

# → 9th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING: AGRICULTURE

16–20 September 2019  
Université catholique de Louvain | Belgium

Mapping cropland and crop type from S2  
time series (Sen2-Agri)

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Hosted by

The UCLouvain logo features a blue square with a white 'U' and the text 'UCLouvain' to its right.

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# Training outline

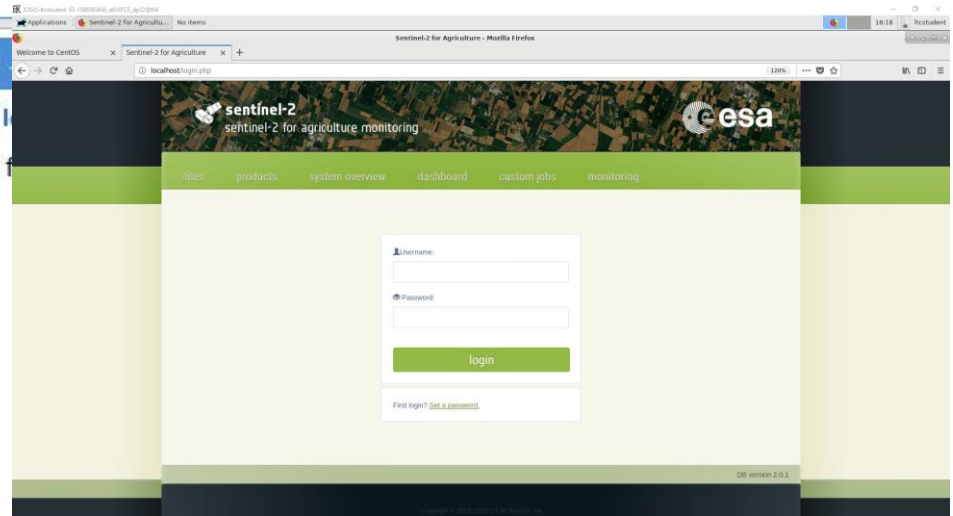
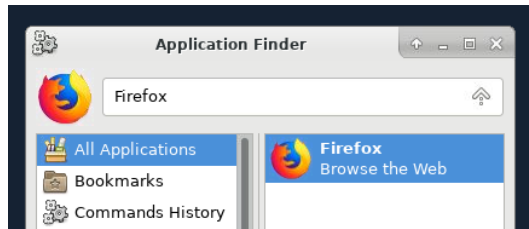
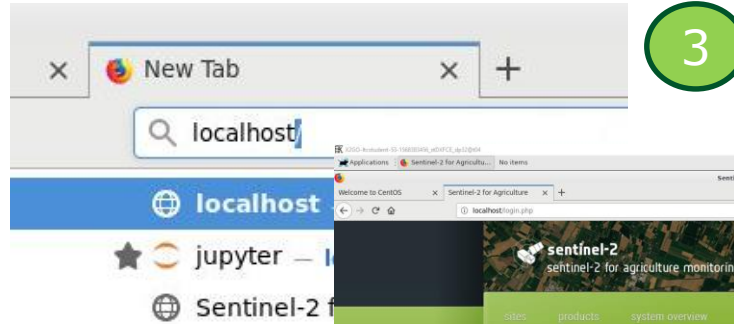
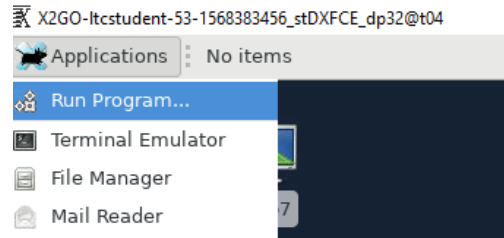
- Launch crop mask and crop type products through Sen2-Agri
- Prepare in situ data
- Understand the crop classification principles on SNAP
- Explore the Sen2-Agri crop mask and crop type products

# Training outline

- Launch crop mask and crop type products through Sen2-Agri
- Prepare in situ data
- Understand the crop classification principles on SNAP
- Explore the Sen2-Agri crop mask and crop type products

# Access to your Sen2-Agri system (web interface)

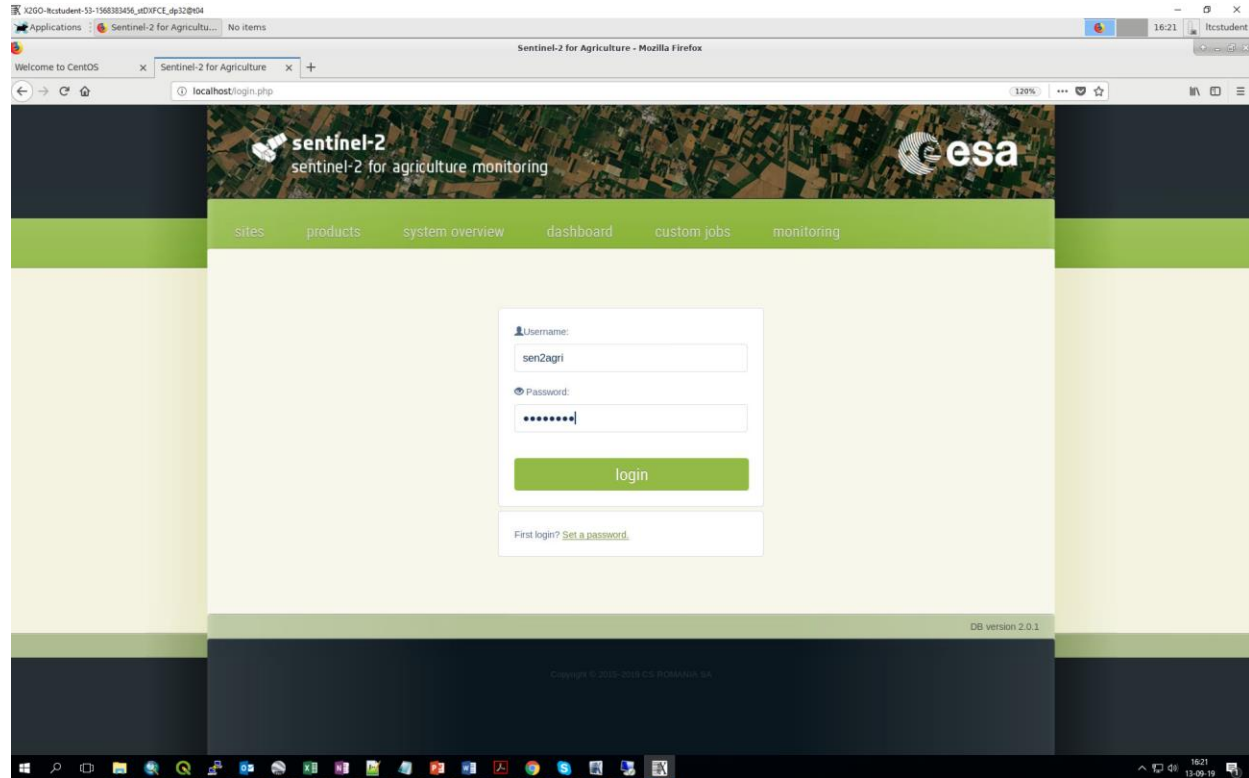
- Open Firefox
- Write « localhost »



# Access to your Sen2-Agri system (web interface)

## ➤ Login

- Username = sen2agri
- Password = sen2agri



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# Sen2-Agri system overview

➤ « sites » tab

The screenshot shows the 'sites' tab in the Sen2-Agri system. At the top, there is a header with the 'sentinel-2' logo and the text 'sentinel-2 for a'. Below the header, there are navigation tabs for 'sites', 'products', and 'system'. A 'Create new site' button is visible. A table lists existing sites:

Site name	Short name
Site 2 tiles	site_2_tiles
Wallonia Subset	wallonia_subset

The 'Edit Site' dialog box is shown, allowing users to modify site details. It includes the following fields and options:

- Site name:** A text input field containing 'Site 2 tiles'.
- Enabled sensor:** A section with two options:
  - S2: 31UFS,31UFR
  - L8: 196026,198025,198026,199024,199025,198024,197024,197025,197026
- List of Seasons:** A table with columns for Season name, Season start, Season mid, Season end, Enabled, Active processors, and Action.
- Enable site:** A toggle switch currently set to 'ON'.
- Insitu data:** A green bar representing a data source.
- Strata data:** A green bar representing a data source.
- Buttons:** 'Delete Site' (red), 'Save Site' (green), and 'Abort' (green).

This screenshot shows the 'Edit' and 'Enabled' controls for a site. The 'Edit' button is circled in red. Below it, there are two 'Enabled' toggle switches, both currently set to 'ON'.

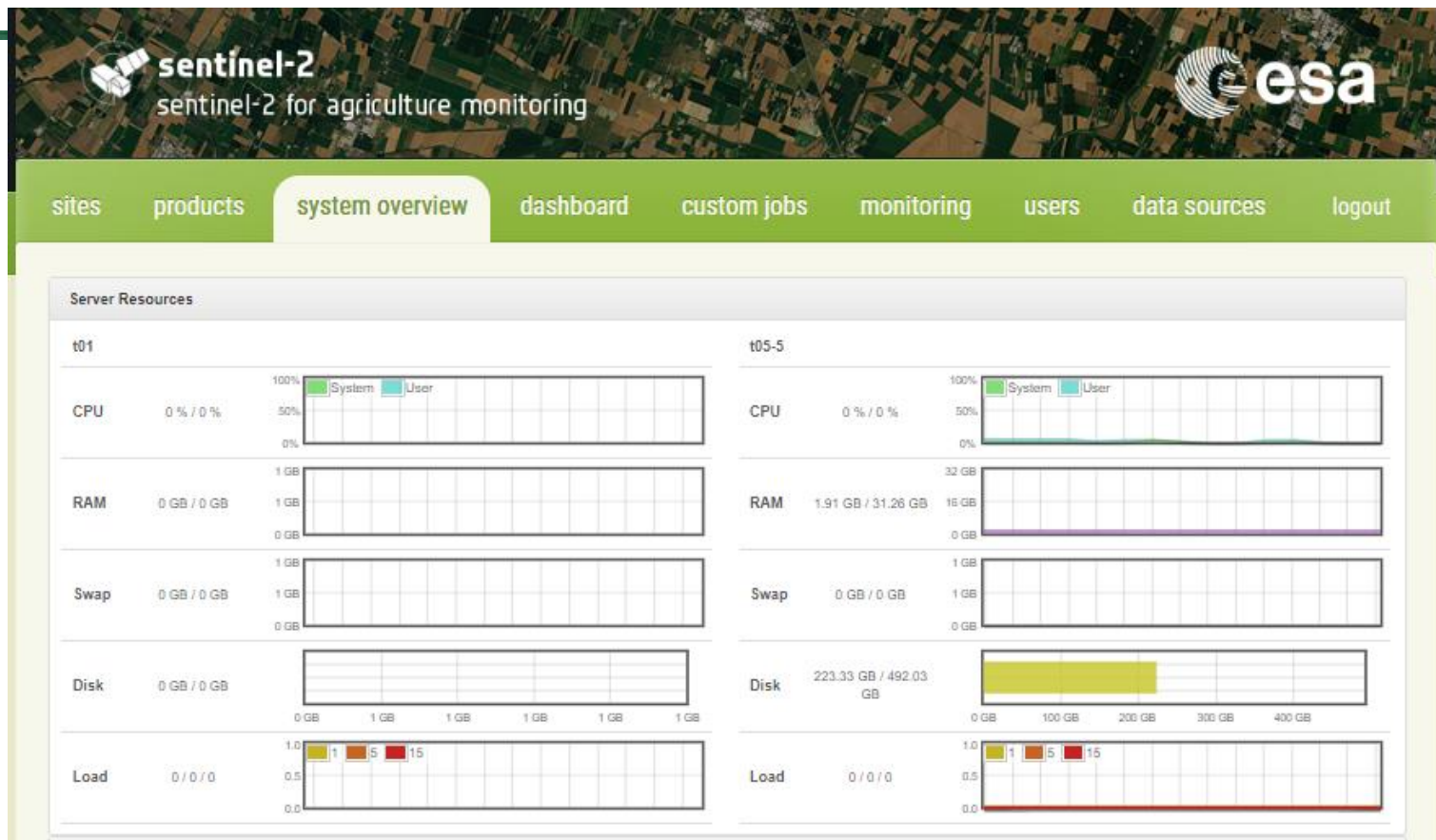
# Sen2-Agri system overview

➤ « products »  
tab

The screenshot displays the Sen2-Agri system interface. At the top, there is a header with the text "sentinel-2 for agriculture monitoring" and the ESA logo. Below the header is a navigation bar with tabs for "sites", "products", "system overview", "dashboard", "custom jobs", "monitoring", "users", "data sources", and "logout". The "products" tab is currently selected. On the left side, there is a "Filter" section with a "Reset Filter" button. Below the filter, there is a list of data files under the heading "Site 2 tiles" and "Wallonia Subset". The files are listed with their IDs, such as "S2A\_MSIL2A\_20180121T105341\_N0206\_R051\_T31UF". The right side of the interface shows a map of a region in Belgium, with a red dashed bounding box highlighting a specific area. The map includes labels for various locations like Tervuren, Overijse, Beauvechain, and Louvain-la-Neuve.

# Sen2-Agri system overview

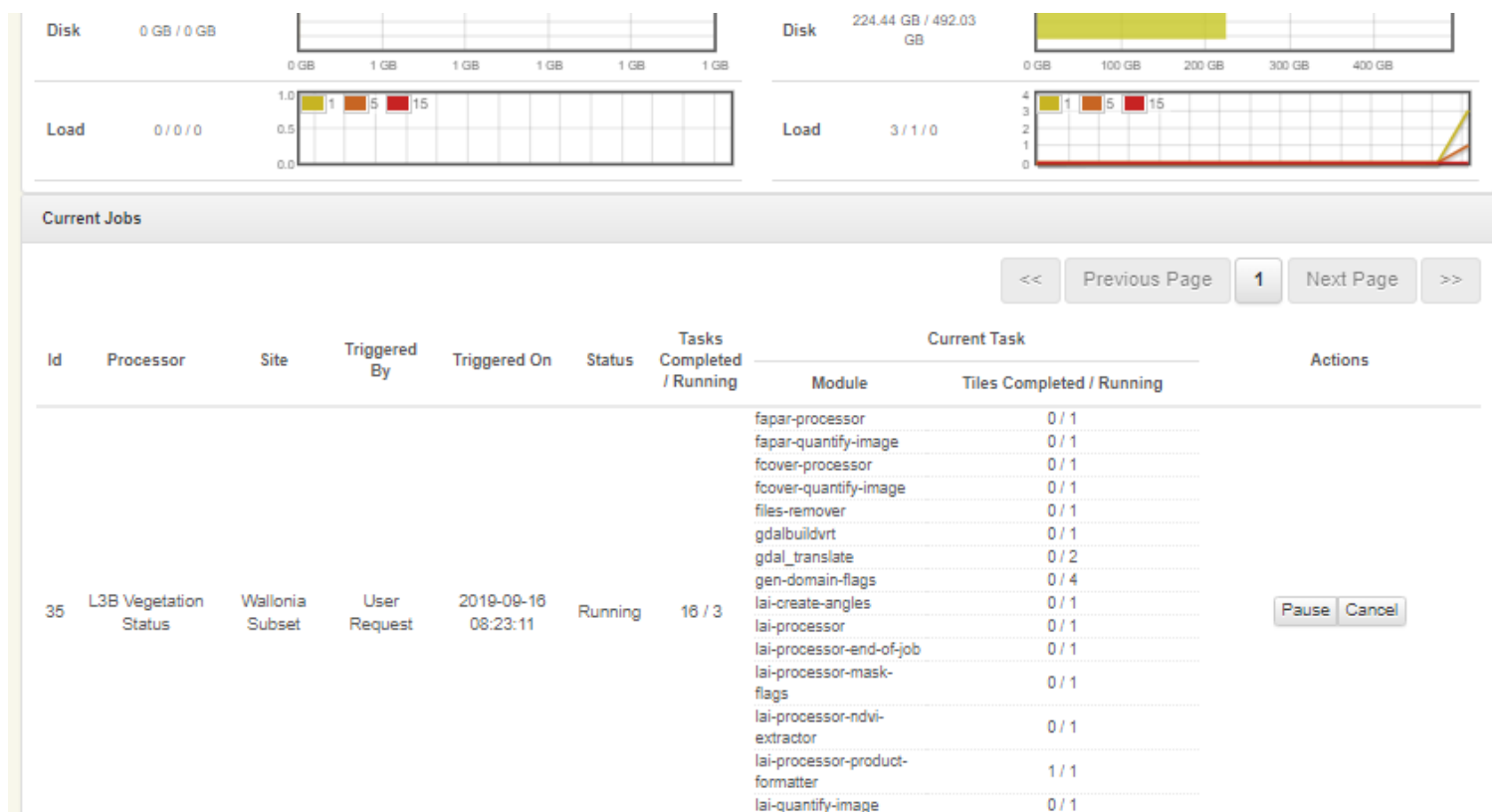
➤ « system overview » tab





# Sen2-Agri system overview

➤ « system overview » tab



# Sen2-Agri system overview

➤ « dashboard »  
tab

**sentinel-2**  
sentinel-2 for agriculture monitoring

esa

sites products system overview **dashboard** custom jobs monitoring users data sources logout

