

# Forestry Thematic Exploitation Platform



## User Manual

v2021.11



**CGI**

## Contents

1	Introduction.....	4
1.1	What is Forestry TEP?.....	4
1.2	Platform infrastructure .....	4
1.3	Data availability.....	4
1.4	Terminology and concepts.....	5
2	Getting started .....	7
2.1	User account.....	7
2.2	Entering the platform .....	7
2.3	Explorer interface.....	8
2.4	Searching for data .....	9
2.5	Databaskets.....	12
2.6	Manage / Share interface.....	15
2.7	Groups.....	17
2.8	Sharing .....	18
2.9	Reference data .....	19
2.10	Files.....	20
3	Running a service .....	22
3.1	Selecting the service.....	22
3.2	Defining inputs .....	22
3.3	Launching the service.....	23
3.4	Managing the job .....	23
3.5	Parallel processing .....	24
4	Processing services.....	25
4.1	Sen2Cor255 & Sen2Cor280 .....	25
4.2	Fmask40 .....	25
4.3	Envimon.....	26
4.4	VegetationIndices .....	27
4.5	ForestChangeS2.....	29
4.6	LandCoverGeotiff.....	32
4.7	S1Stack .....	35
4.8	S1StackTempVar.....	35
4.9	CombS2granules and CombS2granulesZ .....	37
4.10	ALSMetrics .....	38
5	Application services .....	41
5.1	Monteverdi.....	41
5.2	QGIS v2.18.....	42



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5.3	QGIS v3.6.....	44
5.4	SNAP .....	45
6	Advanced features.....	47
6.1	Forestry TEP API.....	47
6.2	Service development .....	47

## 1 Introduction

### 1.1 What is Forestry TEP?

Forestry Thematic Exploitation Platform (Forestry TEP, or F-TEP in short) is an online platform that enables users to efficiently access and process satellite data for forest monitoring purposes. It offers a wide range of readily available processing services and tools, and it enables users to create and share their own processing services, tools and products. On the platform, it is possible to run e.g. change monitoring applications for your areas of interest without the need for downloading the source images, or conduct forest variable estimation combining your own field datasets with satellite imagery available in the cloud storage.

The platform has been developed in projects funded by the European Space Agency (ESA). ESA continues to support the platform development. The platform is operated by VTT in Finland with the support of CGI IT UK, committed to maintain and develop the platform further and support the users. More general information on the platform can be found at: <https://f-tep.com/>

### 1.2 Platform infrastructure

The Forestry TEP is operating on CloudFerro's CREODIAS<sup>1</sup> infrastructure, one of the Copernicus Data Information and Access Services (DIAS) environments. The baseline processing environment available for all users consists of 8 virtual CPUs and 32 GB of RAM, along with temporary workspace storage of approximately 128 GB (SSD-type). Output product storage is not currently limited. Usage levels are monitored to ensure fair use.

Note that specific configurations are possible. If a processing service requires specific capacity for CPU, RAM or storage, we may arrange dedicated resources. Please contact the Forestry TEP team for further details.

From the user system set-up point of view, a screen width of 1920 pixels is recommended. This will improve particularly the visual experience of using the application services (e.g. QGIS, SNAP and Monteverdi).

### 1.3 Data availability

Through F-TEP, users can access all datasets stored in CREODIAS Earth Observation (EO) catalogue<sup>2</sup>. Currently, the list of available satellites includes:

EO Missions	Data Set Type	Archive Format	Availability Since	Geographic Coverage	Temporal Coverage
Sentinel 1 (IW EW)	GRD	SAFE / GEOTIFF	2015	100%	100%
Sentinel 1 (IW EW)	SLC	SAFE / GEOTIFF	2015	EU: full archive. Else: Last 6 months / orderable	100%
Sentinel-2 MSI	L1C, L2A	SAFE / JPEG2000	2015	100%	100%

<sup>1</sup> <https://creodias.eu/>

<sup>2</sup> <https://discovery.creodias.eu/dataset>

Sentinel-3 OLCI/SLSTR/SRAL	L1B, L2	SAFE   NetCDF	2016	100%	100%
Landsat-5 TM	L1G, L1T, L1GT	GEOTIFF	1984	EU	100%
Landsat-7 ETM	L1G, L1T, L1GT	GEOTIFF	1999	EU	100%
Landsat-8 OLI/OLI TIRS	L1T, L1GT	GEOTIFF	2013	EU	100%


## 1.4 Terminology and concepts

This section describes the basic terminology and concepts that the user faces while working on the platform.

**AOI:** Area of Interest. The F-TEP services expect the AOI in the Well-known text (WKT) format, a valid example being: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).

**Databasket:** A databasket refers to a logical grouping of satellite products and/or F-TEP products and/or reference data held together for a particular purpose. A databasket is identified by a name and a description. User can view and manage their databaskets either within the data panel (at the bottom of the map panel in the 'Explorer' interface) or in 'Manage / Share' interface.

**Data Panel:** Data Panel opens along the bottom of the 'Explorer' page and includes details of recent data searches, databaskets, jobs and messages.

**Developer interface:** The developer interface allows a user to create his own workflows as services.

**Explorer interface:** The explorer interface is the main interface for a user to select, manage and use data and services.

**Group:** A group is a collection of users with a common interest. Groups allow users to communicate and share material within a selected number of peers. They are managed via the 'Manage / Share' interface.

**Helpdesk:** The helpdesk interface provides material and support to help users perform actions on the platform. It also provides service desk information.

**Job:** A job is a specific data processing activity that has been instigated by the user. Clicking on the jobs section of the data panel allows users to explore the job status.

**Manage / Share interface:** The Manage / Share interface lists the various groups that a user belongs to. Groups allow users to communicate and share material within a selected number of peers.

**Message Panel:** The message panel shows information from the F-TEP system to the user about jobs, projects, databaskets etc.

**My Account interface:** The My Account interface provides an overview of the user's account including profile and F-TEP account activity.

**Output products:** Data generated within a processing service on F-TEP.

**Project:** A project is a collection of activities that a user has defined to be related. A user can create projects when commencing activities.

**Reference data:** Data generated outside of F-TEP and uploaded onto the platform.

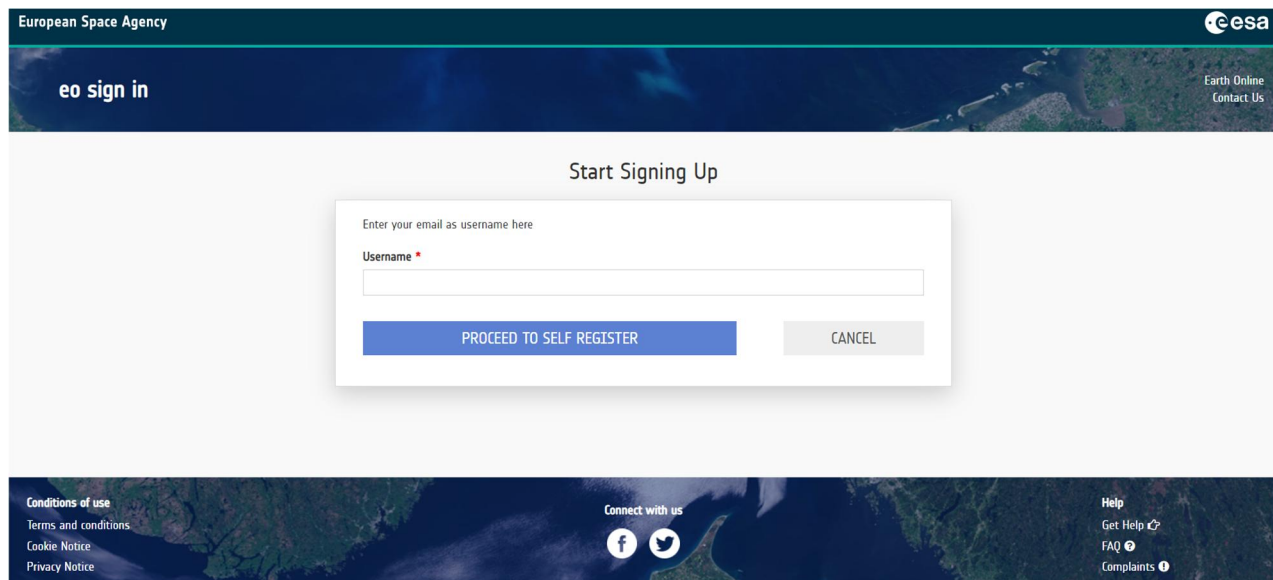
**Service:** A service is a data processing or visualisation application or workflows made available to the users.

**Workspace:** The workspace panel is where the users manage all the activities and entities defined in the system. They can interact with defined databaskets associated to the current project here.

## 2 Getting started

### 2.1 User account

User authentication for the Forestry TEP platform is managed by the ESA EOIAM authentication system. It is possible to access the platform only after a successful authentication. If you do not have an ESA EOIAM account yet, you can register here: <https://eoiam-idp.eo.esa.int/accountrecoveryendpoint/register.do>.



The screenshot shows the ESA EO sign in page. At the top, there is a header with the European Space Agency logo and the ESA logo. Below the header, there is a dark blue banner with the text 'eo sign in' and 'Earth Online Contact Us'. The main content area is white and contains a 'Start Signing Up' form. The form has a text input field labeled 'Username' with a red asterisk indicating it is required. Below the input field are two buttons: 'PROCEED TO SELF REGISTER' (blue) and 'CANCEL' (grey). The footer of the page contains links for 'Conditions of use', 'Terms and conditions', 'Cookie Notice', 'Privacy Notice', 'Connect with us' (with Facebook and Twitter icons), and 'Help' (with 'Get Help', 'FAQ', and 'Complaints' links).

Please follow the link that you will receive in an email to complete the registration.

After the registration process is complete, you can login with your account using your email address as the user name, and you will be redirected to the platform.

### 2.2 Entering the platform

With a user account set up, the F-TEP platform can be accessed from the website front page at <https://f-tep.com/> via the "Enter the platform" link. The platform can also be reached through the direct link <https://f-tep.com/app/>.

On entering, you will first be redirected to ESA's EO-SSO platform and asked to login using the details of your user account. You can also set the maximum idle time and maximum session time that will determine how often you will be presented with the login screen.

The main screens of the platform user interface are the following - accessible through links at the top of the screen:

**Explorer:** This is the main, map-based interface for working with the input data, the services and the processing jobs, as described in the next section.

**Files:** This interface allows users to view and manage files that are stored in the F-TEP platform.

**Developer:** This interface allows expert users to create their own workflows and services. This page is only visible / accessible for expert users. If you cannot see the

‘Developer’ interface but would like to develop your own services, you are encouraged to request for an upgrade of your account status via the ‘Helpdesk’ (see below).

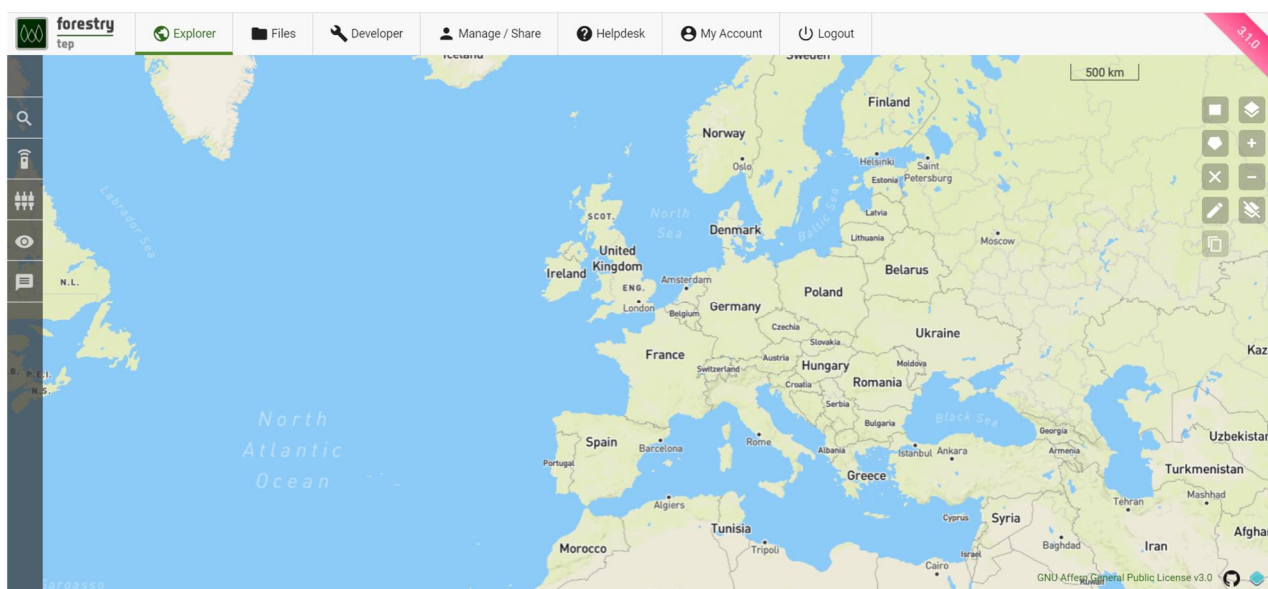
**Manage / Share:** This page allows a user to explore the various groups and projects they belong to as well as access their files, data baskets, logs of their run jobs and any services they have created. This page also allows users to share their services and products with selected users.

**Helpdesk:** This page provides the user with access to useful supporting materials (e.g. user manual and tutorial videos) and official documentation (e.g. Terms & Conditions and License). Contact and feedback address is also provided here.

**My Account:** This page provides the user with information on the activities on F-TEP.

## 2.3 Explorer interface

On entrance, the F-TEP platform opens with the Explorer user interface.



The Explorer interface is built around the map panel. The map acts both as an input element to specify an area of interest and to show the footprint of the results. Clickable icons can be found on the left and right to of the map panel to access various functionalities and to use necessary tools as described below.

The left column contains a series of icons that allow the user to execute various activities:



The ‘Search’ icon allows the user to search for various datasets, including EO data, reference data and existing F-TEP products.



The 'Services' icon shows available services, which includes both satellite data pre-processing tools as well as forest and land cover monitoring applications.

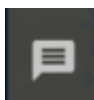


The 'Workspace' icon allows the user to specify the parameters of a service and launch the process.





The 'Data Panel' icon opens the Data Panel along the bottom of the display. Search results, databaskets and information on jobs are provided in this panel.



The 'Messages' icon opens the Messages panel along the bottom of the display. Any messages from the system are provided in this panel.

Map tools can be found in the right column and include:



The 'Draw Square' icon allows the user to draw a square on the map, to be used to define search area.



The 'Draw Polygon' icon allows the user to draw a polygon on the map, to be used to define search area.



The 'Remove Search Polygon' icon deletes the square or polygon areas of interest currently on the map.



The 'Edit Polygon' icon allows the user to manually edit the vertex coordinates of a search polygon.



The 'Copy Polygon to Clipboard' icon allows user to copy the vertex coordinates of a search polygon to clip board, to be copied to any text editor.



The 'Map Layer' icon allows the user to choose the base map to be used.



The 'Zoom in' icon allows to user to zoom in on the map. Note that this can also be done with the scroll wheel of the mouse.



The 'Zoom out' icon allows to user to zoom out on the map. Note that this can also be done with the scroll wheel of the mouse.



