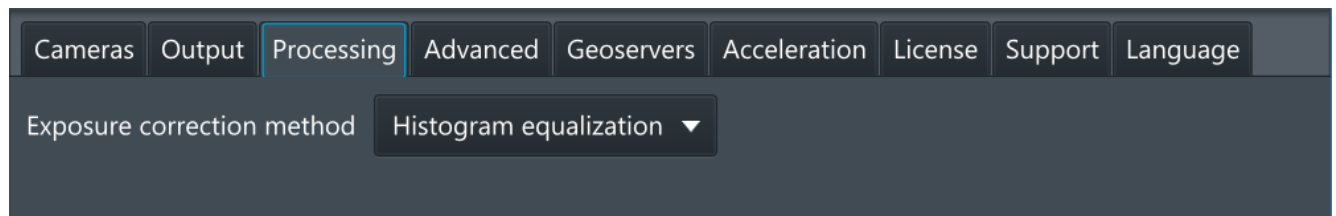


File types that will be used as output formats for the complete project.

MBTiles - MBTiles is a file format for storing map tiles in a single file. It is, technically, a SQLite database.

Map/Terrain GeoTIFF - Georeferenced Tagged Image File Format (GeoTIFF) is an open file format and de facto standard based on the TIFF format and is used as an interchange format for georeferenced raster imagery.

Processing



Processing - Exposure correction method

Algorithm used to compensate exposure difference on different shots. Note that good shots should not have much difference of exposure. Having it means that photogrammetry shooting recommendations most probably were not followed (e.g. exposure was not set manual, weather was too shiny with varying lighting conditions).

Histogram equalization - this method tries to equalize luminance channel histogram for each picture. It is able to smooth local dynamic exposure variations on a separate pictures (like cloud shadows). Side effect is slight color distortion which makes the result to look less natural. However this method is the most universal one and thus is default.

Color correction - analyzes exposure difference graph for all pictures at once and selects correction factor for each picture. The difference is estimated for a whole picture, correction factor is also applied to a whole picture. It means that local dynamic exposure variations cannot be effectively smoothed. This method usually produces bad result for pictures with too significant exposure variation. For good pictures it may produce the best result, preserving natural colors and shading.

None - do not attempt to fix exposure difference. Use it if the original pictures are required, or other methods produce unacceptable results.

Advanced

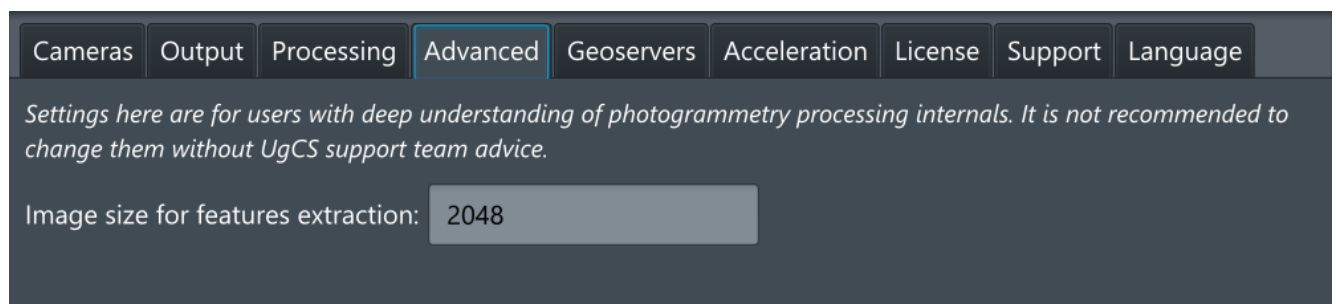
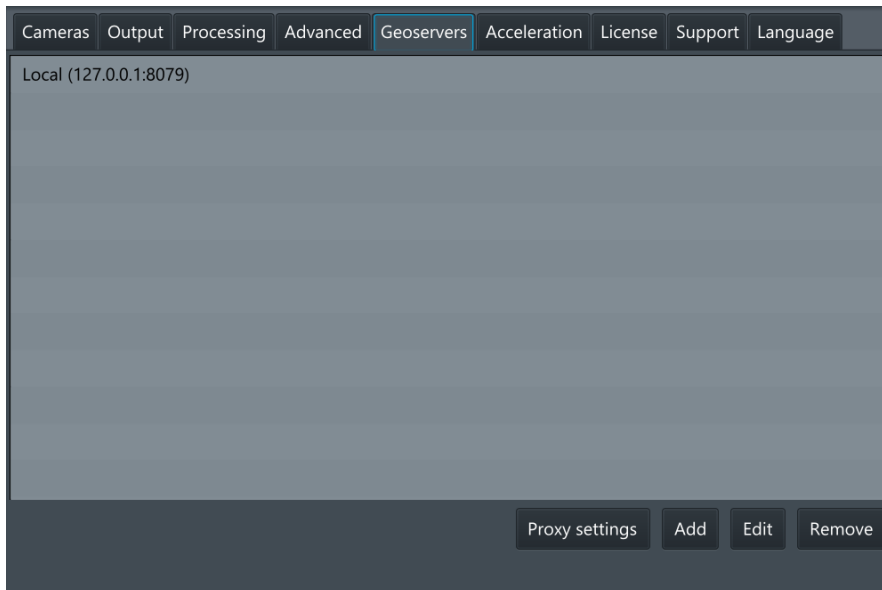


Image size for features extraction - images are downscaled to this size before features detection and extraction. Downscaling discards small details, leaving larger ones for detection. Reducing this parameter value may help to improve result for photos with overwhelming high-frequency noise (e.g. trees, bushes, high grass; wind usually makes it even more noisy).