L3A Composite L3B Vegetation Status L3E Pheno NDVI metrics L4A Crop Mask L4B Crop Type

**Resource Utilization**

Last Run On	2019-09-12 03:51:36
Average Duration	00:04:35.001
Average User CPU	00:14:58.496
Average System CPU	00:01:14.483
Average Max RSS	0.00 MB
Average Max VM	0.00 MB
Average Disk Read	0.00 MB
Average Disk Write	0.00 MB

**Default Configuration**

preproc.scattoeffs_10m	/usr/share/sen2agri/scattering_coeffs_10m.txt
weight.aot.maxaot	0.8
weight.aot.minweight	0.33
weight.aot.maxweight	1
weight.cloud.coarseresolution	240
weight.cloud.sigmasmall	2
weight.cloud.sigmalarge	10
weight.total.weightdatemin	0.5
bandsmapping	/usr/share/sen2agri/bands_mapping_s2.txt
synth_date_sched_offset	30
half_synthesis	25
generate_20m_s2_resolution	1
preproc.scattoeffs_20m	/usr/share/sen2agri/scattering_coeffs_20m.txt
lut_path	/usr/share/sen2agri/composite.map
sched_wait_proc_inputs	1

**Output**

Number of Products	12
Average Tiles per Product	115.67
Average Duration per Tile	00:00:02.327

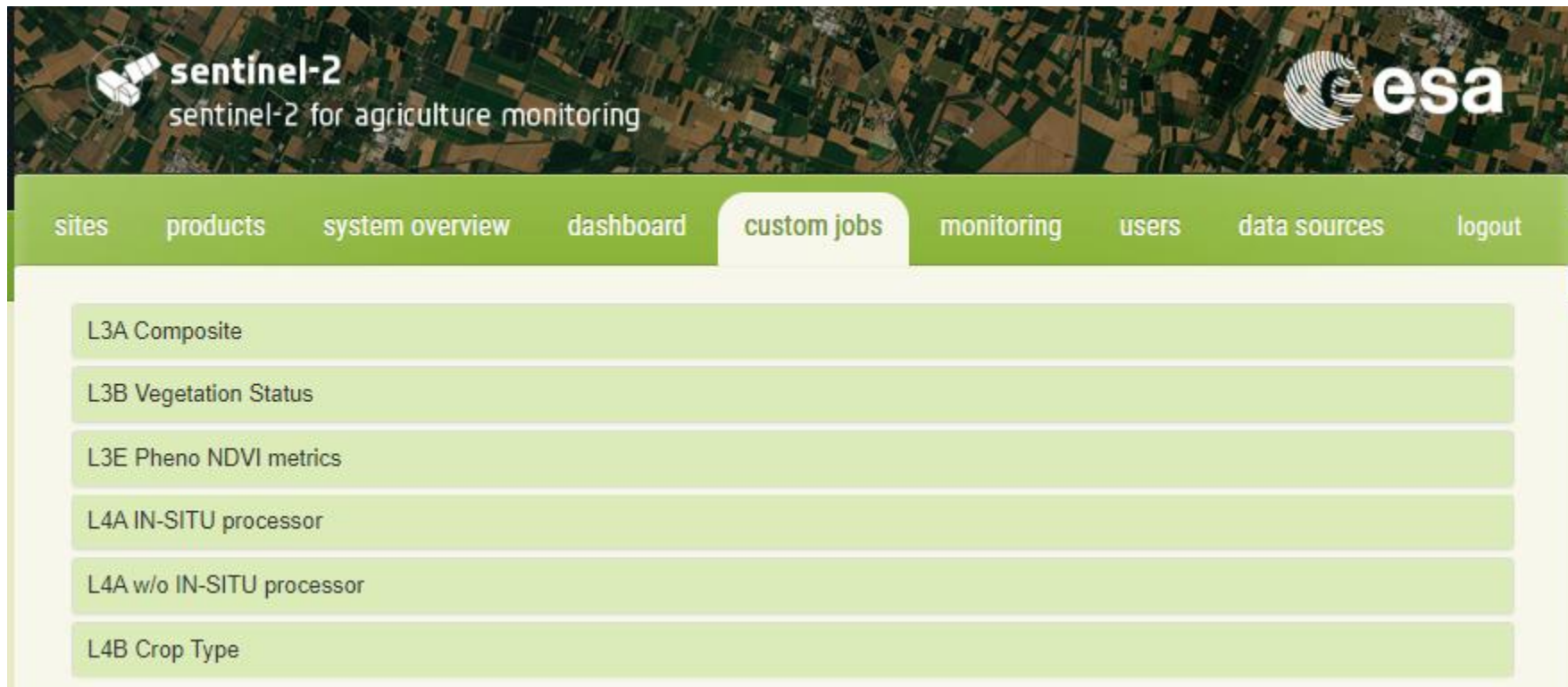
**Add New Job**

Job name	Site name	Season name	Schedule type	First run time	Repeat	Action
WalloniaL3A	Wallonia Subset	2018	Repeat	2018-02-01 00:00:00	Every 1 day of month	Save Delete

Repeat  
Once  
Cycle  
Repeat

# Sen2-Agri system overview

➤ « custom jobs » tab

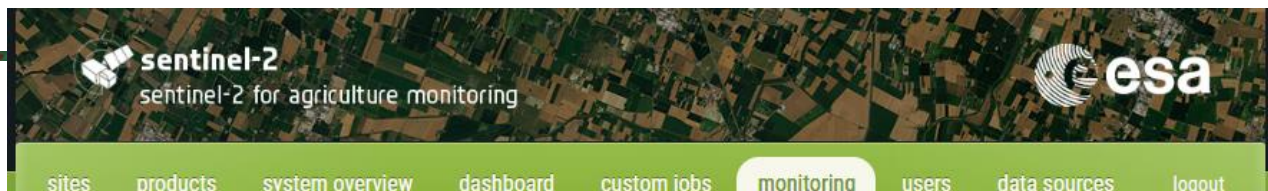


The screenshot shows the 'custom jobs' tab in the Sen2-Agri system. The header features a satellite image of agricultural fields, the 'sentinel-2' logo with the text 'sentinel-2 for agriculture monitoring', and the ESA logo. The navigation bar includes links for 'sites', 'products', 'system overview', 'dashboard', 'custom jobs' (highlighted), 'monitoring', 'users', 'data sources', and 'logout'. Below the navigation bar, a list of job types is displayed in light green boxes:

- L3A Composite
- L3B Vegetation Status
- L3E Pheno NDVI metrics
- L4A IN-SITU processor
- L4A w/o IN-SITU processor
- L4B Crop Type

# Sen2-Agri system overview

➤ « monitoring » tab



```
Command.txt
1 CropTypeFused.py -refp /mnt/upload/Wallonia_Subset/sen2agri_1568226400/WALLONIA_2018_IN_SITU_SUBSET_500.shp -ratio 0.75 -classifier kf -iseed 0 -pksize 10 -kfnbtkces 100 -ifmax 25 -ifmin 25 -tile-threads-hint 4 -siteid 2 -outdir
/mnt/archive/orchestrator_temp/14b/21/2054-crop-type-fused/ -targetfolder /mnt/archive/wallonia_subset/14b/ -outdirpds /mnt/archive/orchestrator_temp/14b/21/2054-crop-type-fused/product_properties.txt -input
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180304T104019_N0206_R008_T31UFS_20180304T124212.SAFE/SENTINEL2B_20180304-104407-968_L2A_T31UFS_C_V1-0/SENTINEL2B_20180304-104407-968_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180314T104019_N0206_R008_T31UFS_20180314T104014-461_L2A_T31UFS_C_V1-0/SENTINEL2B_20180314-104014-461_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180324T104019_N0206_R008_T31UFS_20180324T124438.SAFE/SENTINEL2B_20180324-104016-456_L2A_T31UFS_C_V1-0/SENTINEL2B_20180324-104016-456_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180406T105029_N0206_R051_T31UFS_20180406T125448.SAFE/SENTINEL2B_20180406-105331-061_L2A_T31UFS_C_V1-0/SENTINEL2B_20180406-105331-061_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2A_MSIL2A_20180408T104021_N0206_R008_T31UFS_20180408T124948.SAFE/SENTINEL2A_20180408-104539-942_L2A_T31UFS_C_V1-0/SENTINEL2A_20180408-104539-942_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2A_MSIL2A_20180418T104021_N0206_R008_T31UFS_20180418T125356.SAFE/SENTINEL2A_20180418-104912-083_L2A_T31UFS_C_V1-0/SENTINEL2A_20180418-104912-083_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2A_MSIL2A_20180421T105031_N0206_R051_T31UFS_20180421T125911.SAFE/SENTINEL2A_20180421-105629-238_L2A_T31UFS_C_V1-0/SENTINEL2A_20180421-105629-238_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180423T104019_N0206_R008_T31UFS_20180423T101230.SAFE/SENTINEL2B_20180423-104441-217_L2A_T31UFS_C_V1-0/SENTINEL2B_20180423-104441-217_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180503T104019_N0206_R008_T31UFS_20180503T132654.SAFE/SENTINEL2B_20180503-104209-695_L2A_T31UFS_C_V1-0/SENTINEL2B_20180503-104209-695_L2A_T31UFS_C_V1-0_MTD_ALL.xml
/store/s2a_archive/maccs_def/wallonia_subset/12a/S2B_MSIL2A_20180506T105029_N0206_R051_T31UFS_20180506T155709.SAFE/SENTINEL2B_20180506-105423-569_L2A_T31UFS_C_V1-0/SENTINEL2B_20180506-105423-569_L2A_T31UFS_C_V1-0_MTD_ALL.xml
-maskpds /mnt/archive/wallonia_subset/14a//S2AGRI_L4A_PRD_S2_20190911T010243_V20180304_20180806 -lut /usr/share/sen2agri/crop-type.lut
```

Step name	Command	Output	Errors	Exit code
CropTypeFused	[Copy to clipboard]	[Copy to clipboard]	[Copy to clipboard]	0

Start type	Output
35 - L3B Vegetation Status	Wallonia Subset Finished Requested [output]
34 - L4B Crop Type	Wallonia Subset Cancelled Requested [output]
33 - L3A Composite	Wallonia Subset Finished Scheduled [output]
32 - L3A Composite	Wallonia Subset Finished Scheduled [output]
31 - L3A Composite	Wallonia Subset Finished Scheduled [output]



# Sen2-Agri system overview

➤ « users » tab

The screenshot shows the 'users' tab in the Sen2-Agri system. At the top, there is a header with the Sentinel-2 logo and the text 'sentinel-2 for agriculture monitoring', and the ESA logo on the right. Below the header is a navigation bar with tabs: 'sites', 'products', 'system overview', 'dashboard', 'custom jobs', 'monitoring', 'users' (selected), 'data sources', and 'logout'. The main content area features a green 'Add new user' button, a 'Show 10 entries' dropdown, and a search box. Below these is a table with columns for 'Login', 'Email', 'Role', 'Sites', and 'Actions'. The table contains one entry for 'sen2agri' with email 'sen2agri@c-s.ro' and role 'admin'. At the bottom of the table area, it says 'Showing 1 to 1 of 1 entries' and has 'Previous', '1', and 'Next' navigation buttons.



sentinel-2  
sentinel-2 for agriculture monitoring

esa

sites products system overview dashboard custom jobs monitoring **users** data sources logout

Add new user

Show 10 entries Search:

Login	Email	Role	Sites	Actions
sen2agri	sen2agri@c-s.ro	admin		 

Showing 1 to 1 of 1 entries Previous 1 Next

# Sen2-Agri system overview

➤ « datasource »  
tab

The screenshot displays the 'datasources' configuration interface for the Sen2-Agri system. The header features the 'sentinel-2' logo and the text 'sentinel-2 for agriculture monitoring' alongside the ESA logo. The navigation menu includes 'sites', 'products', 'system overview', 'dashboard', 'custom jobs', 'monitoring', 'users', 'data sources', and 'logout'. The main content area lists four data sources: 'Landsat8 - Amazon Web Services', 'Landsat8 - USGS', 'Sentinel2 - Amazon Web Services', and 'Sentinel2 - Scientific Data Hub'. The 'Sentinel2 - Scientific Data Hub' configuration form is expanded, showing the following settings:

- Scope:** A dropdown menu with options: Query, Download, Query, Query and download, and Overwrite. 'Query' is selected.
- Enable:** A toggle switch set to 'ON'.
- Local root:** An empty text input field.
- Download path:** A text input field containing '/mnt/archive/dwn\_defis2/default'.
- Max connections:** A text input field containing '2'. Below it, the text 'Connections between 1 and 8.' is displayed.
- Max retries:** A text input field containing '72'.
- User:** A text input field containing 'tdemaet'.
- Password:** A password input field with a masked password '.....' and a visibility toggle icon.

A green 'Save' button is located at the bottom of the configuration form.

# Launch crop mask and crop type products through Sen2-Agri

➤ Go in the « custom jobs » tab

The screenshot shows the Sen2-Agri web interface. At the top, there is a header with the Sentinel-2 logo and the text "sentinel-2 for agriculture monitoring". Below the header is a navigation menu with tabs: "sites", "products", "system overview", "dashboard", "custom jobs", "monitoring", and "user". The "custom jobs" tab is selected. Below the navigation menu, there is a list of product options:

- L3A Composite
- L3B Vegetation Status
- L3E Pheno NDVI metrics
- L4A IN-SITU processor
- L4A w/o IN-SITU processor
- L4B Crop Type

Three green callout boxes with arrows pointing to the product options are overlaid on the screenshot:

1. Crop mask with in situ data (L4A) - points to "L4A IN-SITU processor"
2. Crop mask without in situ data (L4A) - points to "L4A w/o IN-SITU processor"
3. Crop type map with in situ (L4B) - points to "L4B Crop Type"

At the bottom of the interface, there is a footer with the text "Logged in as sen2agri | DB version 2.0.1" and "Copyright © 2015-2019 CS ROMANIA SA".

# Launch a crop mask through Sen2-Agri (L4A)

- Select your site = Wallonia Subset
- Select your input L2A images
  - From 2018-03-01 To 2018-05-31
  - Filter
  - Highlight in blue from the list (all or selected ones)

L4A IN-SITU processor

Site:\*  
Wallonia Subset

Filter Criteria For Input Files

Sensor:  S2  L8

Tiles  
31UFS

Tiles  
198025, 19

May 2018						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19

## Available input files:\*

S2A\_MSIL2A\_20180508T104031\_N0206\_R008\_T31UFS\_20180508T175127.SAFE  
S2A\_MSIL2A\_20180518T104021\_N0206\_R008\_T31UFS\_20180518T124554.SAFE  
S2A\_MSIL2A\_20180521T105031\_N0206\_R051\_T31UFS\_20180521T111327.SAFE  
S2A\_MSIL2A\_20180528T104021\_N0206\_R008\_T31UFS\_20180528T110304.SAFE  
S2A\_MSIL2A\_20180531T105031\_N0206\_R051\_T31UFS\_20180531T130613.SAFE  
S2B\_MSIL2A\_20180304T104019\_N0206\_R008\_T31UFS\_20180304T142412.SAFE  
S2B\_MSIL2A\_20180314T104019\_N0206\_R008\_T31UFS\_20180314T142720.SAFE  
S2B\_MSIL2A\_20180324T104019\_N0206\_R008\_T31UFS\_20180324T124438.SAFE

The list of products descriptors (xml files).

S2A\_MSIL2A\_20180207T104211\_N0206\_R008\_T31UFS\_20180207T124633.SAFE



# Launch a crop mask through Sen2-Agri (L4A)

- Upload in situ data
- Submit your job

```
S2B_MSIL2A_20180406T105029_N0206_R051_T31UFS_20180406T125448.SAFE  
S2B_MSIL2A_20180423T104019_N0206_R008_T31UFS_20180423T110230.SAFE  
S2B_MSIL2A_20180503T104019_N0206_R008_T31UFS_20180503T132654.SAFE  
S2B_MSIL2A_20180506T105029_N0206_R051_T31UFS_20180509T155709.SAFE  
S2B_MSIL2A_20180526T105029_N0206_R051_T31UFS_20180526T134138.SAFE
```

The list of products descriptors (xml files).