The 'Clear Map' icon removes all polygons from the map and resets the map to default extent.

## 2.4 Searching for data

The search tool is activated by clicking the 'Search' icon.



This opens the search panel with three tabs to specify the target:

- **Satellite:** enables to search for satellite data. The search request is dispatched to the appropriate backend data provider. For most parameter configurations this will be the CREODIAS EO catalogue<sup>4</sup>. The list of available satellites can be seen in the drop-down menu of the 'Mission' parameter.
- **Reference:** enables to search for data uploaded by or made available to the user.
- **F-TEP Products:** enables to search for products previously processed in F-TEP.

In each of the search panels, a set of parameters can be used to narrow down the search to limit the number of results.

To search for satellite data, the 'Satellite' tab is clicked, which opens the Satellite search panel. Available satellites can be seen in the drop-down menu of the 'Mission' parameter.

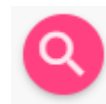
<sup>4</sup> <https://discovery.creodias.eu/dataset>

After choosing the satellite mission, the search panel shows a relevant selection of parameters.

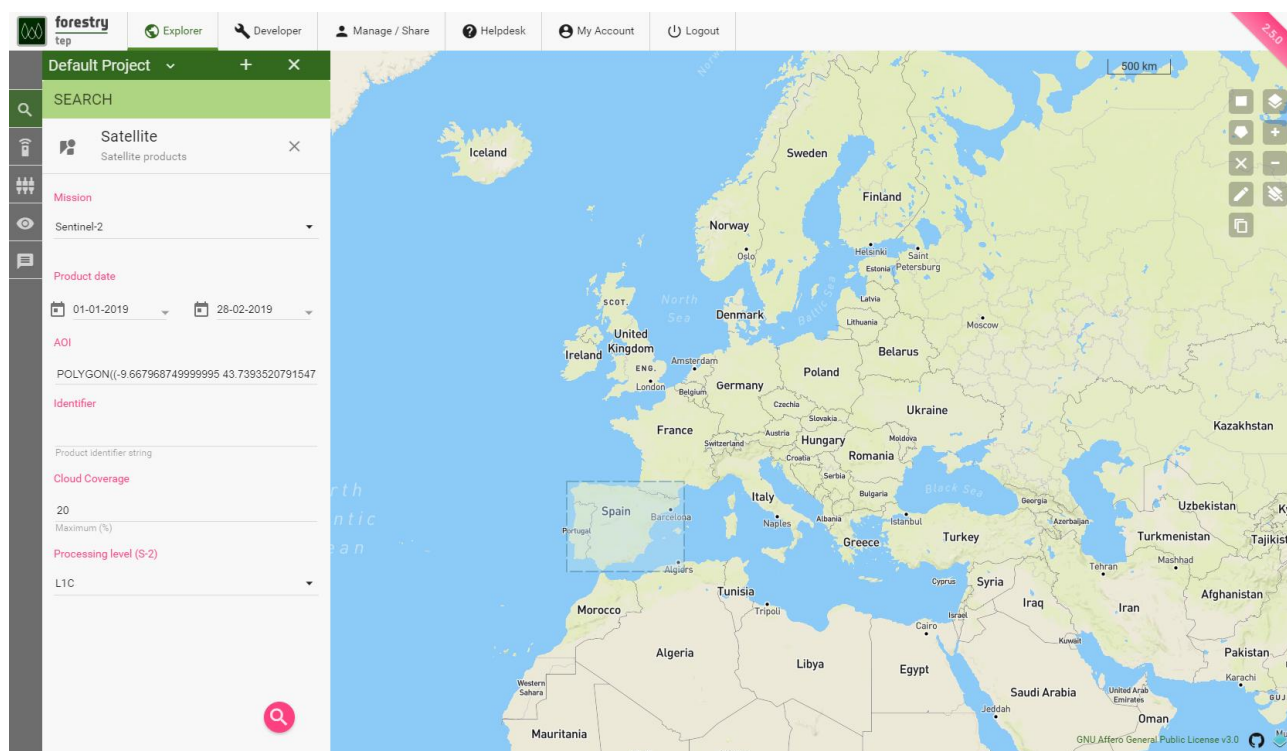
To narrow the search to a specific period, the start and end dates need to be specific in the 'Product date' parameter.

An area of interest (AOI) can be drawn on the map using the map tool provided on the right-hand side. The coordinates of the polygon drawn on the map are automatically read into the 'AOI' parameter. It is also possible to define the Area of Interest (AOI) by drag-and-dropping a KML file from the user's file system on top of the map view.

To submit the search, click the search button at the bottom right corner of the search panel. The system will show a spinner while the search is being submitted and the results collected.

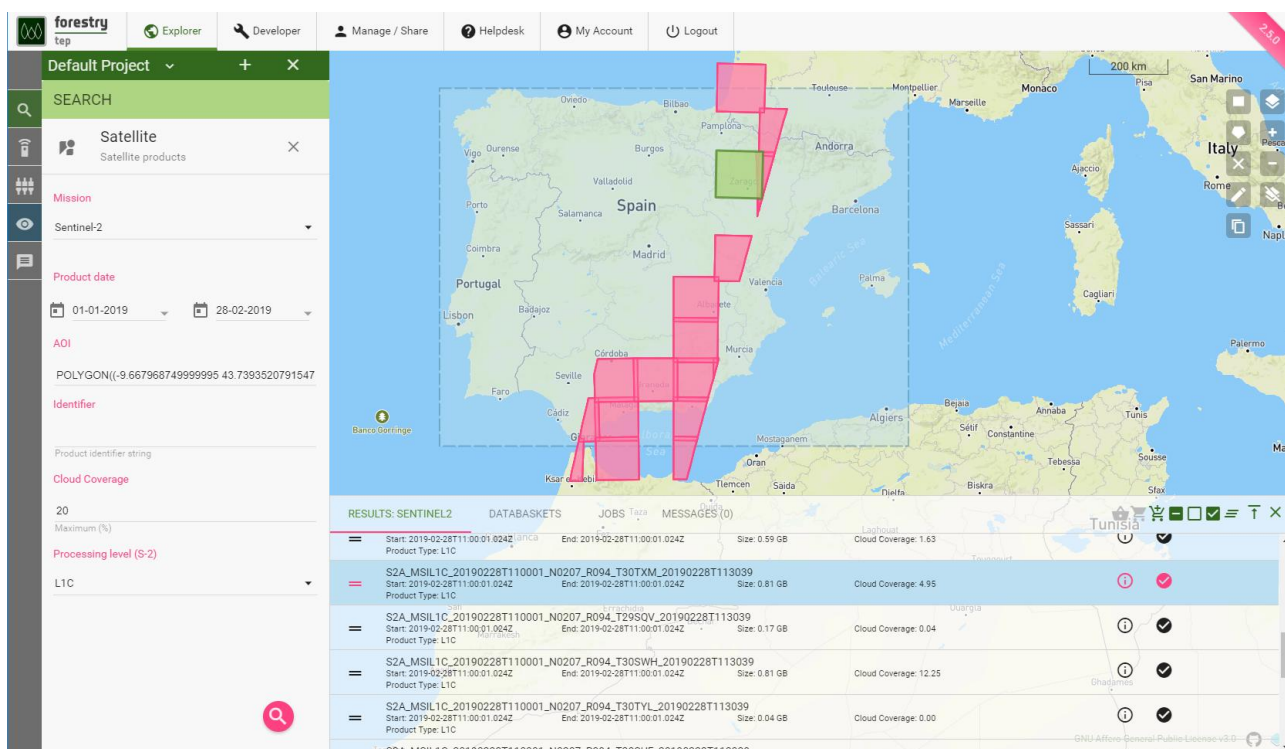


The picture below shows an example search for Sentinel-2 products, with an area of interest on the Iberian Peninsula and time range from Jan 1st to Feb 28th, 2019. In addition, the maximum cloud coverage is set to 20% and level L1C products are searched.

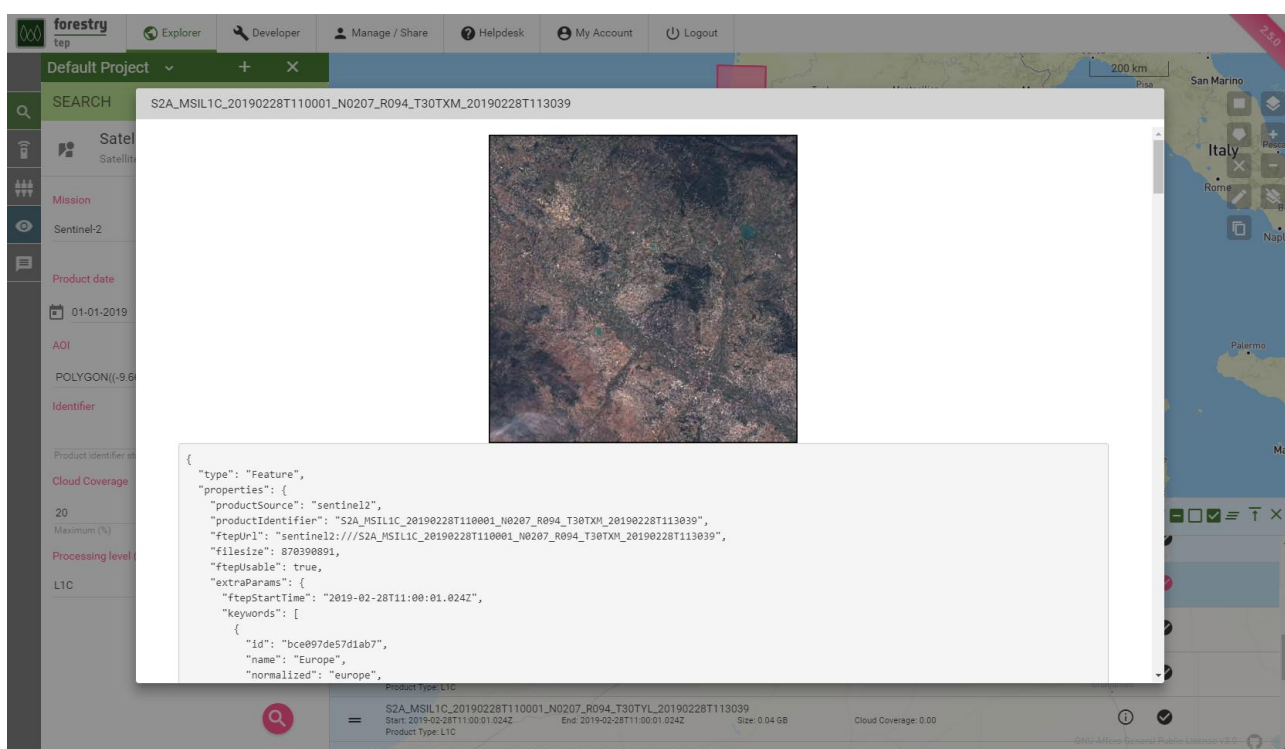


The list of results are shown in the 'Results' panel at the bottom of the page. Image footprints are also presented on the map. By clicking on a particular row or rows in the 'Results' panel, the corresponding map footprint(s) is shown and highlighted on the map.

Note that if the search returns many results, they are divided to multiple pages of results, and only the footprints of the current page of results are shown.



By clicking on the information link, metadata of the selected image will be shown. A quicklook image will also be shown, whenever available.



In case of Sentinel-2 data in particular, the user is generally recommended to identify as cloud-free images as possible.

Having located suitable data to use in processing, the user may be interested to proceed with selecting and launching a particular processing service or application, as described

below in sections 3, 4 and 5. Alternatively, the user might want to collect the search results for later reference in a databasket, as described next in section 2.5.

## 2.5 Databaskets

A Databasket is a logical grouping of satellite data and/or F-TEP products and/or reference data held together for a particular purpose and identified by a name.

By selecting a number of products in the Result Panel and clicking on the 'Create New Databasket' button it is possible to create a databasket containing the selected products. A pop-up window listing all the selected images will open. In this window the user should give a name for the databasket. A short description of the databasket may also be given.

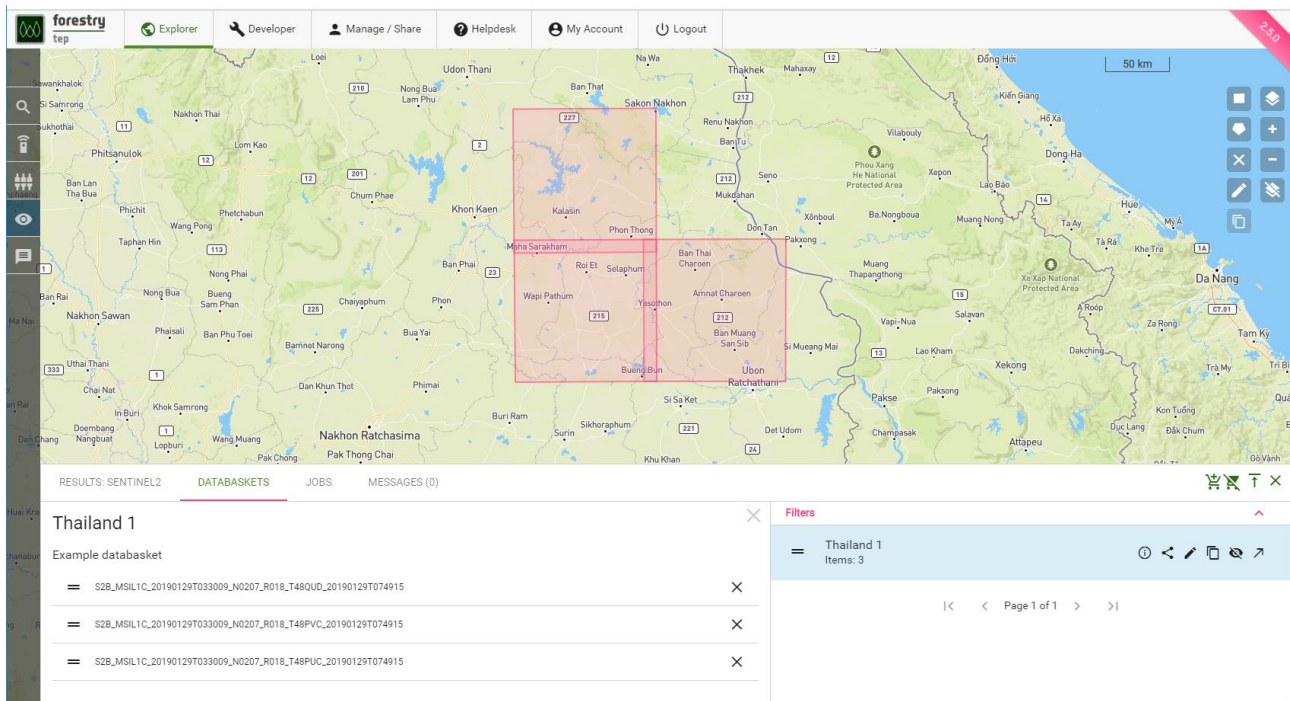


The screenshot displays the Forestry TEP web application interface. On the left, a sidebar contains navigation options: Explorer, Developer, Manage / Share, Helpdesk, My Account, and Logout. Below these is a 'Default Project' dropdown and a 'SEARCH' bar. The main map area shows a satellite image of Southeast Asia, with a pink rectangular area of interest (AOI) highlighted over a region in Thailand and Laos. The bottom panel, titled 'RESULTS: SENTINEL2', lists search results in a table. The table has columns for Start, End, Size, and Cloud Coverage. The results are grouped by Product Type: L1C. The 'DATABASKETS' tab is active, showing a list of existing databaskets with their names, start/end dates, sizes, and cloud coverage percentages. A 'Create New Databasket' button is visible in the top right corner of the results panel.