Geoservers

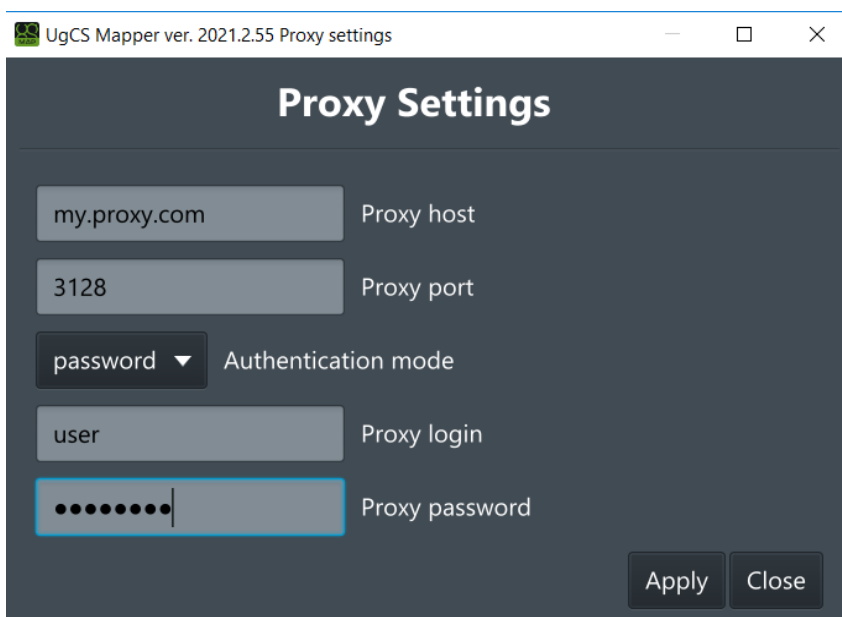


This tab is used to indicate the server address the data is being sent to. By default, is set to local computer. To change it, click “Add” button and enter the required address.

Note, that it’s possible to have several servers added to the list. To edit server address, select it by right-clicking and click “Edit”.

Note: During orthophoto stitching, UgCS Mapper will use the first server in the list. In case it is not available, the warning window will appear asking to select the correct server. During publishing, UgCS mapper will ask first, which server to use.

If you work on network behind proxy you can configure it with “Proxy settings” button. It opens up such dialog:



Mapper supports these modes of proxy, selected with Authentication mode list:

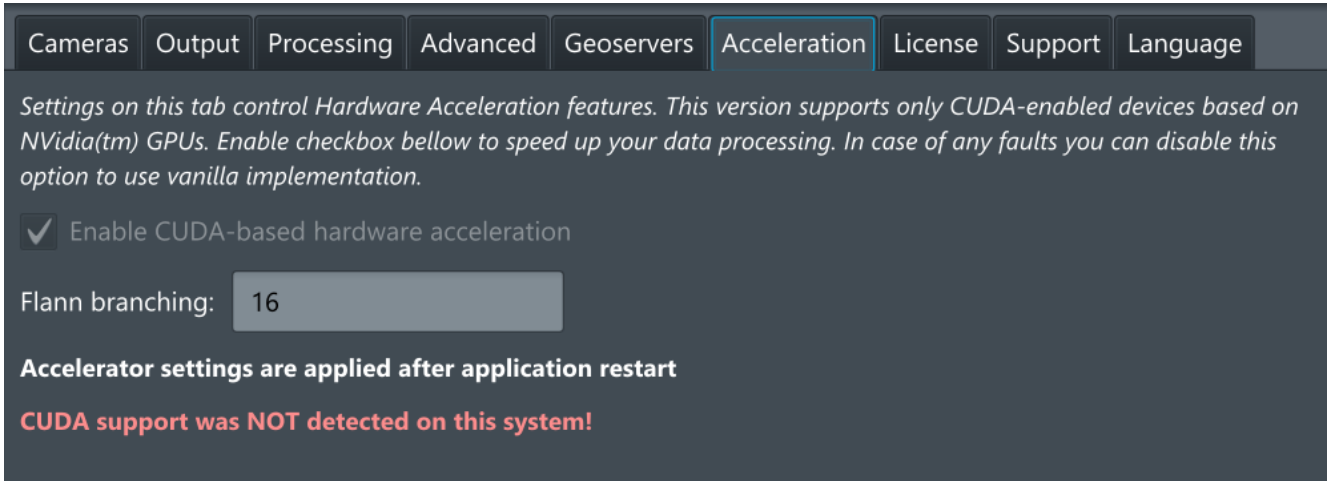
- None – do not use any proxy settings
- Noauth – use proxy without authentication

- System – use system-wide proxy settings configured in operation system
- Password – use username and password to authenticate with proxy server

In any mode except “None” and “System” proxy host and proxy port are required. These are used to connect proxy for any requests.

If you need to authenticate with proxy server in “System” or “Password” mode you can enter them in “Proxy login” and “Proxy password”.

Acceleration



Cameras Output Processing Advanced Geoservers **Acceleration** License Support Language

Settings on this tab control Hardware Acceleration features. This version supports only CUDA-enabled devices based on NVidia(tm) GPUs. Enable checkbox bellow to speed up your data processing. In case of any faults you can disable this option to use vanilla implementation.