## Resolution:

Resolution of the output image (in meters).

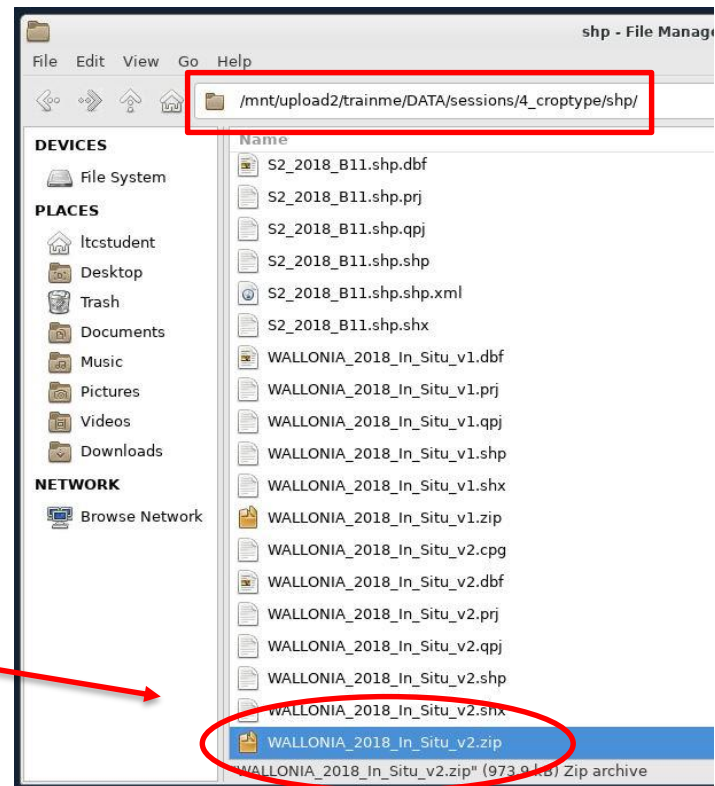
## Reference polygons:\*

 No file selected.

The reference polygons. A .zip file containing the shapefile is expected. See Software Use

L4A w/o IN-SITU processor

L4B Crop Type



# Launch a crop type map through Sen2-Agri (L4A)

- Select your site = Wallonia Subset
- Select your input L2A images
  - From 2018-03-01 To 2018-05-31
  - Filter
  - Highlight in blue from the list (all or selected ones)

L4A w/o IN-SITU processor

L4B Crop Type

Site:\*  
Wallonia Subset

Filter Criteria For Input Files

Sensor:  S2  L8

Tiles  
31UFS

Tiles  
198025,19

May 2018

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12

Available input files:\*

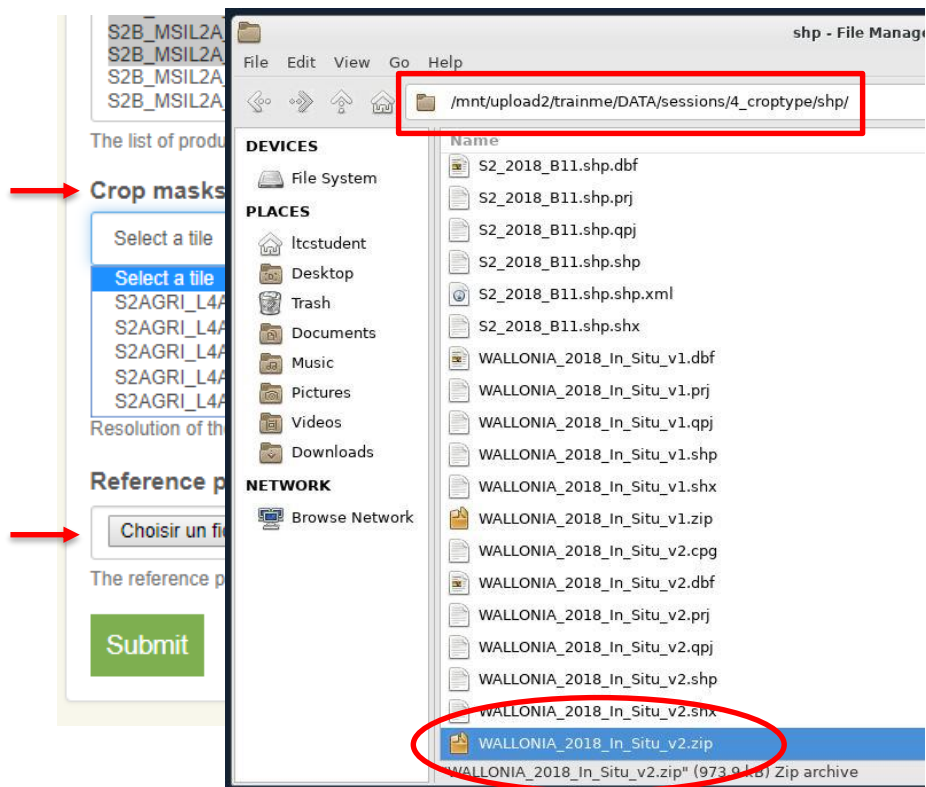
```
S2A_MSIL2A_20180508T104031_N0206_R008_T31UFS_20180508T175127.SAFE
S2A_MSIL2A_20180518T104021_N0206_R008_T31UFS_20180518T124554.SAFE
S2A_MSIL2A_20180521T105031_N0206_R051_T31UFS_20180521T111327.SAFE
S2A_MSIL2A_20180528T104021_N0206_R008_T31UFS_20180528T110304.SAFE
S2A_MSIL2A_20180531T105031_N0206_R051_T31UFS_20180531T130613.SAFE
S2B_MSIL2A_20180304T104019_N0206_R008_T31UFS_20180304T142412.SAFE
S2B_MSIL2A_20180314T104019_N0206_R008_T31UFS_20180314T142720.SAFE
S2B_MSIL2A_20180324T104019_N0206_R008_T31UFS_20180324T124438.SAFE
```

The list of products descriptors (xml files).

S2A\_MSIL2A\_20180121T105341\_N0206\_R051\_T31UFS\_20180121T143420.SAFE

# Launch a **crop type map** through Sen2-Agri (L4A)

- Select the crop mask that you want to apply
- We processed already several L4A crop masks, based on different periods
- The crop mask is used to mask the non crop area of the processed crop type map but the two products are delivered (with and without the mask)
- Upload in situ data
- Submit your job



# Process monitoring of your Sen2-Agri jobs

- Go in the « system overview » tab
- Check the IT ressources used by the system
- Check the status of your running jobs



## Current Jobs

<< Previous Page 1 Next Page >>

Id	Processor	Site	Triggered By	Triggered On	Status	Tasks		Current Task		Actions
						Completed / Running	Module	Tiles Completed / Running		
34	L4B Crop Type	Wallonia Subset	User Request	2019-09-12 08:12:38	Running	0 / 1	crop-type-fused	1 / 1	Pause Cancel	





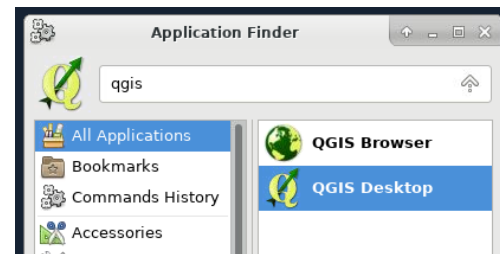
# Training outline

- Launch crop mask and crop type products through Sen2-Agri
- Prepare in situ data
- Understand the crop classification principles on SNAP
- Explore the Sen2-Agri crop mask and crop type products

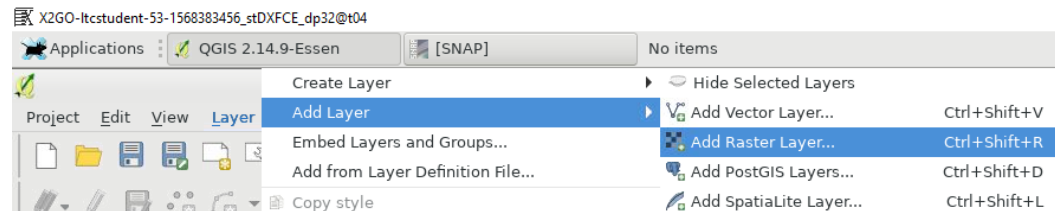
# Display surface reflectance in the background

- Open QGIS
- Add a background surface reflectance image (composite image made of S2 data from August 2018 using Sen2-Agri)

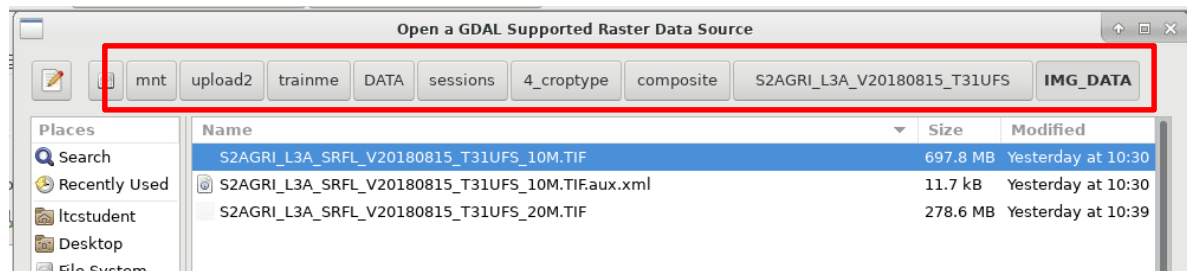
1



2



3



[/mnt/upload2/trainme/DATA/sessions/4\\_croptype/composite/\\*/IMG\\_DATA](#)

# Display surface reflectance in the background

- Right-click on the layer -> Properties
- Set the right bands
  - 1 = Blue
  - 2 = Green
  - 3 = Red
  - 4 = NIR
- Load the min-max values calculation -> for the contrast
- Apply

Layer Properties - S2AGRI\_L3A\_SRFL\_V20180815\_T31UFS\_10M | Style

**Band rendering**

Render type: Multiband color

Red band: Band 3  
Min/max: 181 2638

Green band: Band 2  
Min/max: 301 1776

Blue band: Band 1 (Gray)  
Min/max: 191 1249

Contrast enhancement: Stretch to MinMax

**Load min/max values**

Cumulative count cut: 2.0 - 98.0 %

Min / max

Mean +/- standard deviation x: 2.00

**Extent**

Full

Current

**Accuracy**

Estimate (faster)

Actual (slower)

**Color rendering**

Blending mode: Normal

Brightness: 0

Saturation: 0

Hue:  Colorize

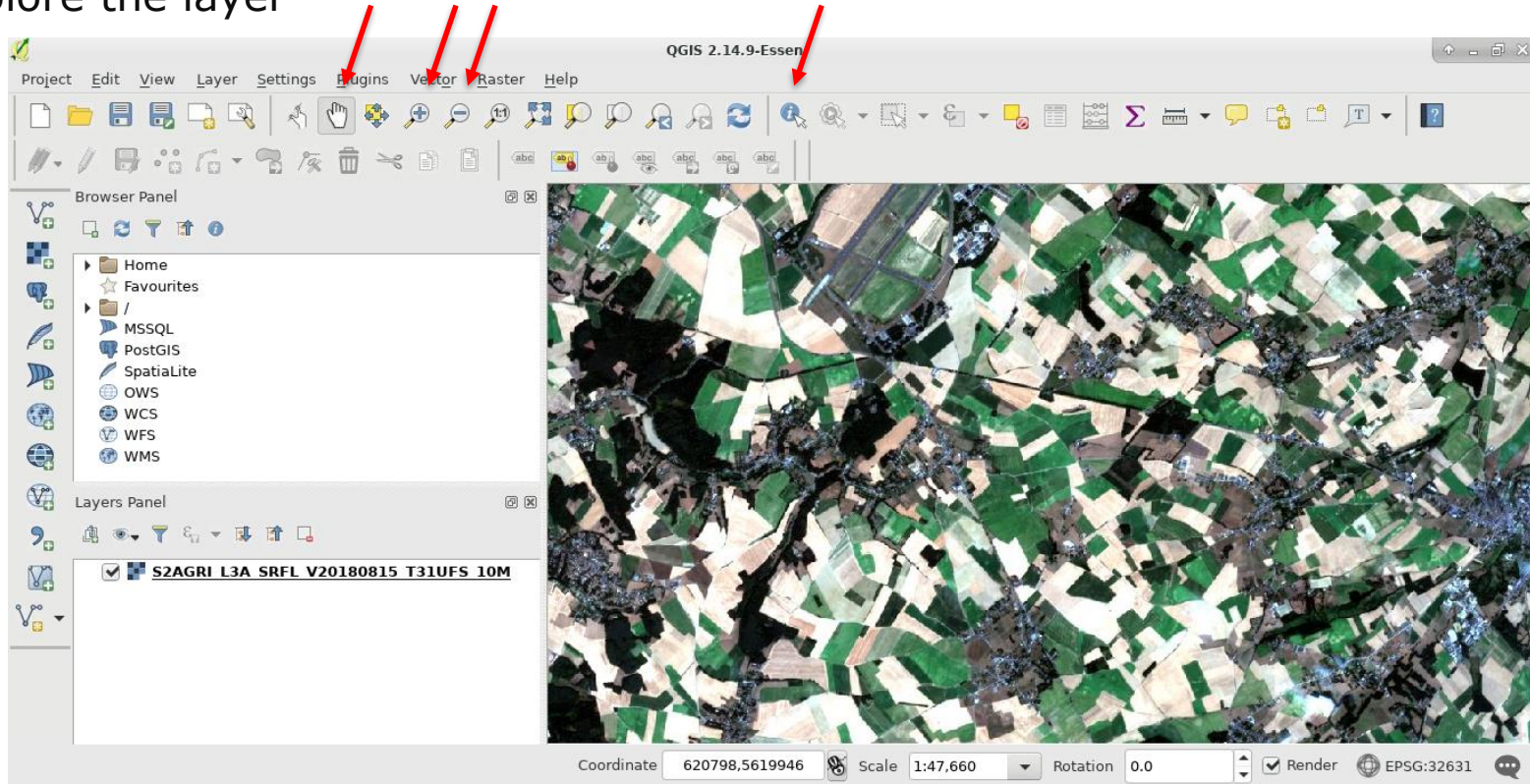
Strength: 100%

Buttons: Help, Style, **Apply**, Cancel, OK

Coordinate: 541570,5596217 | Scale: 1:871,483 | Rotation: 0.0

# Display surface reflectance in the background

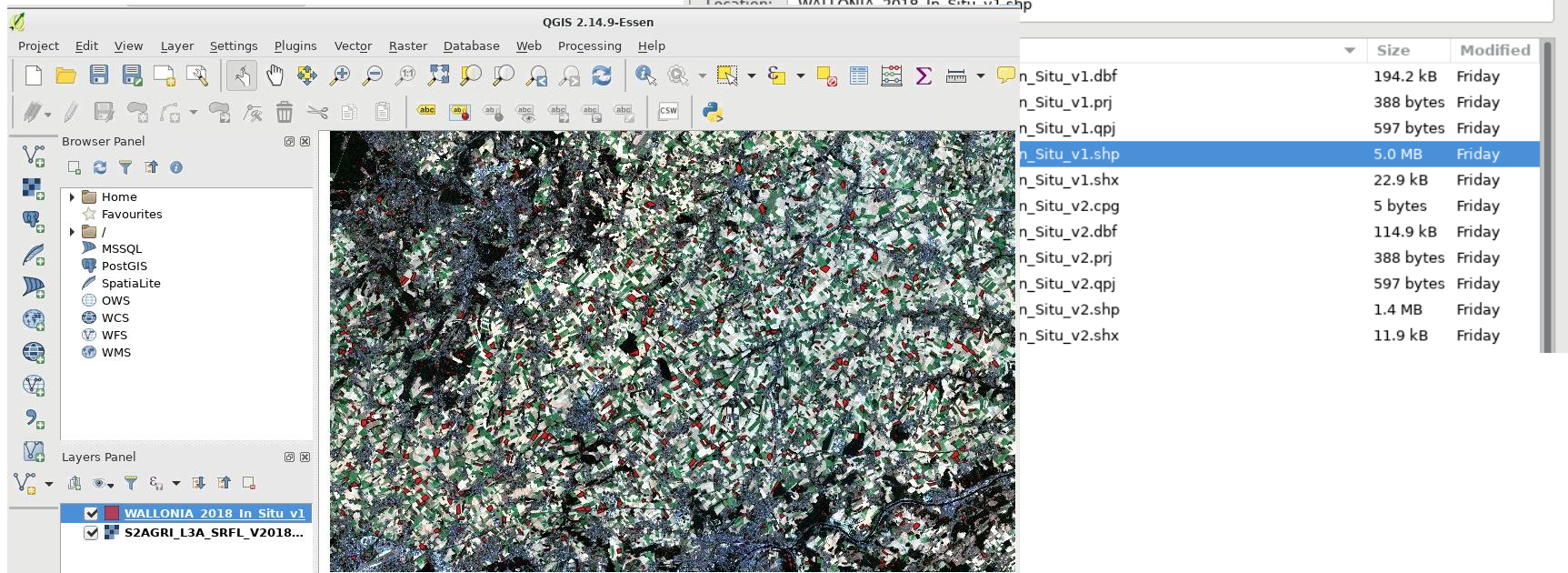
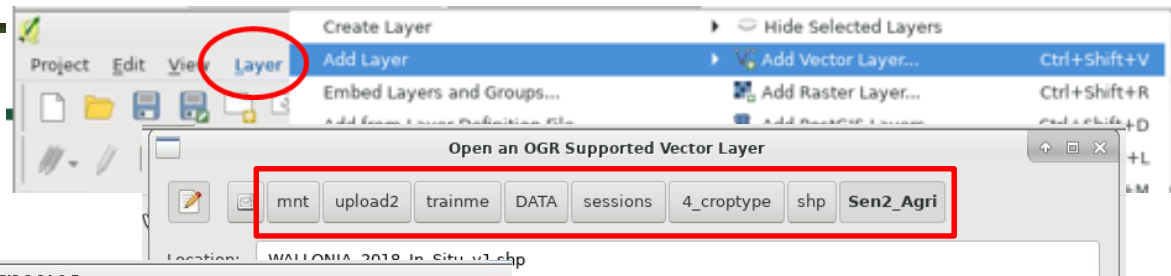
## ➤ Explore the layer