Start	End	Size	Cloud Coverage
Start: 2019-01-29T03:30:09.024Z	End: 2019-01-29T03:30:09.024Z	Size: 0.07 GB	Cloud Coverage: 0.00
Start: 2019-01-29T03:30:09.024Z	End: 2019-01-29T03:30:09.024Z	Size: 0.36 GB	Cloud Coverage: 0.00
Start: 2019-01-29T03:30:09.024Z	End: 2019-01-29T03:30:09.024Z	Size: 0.81 GB	Cloud Coverage: 0.00
Start: 2019-01-29T03:30:09.024Z	End: 2019-01-29T03:30:09.024Z	Size: 0.81 GB	Cloud Coverage: 0.00
Start: 2019-01-29T03:30:09.024Z	End: 2019-01-29T03:30:09.024Z	Size: 0.82 GB	Cloud Coverage: 0.02

The 'Databaskets' panel allows managing and/or creating databaskets. The panel lists all the databaskets created by or shared to the user.





For each databasket the available actions are detailed below.



The 'Information' icon provides basic information on the databasket.



The 'Share' icon allows the user to share the databasket with a selected group and choose the permissions to be given for the group.



The 'Edit' icon allows the user to modify the basic information and to delete the entire databasket. A confirmation will be needed to delete the databasket.



The 'Clone' icon creates a new databasket with the same content of the selected one. The user can specify the name and the description of the new databasket.



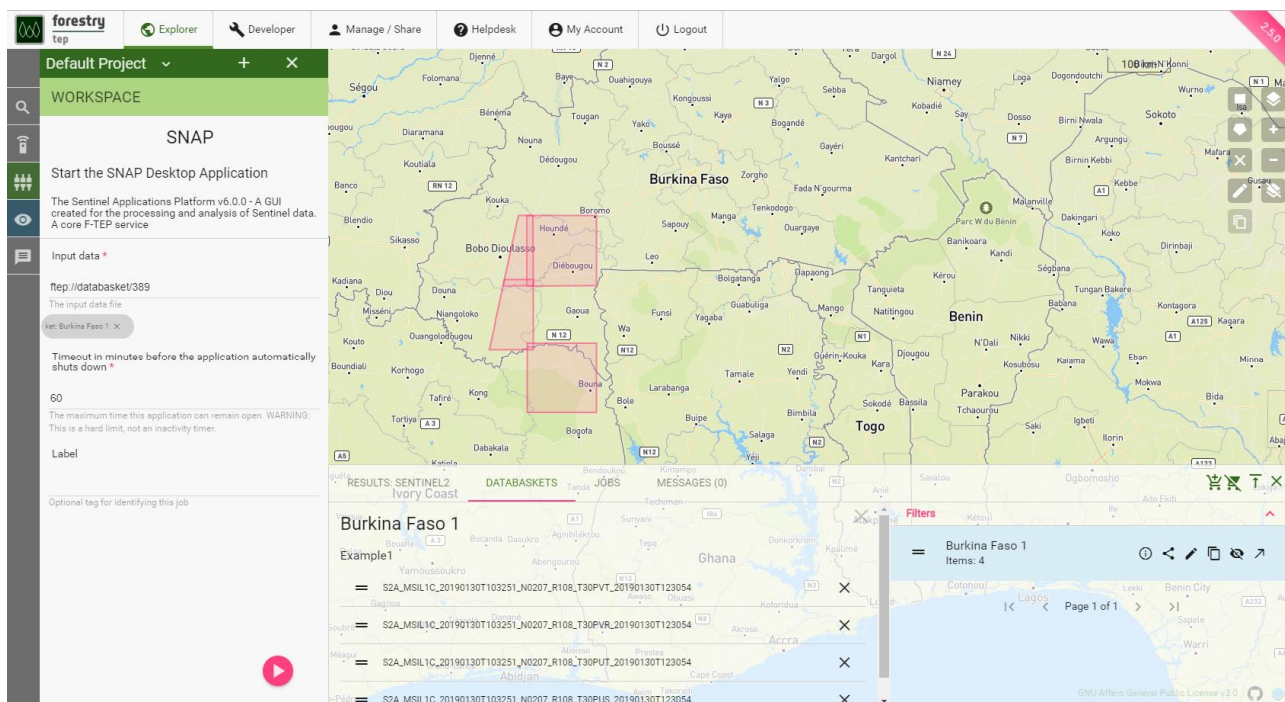
The 'Load/Unload' icon loads/unloads the images of the databasket on the map.



The 'Open in Manage/Share' icon will open the databasket in the Manage/Share interface. As well as managing within the Explorer interface, databaskets can also be created, deleted, and managed in the Manage/Share interface.

A Databasket can be used as input for a process, thus allowing launching a service or a graphical application on several files. The following picture shows the content of the databasket "Burkina Faso 1" loaded on the map and used as input to the service 'SNAP' (i.e. the Sentinel Applications Platform). The databasket can be dragged into the 'Input data' parameter field of a service by grabbing and dragging the 'Drag databasket' icon in front to the databasket name.

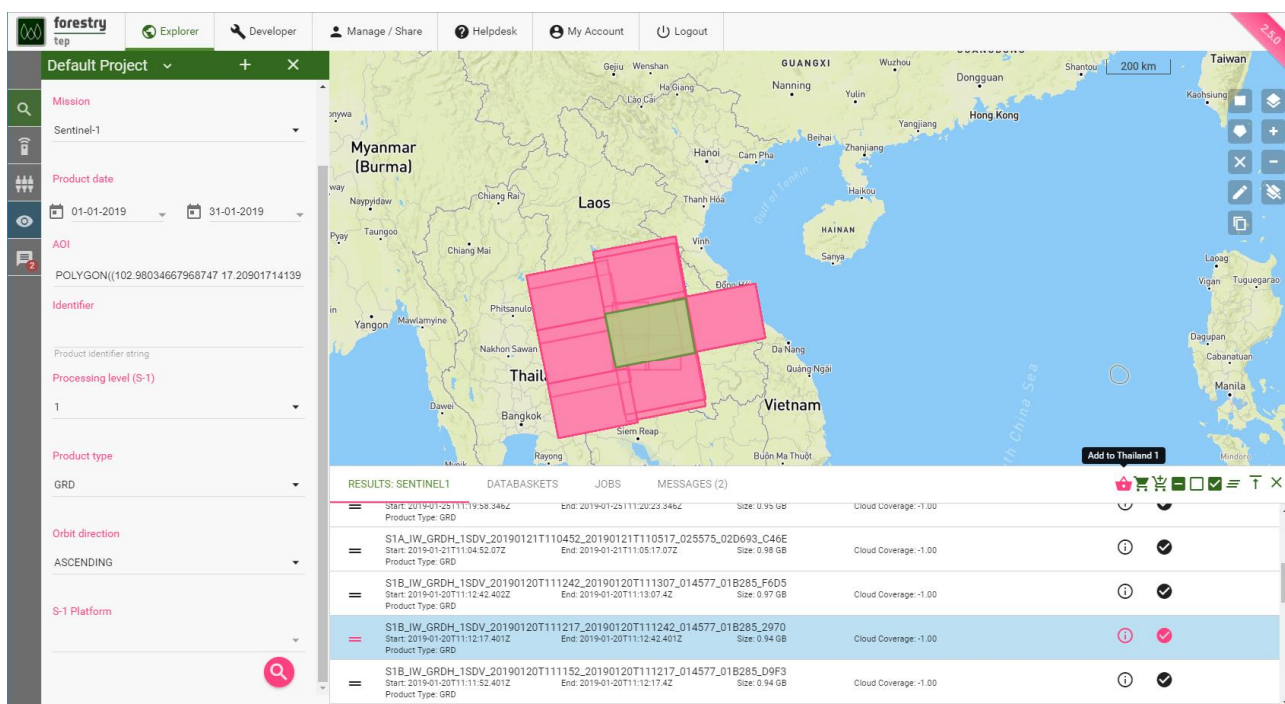




It is possible to modify the content of a databasket at any time after its creation.

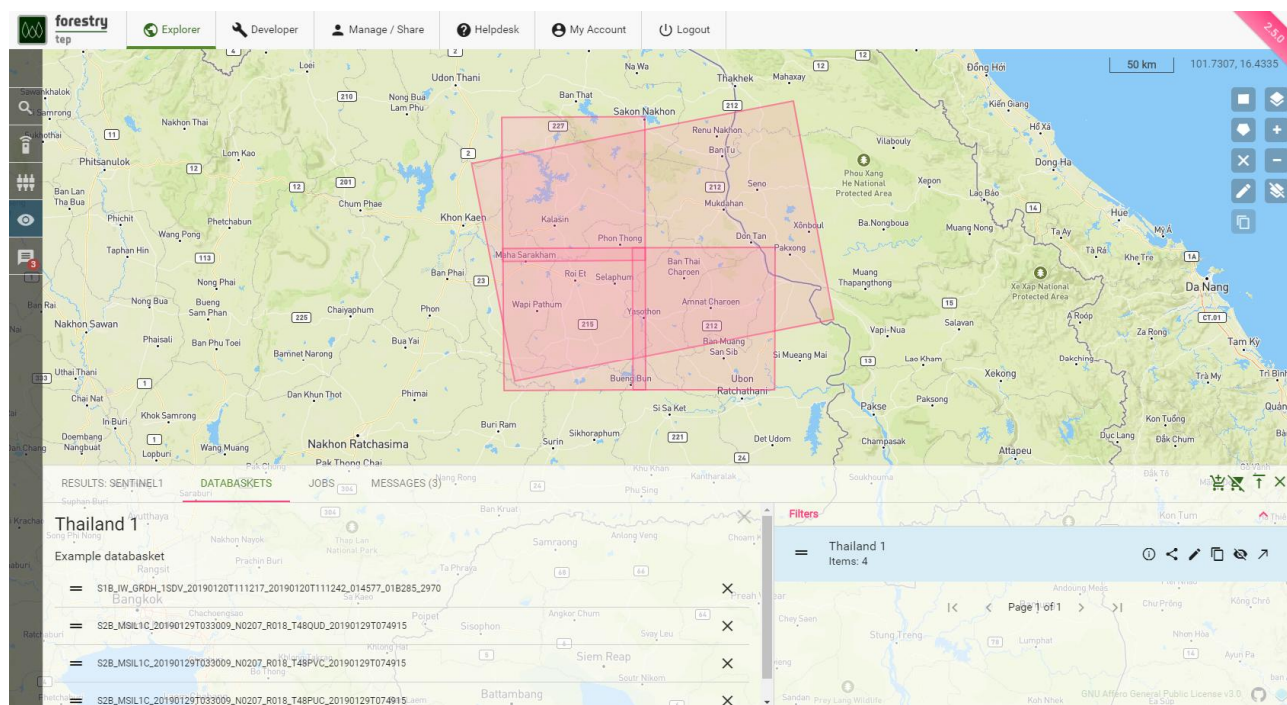
It is also possible to create a databasket containing mixed content. The sequence of pictures below shows the addition of a Sentinel-1 product to the databasket "Thailand 1" shown above containing Sentinel-2 products.

The following picture shows the result of a search for Sentinel-1 products. The selected item(s) can be added to any databasket the user has WRITE access to, by clicking the 'Add to...' icon. If necessary, the desired databasket can be selected using the 'Select Databasket' icon.





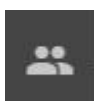
The following picture shows the content of the "Thailand 1" databasket after the addition of the Sentinel-1 product.



## 2.6 Manage / Share interface

This interface allows users to manage and share their various assets and data. They can e.g. explore the various groups and projects they belong to, as well as access and manage their files, data baskets, logs of their jobs and any services they have created. This page also allows users to share their services and products with selected users.

The functionalities of the Manage / Share interface are accessed through the icons on the left hand side the page. After clicking the icons, the respective panel will open on the left hand side. In these panels users can filter between generic ('All'), their own ('Mine') or shared ('Shared') assets respectively. They can also search by name for a specific asset.



**Groups:** allows the user to see and manage all the groups that the user belongs to or has created. Through this interface the user can e.g. change permission levels, add/remove users etc., or delete the entire group.



**Projects:** allows the user to see and manage all the projects that the user may have created. This feature is under development.



**Databaskets:** allows the user to see and manage all the databaskets the user has created or has permissions on. The user can e.g. add result products or reference data into the baskets, remove files from the basket, or delete the entire basket.



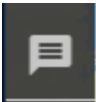
**Jobs:** allows the user to see and manage all the jobs the user has run or has permissions on. In addition to all the technical details of the job, the input files, output products and log files can be seen and the output products can be downloaded through this interface. The user can also share the job with other users.



**Services:** allows the user to see and manage all the services the user has created or has permissions on. The user can edit the service descriptions and see the list of associated files. Note, however, that services are created and modified in the 'Developer' interface.



**Files:** allows the user to see and manage all the files on the platform that the user has permissions on. The user can filter between reference data (uploaded to the platform) and output products (generated on the platform). The user can also filter between all accessible data ('All'), owned data ('Mine') or data specifically shared by others with that user ('Shared'). The file can also be searched by name.



**Messages:** opens the Messages panel along the bottom of the display. Any messages from the system are provided in this panel.

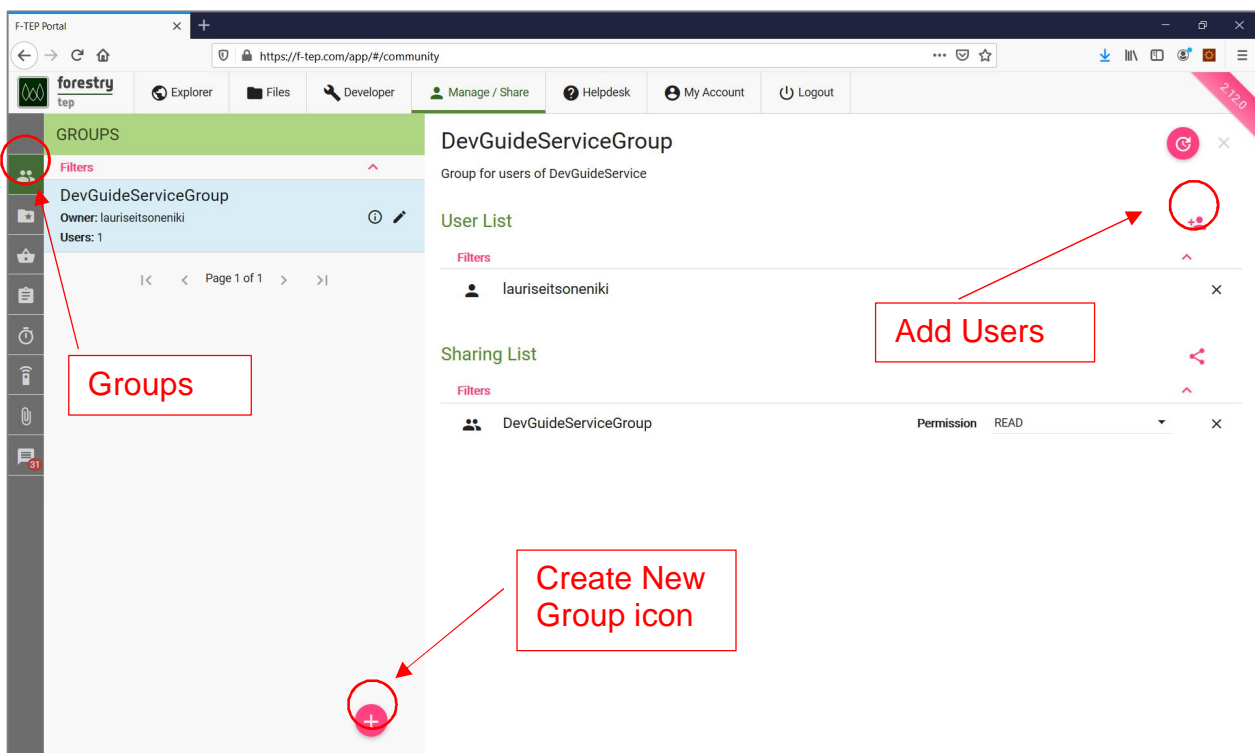


## 2.7 Groups

In order to efficiently share data, processing services or other work to other F-TEP users, it is possible to create groups of users using the 'Groups' function. Groups are created and managed in the 'Manage / Share' interface, within the 'Groups' panel that is accessible by clicking the 'Groups' icon. The panel on the left lists all the groups that the user has access to.