☒ Enable CUDA-based hardware acceleration

Flann branching:

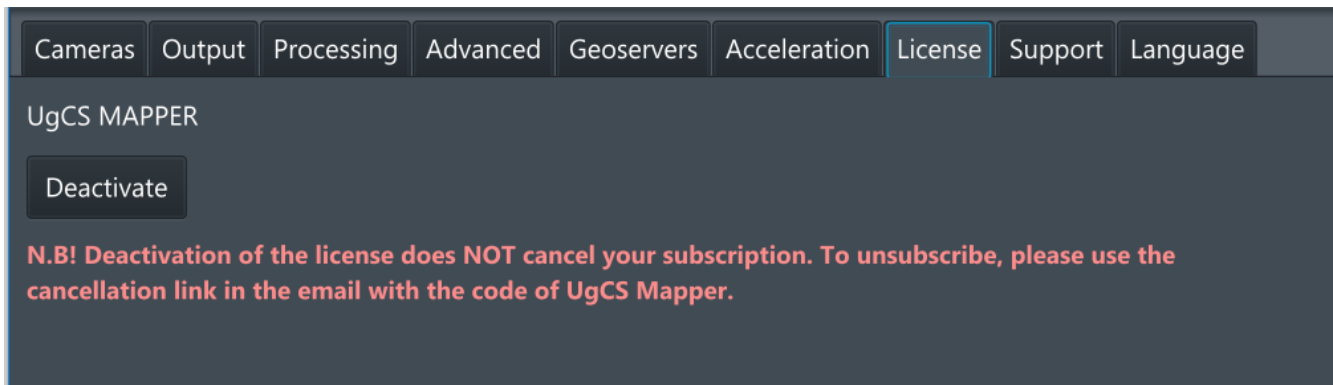
Accelerator settings are applied after application restart

CUDA support was NOT detected on this system!

The tab is used to enable or disable hardware acceleration features. Only NVidia CUDA 10 compatible GPUs are supported at this time.

Note: In case of hardware issues during orthophoto stitching, turn off the CUDA acceleration and restart the UgCS Mapper.

License



Cameras Output Processing Advanced Geoservers Acceleration **License** Support Language

UgCS MAPPER

N.B! Deactivation of the license does NOT cancel your subscription. To unsubscribe, please use the cancellation link in the email with the code of UgCS Mapper.

Activate or deactivate the copy of UgCS Mapper here.

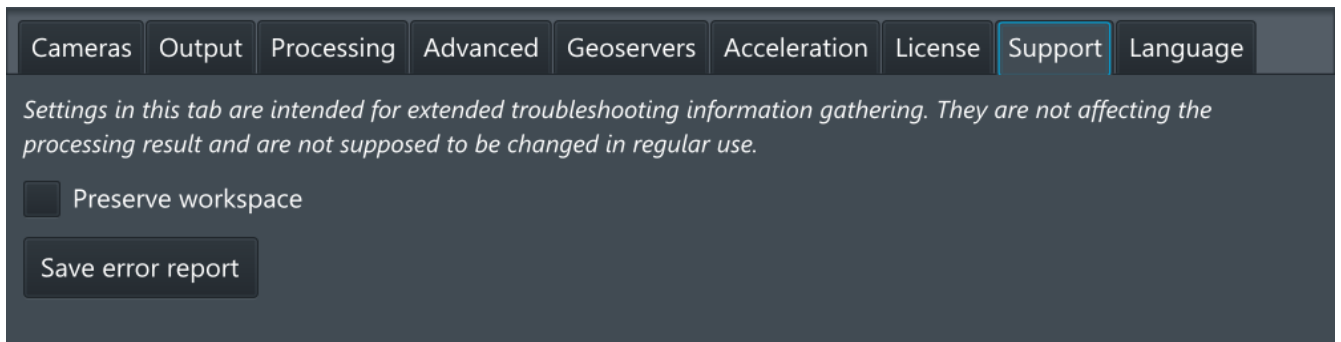
Name of activated license is available at this screen.

Support

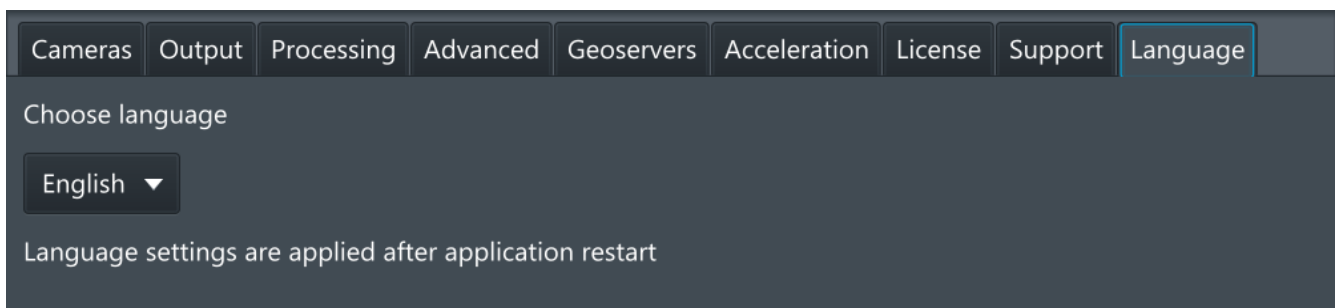
Settings in this tab are intended for extended troubleshooting information gathering. They are not affecting the processing result and are not supposed to be change in regular use.