# Display original in situ dataset

- Add the original crop parcel (and non crop) layer





# Display original in situ dataset

Used for the  
crop mask

Used for the  
crop type

Needed attributes for Sen2-Agri

ID	CROP	LC	CODE	IRRIGATION
2846	30860	1 Grassland (temporary)	62	0
2847	30880	1 Rapeseed (winter)	4111	0
2848	30897	1 Maize (for livestock)	201	0
2849	30917	1 Maize (for livestock)	201	0
2850	30940	1 Barley (winter)	321	0
2851	30943	1 Sugar beet	91	0
2852	30958	1 Peas	931	0
0	178562	0 Not agriculture	19	0
1	178566	0 Not agriculture	6	0
2	178567	0 Not agriculture	19	0
3	178569	0 Not agriculture	6	0
4	178570	0 Not agriculture	19	0
5	178571	0 Not agriculture	6	0
6	178573	0 Not agriculture	19	0
7	178574	0 Not agriculture	20	0

# Display original in situ dataset

- Display the LC class of the in situ

QGIS 2.14.9-Essen

Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help

Layer Properties - WALLONIA\_2018\_In\_Situ\_v1 | Style

General Style

Column: abc LC

Symbol: [Red Swatch] Change... Color ramp: [Multi-color Swatch] [source] Edit Invert

Symbol	Value	Legend
<input checked="" type="checkbox"/> [Yellow Swatch]	Asparagus	Asparagus
<input checked="" type="checkbox"/> [Green Swatch]	Barley (for brewery)	Barley (for brewery)
<input checked="" type="checkbox"/> [Red Swatch]	Barley (spring)	Barley (spring)
<input checked="" type="checkbox"/> [Green Swatch]	Barley (winter)	Barley (winter)
<input checked="" type="checkbox"/> [Light Green Swatch]	Broad bean (fava bean or field bean) (spring)	Broad bean (fava bean or field bean)
<input checked="" type="checkbox"/> [Light Green Swatch]	Brussels endives (for roots) (industrial)	Brussels endives (for roots) (industri...
<input checked="" type="checkbox"/> [Light Green Swatch]	Butternut squash (fresh consumption)	Butternut squash (fresh consumption)
<input checked="" type="checkbox"/> [Blue Swatch]	Carrots	Carrots

Classify Add Delete Delete all Advanced

Layer rendering

Layer transparency: 0

Layer blending mode: Normal Feature blending mode: Normal

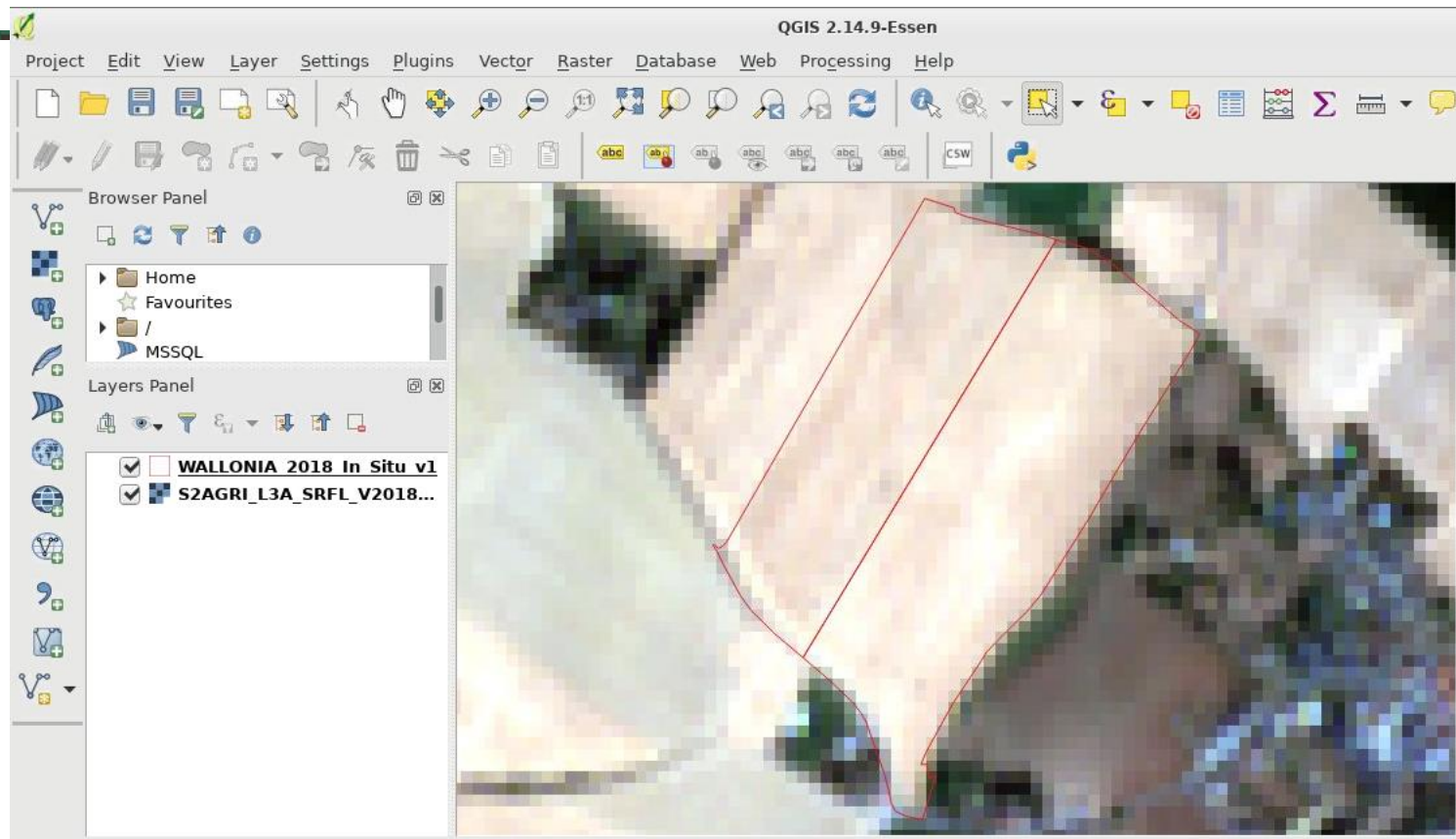
Draw effects:  Control feature rendering order: [ ]

Help Style Apply Cancel OK

# Prepare the final in situ dataset

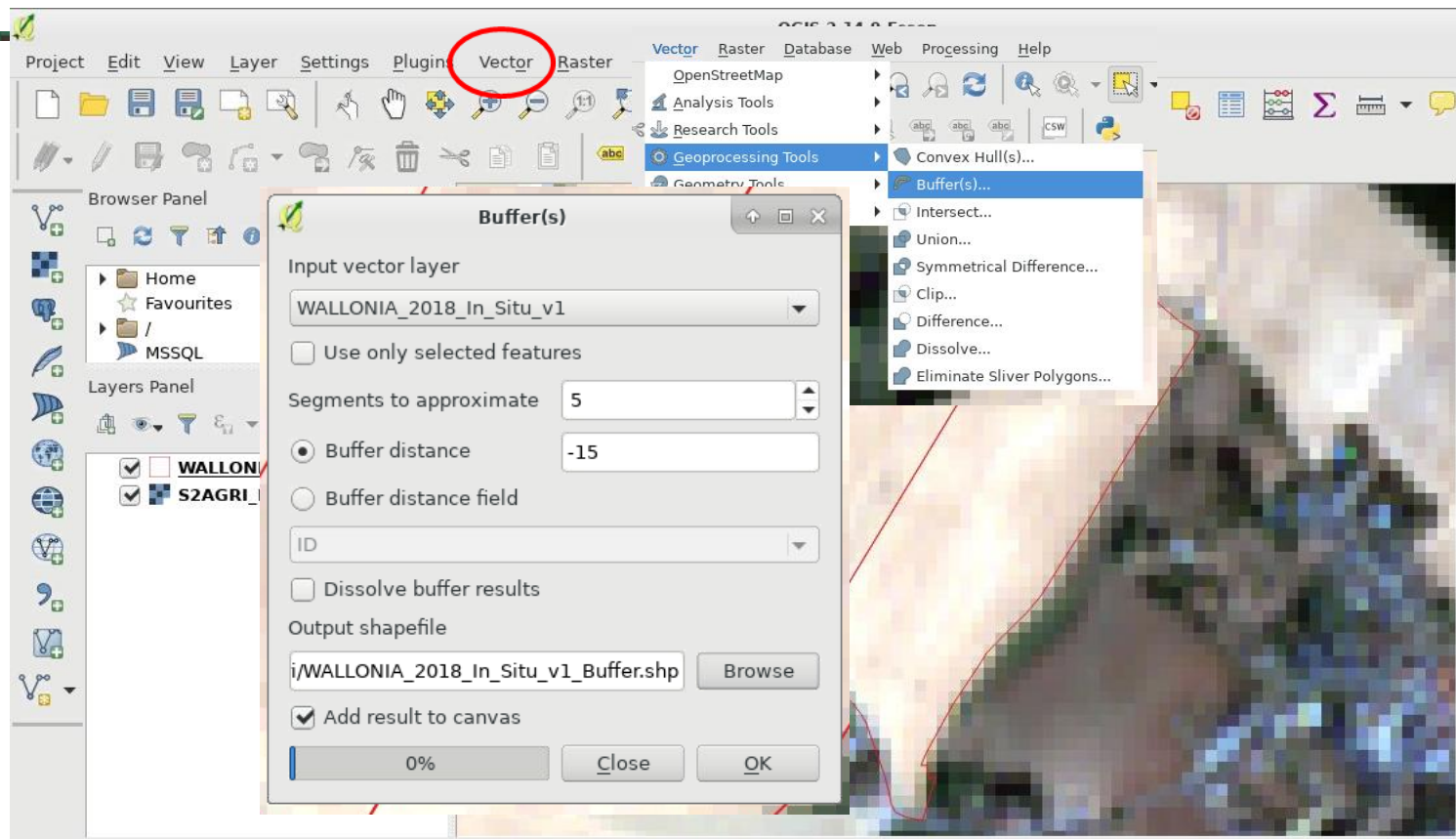
- Mixed pixels at the borders of the parcels

-> Apply a 15m inner buffer



# 15m inner buffer of the in situ dataset

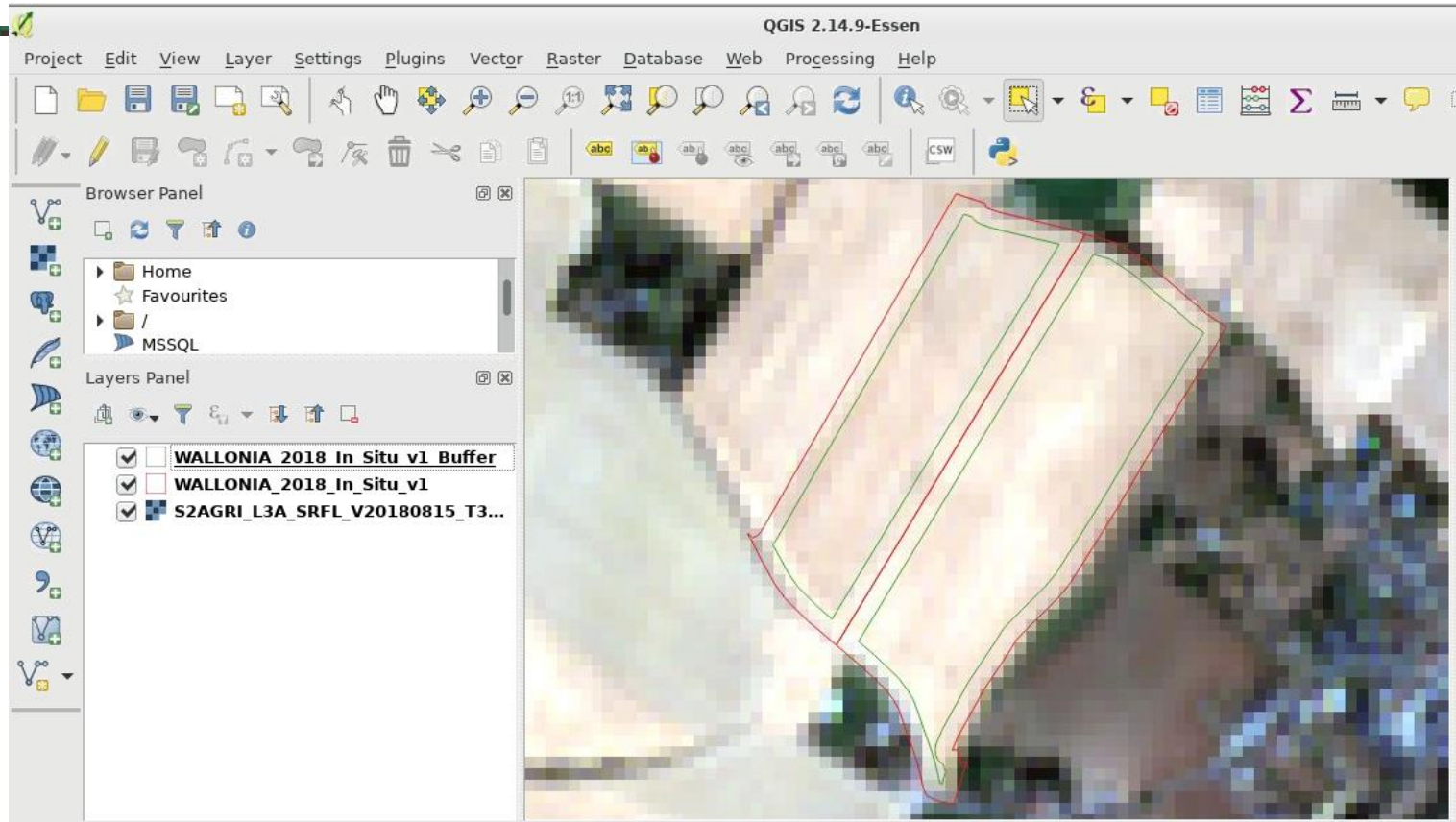
- Vector -> Geoprocessing tools -> Buffer
- Set parameters