A new group can be created by clicking the 'Create New Group' icon (plus sign) at the bottom. In the dialog that opens, assign the group a name and a description. The new group will open in the right pane as shown in the below image.

To add users to a group, use the 'Add users' icon. You can search all F-TEP users and add members to the group one by one. In the dialog that opens, write the user name or part of it, select the intended user and click Add. The user is added to the 'User List'.



Groups are inherently one-way conceptual structures, i.e. owned and managed by the user who establishes it.

The 'Sharing List' on the bottom right shows the permissions concerning this group definition. By default, the group itself will be included here, with READ permission. This means that apart from the group creator, members of this group will be able to see and use the group. This practice allows, for example, members of a project team to easily share items to the same group.

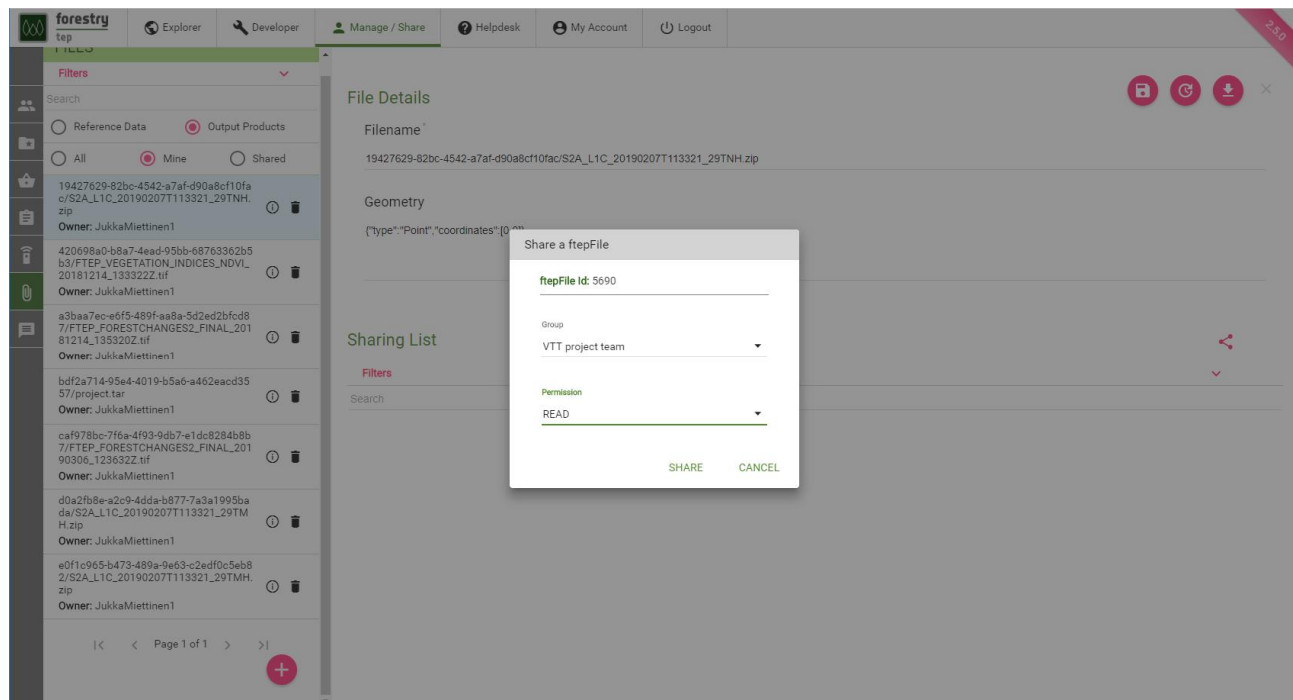
The permissions WRITE and ADMIN would (both) allow the group members to modify the group.

Permissions concerning each share activity are defined individually, at the time of using the group in sharing items.

## 2.8 Sharing

A key aspect of F-TEP is the ability to share items with other F-TEP users. Sharable items include groups, projects, databaskets, processing jobs, services and data (both output products and reference data). Most of this is controlled via the 'Manage / Share' interface.

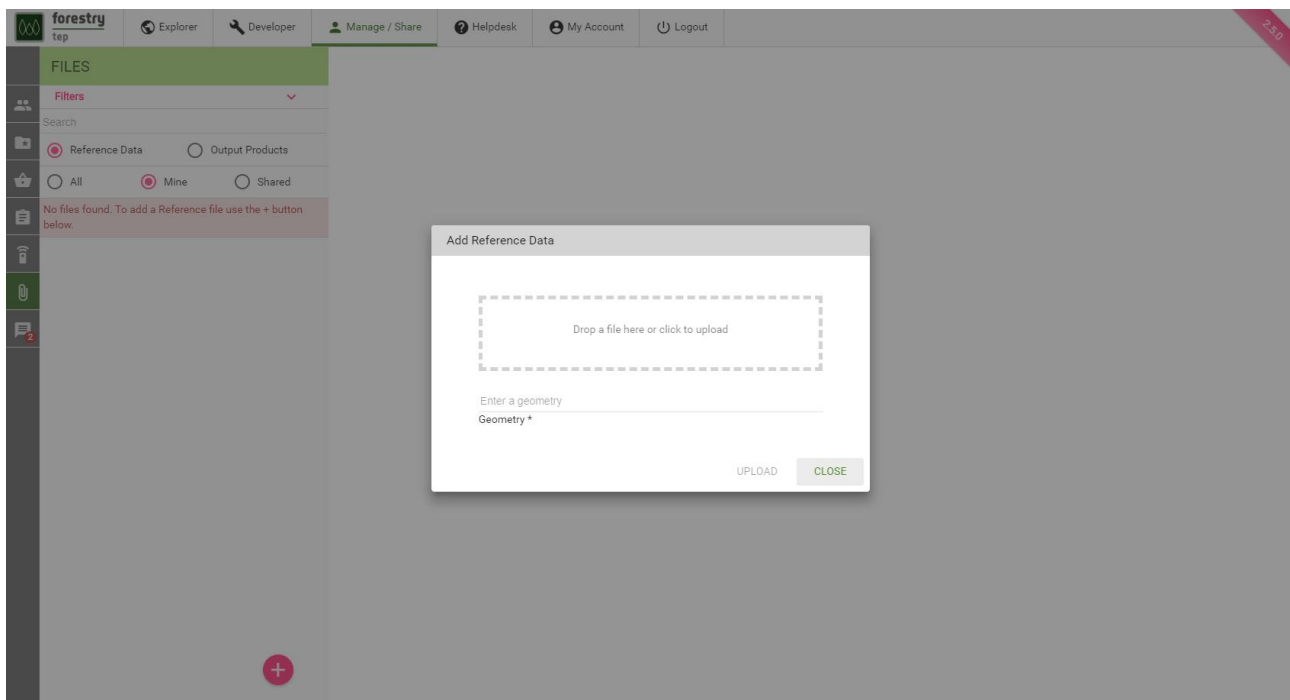
To share reference data or an output product, the user accesses the 'Files' tab in the 'Manage / Share' interface. By selecting the file and clicking the 'Share' icon, the user can grant a particular group of users an access to the file. The level of permission rights (read or edit) is also assigned at this stage. All members of the target group can now see the file in question, and they have the assigned level of right to work with it.



## 2.9 Reference data

One approach to uploading reference data is via the Manage / Share interface. See also the separate section on the 'Files' interface.

To add reference data via the Manage / Share interface, select the 'Files' section and click the 'Add' icon at the bottom of the panel. Then drag and drop or click to select the local file to be uploaded (see the image below). Users will also need to define the geometry to allow the data to be geographically mapped within the system. This is the geographic coverage of the data file and is given in the Well-known text (WKT)<sup>6</sup> POLYGON specification. An example of a valid AOI specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).



<sup>6</sup> [https://en.wikipedia.org/wiki/Well-known\\_text\\_representation\\_of\\_geometry](https://en.wikipedia.org/wiki/Well-known_text_representation_of_geometry)


## 2.10 Files

The 'Files' interface allows users to view and manage files that are stored in the F-TEP platform. They can search and browse all the files they have permissions for, view file details and conduct various management operations, including file deletion. It is also possible to upload new files into the system through this interface. The two main functionalities of the 'Files' interface are accessed through the icons on the left hand side of the page. After clicking the icons, the respective panel will open on the left hand side.



The 'Search' icon opens the search panel on the left hand side of the page.

Through this panel, the user can search and view all the files the user has produced, uploaded or has permissions on. The user can search the files by keywords. Note that the keyword search includes the labels the user may have used to identify jobs. This is often the easiest way to look for a specific file. The search can also be restricted by file type (limiting it to external product, output products or reference data), by ownership or by file size.

The search results update on the fly and are displayed on the right hand side of the page. Clicking the  sign in front of the file name opens a box with the file details. Through this interface, the user can view full URI address of the file and geometry information. Both of these pieces of information can be copied from this screen for easy input to a workflow. It is also possible to see if the files have been shared with someone or included in databaskets. A JSON file preview is also provided. Furthermore, the file can be downloaded or deleted through this view. Note that file deletions will break all job configurations where the file has been used as input data. After the deletion, these jobs cannot be re-run. For this reason, there is a warning before any deletion, listing all the connections the file has (e.g. "0 databaskets, 1 jobs and 0 job configurations") and requesting the user to verify the deletion.

Filename	Owner	Type	Filesize
70489600-2cac-4f60-9038-f283815753e4/GranCanaria_fire_19082019-real_colour.tif	JukkaMiettinen1	OUTPUT_PRODUCT	0.449 GB
70489600-2cac-4f60-9038-f283815753e4/GranCanaria_fire_19082019-12-8-4.tif	JukkaMiettinen1	OUTPUT_PRODUCT	0.449 GB
e195debd-401a-4348-982f-a187bc7bad4d/S2A_L1C_20190819T115221_28RDS_20190820_070352Z.zip	JukkaMiettinen1	OUTPUT_PRODUCT	1.367 GB
30a54d67-0db8-486b-b38f-23aa6417eda7/S2A_L1C_20181115T101251_32TQS_20190814_133052Z.zip	JukkaMiettinen1	OUTPUT_PRODUCT	0.777 GB
6a365101-95d3-40df-8e07-2b362de40501/Siberia06082019_realcolour-VIIRS.tfw	JukkaMiettinen1	OUTPUT_PRODUCT	0.000 GB
6a365101-95d3-40df-8e07-2b362de40501/Siberia06082019_realcolour-VIIRS.tif	JukkaMiettinen1	OUTPUT_PRODUCT	0.092 GB

**URI**  
ftp://outputProduct/6a365101-95d3-40df-8e07-2b362de40501/Siberia06082019\_realcolour-VIIRS.tif

**Geometry**  
"POLYGON ((97.20693850996 59.462916930287, 99.175425107413 59.462916930287, 99.175425107413 60.447251264143, 97.20693850996 60.447251264143, 97.20693850996 59.462916930287))"

**JSON**  
Preview JSON Download File

**Filename**  
6a365101-95d3-40df-8e07-2b362de40501/Siberia06082019\_realcolour-VIIRS.tif

**Databaskets**  
(Not within any databaskets)

**Sharing List**  
(Not currently sharing)

**Delete**



The 'Upload' icon opens a panel that allows the user to upload new data into the system. The file can be dragged and dropped into the box. Alternatively, clicking







- Item(s) contained in a databasket
- A databasket itself, to add at once all the items contained



Note also the 'plus' sign on the right of the input data field. This allows opening a new input data field (for direct manual input) for those services that allow several input data files. The same effect can be reached by dragging any input image into the input data field, which will automatically open a new field for potential additional input data.

Apart from the inputs, each service will have a specific set of parameters, briefly described in the workspace. More information on particular services and the parameters needed to run them can be found in the service descriptions provided in the user manual.

### 3.3 Launching the service

Once the input data and other parameters have been defined, the service is executed by clicking the 'Launch' button at the bottom of the Workspace panel. After launching, the Data Panel opens at the bottom of screen with the 'Jobs' section open.



The launched job will appear at the top of jobs list, showing its unique numeric ID, the service name and the starting time (UTC). A coloured icon on the left depicts the status of the processing jobs. Below is an example of a successfully completed job.



Job ID: 4434 (ForestChangeS2)  
Start: 2019-03-27T15:27:48.147



### 3.4 Managing the job

The jobs listing provides for each job functional icons that allow to (from left to right):

- **View job metadata** such as the job owner, status, and start and end times;
- **'Share'**: share the job, including its outputs, to a specified group of users;
- **'Edit and re-run'**: use the input parameters defined for this job as a template for configuring a new run of the same service;
- **'Open in Manage/Share'**: open the job details in the Manage / Share interface.
- **'Terminate'** (for running jobs): allows to terminate the job execution manually, before its automatic termination that would happen on job completion, failure or timeout. In case of GUI applications, manual termination is useful in getting access to any data that the user may have saved to the 'outDir' folder; these outputs will only be available after the job termination.

When clicking on a job, a panel opens with the INPUTS, OUTPUTS and LOGS sections.

- INPUTS shows a concise list of the parameters that were used for this job.
- OUTPUTS lists any outputs that were produced. The user can download each result, and in case of specific file types (GeoTiff in particular) also have the output visualized on the map interface. Note that the intensity scaling may not appear optimal, wherefore it is often favourable to instead open the file e.g. in QGIS. This would be done by dragging the output file to the input data field when preparing a QGIS job; in a similar fashion the output can be used as the input of other services too.