Save error report – generates zip file with logs that is supposed to be provided to tech support for investigation

Preserve workspace checkmark is intended to preserve all the temporary files generated by mapper for deep investigation and is only required by the tech support request



Language



Language selection tab. Mapper support these localizations of user interface:

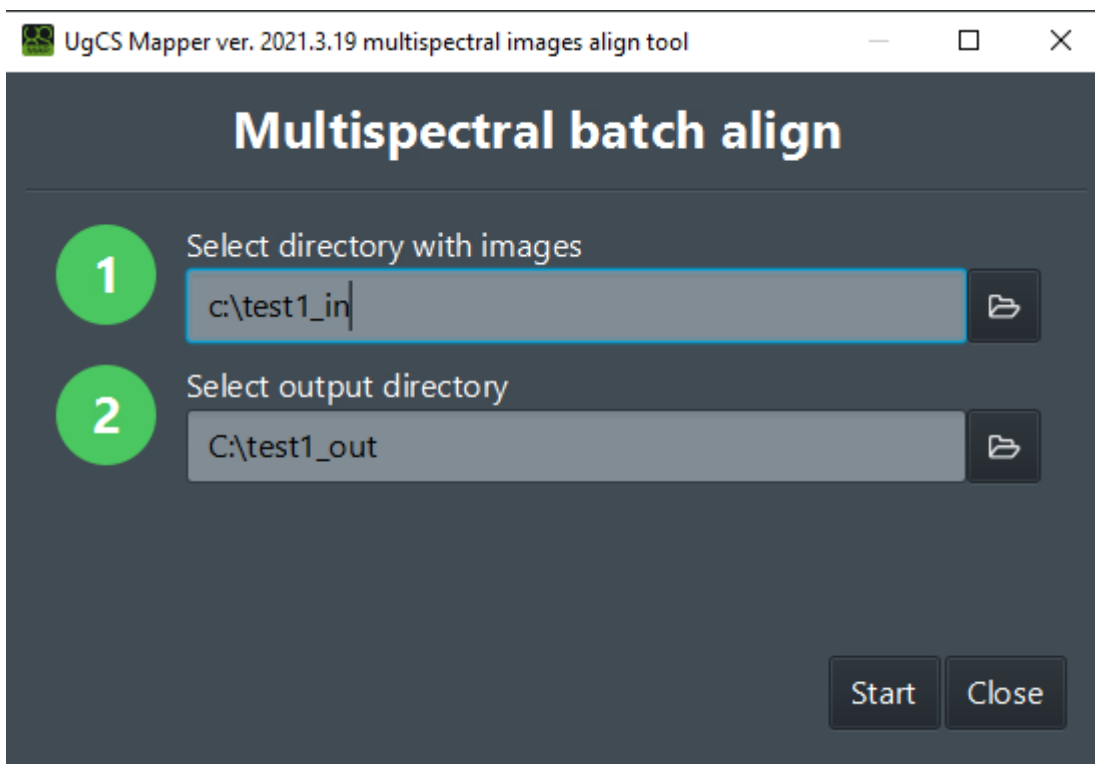
- English
- Spain
- Russian

Mapper tools

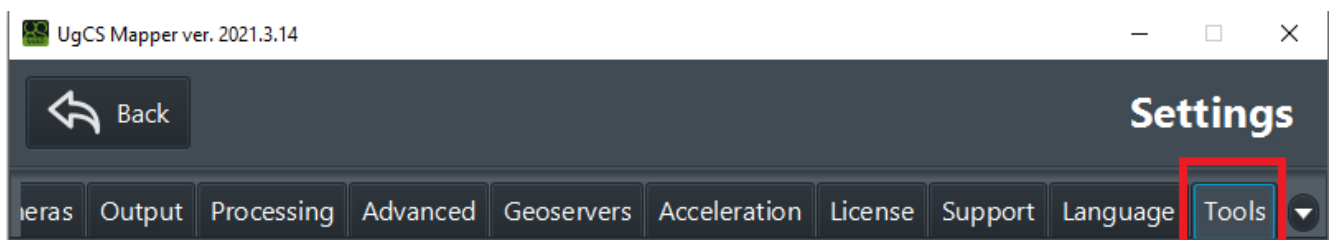
Mapper Tools is a special extension for Mapper to support multispectral images align and pre-processing before stitching to orthomosaic. If Mapper tools are installed in system, this functionality is accessible in Mapper GUI with this button:



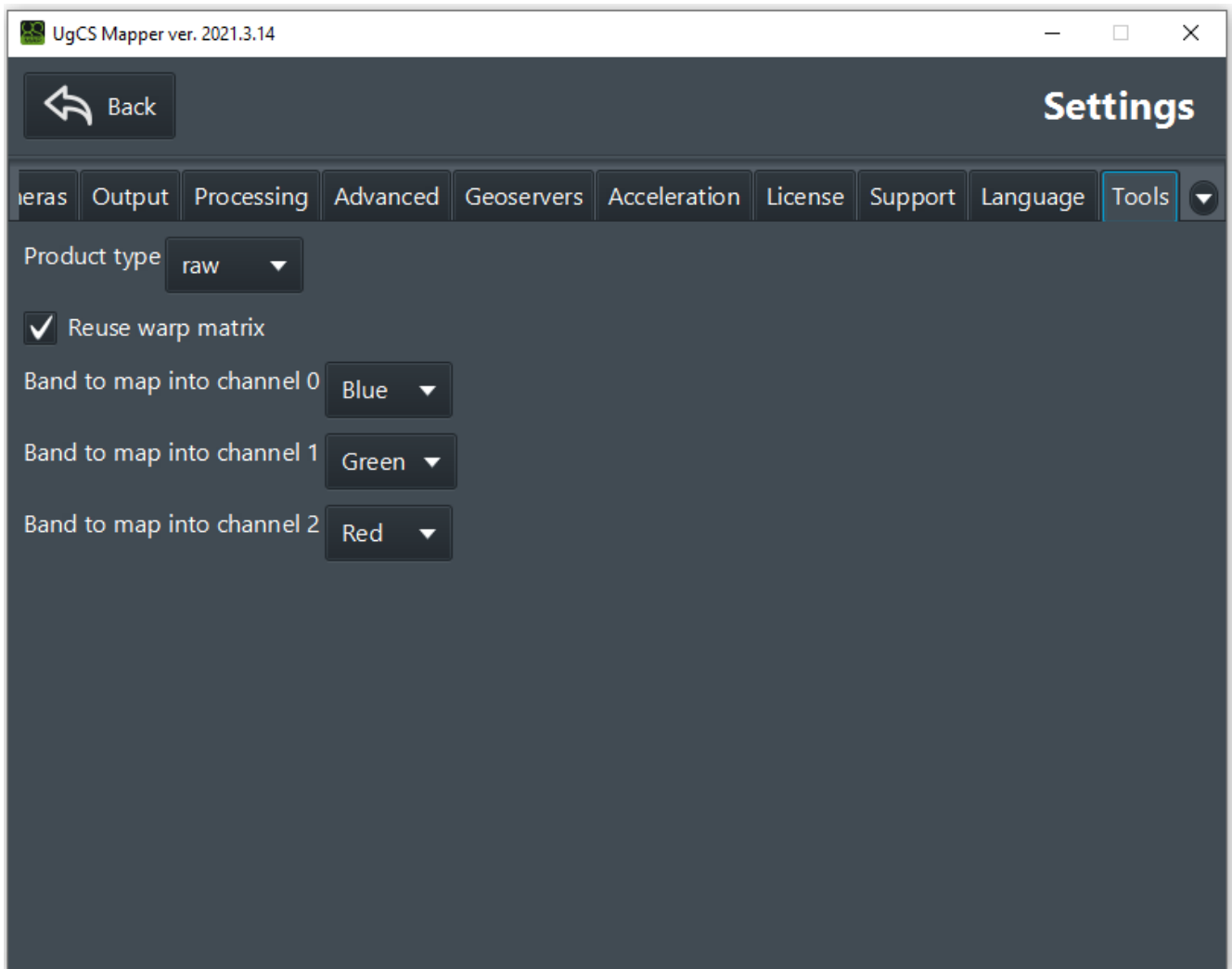
Pressing Tools button will bring Multispectral alignment tool dialog, similar to the main UI of mapper: you need to specify input and output folders and press “Start” to begin alignment:



To setup exact parameters of Alignment process Mapper brings additional tab “Tools” in Settings menu:



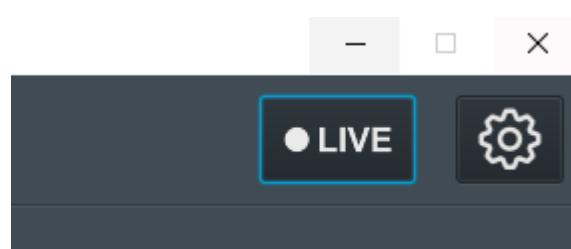
Here can set parameters affecting alignment:



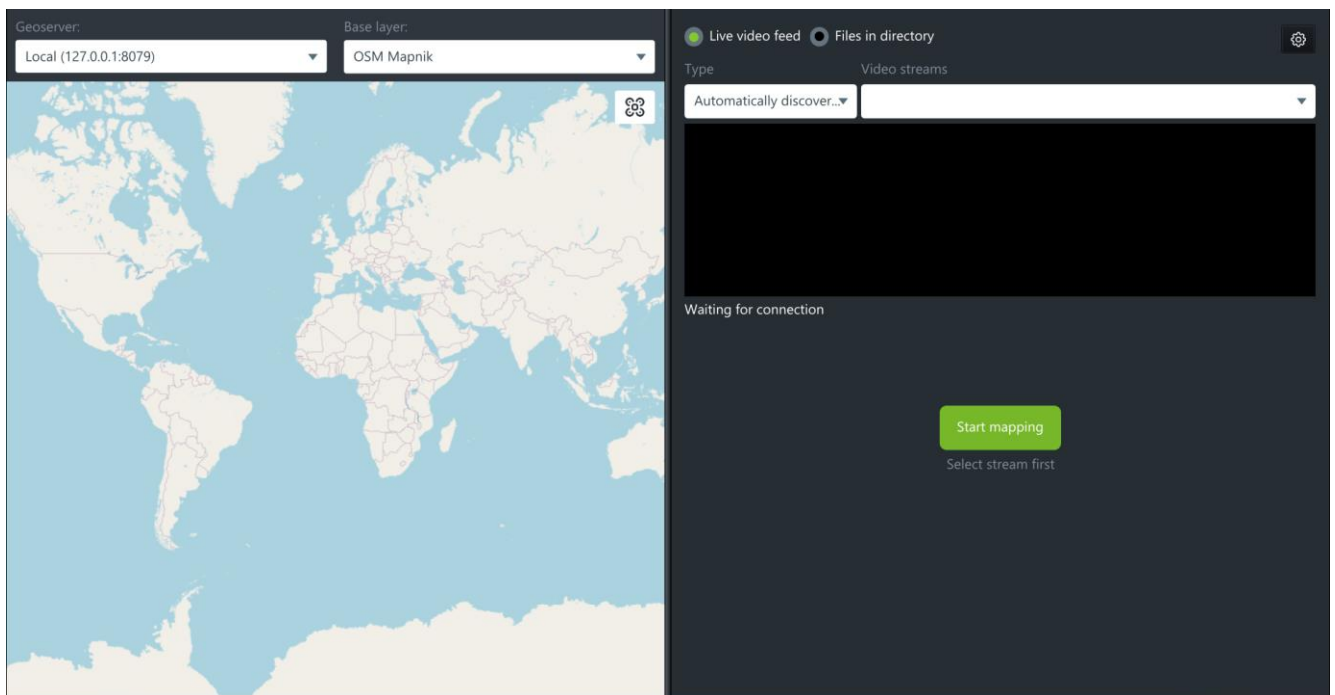
- Product Type. Select desired type of output data: Raw – for copy of source raw data of each band to target channel, Radiance – convert source data to radiance values, Reflectance – convert source data to the values of reflected light.
- Reuse warp matrix – use this flag to greatly speed up processing, if your source data was taken at the same height and the same angle. If altitude is volatile while flight, you will not get an adequate result with this flag.
- Mapping specific source band (part of light specter) into channel of output format (JPEG). You have to map bands to 3 channels.