# 15m inner buffer of the in situ dataset

## ➤ Results

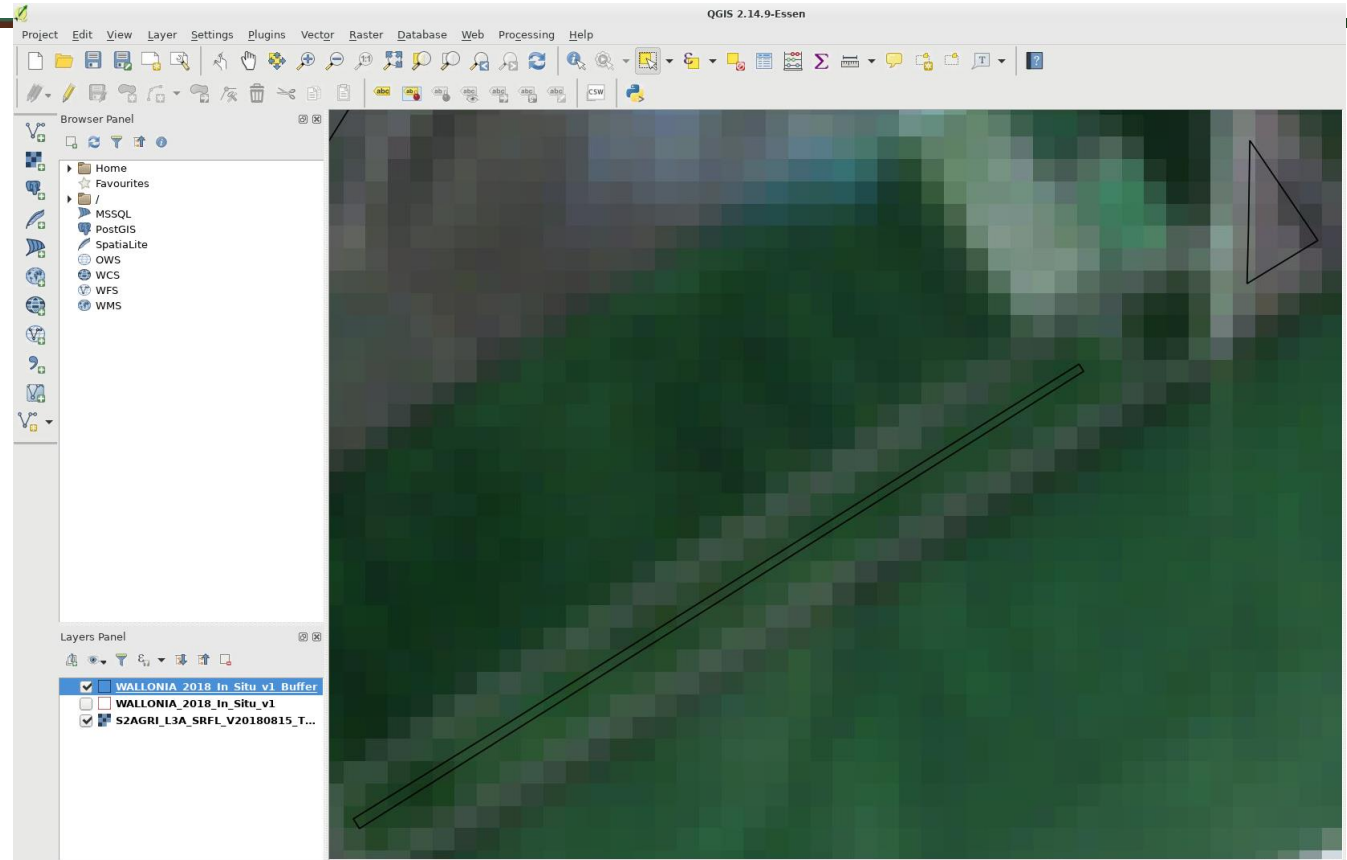




# Prepare the final in situ dataset

- Small parcels
- subject to heterogeneity
- don't contain much information

-> Select only parcels > 5000 m<sup>2</sup> (0,5 ha)



# Calculate AREA

- Field calculator
- Create a new field AREA
- Save the changes by going out of editing mode

The screenshot shows the QGIS 2.14.9-Essen interface. The 'Field calculator' dialog is open, with the 'Create a new field' option selected. The output field name is 'AREA', the type is 'Whole number (integer)', and the length is 10. The expression field contains '\$area'. The 'Output preview' shows the value 2518.65942382812. A data table for 'WALLONIA\_2018\_In\_Situ\_v1\_Buffer' is also visible, showing columns for ID, CROP, LC, CODE, IRRIGATION, and AREA.

ID	CROP	LC	CODE	IRRIGATION	AREA
0	178562	0 Not agricult...	19	0	2519
1	178566	0 Not agricult...	6	0	8643
2	178567	0 Not agricult...	19	0	678
3	178569	0 Not agricult...	6	0	3528
4	178570	0 Not agricult...	19	0	2583
5	178571	0 Not agricult...	6	0	2940
6	178573	0 Not agricult...	19	0	304
7	178574	0 Not agricult...	20	0	4301
8	178575	0 Not agricult...	6	0	5110
9	178579	0 Not agricult...	6	0	1941
10	178580	0 Not agricult...	6	0	19780
11	178581	0 Not agricult...	6	0	2987
12	178582	0 Not agricult...	6	0	NULL

# Select the big (enough) parcels and export

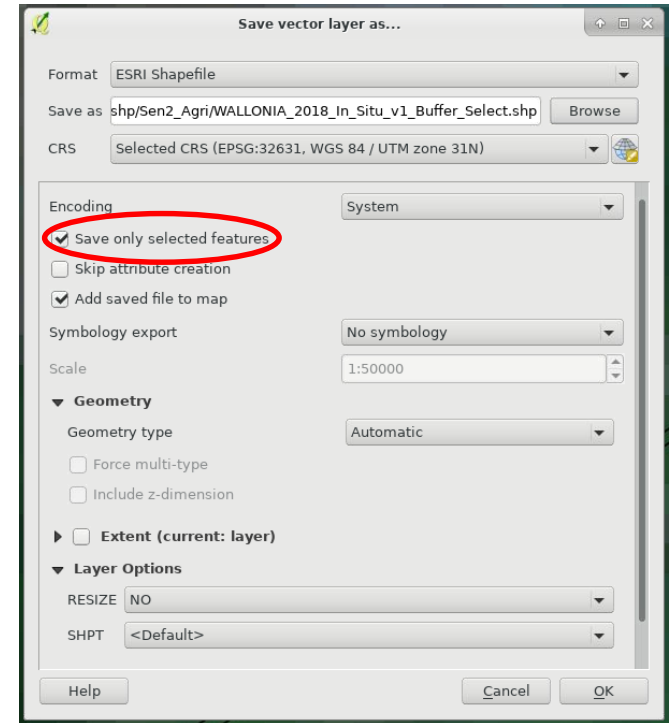
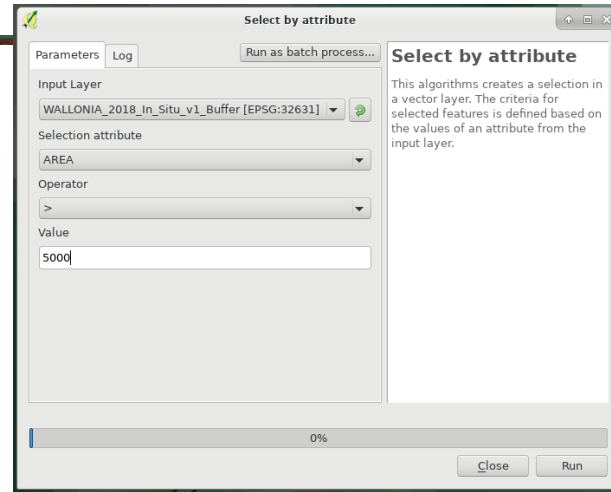
- Display the processing toolbox
- Search for « Select by attribute »

The screenshot displays the QGIS 2.14.9-Essen interface. The Processing Toolbox is open, showing the 'select by attribute' tool. A red arrow points from the 'select by attribute' tool in the toolbox to a large parcel on the map. The map shows a satellite-style image with a black outline around a large parcel. The Layers Panel at the bottom left shows the following layers: **WALLONIA\_2018\_In\_Situ\_v1 Buffer** (checked), WALLONIA\_2018\_In\_Situ\_v1, and S2AGRI\_13A\_SRF1\_V20180815\_T. The Processing Toolbox also shows 'QGIS georalgorithms [100 geo...' and 'Vector selection tools' with 'Select by attribute' and 'Select by attribute sum' checked.

You can add more algorithms to the toolbox: [enable additional providers](#), [close](#)

# Select the big (enough) parcels and export

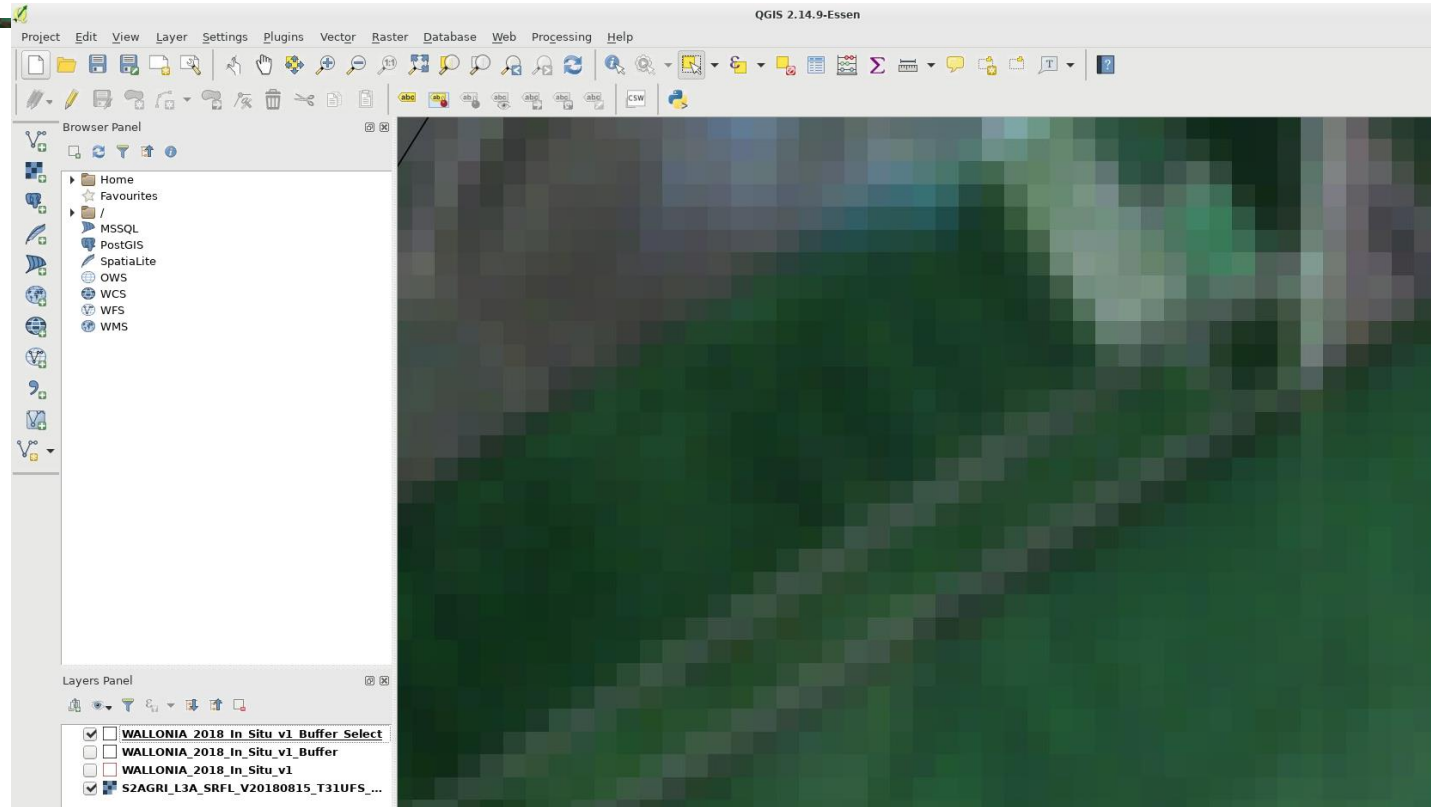
- Select parcels with AREA > 5000 m<sup>2</sup>
- Export
  - Right-click on the layer
  - Save as...
  - Save only selected features



# Prepare the final in situ dataset

➤ Zip the generated shp in a folder

-> ready to be used in Sen-Agri!



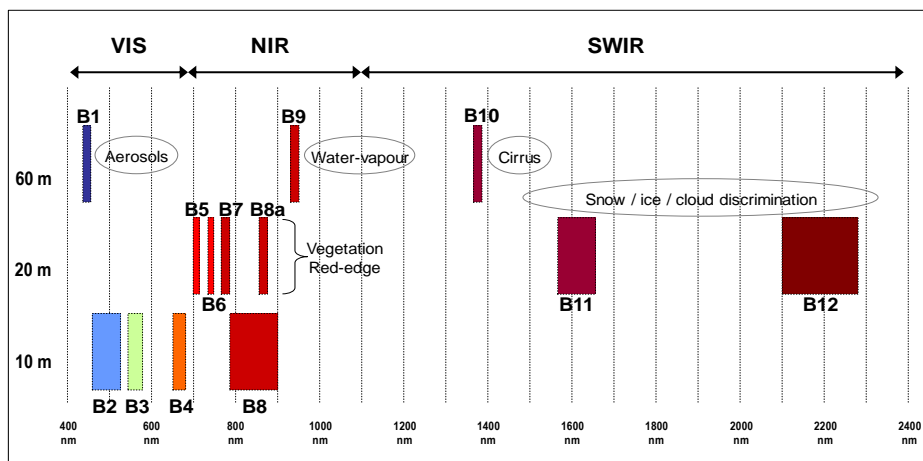
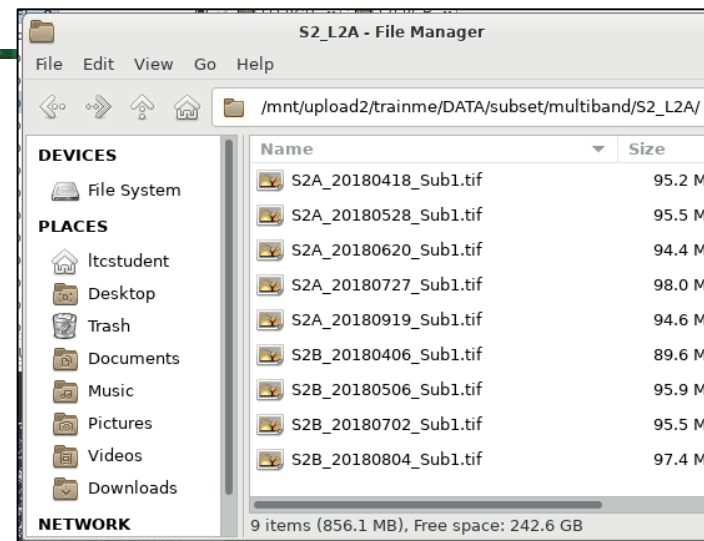


# Training outline

- Launch crop mask and crop type products through Sen2-Agri
- Prepare in situ data
- Understand the crop classification principles on SNAP
- Explore the Sen2-Agri crop mask and crop type products

# Understand the crop classification principles on SNAP

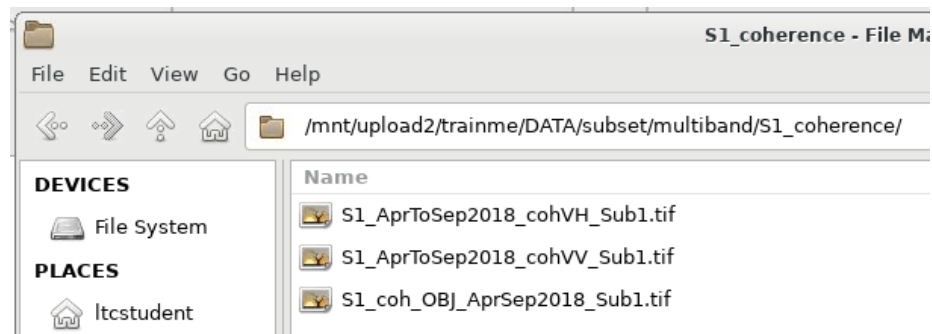
- A series of multiband layers have been processed in: `/mnt/upload2/trainme/DATA/subset/multiband`
- S2\_L2A:
  - 9 dates
  - 5 bands



Band\_1 = green (B3)  
Band\_2 = red (B4)  
Band\_3 = red-edge (B5)  
Band\_4 = NIR (B8)  
Band\_5 = SWIR (B11)