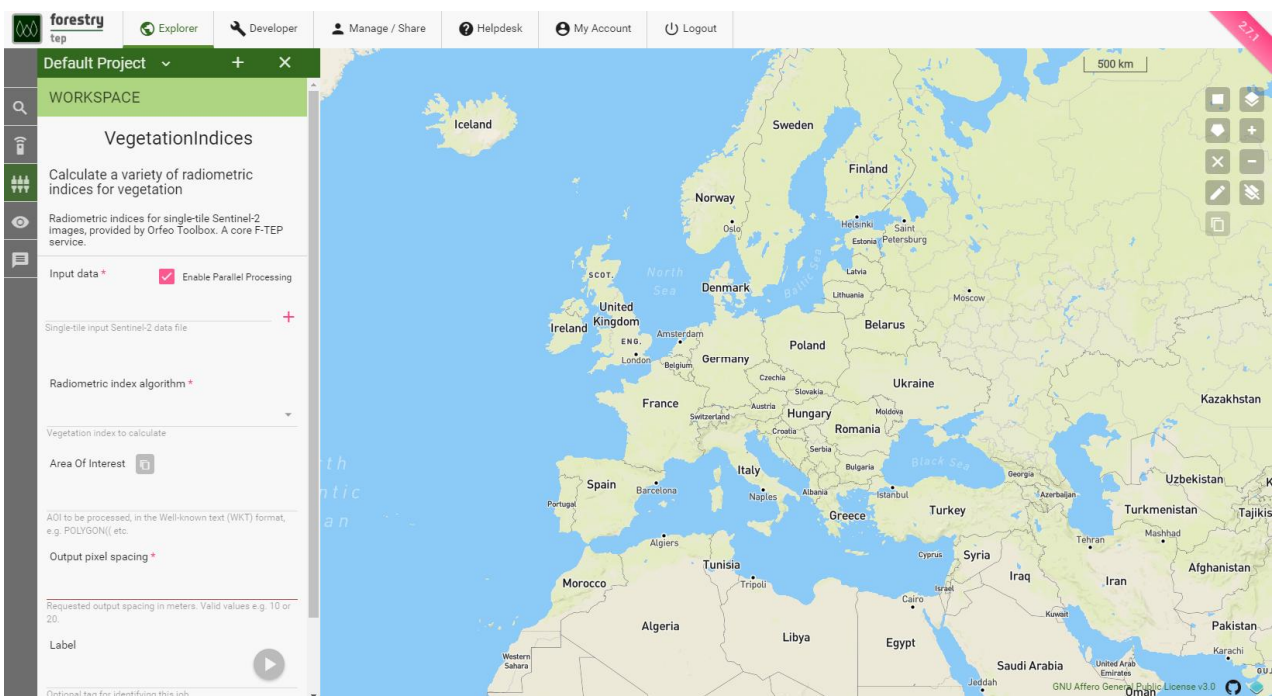
- LOGS shows both the system logs and developer-specified output from the execution of the processing job. Note that the logging data does not update in real-time nor is it fully chronological, as the data is collected by a separate platform component. Its primary purpose is to enable service developers to debug the service.

### 3.5 Parallel processing

Some processor services are implemented in such a way as to permit configuration in 'parallel' mode. Whereas in a standard processor all input data products are passed to one processing job, the parallel processing mode will configure one 'sub-job' per input data product; all other input parameters remain constant.

When a parallel processing job is started, the user can see the "View subjobs" icon in the job field. By clicking this icon the user can see each individual 'sub-job' listed separately and can access their information and functions. After the job is finished, outputs of all parallel jobs can also be seen and accessed through the parent job.

The parallel processing can be enabled by activating the 'Enable Parallel Processing' icon next to the parameter. If checked, this job will execute in parallel mode. Each sub-job is discretely configured and can be inspected individually, including accessing the individual sub-job output products. The parent job provides a way to work with the aggregated output products of the sub-jobs.





## 4 Processing services

### 4.1 Sen2Cor255 & Sen2Cor280

#### 4.1.1 Service description

These services can be used to convert Sentinel-2 Level 1 C imagery to Level 2 A format. Sen2Cor 2.5.5 applies to older (prior to October 2016) Sentinel-2 data and Sen2Cor 2.8.0 to newer data. Note that the services do not currently utilize a DEM or ESA auxiliary data package in the processing.

#### 4.1.2 Input data

The services requires one or more Sentinel-2 L1C image as input. When multiple input images are given the checkbox Enable Parallel Processing should be selected to speed up processing.

#### 4.1.3 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.



### 4.2 Fmask40

#### 4.2.1 Service description

These generates a cloud mask from Sentinel-2 Level 1 C or Landsat 8 imagery using Fmask 4.0 algorithm. The output is a GeoTiff classification image for each input image with the following classes:

- 0 = clear land
- 1 = clear water
- 2 = cloud shadow
- 3 = snow
- 4 = cloud
- 5 = no data

#### 4.2.2 Input data

The services requires one or more Sentinel-2 L1C or Landsat 8 image as input. When multiple input images are given the checkbox Enable Parallel Processing should be selected to speed up processing.

#### 4.2.3 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.



## 4.3 Envimon

### 4.3.1 Service description

The Envimon service unpacks a Sentinel-2 or Landsat 8 image and converts it to ERMapper .ers format. Band order of the generated Sentinel 2 image is B2, B3, B4, B8, B5, B6, B7, B8A, B11, B12, B1, B9, and B10 (i.e. 10 m bands, 20 m bands and then 60 m bands). For Landsat 8 the bands are in order B1, B2, B3, B4, B5, B6, B7, B9, B8, B10 and B11. Bands B10 and B11 are only available if the image contains those thermal bands.

For Sentinel-2 Level 1C input it produces two cloud mask images using cloud masking algorithm of VTT:

1. ERMapper .ers file with 6 classes:
  - 1 =cirrus
  - 2 =water
  - 3 =clear land
  - 4 =shadow
  - 5 =cloud
  - 6 =snow
2. GeoTiff file with cirrus, cloud and shadow set to value 255

For Sentinel-2 Level 2A input it generates a cloud mask from the 20 meter SCL image, producing a GeoTiff with the following SCL classes set to the following values:

- |  |     |
|--|-----|
| 1. Saturated/defective                   | 255 |
| 2. Cloud shadows                         | 255 |
| 3. Clouds low probability / Unclassified | 253 |
| 4. Clouds medium probability             | 254 |
| 5. Clouds high probability               | 255 |
| 6. Cirrus                                | 255 |

A cloud mask for Landsat 8 input is generated from the quality bits in the image. The mask file is in ERMapper .ers format and its name ends with \_L8\_cloud.ers. The mask contains the following values:

- |                              |     |
|------------------------------|-----|
| 1. Low probability clouds    | 253 |
| 2. Medium probability clouds | 254 |
| 3. High probability clouds   | 255 |

Output is a .zip file containing the generated image and the cloud images.

### 4.3.2 Input data

The services takes 1-20 Sentinel-2 L1C, Sentinel-2 L2A, or Landsat 8 data folders in a .zip archives as input.

### 4.3.3 Parameters

**Input images:** One to 20 Sentinel-2 L1C, Sentinel-2 L2A or Landsat 8 .zip archives. Sentinel-2 and Landsat images cannot be processed at the same time as they require different parameters for processing.

**Target resolution:** Resolution of the unpacked image, either 10, 20 or 60 meters for Sentinel-2 data or 15 or 30 meters for Landsat 8 data. Default values are 10 meters for Sentinel-2 and 30 meters for Landsat 8.

**Bands:** A space-separated list of band identifiers B1, B2... Default is all bands.

**Output mode:** By default, creates one image with selected bands and resolution together with cloud mask images. Set output mode to 'All' to generate also separate images for all 10 m, 20 m, and 60 m bands, together with angles grid and calibration files.

Parameters used in VTT cloud detection algorithm for Sentinel-2 L1C images:

**Minimum reflectance:** Minimum reflectance (in %) in visible channels for cloud. Default 30.

**Aerosol Optical Depth (AOD) ratio:** Minimum threshold B/G for shadow. Default 1.2.


**Minimum snow index:** Minimum snow index from channels red and 1.6  $\mu\text{m}$  for snow. Default 0.7.

**Minimum cirrus:** Minimum threshold from cirrus channel 1.4  $\mu\text{m}$  for cirrus. Default 0.3.

**Buffer:** Number of dilation iterations, each dilates two pixels. Default 12.

**Label:** Allows free form tagging for later identification of this processing job.

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output is .zip file containing the generated image and the cloud images. It can be downloaded, re-used or displayed in one of the GUI applications, such as QGIS. Soon after desired application

process (e.g. QGIS) is started, a  'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.

## 4.4 VegetationIndices

### 4.4.1 Service description

The measured reflectance in various parts of visible and infrared spectrum (*i.e.* in various spectral bands of the MSI instrument aboard Sentinel-2 satellites) correlates to properties of vegetation canopies. When applying ratios between spectral bands, indices with correlation to canopy properties and photosynthetic capacity can be derived. Using band ratios, the effects of potential inter-image variation caused (*e.g.* by atmospheric effects) are reduced.

The most commonly used vegetation index is the Normalized Difference Vegetation Index (NDVI), which correlates very strongly with the proportion covered by leaves when the background is bare soil and when the proportion covered by leaves is not excessively high. In addition to NDVI, several other vegetation indices have been developed. These newer indices make modifications to counter-act effects of soil properties or atmospheric effects.

The following vegetation indices can be calculated using the VegetationIndices service:

- **NDVI**, Normalized Difference Vegetation Index  $(\text{NIR}-\text{Red})/(\text{NIR}+\text{Red})$ ,
- **TNDVI**, Transformed Normalized Difference Vegetation Index  $(\sqrt{\text{NDVI} + 0.5})$ ,
- **RVI**, Ratio Vegetation Index  $(\text{Red}/\text{NIR})$ ,
- **SAVI**, Soil Adjusted Vegetation Index  $(\text{NDVI} \cdot (1+S))$ , S = soil adjustment factor),
- **TSAVI**, Transformed Soil Adjusted Vegetation Index,
- **MSAVI**, Modified Soil Adjusted Vegetation Index,
- **MSAVI2**, Modified Soil Adjusted Vegetation Index 2,
- **GEMI**, Global Environment Monitoring Index, &
- **IPVI**, Infrared Percentage Vegetation Index.

#### 4.4.2 Input data

The VegetationIndices service requires one or more Sentinel-2 L1C image. Note that cloud-free images should be selected, as the service does not perform radiometric corrections or cloud masking.

#### 4.4.3 Parameters

**Input data:** The input Sentinel-2 image which has been previously defined. Drag the input Sentinel-2 image (grabbing from the horizontal lines in front of its name) from the Results tab at the bottom of the screen to the input field.

**Vegetation Index:** Using the drop-down list, select a vegetation index. Options include: NDVI, TNDVI, RVI, SAVI, TSAVI, MSAVI, MSAVI2, GEMI, IPVI.

**Target CRS identifier:** This field defines the target coordinate reference system (CRS). It must be a string beginning with 'EPSG:', appended by a numeric code that is a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32615, where "6" or "7" defines Northern/Southern hemisphere, and 15 represents the UTM zone.

**Area of interest (AOI):** An AOI to be processed is inserted here. This can be copied from an area drawn on the map by pressing the 'Copy From Map' icon. Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)). The AOI should be large enough that it includes enough reference data for all target class.

**Target Image Resolution:** The requested output image pixel spacing (in metres) is inserted here. For Sentinel-2 optical data, feasible values are between 10 and 100 m. Example: 20

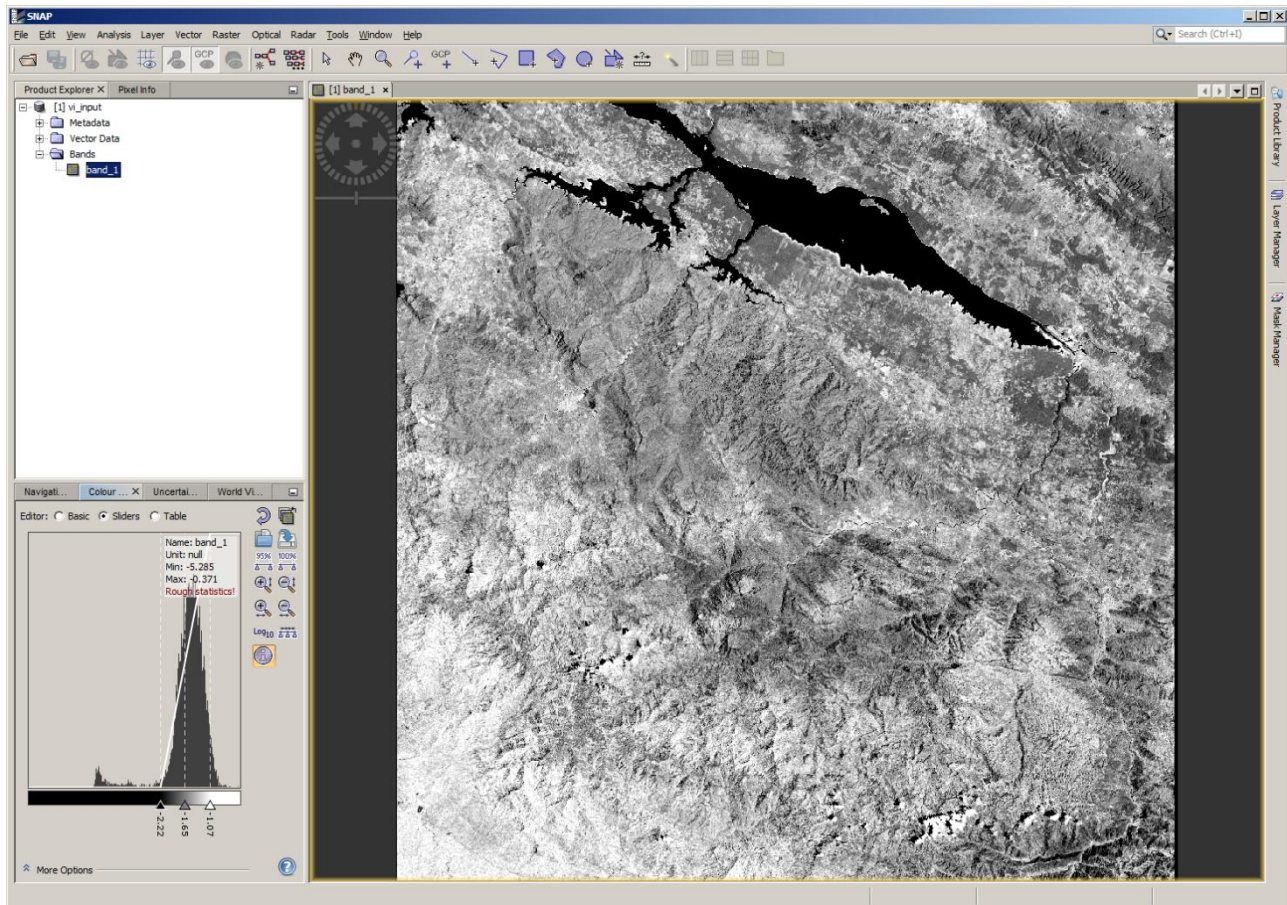
**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

#### 4.4.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.

The image below shows a generated TSAVI index map within SNAP.





## 4.5 ForestChangeS2

### 4.5.1 Service description

Forest clearance causes substantial changes in visible and near infrared reflectance. This is evident when investigating the various spectral bands of Sentinel-2 satellite images. Due to the reduction of photosynthetically active vegetation in logging operations, especially if bare ground is exposed, red reflectance rises significantly. This increase in red reflectance can be used as a simple indicator for potential forest clearance. The ForestChangeS2 service produces the ratio of red reflectance between to input images (*i.e.* “before” and “after” images). The service computes a red-reflectance ratio layer, which can then be further analysed *e.g.* in the QGIS application service together with other products (forest or land cover maps).