Video orthophoto processing

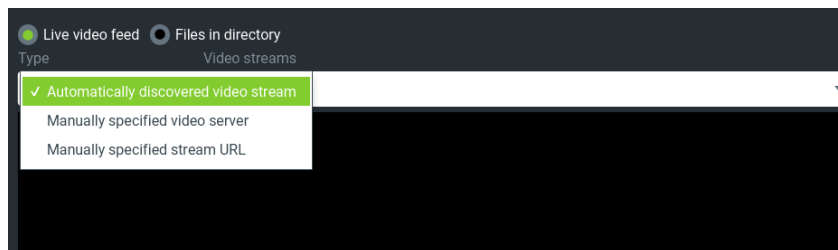
Clicking “LIVE” button allows to process orthophoto from prerecorded set of images or from live video stream:



The new window will appear:

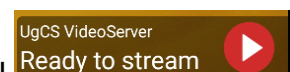


To start mapping from the drone's life stream, select "life video feed"



Select "Automatically discovered video stream" and select the drone (drop down menu to the right) from which the video should be streamed.

Note that life video stream should be successfully enabled in UgCS for DJI



It is also possible to specify video server and select the required stream:

Type	Video server location	Stream
Manually specified vid...	<IP address>:<port>	

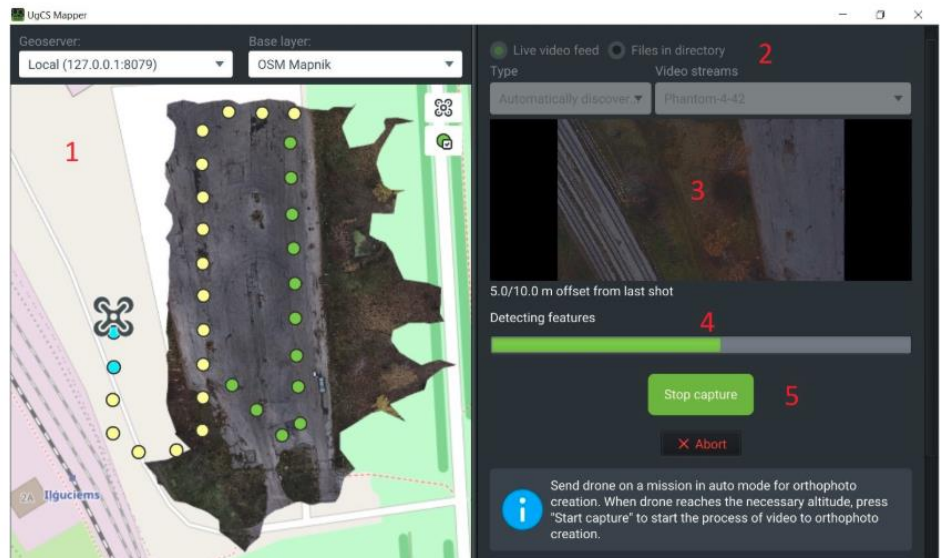
Or Manually specify stream URL

Type	URL
Manually specified str...	udp://0.0.0.0:3338

During the mapping process, the images will be taken from the drone and displayed on the left side of the screen with a slight time delay.

LIVE mode: how it looks

1. Map preview window
2. Source selection
3. Video stream preview
4. Progress indicator
5. Progress controls

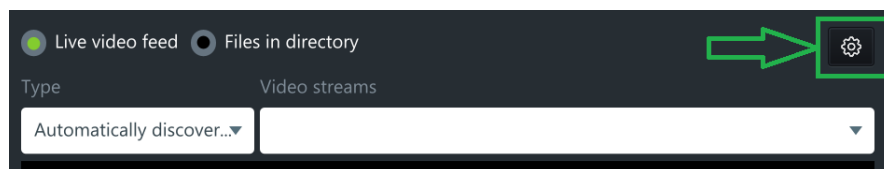


Geoserver tab, indicates currently selected geoserver.

Base layer tab, indicates the selected map provider. Any custom layers from UgCS will be displayed in this tab along with preinstalled maps.

Advanced Video settings

Click the “gear” button while in the “live” mode to open settings menu.



Cameras

Cameras – The location of the calibrated cameras and preinstalled camera profiles, can be highlighted by right-clicking and clicking “Set uncalibrated” button to reset calibration settings.

Geoservers

This tab is used to indicate the server address the data is being sent to. By default, is set to local computer. To change it, click “Add” button and enter the required address.