# Understand the crop classification principles on SNAP

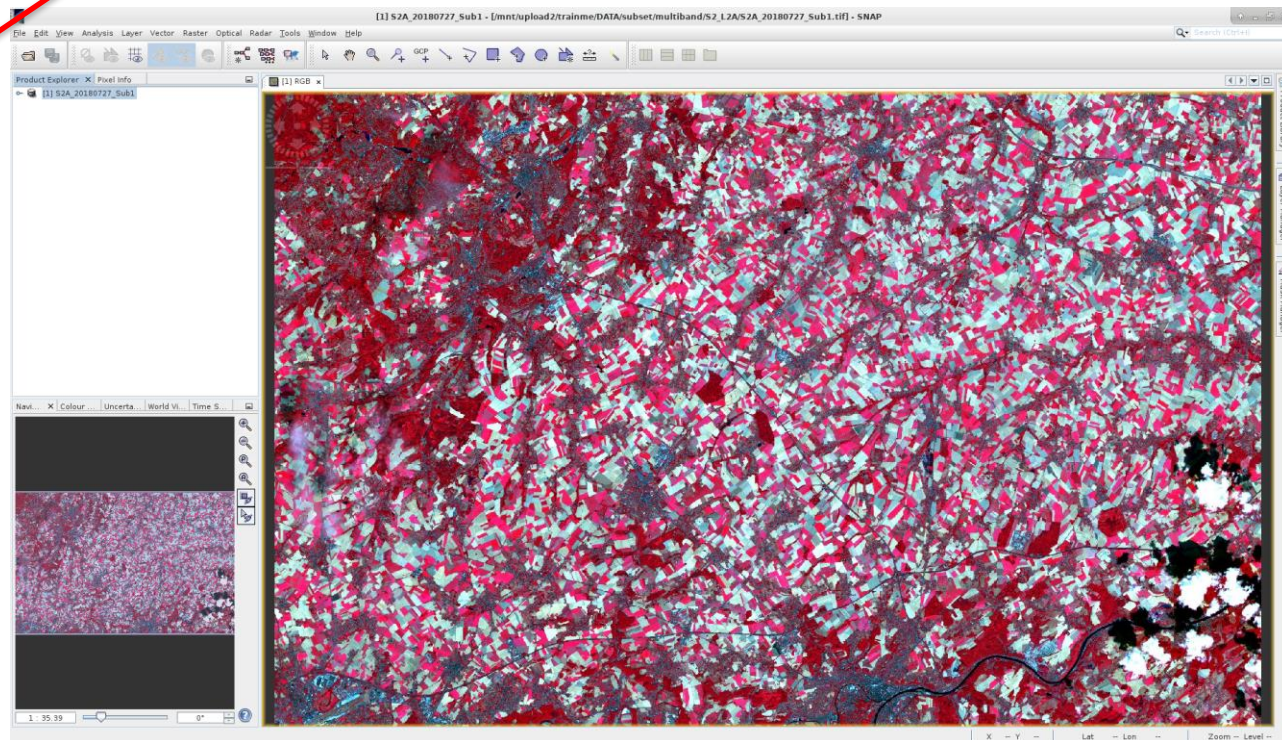
- A series of multiband layers have been processed in:  
/mnt/upload2/trainme/DATA/subset/multiband
- S2\_L2A
- S2\_L2A\_obj:
  - S2\_L2A aggregated by parcel (mean)
- S1\_coherence:
  - Weekly coherence values VV and VH from Apr to Sept 2018
  - + aggregated by parcel (mean)



# Understand the crop classification principles on SNAP

- Open SNAP7 from the desktop
- Open a S2\_L2A multiband image from July
- Display a false-color IR image (4-2-1) from it

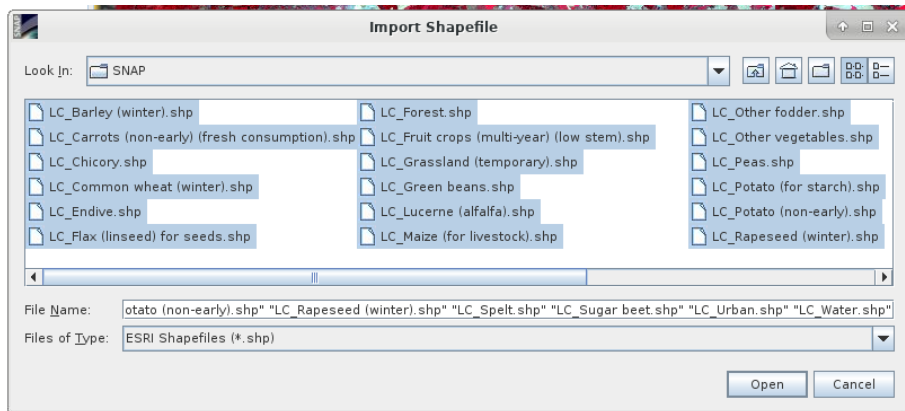
/mnt/upload2/trainme/DATA/subset/multiband/S2\_L2A/S2A\_20180727\_sub1



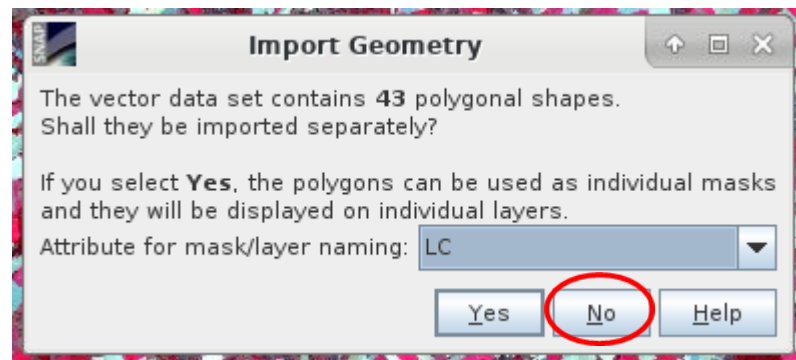
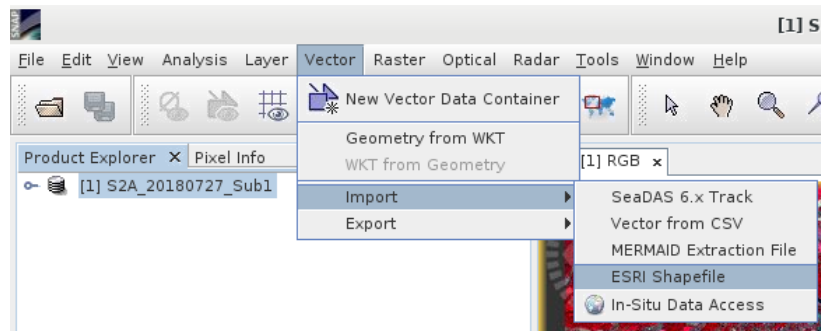
# Understand the crop classification principles on SNAP

- Add in situ data to the layer: vector layers of samples in the different crop types
- + non crop samples: Urban, Forest and Water

/mnt/upload2/trainme/DATA/sessions/4\_croptype/shp/SNAP/\*



Add all classes



For all classes



# Understand the crop classification principles on SNAP

- Perform a RF classification (100 trees, 25 samples by class)
- Add the layer

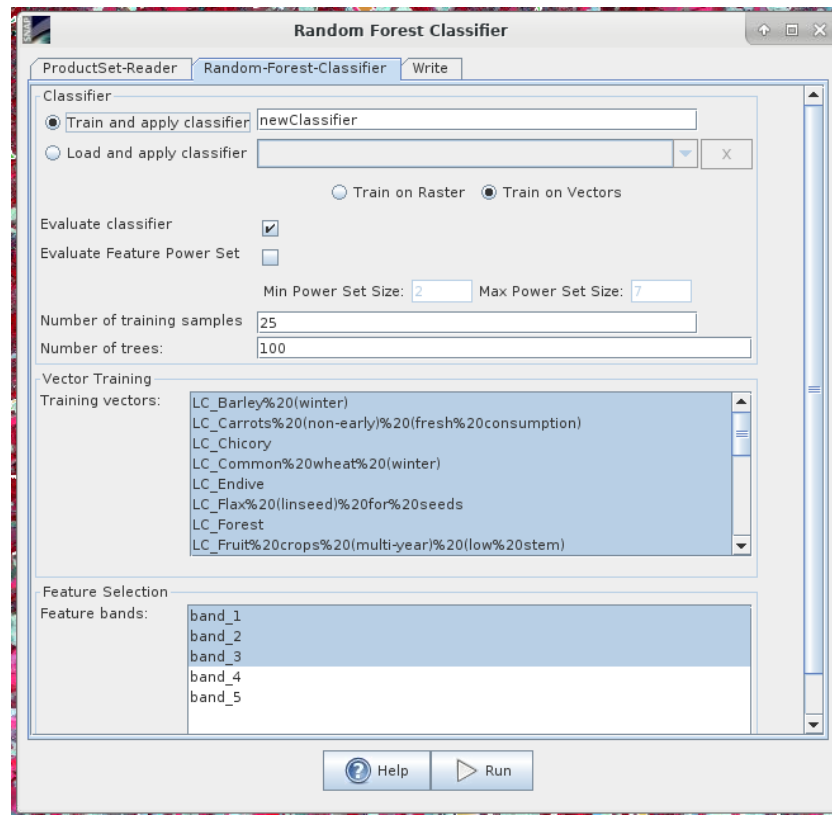
The screenshot displays the SNAP (Sentinel Application Platform) interface. In the foreground, the 'Random Forest Classifier' dialog is open, showing a table with columns for File Name, Type, Acquisition, Track, and Orbit. Below it, the 'Add Product' dialog is open, showing a list of files in the 'S2\_L2A' directory. The file 'S2A\_20180727\_Sub1.tif' is selected. The 'File Name' field contains 'S2A\_20180727\_Sub1.tif'. In the background, the main SNAP window shows a satellite image of a field. The 'Classification' menu is open, showing options for Unsupervised Classification and Supervised Classification. The 'Random Forest Classifier' option is highlighted under Supervised Classification.

File Name	Type	Acquisition	Track	Orbit

File Name	Type	Acquisition	Track	Orbit
S2A_20180418_Sub1.tif	S2B_20180702_Sub1.tif			
S2A_20180528_Sub1.tif	S2B_20180804_Sub1.tif			
S2A_20180620_Sub1.tif				
S2A_20180727_Sub1.tif				
S2A_20180919_Sub1.tif				
S2B_20180406_Sub1.tif				
S2B_20180506_Sub1.tif				

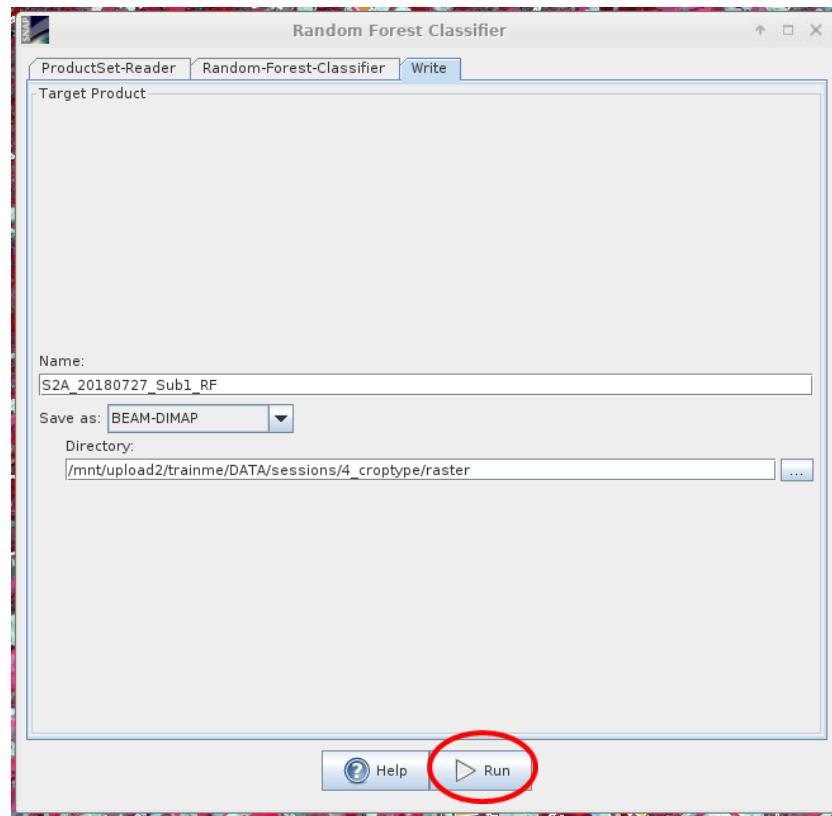
# Understand the crop classification principles on SNAP

- Perform a RF classification (100 trees, 25 samples by class)
- Set the parameters
- Select the LC classes and input bands



# Understand the crop classification principles on SNAP

- Perform a RF classification (100 trees, 25 samples by class)
  - Set the parameters
  - Select the LC classes and input bands
  - Save the generated layer
  - Run



# Understand the crop classification principles on SNAP

- Explore the output txt file
- Display the generated layer

The image displays the SNAP (Sentinel Application Platform) interface. On the left, the Product Explorer shows a project named 'S2A\_20180727\_Sub1' with various layers including 'LabeledClasses' and 'Confidence'. The main window shows a satellite image of a field with a color-coded classification overlay. Below the image is a legend table with columns for 'Label', 'Colour', 'Value', and 'Frequency'. On the right, a text window titled 'newClassifier.txt' displays the output of a RandomForest classifier, showing cross-validation results for 17 classes, including accuracy, precision, correlation, error rate, true positives, and false negatives for each class.

Label	Colour	Value	Frequency
no data		-1	0.00
LC_Barley%20(winter)		0	0.00
LC_Carrots%20(non-early)		1	0.00
LC_Chicory		2	1.47
LC_Common%20wheat%2		3	23.61
LC_Endive		4	1.33
LC_Flav%20(linseed%20f		5	4.51
LC_Forest		6	25.48
LC_Fruit%20crops%20(mu...		7	0.00
LC_Grassland%20(tempor...		8	10.21
LC_Green%20beans		9	0.00
LC_Lucerne%20(alfalfa)		10	0.00
LC_Maize%20(for%20lives...		11	1.12
LC_Other%20fodder		12	10.45
LC_Other%20vegetables		13	0.00
LC_Peas		14	0.20
LC_Potato%20(for%20star...		15	0.07
LC_Potato%20(non-early)		16	0.28
LC_Rapeseed%20(winter)		17	1.24
LC_Spelt		18	0.00
LC_Sugar%20beet		19	1.53
LC_Urban		20	0.00
LC_Water		21	22.78

```
RandomForest classifier newClassifier
Cross Validation
Number of classes = 17
class 0:0: LC_Barley%20(winter)
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 0.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 2:0: LC_Chicory
accuracy = 0.9412 precision = NaN correlation = NaN errorRate = 0.0588
TruePositives = 0.0000 FalsePositives = 0.0000 TrueNegatives = 16.0000 FalseNegatives = 1.0000
class 3:0: LC_Common%20wheat%20(winter)
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 1.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 4:0: LC_Endive
accuracy = 0.9412 precision = NaN correlation = NaN errorRate = 0.0588
TruePositives = 0.0000 FalsePositives = 0.0000 TrueNegatives = 16.0000 FalseNegatives = 1.0000
class 5:0: LC_Flav%20(linseed)%20for%20seeds
accuracy = 0.8235 precision = 0.0000 correlation = 0.8913 errorRate = 0.1765
TruePositives = 0.0000 FalsePositives = 2.0000 TrueNegatives = 14.0000 FalseNegatives = 1.0000
class 6:0: LC_Forest
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 1.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 8:0: LC_Grassland%20(temporary)
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 1.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 11:0: LC_Maize%20(for%20livestock)
accuracy = 0.7647 precision = 0.0000 correlation = 0.1157 errorRate = 0.2353
TruePositives = 0.0000 FalsePositives = 3.0000 TrueNegatives = 13.0000 FalseNegatives = 1.0000
class 12:0: LC_Other%20fodder
accuracy = 0.9412 precision = NaN correlation = NaN errorRate = 0.0588
TruePositives = 0.0000 FalsePositives = 0.0000 TrueNegatives = 16.0000 FalseNegatives = 1.0000
class 14:0: LC_Peas
accuracy = 0.8235 precision = 0.0000 correlation = 0.8913 errorRate = 0.1765
TruePositives = 0.0000 FalsePositives = 2.0000 TrueNegatives = 14.0000 FalseNegatives = 1.0000
class 15:0: LC_Potato%20(for%20starch)
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 1.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 17:0: LC_Rapeseed%20(winter)
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
TruePositives = 0.0000 FalsePositives = 1.0000 TrueNegatives = 15.0000 FalseNegatives = 1.0000
class 18:0: LC_Spelt
accuracy = 0.8824 precision = 0.0000 correlation = 0.8625 errorRate = 0.1176
```