### 4.5.2 Input data

The service requires as its input data two Sentinel-2 L1C image tiles. The correct Sentinel-2 data format can be recognized by file names that begin with “S2A\_MSIL1C” or “S2B\_MSIL1C”. The images must cover the same area (*i.e.* the same Sentinel-2 tile). Cloud masking is performed with the cloud masks included in the Sentinel-2 L1C products. However, note that some clouds may have passed through the L1C cloud masking procedure, causing errors in the change detection. This has to be taken into account when interpreting the results. For the best results, both of the input images should be completely cloud-free.

### 4.5.3 Parameters

**Start product:** The first input Sentinel-2 image, which has been acquired before the assumed forest change. Drag the input Sentinel-2 image from a search results listing or from databasket contents at the bottom of the screen, by grabbing from the horizontal lines in front of its name.

**End product:** Select the second image in the same way and drag it here.

**Target CRS identifier:** This field is OPTIONAL. It defines the target coordinate reference system (CRS). If left empty, the CRS of the input data is used as default. This must be a string beginning with 'EPSG:', appended by a numeric code that is a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32635, where "6" or "7" defines Northern/Southern hemisphere, and 35 represents the UTM zone.

**Area of interest:** This field is OPTIONAL. It defines the area of interest (AOI) that the output image is cropped to. Note that full Sentinel-2 tiles are processed regardless of this setting. If left empty, an image covering the entire tile area is produced. The AOI can be copied from the area drawn on the map by clicking the 'Copy From Map' icon.

Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).

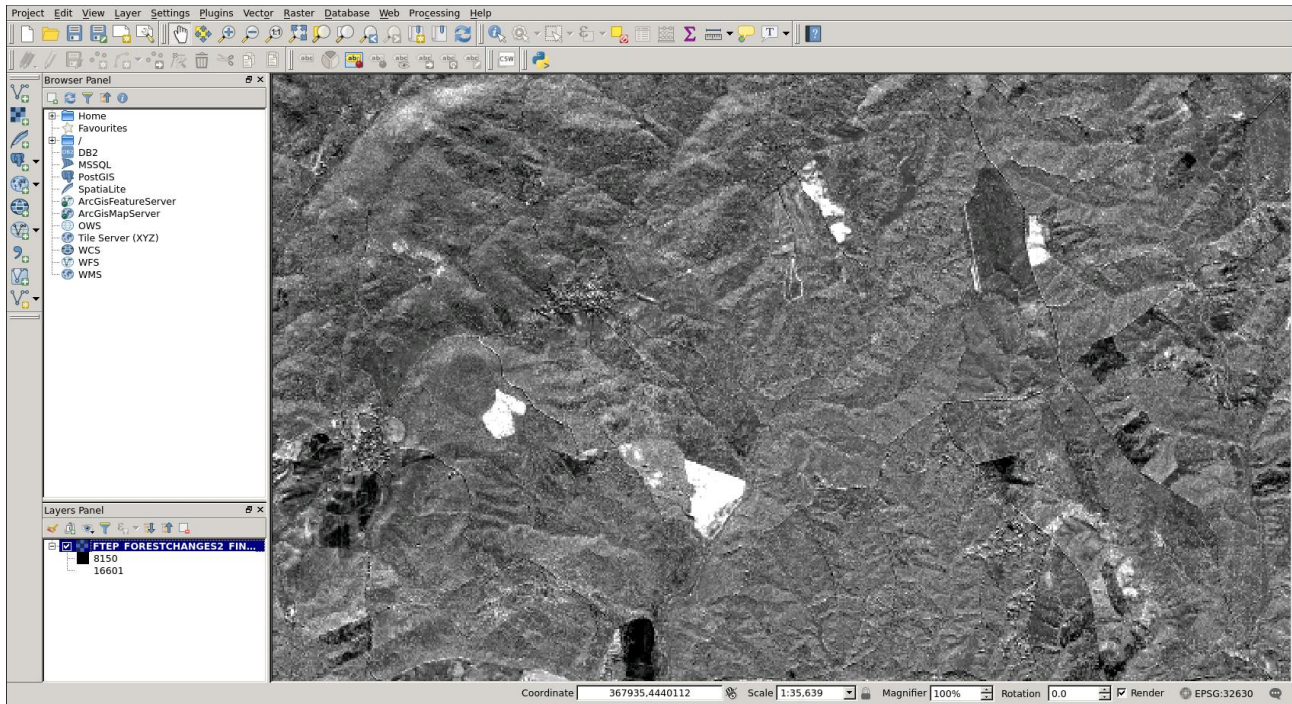
**Target image resolution:** This field is OPTIONAL. It specifies the desired image resolution in metres, controlling resampling of the output image (pixel spacing). If left empty, resolution of the input data (10) is used as default. For Sentinel-2 optical data, feasible values are between 10 and 100 (meters).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

### 4.5.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The processing can typically take 25 minutes. The resulting output is GeoTIFF file that can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. The desired GUI application can then accessed by clicking this icon, which opens the GUI in another browser tab.

The image below shows the red ratio result opened in QGIS, with some potential clearings visible (in white).





## 4.6 LandCoverGeotiff

### 4.6.1 Service description

Land cover types (such as water, coniferous forest, or wheat field) reflect different amount of incoming sun radiation in different parts of the electromagnetic spectrum. This information can be used for land cover classification of satellite images. Many land cover mapping or classification algorithms have been developed over the past decades.

The LandCoverGeotiff service makes land cover classification using a random forest classifier as implemented in the Orfeo toolbox. Based on samples of land cover classes, a set of decision trees are produced. For each tree, a random set of spectral bands at each decision node is chosen. The final land cover class is then chosen based on majority voting between the output of each decision tree. The benefits of the random-forest algorithm include good adaptation to many different types of classification problems as well as independence of assumptions on statistical distribution of band-wise reflectance values within a (land-cover) class.

The service requires training data in the form of a shape file. The used earth observation data is not limited to any specific sensor. The input geotiff file can be from any satellite sensor or even a combination of several sensors.

### 4.6.2 Input data

The service requires an input geotiff image file which can be from any satellite sensor, as well as reference data. The reference data shape file must include polygons, each polygon covering area belonging to just one land cover class. For each target class, the reference data must include several hundred pixels in the used input data at the selected pixel size. The reference data shape file – and all supporting files like the .dbf file, .prj file and the .shx file - must be packaged into a single .zip file. The zip file must be uploaded to F-TEP.

The service does not pose strict requirements on the geographic distribution of the reference data as long as there are enough reference polygons for each class within the selected input image. The shape file can include e.g. 50 m by 50 m squares in a regular grid pattern and interpreted in some satellite imagery, air photos or maps. Or it can contain more freely selected polygons in places where the user knows the land cover. A good reference dataset includes all within class variation of the land cover classes. For instance, if land cover class “water” includes both clear water and turbid water with sediment, the water class in the reference data should include samples of both of these cases.

### 4.6.3 Parameters

**Input Data:** The name of the input geotiff file is inserted here. The file can be dragged from the search results panel at the bottom of the screen to the ‘Input data’ field. Typically the input data is taken from reference data if the user has uploaded an external geotiff file or from the F-TEP results if e.g. the user wants to use a multi-temporal stack of Sentinel-1 data or some mosaic of Sentinel-2 data.

**Reference data shapefile:** The reference data shapefile to be used (*i.e.* a .zip package file containing all the files belonging to the shapefile) is defined here.

If the reference data has been uploaded to the platform (using the ‘Files’ feature in the ‘Manage / Share’ interface), the file can be found by running a search on reference data. After selection of the correct file in the search results, it can be dragged into the input field in the workspace.



Alternatively, you can write in the reference data input field the URL of a reference data (zip packaged shapefile) that you have available in a publicly available web location. An example of a valid reference data address is:

<https://f-tep.com/sites/default/files/F-TEPchiapasLandCover.zip>

**Reference data field:** The field in the reference data shapefile that will be used to train the classifier needs to be defined here. The name of the column (e.g. 'tessellate') is inserted in this field. GIS tools show the column names in an attribute table.

**Target CRS identifier:** This field defines the target coordinate reference system (CRS). It must be a string beginning with 'EPSG:', appended by a numeric code that is a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32615, where "6" or "7" defines Northern/Southern hemisphere, and 15 represents the UTM zone.

**Area of interest (AOI):** An AOI to be processed is inserted here. The AOI should be large enough that it includes enough reference data for all target class. This can be copied from an area drawn on the map by pressing the 'Copy From Map' icon. Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).

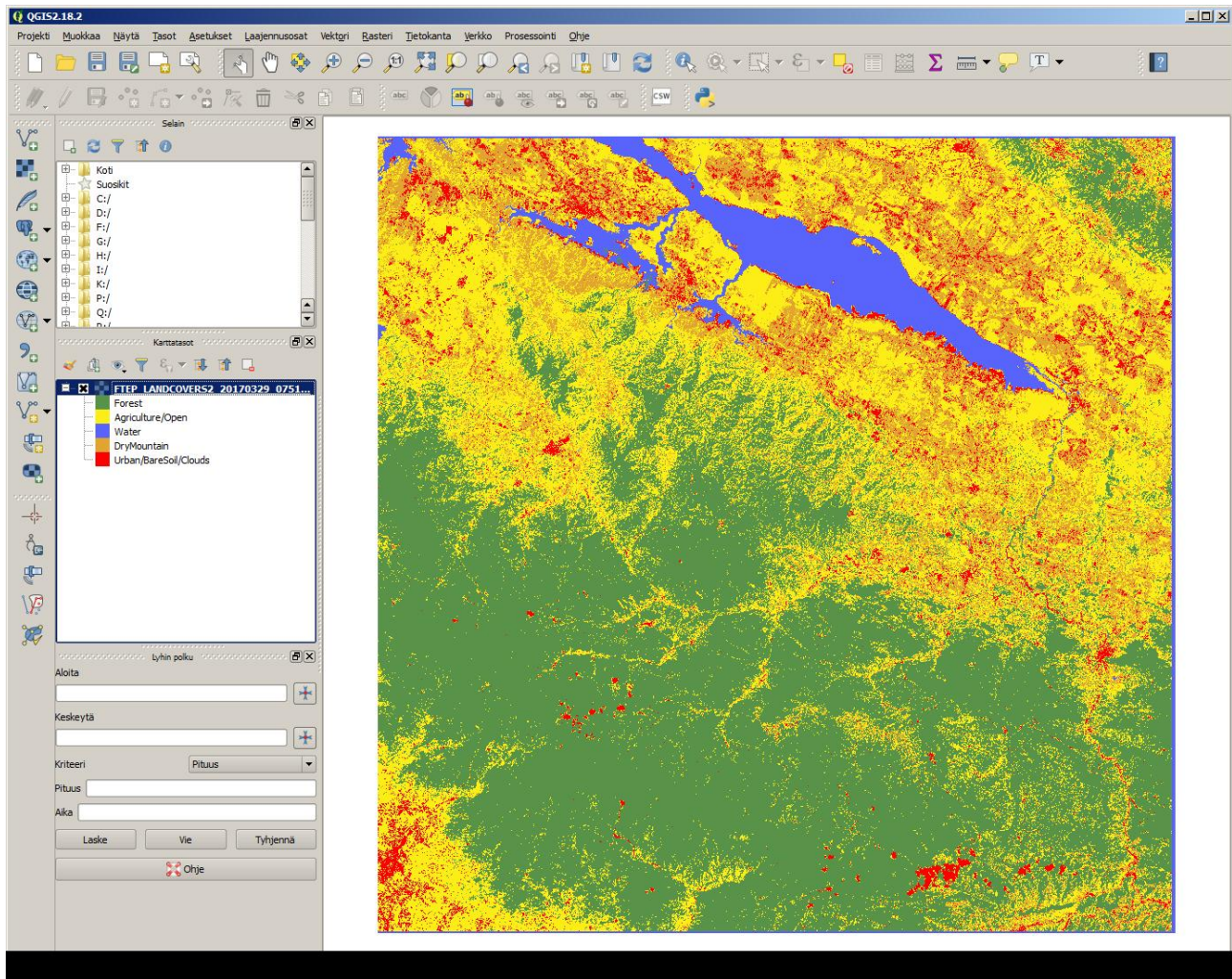
**Target Image Resolution:** The requested output image pixel spacing (in metres) is inserted here. For Sentinel-2 optical data, feasible values are between 10 and 100 m. Example: 20

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

#### 4.6.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.

The image below shows a generated land cover map within QGIS.



## 4.7 S1Stack

### 4.7.1 Service description

The S1stack service mosaics dual-polarized Sentinel-1 GRD images along orbit and assigns acquisition dates as bands in a multi-temporal output image. This way, areas crossing scene boundaries can be used as input to e.g. the LandCoverGeotiff service.

### 4.7.2 Input data

The S1Stack service requires a set of same-geometry dual-polarized Sentinel-1 images in GRD format as input data.

### 4.7.3 Parameters

**S1/GRDH/SDV images:** A set of same-geometry dual-polarized Sentinel-1 images in GRD format, preferably collected into a databasket.

**Coordinate system:** This field defines the target coordinate reference system (CRS). It must be a string beginning with 'EPSG:', appended by a numeric code that is a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32615, where "6" or "7" defines Northern/Southern hemisphere, and 15 represents the UTM zone.

**Area of interest (AOI):** An AOI to be processed is inserted here. This can be copied from an area drawn on the map by pressing the 'Copy From Map' icon. Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).



**DEM file:** If the input field is empty the service uses SRTM DEM, which is downloaded automatically by SNAP. In areas outside the coverage of SRTM DEM (valid between -60 and 60 latitudes), an external DEM must be uploaded as reference data and then dragged to this input field. The DEM must be in plate carre projection (equal pixel spacing in latitude and longitude, its unit must be 1 m, and its format must be GeoTiff).

**Output label:** A string that is used as part of the output filename

**Output pixel spacing:** The requested output image pixel spacing (in metres) is inserted here. For Sentinel-1 radar data, feasible values are between 20 and 100 m. Example: 20

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

### 4.7.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.



## 4.8 S1StackTempVar

### 4.8.1 Service description

The S1stackTempvar service mosaics dual-polarized Sentinel-1 GRD images along orbit and assigns acquisition dates as bands in a multi-temporal output image. This way,

areas crossing scene boundaries can be used as input to e.g. the LandCoverGeotiff service. In addition, the S1stackTempvar computes temporal variability (standard deviation of the logarithm of amplitude, multiplied by a scaling factor of 50000) over the multi-temporal time-series - both for VV and VH polarisations.

#### 4.8.2 Input data


The S1Stack service requires a set of same-geometry dual-polarized Sentinel-1 images in GRD format as input data.

#### 4.8.3 Parameters

**S1/GRDH/SDV images:** A set of same-geometry dual-polarized (use SDV as identifier in image search) Sentinel-1 images in GRD format, preferably collected into a databasket.

**Coordinate system:** This field defines the target coordinate reference system (CRS). It must be a string beginning with 'EPSG:', and the following numeric code must be a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32615, where "6" or "7" defines Northern/Southern hemisphere, and 15 represents the UTM zone.