It's possible to have several servers added to the list. To edit server address, select it by right-clicking and click “Edit”.

Note: During orthophoto stitching, UgCS Mapper will use the first server in the list. In case it is not available, the warning window will appear asking to select the correct server. During publishing, UgCS mapper will ask first, which server to use.

If you need to configure proxy settings, use Proxy Settings button. See details in Image processing > Geoservers section.

Processing

Log4j configuration file – Part of UgCS Mapper is event viewer settings file. See Appendix 1 for more information.

Workspace directory – temporary video processing folder. UgCS Mapper will use default folder if not indicated by user. **Not a mandatory field.**

Logs directory – Log folder. UgCS Mapper will use default folder if not indicated by user. **Not a mandatory field.**

Calibration directory – Temporary camera calibration folder. UgCS Mapper will use default folder if not indicated by user. **Not a mandatory field.**

LIVE stream directory – Temporary video files folder. UgCS Mapper will use default folder if not indicated by user. **Not a mandatory field.**

Number of processing threads – UgCS Mapper will use all the processor threads. Lower the number in case lowering resource consumption is required.

Acceleration

The tab is used to enable or disable hardware acceleration features. Only NVidia CUDA 10 compatible GPUs are supported at this time.

Note: In case of hardware issues during orthophoto stitching, turn off the CUDA acceleration and restart the UgCS Mapper.

Advanced

The setting located under this tab is for users with deep understanding of photogrammetry processing. It is not recommended to change them without UgCS support team advise.

Common settings profile – is standard profile used in most cases

CUDA settings profiles – in used for CUDA acceleration with only NVidia CUDA 10 compatible GPUs

Custom settings profile – will be enabled if any of the advanced settings will be changed.

Note: Switching between profiles can be done at any time.

Support

Settings in this tab are intended for extended troubleshooting information gathering. They are not affecting the processing result and are not supposed to be change in regular use.

Save error report – generates zip file with logs that is supposed to be provided to tech support for investigation

Preserve workspace checkmark is intended to preserve all the temporary files generated by mapper for deep investigation and is only required by the tech support request

Considerations

- It is not recommended to fly backwards. Collect all of the data while drone is moving forward. Most aerial cameras have rolling shutters, that is why mixed forward and backward flight ruins the chances of turning out the task well.

- Collect images at a consistent speed. All images for a set should be collected on as constant speed as it possible. With a rolling shutter, images taken at differing speeds will have different geometries and harm the accuracy of the final files.
- Preprocessing. Images should not be processed to remove lens distortion. Color correction is possible, but make sure the tags are intact.
- Overlap. Along pass and across pass overlap should exceed 70%. More complex scenes require more overlap.
- Exposure time vs speed. Try to keep the ground smear below the GSD value. 15 m/s flight at 1/1000s exposure will allow 1.5 cm GSD.
- Contiguous. All images must share a common boundary. Don't upload non connecting sections or separate of coverage islands.
- Job shape. When doing long, linear works, please, make sure there are at least two passes so there are enough perspectives to reconstruct the scene. Increased overlap will need to be used to make up for the lost width.
- EXIF tag accuracy. Camera GPS Workflow images should have geotag accuracy of less than 10 m and contain elevation values. Also, precision should be reported with at least 3 decimals of seconds precision. In this format - DD:MM:SS.SSS, not in this - DD:MM:SS.000.
- EXIF tags are intact. EXIF tags should not be modified by 3rd party image processing software. The software requires all of the camera tags originally places in the image files. Photoshop, Photos, Photo Manager and lots of other applications are known to corrupt the tags.
- Inclusion area. Be sure to fly over areas that are required on the map. The software cuts the jagged edges off and the best way to make sure something will be included is to fly over it or make sure it is within the interior of the flight path.
- Repeating patterns. Since the processing is based on matching similar features, target areas with repeating patterns, such as roofs or crops, can confuse the application and be the reason of low-quality outputs.
- Terrain. Terrain greatly affects to overlap. If the terrain rises from the nominal overlap planning point, it will be reduced. If the terrain drops from the planning point, it will be increased. Take the high point of the survey area into account.
- Weather conditions. Clouds will affect the amount of light that is available and winds will affect the symmetry of the ground speed from pass to pass.
- Cruising altitude images only. Only images that taken at the cruising altitude should be uploaded into the system. Please, do not upload images from different altitudes, like those taken during ascent and descent.
- Minimize the Inclusion of water because it moves constantly and indiscrete.
- Avoid sun glare and highly reflective surfaces (like roofs of large buildings and wet pavement).
- Use high overlap in trees areas because they are typically in motion and have a lot of fine details.

- Cameras with a super wide field of view or fisheye lens are not suitable for mapping applications.
- Avoid overexposed and underexposed Images. It is recommended to surveillance the area ahead and take some exposure test images to determine the values that will work.
- If objects in the scene are moving, the processing gets confused and can generate positional errors.
- Do not attempt to stitch vertical surfaces.
- Any images that include the horizon should be kept out of the upload list.
- Only Nadir (straight down) images should be used.
- Avoid mapping late in the day when the sun is low and the shadows are long.

Troubleshooting

Logs

To provide support for certain questions and issues UgCS Mapper logs would be required. Go to Settings – support – Save error report.

Share the generated zip file with UgCS support team

Appendix 1

Log4j configuration file – Part of UgCS Mapper is event viewer settings file, called log4j-config.xml located at C:\Program Files (x86)\UgCS-Mapper\mapper

In the event it's required to change event logging level, event logs location and it's names, it can form it's own log4j-config.xml and indicate to use it in settings menu.