# To go further

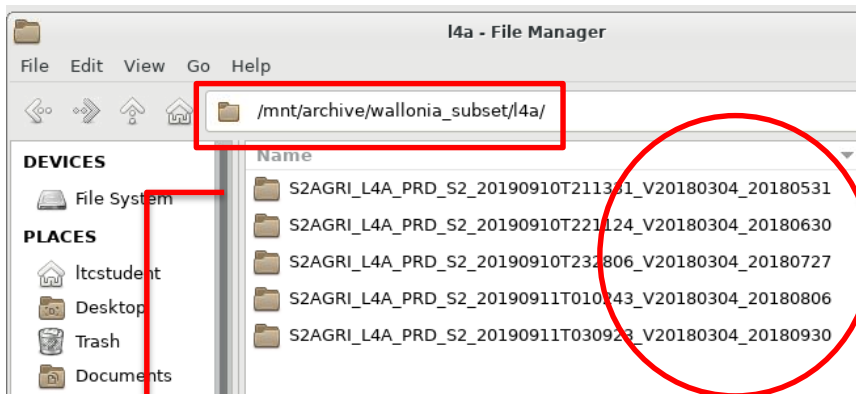
- S2 L2A (per-pixel data): `/mnt/upload2/trainme/DATA/subset/multiband/S2_L2A/*`
  - > test other configurations: bands, another date, RF parameters (trees and number of samples by class)
- S2 L2A aggregated by object: `/mnt/upload2/trainme/DATA/subset/multiband/S2_L2A_obj/*`
  - > test different configurations
- S1 coherence aggregated by object:  
`/mnt/upload2/trainme/DATA/subset/multiband/S1_coherence/S1_coh_OBJ_AprSep2018_Sub1.tif`
  - > test different configurations
  
- Compare the results using the different datasets



# Training outline

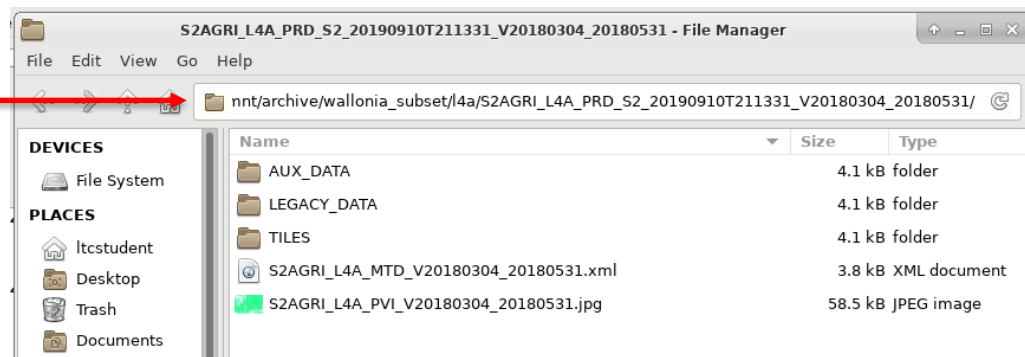
- Launch crop mask and crop type products through Sen2-Agri
- Prepare in situ data
- Understand the crop classification principles on SNAP
- Explore the Sen2-Agri crop mask and crop type products

# Let's explore the **crop mask** products

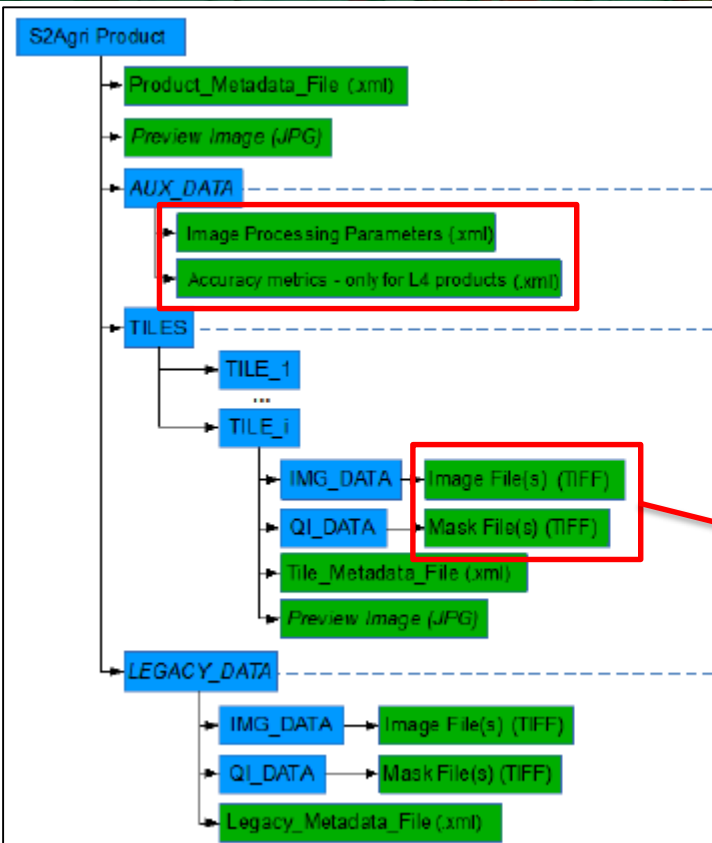
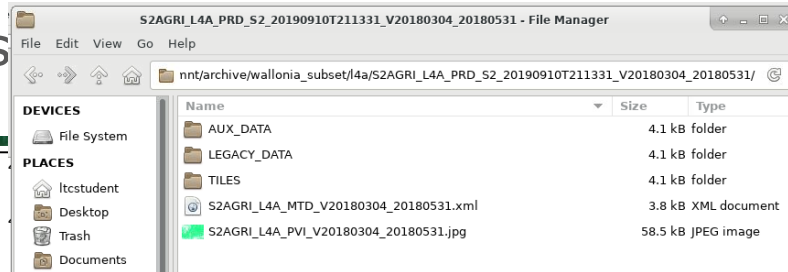


We processed already several versions of the crop masks, with different monitoring period

Always the same structure of the Sen2-Agri products



# Let's explore the **crop mask** products



Contains the **Image Processing Parameters (IPP)**.  
For the L4A and L4B products, it also contains the **accuracy metrics** and the in situ data split into calibration and validation dataset.

Contains the **product images** split in tiles.  
Inside the TILES folder, each folder contains one tile. Tile ID = T00XXX.  
The tile ID and tile spatial extents are inherited from the Sentinel-2 or Landsat 8 tile system.  
The number of tiles varies in accordance with your site extent.

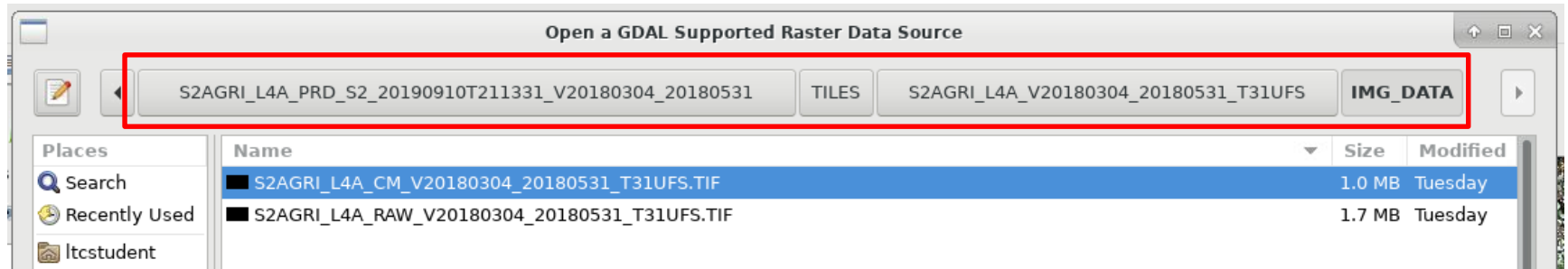
Let's explore them on QGIS

Contains the **mosaic of the product images** and quality masks resampled at 60 meters resolution.

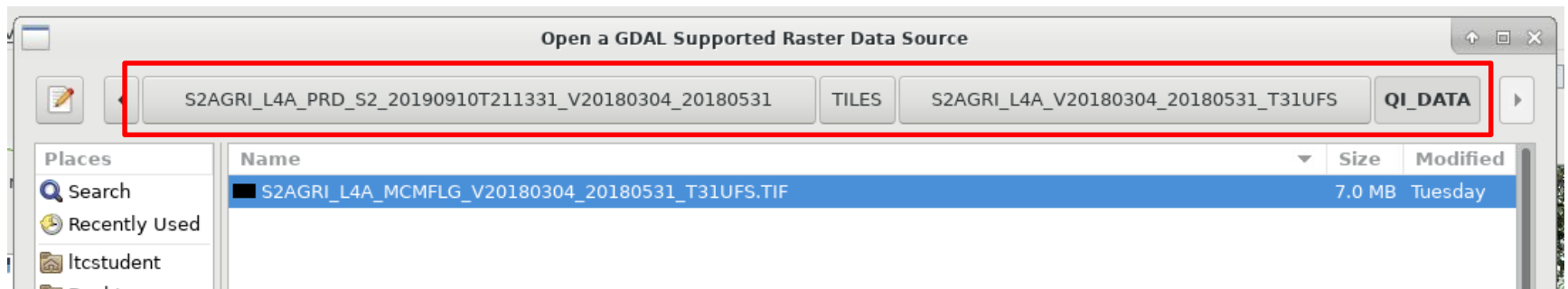
Sen2-Agri Common Structure and Naming convention

# Let's explore the **crop mask** products

- Add a crop mask product: `/mnt/archive/wallonia_subset/l4a/*/TILES/*/IMG_DATA/`

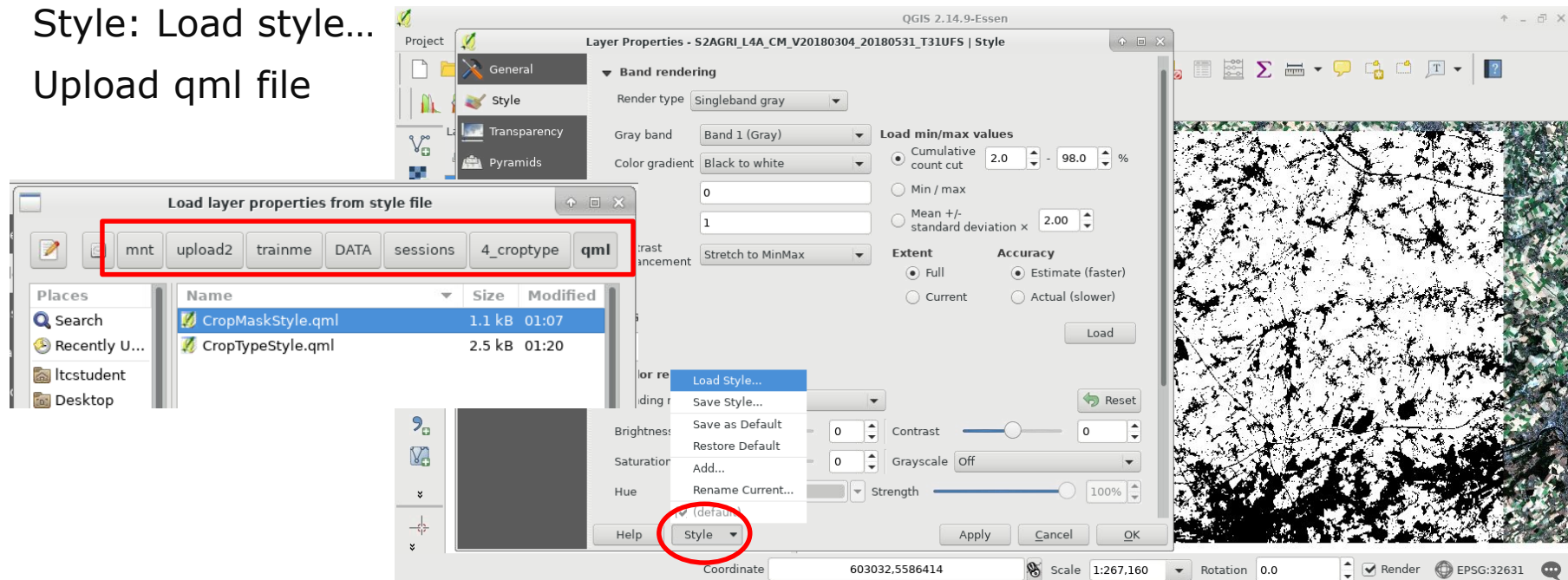


- Add the corresponding quality layer: `/mnt/archive/wallonia_subset/l4a/*/TILES/*/QI_DATA/`



# Let's explore the **crop mask** products

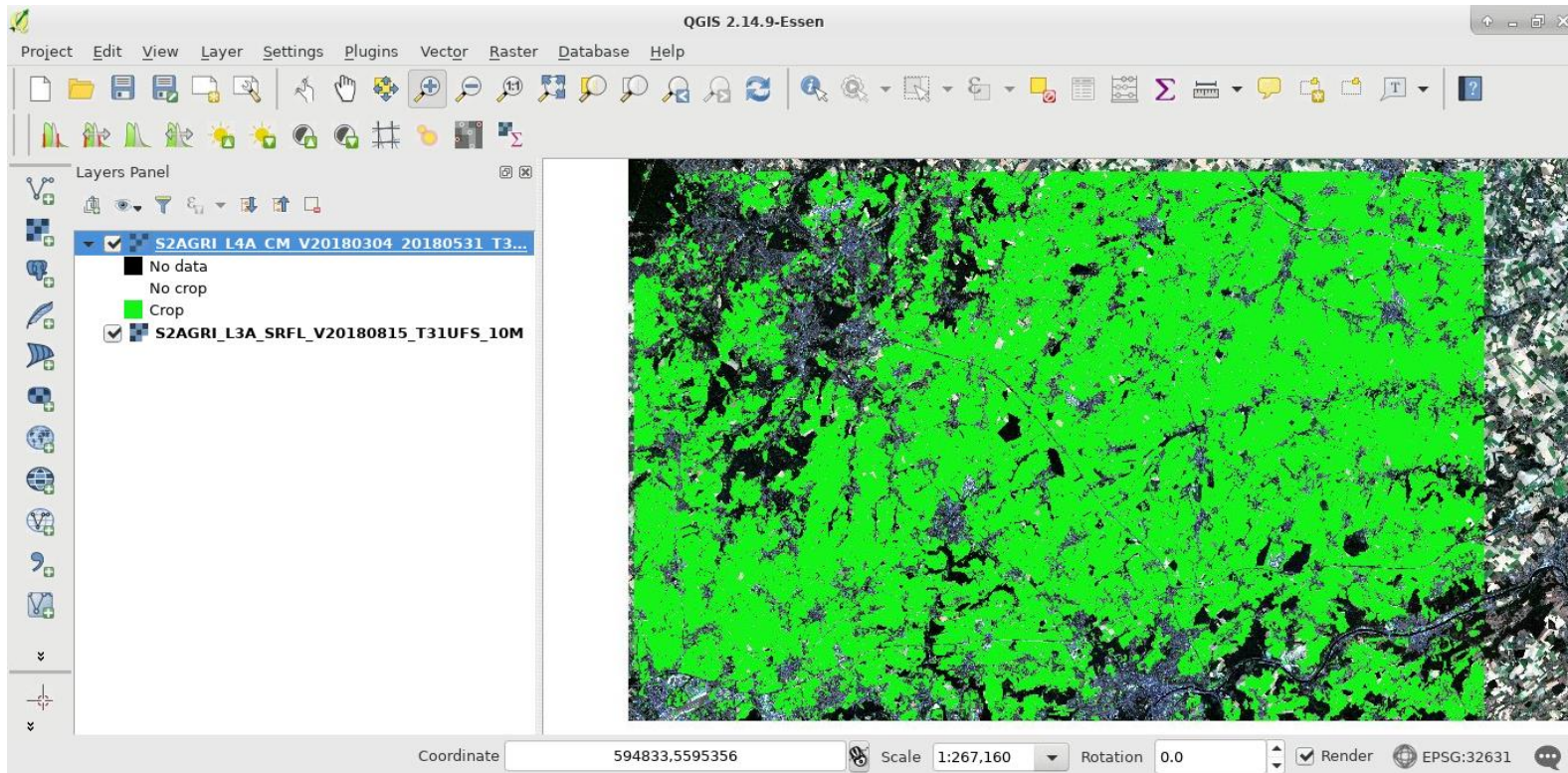
- Apply the predefined symbology to the crop mask
  - Layer properties
  - Style: Load style...
  - Upload qml file





# Let's explore the **crop mask** products

## ➤ Explore the layer



# Let's explore the **crop mask** products

- Explore the quality file
- Layer properties
- Display the different bands

Layer Properties - S2AGRI\_L4A\_MCMFLG\_V20180304\_20180531\_T31UFS | Style

Render type: Singleband pseudocolor

Band: Band 4

Color interpolation: Linear

Generate new color map

Mode: Continuous | Classes: 5

Min: 3 | Max: 10

Classify

Min / max origin: Estimated cumulative cut of full extent.