**Area of interest (AOI):** An AOI to be processed is inserted here. This can be copied

from an area drawn on the map by pressing the  'Copy From Map' icon. Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)). The AOI is used to determine the bounding box of the area to process. The area around the polygon is not masked out.

**DEM file:** If the input field is empty the service uses SRTM DEM, which is downloaded automatically by SNAP. In areas outside the coverage of SRTM DEM (valid between -60 and 60 latitudes), an external DEM must be uploaded as reference data and then dragged to this input field. The DEM must be in plate carre projection (equal pixel spacing in latitude and longitude), its unit must be 1 m, and its format must be GeoTiff.

**Output label:** A string that is used as part of the output filename. The S1stackTempvar service produces three output images:

1. stack - multi-temporal stack of the time-series of images,
2. stack\_int - multi-temporal stack of the time-series of images, with image seams interpolated along orbit, and
3. tempvar - a five-band image:
  - a. band 1 - number of observations
  - b. band 2 - VV variability
  - c. band 3 - VH variability
  - d. band 4 - VV average
  - e. band 5 - VH average


All output files are in geotiff format. In all output files, band names are in the TIFF tag image description, separated by underscore. If there are no interpolated pixels, the output file stack\_int is not produced.



**Output pixel spacing:** The requested output image pixel spacing (in metres) is inserted here. For Sentinel-1 radar data, feasible values are between 20 and 100 m. Example: '20'

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as Sentinel

Toolbox or QGIS. Soon after the desired application process (e.g. QGIS) is started, a  'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.

## 4.9 CombS2granules and CombS2granulesZ

### 4.9.1 Service description

The standard Sentinel-2 format splits each image into granules or tiles of 110 km by 110 km. These services combine these granules (the four 10-m bands, level 1C products) into a single geotiff file for later analysis as a single unit. The basic form CombS2granules accepts granules that are all in the same UTM zone. The version CombS2granulesZ accepts tiles in several UTM zones and re-projects them into the defined output coordinate system.

### 4.9.2 Input data

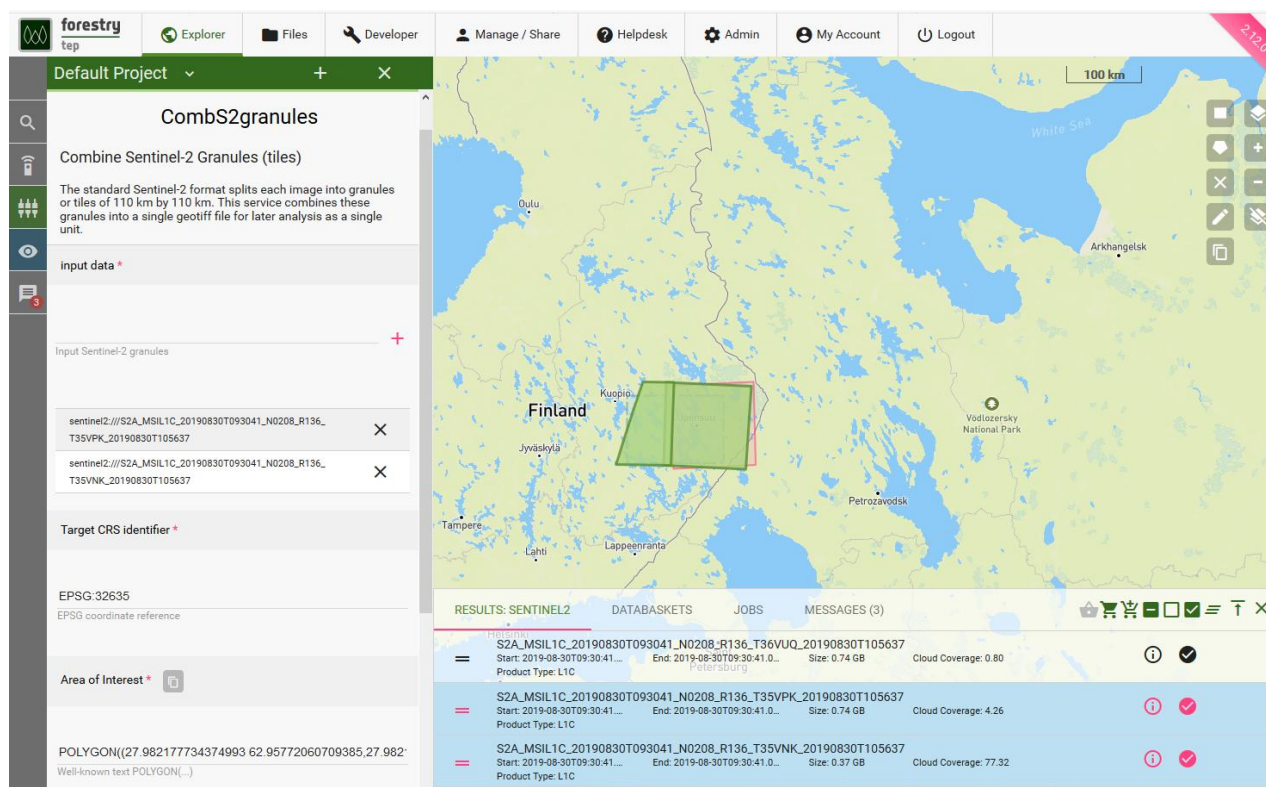
The services require two or more Sentinel-2 level 1C granules. In the first service they must be in the same UTM zone (in the below figure: UTM zone 35, North), while in the second service they may be in different UTM zones.

### 4.9.3 Parameters

The two services take exactly the same parameters.

**Input Data:** The input file is defined here. The file can be dragged from the search results panel at the bottom of the screen to the 'Input data' field.

**Target CRS identifier:** This field defines the target coordinate reference system (CRS). It must be a string beginning with 'EPSG:', appended by a numeric code that is a valid system as defined by the European Petroleum Survey Group (EPSG). For UTM zones in the northern hemisphere and with the WGS84 datum, the numeric code is 32600 + the UTM zone number. An example of a valid CRS specification is EPSG:32615, where "6" or "7" defines Northern/Southern hemisphere, and 15 represents the UTM zone.



**Area of interest (AOI):** An AOI to be processed is inserted here. The AOI should be large enough that it includes enough reference data for all target class. This can be copied from an area drawn on the map by pressing the 'Copy From Map' icon. Alternatively, it can be specified in the Well-Known Text (WKT) POLYGON format. An example of a valid specification is: POLYGON((-92.906633 16.190411,-92.066559 16.188383,-92.070266 15.376645,-92.907004 15.378567,-92.906633 16.190411)).

**Beginning of name of output GeoTiff file:** The beginning of the output file name. Date and time are added to obtain unique file names (to prevent accidental overwrite).

**Target Image Resolution:** The requested output image pixel spacing (in metres) is inserted here. For Sentinel-2 optical data, the most feasible value is 10 (the pixel spacing of the input data).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

#### 4.9.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as SNAP or QGIS. Soon after the desired application process (e.g. QGIS) is started, a 'Go to GUI' icon appears in the job description. You can access the desired GUI application by clicking this icon which opens the GUI in another browser tab.



## 4.10 ALSMetrics

### 4.10.1 Service description:

The ALSMetrics derives metrics from airborne laser scanning data into a raster file that is suitable for joint use with Sentinel-2 data.

The output GeoTiff raster has six bands, each band including single metric. The output has only integer values, and the original derived metrics have been scaled (Table 1). The output raster datatype is UInt16 and no data value is 0.

*Table 1. Description of the output bands. The original values of kurtosis and skewness were occasionally negative. Hence, first 10 was added to the value and then it was scaled by 1000.*

Band number	Description	Scaling	Units
Band 1	95th percentile of height	value $\times$ 1000	Original value: meters
Band 2	Maximum height	value $\times$ 1000	Original value: meters
Band 3	Average height	value $\times$ 1000	Original value: meters
Band 4	Standard deviation of heights	value $\times$ 1000	Original value: meters
Band 5	Kurtosis of heights	(value + 10) $\times$ 1000	–
Band 6	Skewness of heights	(value + 10) $\times$ 1000	–

User defines the area of interest (AOI) for which the metrics are gathered. The AOI should be a square or at least a rectangular. The user is responsible for providing the required ALS data files. The point cloud data is filtered so that only the first returns are used and points below 1.30 m and above 35.00 m are ignored.

The user defines also the window size for the sampling. Suitable choices are 2, 5, 10, 20, 40 and 60 meters. The output area of the service is defined by the minimum and maximum eastern/northern extents of the input AOI. The output area is adjusted so that it aligns with Sentinel-2 pixel boundaries and so that the height and width of the produced image are divisible by the pixel size.

#### 4.10.2 Input data:

The service takes airborne laser scanning data in LAS format as input.

#### 4.10.3 Parameters:

(mandatory parameters are marked with \*)

**Airborne laser scanning data \***: Data in LAS format, file extensions .las and .laz allowed.

**Area of interest \***: A polygon in Well Known Text (WKT) longitude latitude format (POLYGON((lon1 lat1, lon2 lat2, ..., lon1 lat1))), can be copied from the map or given as a string. If the longitude values in the range [-180,180] and the latitude values are in the

range [-90,90] it is assumed the values are in WGS84 degrees, otherwise in output projection units.

**Output EPSG code \*:** EPSG code for the projection used in the output image, e.g. 3067 in Finland.

**Window size:** Pixel size in the output image. Suitable choices are 2, 5, 10, 20, 40 and 60 meters, default is 10 meters.

**Output image name:** The name of the generated output GeoTiff file. The default is ALS\_metrics\_<timestamp>.tif.

**Label:** Optional tag for identifying this job

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. The resulting output can be downloaded, re-used or displayed in one of the GUI applications, such as Sentinel Toolbox or QGIS.



## 5 Application services

### 5.1 Monteverdi

#### 5.1.1 Service description

Monteverdi, provided within the Orfeo Toolbox v 5.8.0, is a GUI application that allows users to view, edit and analyse satellite imagery and data products. This service runs the Monteverdi application in a browser tab on any image either produced inside the F-TEP system or resulting from a search query. Comprehensive advice about how to use Monteverdi within the Orfeo Toolbox is provided here: <https://www.orfeo-toolbox.org/CookBook/Monteverdi.html>

#### 5.1.2 Input data

As input data, the Monteverdi service requires an input image or product which the user wants to open in Monteverdi.

#### 5.1.3 Parameters

**Input data:** Input image or product file name is inserted here. It can be dragged from the result list of a search or job run previously.

**Timeout:** A timeout in minutes before the application automatically shuts down is inserted here. Note, this is not an inactivity timer but a hard limit after which the service shuts down (unless terminated earlier by clicking the 'Terminate this job' icon in the job description).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

#### 5.1.4 Usage

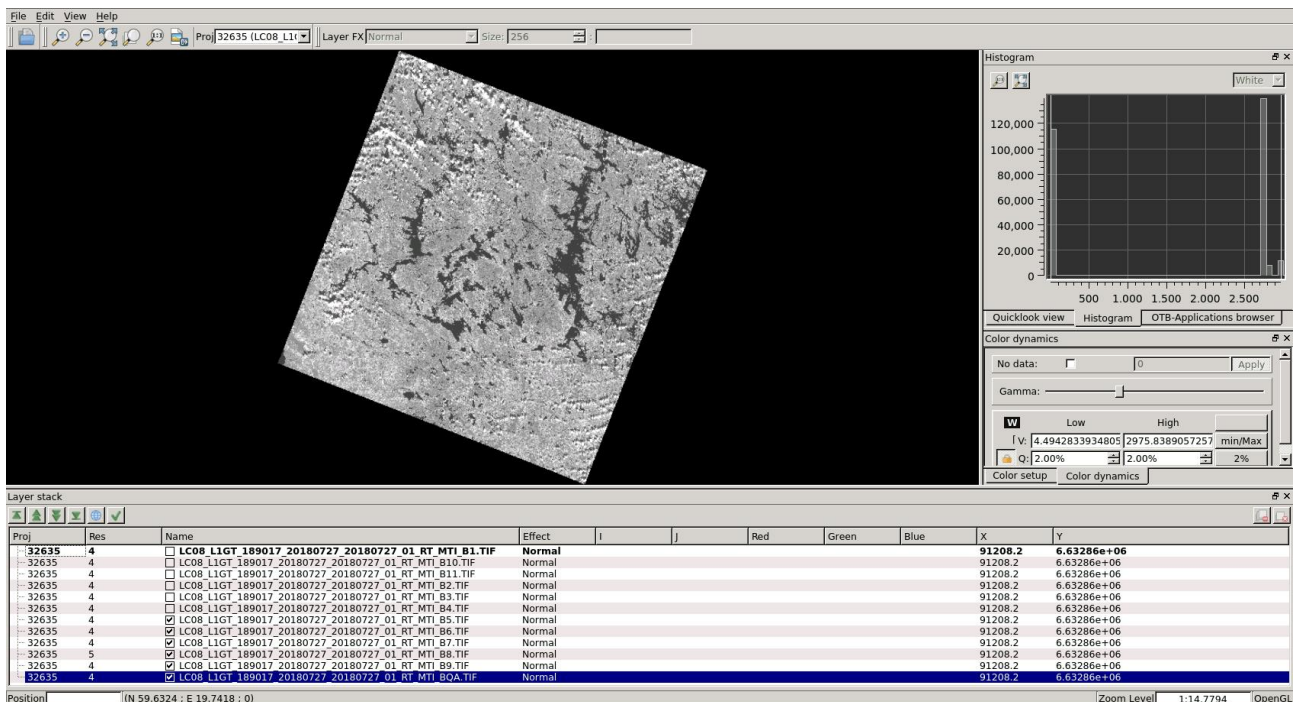
After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. This starts a 'Job' which can be seen in the 'Job' tab on the results panel at the bottom of the map panel. The job runs through three different states: 1. Fetching data, 2. Processing and 3. Completed. While in the status 'Processing', the user can open a browser interface of the application and use the selected inputs.

When the Monteverdi service job reaches 'Processing' status, a 'Go to GUI' icon appears in the job description. By clicking on the "Go to GUI" icon a user is presented - in a new browser tab - a login panel to access the graphical interface of the Monteverdi application. By clicking the OK button the user is directly to the Monteverdi interface.

If the user e.g. wants to open a Landsat 8 image in the Monteverdi application, the desired image can be dragged directly from the search results to the Monteverdi service 'Input data' field.

A while after launching the service, the 'Go to GUI' icon appears in the job description. By clicking the icon, and accepting the login screen, the user can reach the Monteverdi application.

After accepting the 'Multi-resolution pyramid' screen, the image will open (bands separated in different files). If no image/product opens automatically, the user can look for the data at 'File' → 'Open image' → 'InDir' → 'Inputfile' → and select the desired file. Below image shows Landsat 8 band 5 visible in the Monteverdi application. All the functionalities (including Orfeo Toolbox if selected under 'View' → 'OTB applications browser') are now the user's disposal.



## 5.2 QGIS v2.18

### 5.2.1 Service description

QGIS (previously known as Quantum GIS) is a cross-platform free and open source desktop geographic information system (GIS) application that provides data viewing, editing, and analysis capabilities. This service runs the QGIS version 2.18 application in a browser tab on any image either produced inside the F-TEP system or resulting from a search query. Further guidance on QGIS functionalities can be found here:

<https://www.qgis.org/en/site/about/index.html>

### 5.2.2 Input data

As input data, the QGIS service requires and input image or product which the user wants to open in QGIS.