Example of log4j-config.xml contents:

```
<?xml version="1.0" encoding="UTF-8"?>
<Configuration status="WARN" packages="com.ugcs.mapper.logging">
  <Appenders>
    <Console name="Console" target="SYSTEM_OUT">
      <PatternLayout pattern="%d{HH:mm:ss.SSS} [%t] %-5level %logger{36} - %msg%n"/>
    </Console>

    <RollingFile name="MainAppLog"
      fileName="${sys:logDir}/mapper.log"
      filePattern="${sys:logDir}/mapper-$$${date:yyyy-MM}/app-%d{MM-dd-yyyy}-%i.log.gz"
      immediateFlush="false" append="true">
      <PatternLayout>
        <Pattern>%d %p %c{1.} [%t] %m %ex%n</Pattern>
      </PatternLayout>
      <Policies>
        <TimeBasedTriggeringPolicy />
        <SizeBasedTriggeringPolicy size="10 MB"/>
      </Policies>
    </RollingFile>
  </Appenders>
</Configuration>
```

```

<RollingFile name="VideoLog"
    fileName="${sys:logDir}/mapper-video.log"
    filePattern="${sys:logDir}/mapper-$$${date:yyyy-MM}/app-%d{MM-dd-yyyy}-%i.log.gz"
    immediateFlush="false" append="true">
    <PatternLayout>
        <Pattern>%d %p %logger [%t] %m %ex%n</Pattern>
    </PatternLayout>
    <Policies>
        <TimeBasedTriggeringPolicy />
        <SizeBasedTriggeringPolicy size="10 MB"/>
    </Policies>
</RollingFile>

<RollingFile name="CudaLog"
    fileName="${sys:logDir}/mapper-cuda.log"
    filePattern="${sys:logDir}/mapper-cuda-$$${date:yyyy-MM}/app-%d{MM-dd-yyyy}-
%i.log.gz"
    immediateFlush="false" append="true">
    <PatternLayout>
        <Pattern>%d %p %logger [%t] %m %ex%n</Pattern>
    </PatternLayout>
    <Policies>
        <TimeBasedTriggeringPolicy />
        <SizeBasedTriggeringPolicy size="10 MB"/>
    </Policies>
</RollingFile>

<CustomLogAppender name="CustomLog">
    <PatternLayout>
        <Pattern>%d %p %c{1.} [%t] %m %ex%n</Pattern>
    </PatternLayout>
</CustomLogAppender>
</Appenders>

<Loggers>
    <Logger name="MatMemoryManager" level="info" />

    <Logger name="com.j256.ormlite.stmt.StatementBuilder" level="info" />
    <Logger name="com.j256.ormlite.stmt.mapped.BaseMappedStatement" level="info" />
    <Logger name="com.j256.ormlite.stmt.StatementExecutor" level="info" />
    <Logger name="com.j256.ormlite.dao.DaoManager" level="info" />
    <Logger name="com.j256.ormlite.stmt.SelectIterator" level="info" />

    <Logger name="ImageProcNative.FFMPEG" level="debug" additivity="false">
        <AppenderRef ref="Console" />
        <AppenderRef ref="VideoLog" />
    </Logger>
    <Logger name="ImageProcNative.LiveInputSession" level="debug" additivity="false">
        <AppenderRef ref="Console" />
        <AppenderRef ref="VideoLog" />
    </Logger>
    <Logger name="ImageProcNative.VideoClient" level="debug" additivity="false">
        <AppenderRef ref="Console" />

```



```

    <AppenderRef ref="VideoLog" />
</Logger>
<Logger name="ImageProcNative.UdpInputEndpoint" level="debug" additivity="false">
    <AppenderRef ref="Console" />
    <AppenderRef ref="VideoLog" />
</Logger>
<Logger name="ImageProcNative.UrtplInputEndpoint" level="debug" additivity="false">
    <AppenderRef ref="Console" />
    <AppenderRef ref="VideoLog" />
</Logger>
<Logger name="ImageProcNative.TcpInputEndpoint" level="debug" additivity="false">
    <AppenderRef ref="Console" />
    <AppenderRef ref="VideoLog" />
</Logger>
<Logger name="HwAcceleration" level="debug" additivity="false">
    <AppenderRef ref="Console" />
    <AppenderRef ref="CudaLog" />
</Logger>

<Root level="debug">
    <AppenderRef ref="Console" />
    <AppenderRef ref="MainAppLog" />
    <AppenderRef ref="CustomLog" />
</Root>
</Loggers>
</Configuration>

```

The Appenders section is responsible for the parameters of individual logs: the name of the file where the recording is made, at which size a new file starts, etc.

The complete list of valid settings in this section corresponds to <https://logging.apache.org/log4j/2.x/manual/configuration.html>

The Loggers section describes the subsystems implemented by the Mapper that record diagnostic information to the log files configured in the previous section.

Messages from the following subsystems are logged:

1. MatMemoryManager - Mapper memory manager
2. ImageProcNative. * - separate modules responsible for the video server, processing the resulting video.
3. HwAcceleration - GPU computing subsystem

By default, all subsystems are configured to output to the console and one of the event files.

For each subsystem, the level of debugging information is set separately: in ascending order of size: none - error - warn - info - debug.

In error mode, only error messages will be saved to the logs, in warn mode - errors and warnings, in info mode - errors, warnings and normal state of operation.

In debug mode, a significant amount of information about mapper's internal events will be added, which can be useful for troubleshooting.

In none mode, no information will be added to the log.