Load min/max values

Cumulative count cut | 2.0 | 98.0 %

Min / max

Mean +/- standard deviation x | 2.00

Extent

Full

Current

Accuracy

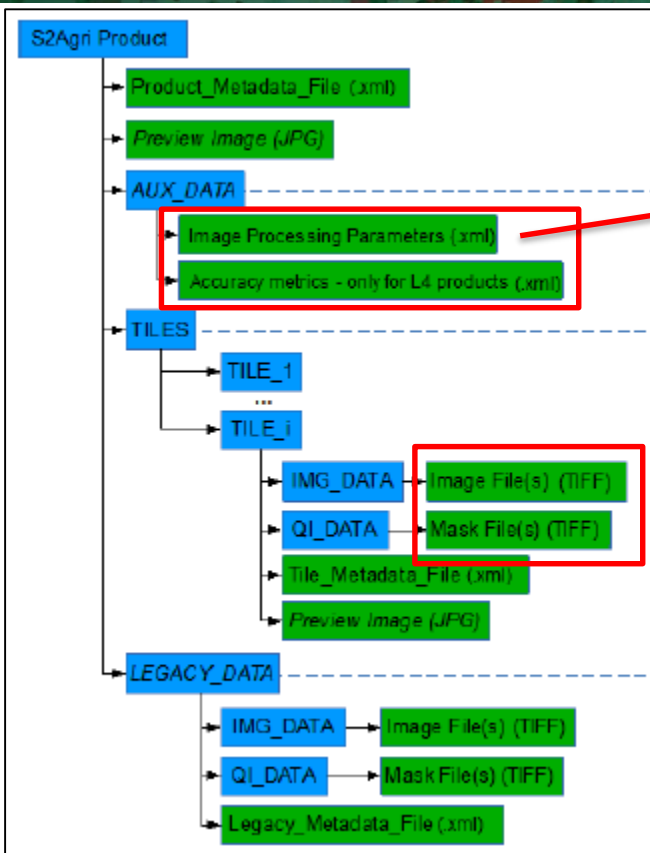
Estimate (faster)

Actual (slower)

Value	Color	Label
3.000000	Yellow	3.000000
4.750000	Light Orange	4.750000
6.500000	Orange	6.500000
8.250000	Dark Orange	8.250000
10.000000	Dark Brown	10.000000

/QI_DATA	Status of the pixel during the period used to generate the map
MCMFLG	<p>Band 1 = number of dates which are associated with the "land" status</p> <p>Band 2 = number of dates which are associated with the "water" status</p> <p>Band 3 = number of dates which are associated with the "snow" status</p> <p>Band 4 = number of dates which are associated with the other status ("cloud", "cloud shadow", "no data")</p>

# Let's explore the **crop mask** products

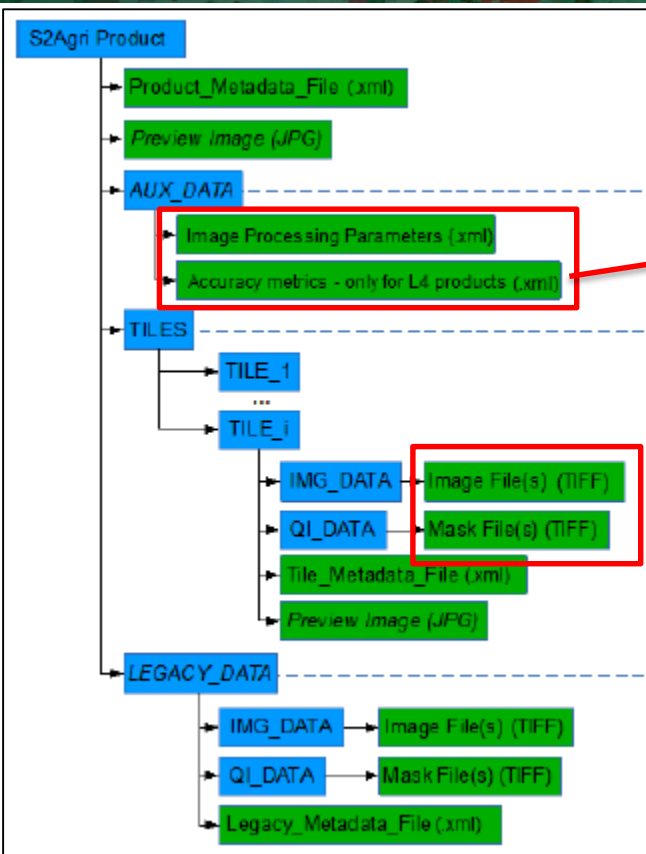


```
<Input>SENTINEL2A_20180720-105213-085_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2B_20180722-104020-458_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2B_20180725-105415-357_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2A_20180727-104023-458_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2B_20180801-104018-457_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2B_20180804-105022-459_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
<Input>SENTINEL2A_20180806-104340-891_L2A_T31UFS_C_V1-0_MTD_ALL</Input>
</Input>
</Tile>
</Tiles>
- <Parameters>
  <MainMission>SENTINEL</MainMission>
  <PixelSize>10</PixelSize>
  <SampleRatio>0.75</SampleRatio>
  <Classifier>rf</Classifier>
  <Seed>0</Seed>
  <IncludeRedEdge>True</IncludeRedEdge>
  <LUT>crop-mask.lut</LUT>
- <Classifier>
  <TrainingSamplesPerTile>40000</TrainingSamplesPerTile>
- <RF>
  <NbTrees>100</NbTrees>
  <Min>25</Min>
  <Max>25</Max>
</RF>
</Classifier>
- <Segmentation>
  <PCAComponents>6</PCAComponents>
  <SpatialRadius>10</SpatialRadius>
  <RangeRadius>0.65</RangeRadius>
  <MinSize>10</MinSize>
  <MinCropArea>20</MinCropArea>
</Segmentation>
</Parameters>
</Metadata>
```

List of input images

Algorithm parameters

# Let's explore the **crop mask** products



```

- <CropMask xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
- <ConfusionMatrix>
  - <ReferenceLabels>
    <RowLabel>0</RowLabel>
    <RowLabel>1</RowLabel>
  </ReferenceLabels>
  - <ProducedLabels>
    <ColumnLabel>0</ColumnLabel>
    <ColumnLabel>1</ColumnLabel>
  </ProducedLabels>
  - <Data>
    - <Row>
      <Column>7822</Column>
      <Column>90</Column>
    </Row>
    - <Row>
      <Column>212</Column>
      <Column>21596</Column>
    </Row>
  </Data>
</ConfusionMatrix>
- <QualityMetrics>
  <Precision class="0">0.973612</Precision>
  <Recall class="0">0.988625</Recall>
  <F-score class="0">0.981061</F-score>
  <Precision class="1">0.99585</Precision>
  <Recall class="1">0.990279</Recall>
  <F-score class="1">0.993057</F-score>
  <Kappa>0.974118</Kappa>
  <Accuracy>0.989838</Accuracy>
</QualityMetrics>
</CropMask>

```

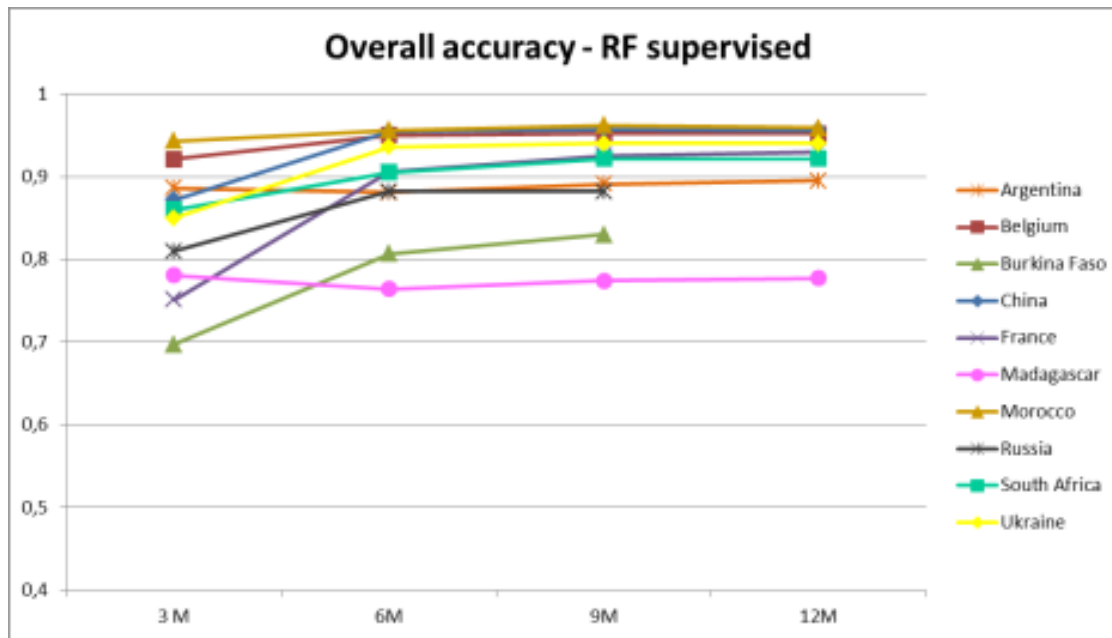
Confusion matrix

Accuracy metrics:

- Precision, Recall and F-Score of the individual classes
- Overall Accuracy and Kappa of the classification

# To go further

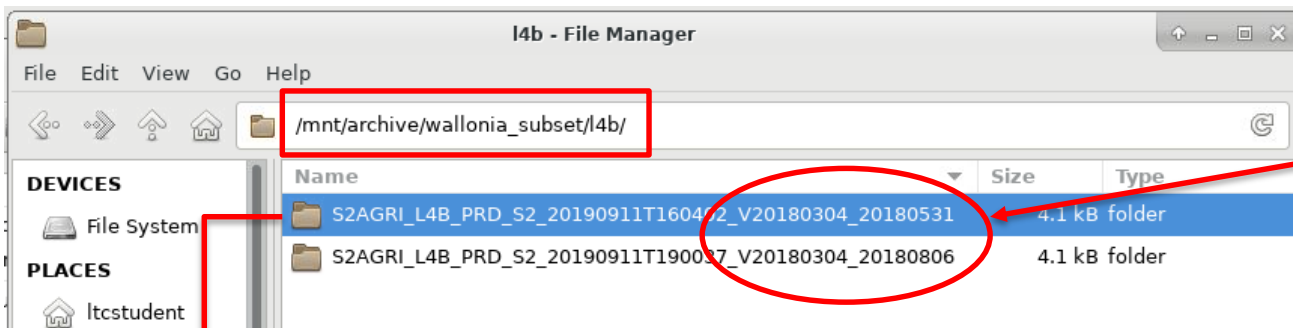
- Display the different crop masks corresponding to the different monitoring periods
- Compare them visually and in terms of Overall Accuracy



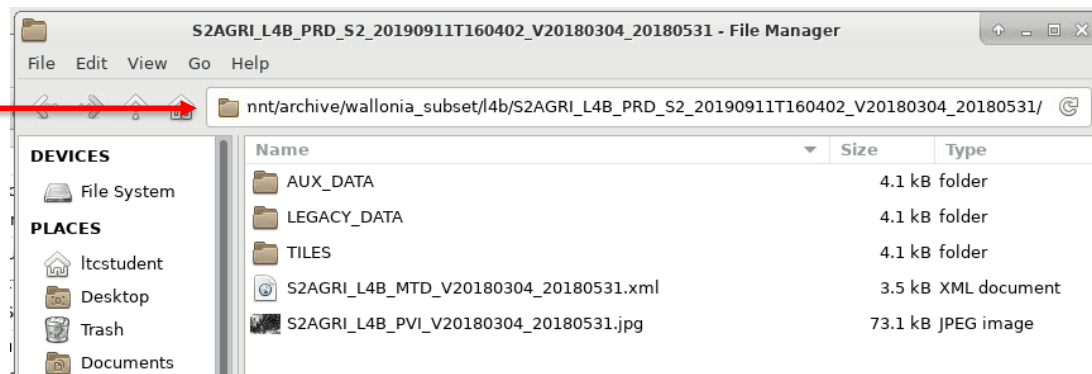


# Let's explore the **crop type** products

We processed already 2 crop type maps: end of May and end of August

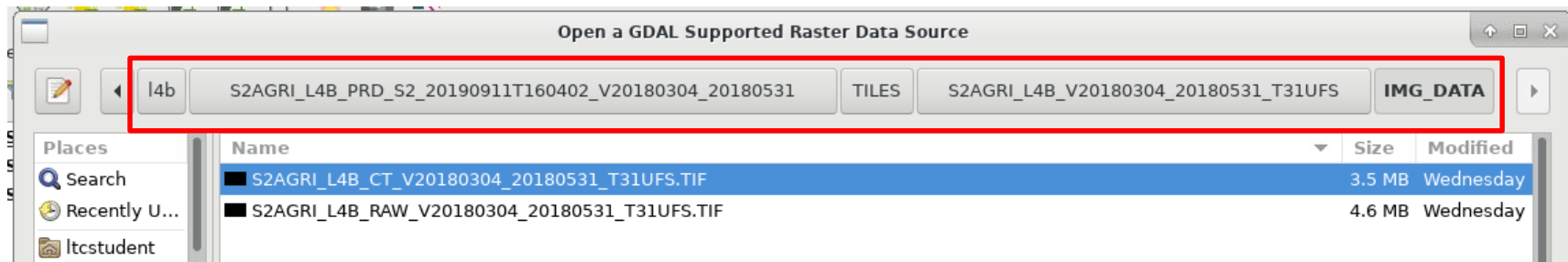


The same structure as the crop mask



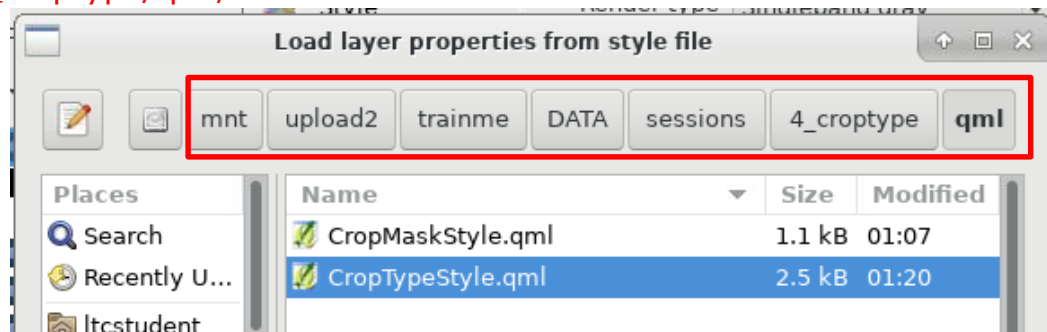
# Let's explore the **crop type** products

- On QGIS: Add a crop type product: [/mnt/archive/wallonia\\_subset/l4b/\\*/TILES/\\*/IMG\\_DATA/](/mnt/archive/wallonia_subset/l4b/*/TILES/*/IMG_DATA/)



- Apply the predefined symbology to the crop type map:  
[/mnt/upload2/trainme/DATA/sessions/4\\_croctype/qml/](/mnt/upload2/trainme/DATA/sessions/4_croctype/qml/)

- Layer properties
- Style: Load style...
- Upload qml style



# Let's explore the **crop type** products

## ➤ Explore the layer

The screenshot displays the QGIS 2.14.9-Essen interface. The main window shows a satellite image of a field with a semi-transparent crop type layer overlaid. The layer is color-coded according to the legend in the Layers Panel. The legend lists the following crop types and their corresponding colors:

- No data (Black)
- No crop (White)
- Spelt (Light yellow)
- Flax (linseed) for seeds (Orange)
- Grassland (temporary) (Light green)
- Lucerne (alfalfa) (Light blue)
- Sugar beet (Pink)
- Maize (for livestock) (Yellow)
- Common wheat (winter) (Brown)
- Barley (winter) (Dark red)
- Other fodder (Dark green)
- Potato (non-early) (Blue)
- Potato (for starch) (Cyan)
- Peas (Light cyan)
- Other vegetables (Red)
- Rapeseed (winter) (Light grey)
- Green beans (Purple)
- Endive (Light green)
- Carrots (non-early) (fresh consumption) (Orange)
- Fruit crops (multi-year) (low stem) (Magenta)
- Chicory (Light purple)

The Layers Panel on the left shows the selected layer: **S2AGRI L4B CT V20180304 20180531 T...**. The status bar at the bottom indicates the coordinate (596176,5624549), scale (1:267,160), rotation (0.0), and render status (checked). The EPSG:32631 coordinate system is also displayed.

# To go further

- Display the 2 crop type maps: end of May and end of August
- Compare them visually and in terms of Overall Accuracy
- Check the F-Score of the main crop types