### 5.2.3 Parameters

**Input data:** Input image or product file name is inserted here. It can be dragged from the result list of a search or job run previously.

**Timeout:** A timeout in minutes before the application automatically shuts down is inserted here. Note, this is not an inactivity timer but a hard limit after which the service shuts down (unless terminated earlier by clicking the 'Terminate this job' icon in the job description).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

### 5.2.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. This starts a 'Job' which can be seen in the 'Job' tab on the results panel at the bottom of the map panel. The job runs through three different states: 1. Fetching data, 2. Processing and 3. Completed. While in the status 'Processing', the user can open a browser interface of the application and use the selected inputs.

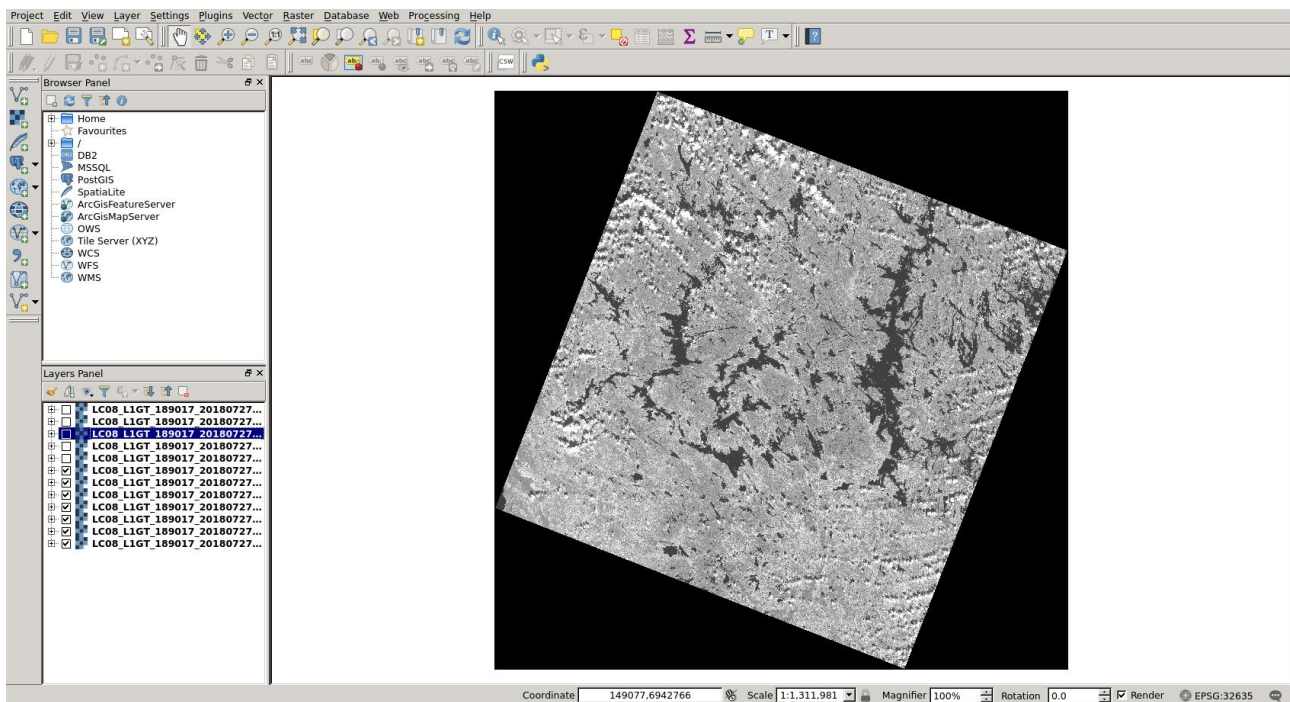
When the QGIS service job reaches 'Processing' status, a 'Go to GUI' icon appears in the job description. By clicking on the "Go to GUI" icon a user is presented - in a new browser tab - a login panel to access the graphical interface of the QGIS application. By clicking the OK button the user is directly to the QGIS interface.



If the user e.g. wants to open a Landsat 8 image in the QGIS application, the desired image can be dragged directly from the search results to the QGIS service 'Input data' field.

A while after launching the service, the 'Go to GUI' icon appears in the job description. By clicking the icon, and accepting the login screen, the user can reach the QGIS application.

QGIS will automatically open the Landsat 8 image (bands separated in different files). If no image/product opens automatically, the user can look for the data at 'Layer' à 'Add Layer' à 'Add Raster Layer' à 'InDir' à 'Inputfile' and select the desired file. Below image shows Landsat 8 band 5 visible in the QGIS application. All the functionalities of QGIS are now the user's disposal.



## 5.3 QGIS v3.6

### 5.3.1 Service description

QGIS (previously known as Quantum GIS) is a cross-platform free and open source desktop geographic information system (GIS) application that provides data viewing, editing, and analysis capabilities. This service runs the QGIS version 3.6 application in a browser tab on any image either produced inside the F-TEP system or resulting from a search query. Further guidance on QGIS functionalities can be found here:

<https://www.qgis.org/en/site/about/index.html>

### 5.3.2 Input data

As input data, the QGIS service requires an input image or product which the user wants to open in QGIS.

### 5.3.3 Parameters

**Input data:** Input image or product file name is inserted here. It can be dragged from the result list of a search or job run previously.

**Timeout:** A timeout in minutes before the application automatically shuts down is inserted here. Note, this is not an inactivity timer but a hard limit after which the service shuts down (unless terminated earlier by clicking the 'Terminate this job' icon in the job description).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

### 5.3.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. This starts a 'Job' which can be seen in the 'Job' tab on the results panel at the bottom of the map panel. The job runs through three different states: 1. Fetching data, 2. Processing and 3. Completed. While in the status 'Processing', the user can open a browser interface of the application and use the selected inputs.

When the QGIS service job reaches 'Processing' status, a 'Go to GUI' icon appears in the job description. By clicking on the "Go to GUI" icon a user is presented - in a new browser tab - a login panel to access the graphical interface of the QGIS application. By clicking the OK button the user is directly to the QGIS interface.

## 5.4 SNAP

### 5.4.1 Service description

The Sentinel Application Platform (SNAP) consists of a rich set of visualisation, analysis and processing tools for the exploitation of Sentinel data. It also supports other ESA Earth Observation missions, such as Envisat (MERIS & AATSR), ERS (ATSR), as well as third party data from RapidEye, SPOT, MODIS (Aqua and Terra), Landsat (TM), ALOS (AVNIR & PRISM) and others. The various tools can be run from an intuitive desktop application or via a command-line interface. A rich application programming interface allows for development of plugins using Java or Python. This service runs the SNAP application in a browser tab on any image either produced inside the F-TEP system or resulting from a search query. Further guidance on SNAP functionalities can be found here: <http://step.esa.int/main/toolboxes/snap/>

### 5.4.2 Input data

As input data, the SNAP service requires an input image or product which the user wants to open in SNAP.

### 5.4.3 Parameters

**Input data:** Input image or product file name is inserted here. It can be dragged from the result list of a search or job run previously.

**Timeout:** A timeout in minutes before the application automatically shuts down is inserted here. Note, this is not an inactivity timer but a hard limit after which the service shuts down (unless terminated earlier by clicking the 'Terminate this job' icon in the job description).

**Label:** OPTIONAL. Allows free form tagging for later identification of this processing job.

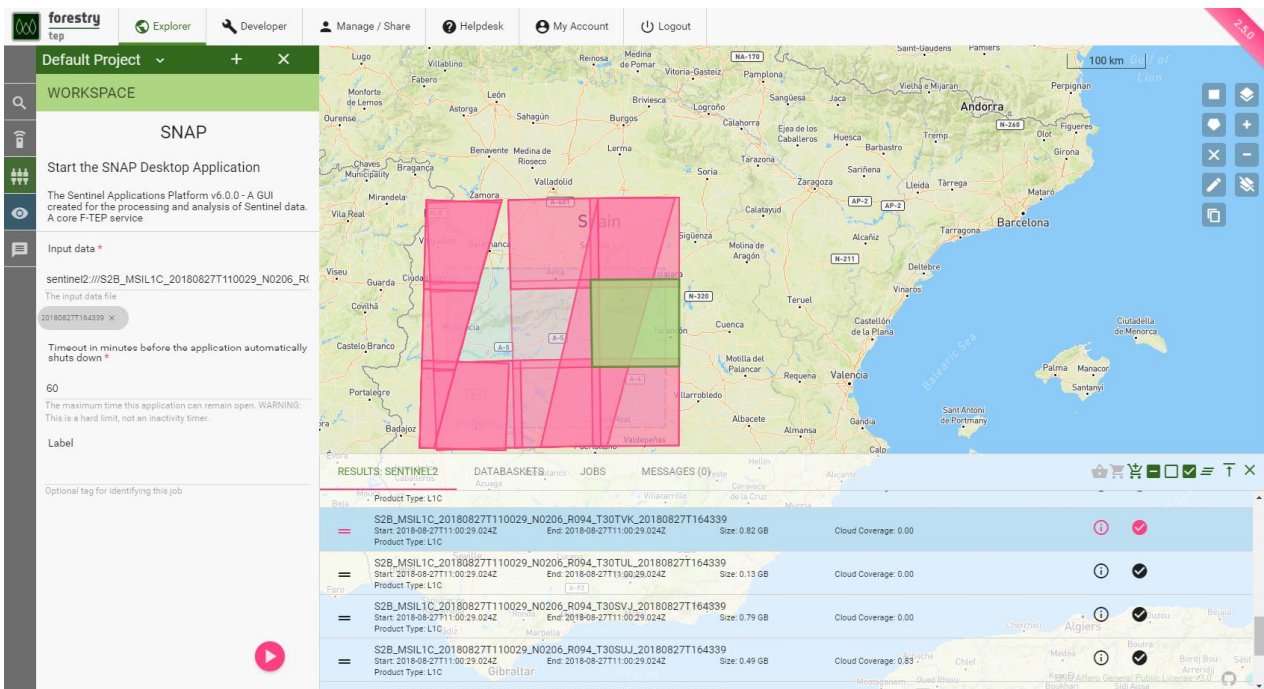
### 5.4.4 Usage

After all input fields have been filled in, the service is launched by clicking the round play button at the bottom right corner of the input dialogue area. This starts a 'Job' which can be seen in the 'Job' tab on the results panel at the bottom of the map panel. The job runs through three different states: 1. Fetching data, 2. Processing and 3. Completed. While in the status 'Processing', the user can open a browser interface of the application and use the selected inputs.

When the SNAP service job reaches 'Processing' status, a 'Go to GUI' icon appears in the job description. By clicking on the "Go to GUI" icon a user is presented - in a new browser tab - a login panel to access the graphical interface of the SNAP application. By clicking the OK button the user is directly to the SNAP interface.

If the user e.g. wants to open a Sentinel-2 image in the SNAP application, the desired image can be dragged directly from the search results to the SNAP service 'Input data' field, as seen in the image here:

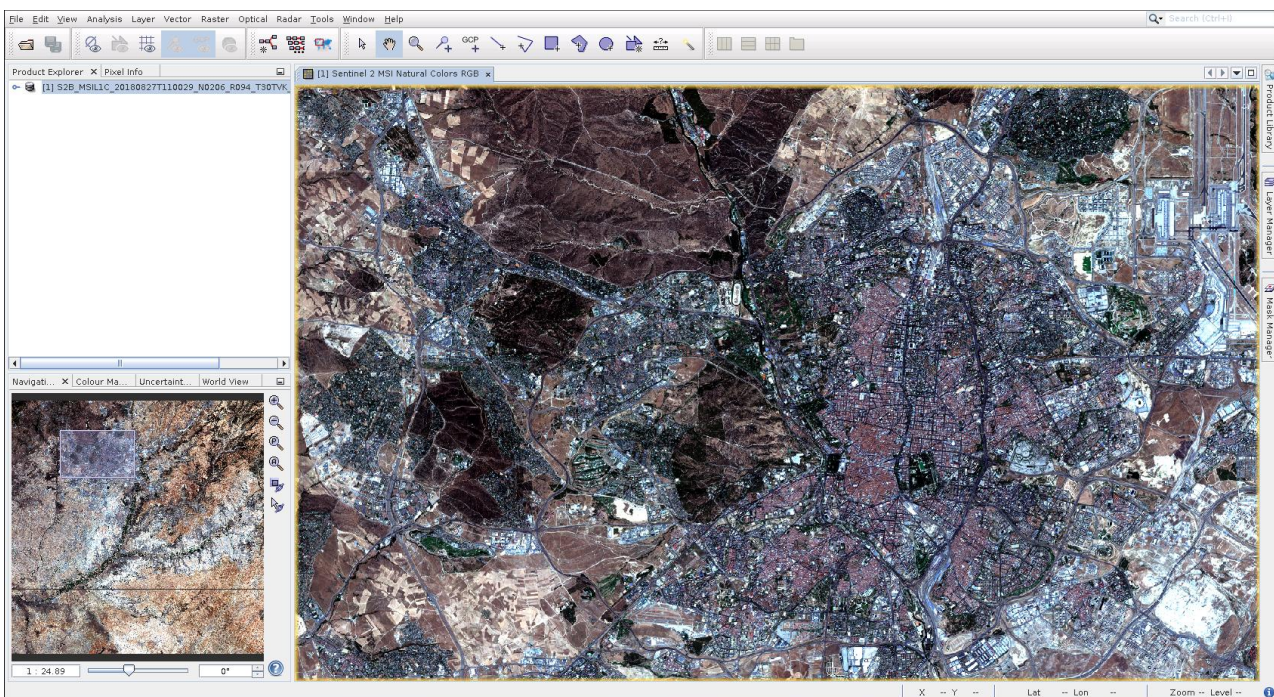




A while after launching the service, the 'Go to GUI' icon appears in the job description. By clicking the icon, and accepting the login screen, the user can reach the SNAP application.



The Sentinel-2 image can be seen listed in the 'Product explorer'. The user may e.g. want to view the image (right click the product name à 'Open RGB image window') or perform any other work on the image using the SNAP functionalities which are all at the user's disposal. If no image/product opens automatically, the user can look for the data at 'File' à 'Open Product' à 'InDir' à 'Inputfile' and select the desired file. Below image shows a natural colour Sentinel-2 image opened in in the SNAP application.



[Can you recognize the capital city in the image?]

## 6 Advanced features

### 6.1 Forestry TEP API

Forestry provides also an Application Programming Interface (API) for interconnecting between systems. This allows the user to (e.g.):

- Query the data catalogue (HTTP GET)
- Query the available services and their parameters
- Create and launch processing jobs
- Retrieve outputs of the completed job

The API is based on Spring Data REST, with JSON contents. It allows authenticated use of the F-TEP resources (services, data, processing) from external systems.

Please refer to <https://f-tep.com/usermanual> to access an up-to-date API documentation.

### 6.2 Service development

One of the key features of Forestry TEP is the ability for users to create new processing services on the platform. The users can shape the services that F-TEP already offers or develop brand new services. This feature has also a collaborative aspect, as the developer can optionally share the service with others or make it public to all, giving other users the chance to use novel algorithms and processors on a satellite data tailored for their needs.

Please refer to <https://f-tep.com/usermanual> to access an up-to-date service development guide.