AIRBUS

APS303 - APPLICATIONS & SERVICES, AGRICULTURE & FOREST

DEFORESTATION MONITORING

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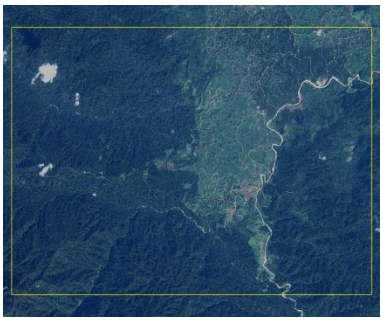
OBJECTIVE OF THE PRACTICAL WORK

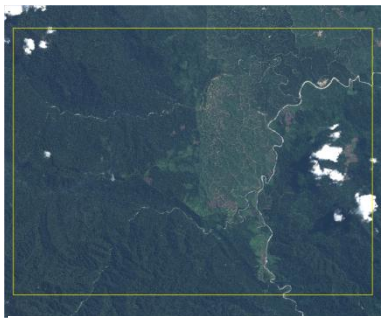
The objective of this practical work consists on producing a land use map (Basemap) to locate the forest area at a reference date then use the Basemap classification to detect deforestation on more recent images.

To this end, a database WP_FOREST was built containing:

- 2 SPOT7 images from January 2016 and June 2016 and one Landsat8 image from Mai 2016 (WP_FOREST\RASTER)
- A shapefile with oil palm plantation boundaries and a shapefile with the Area of interest (AOI) (WP_FOREST\VECTOR)



SPOT 7 – 20160121 (Basemap)



SPOT 7 - 20160611 (Monitoring)

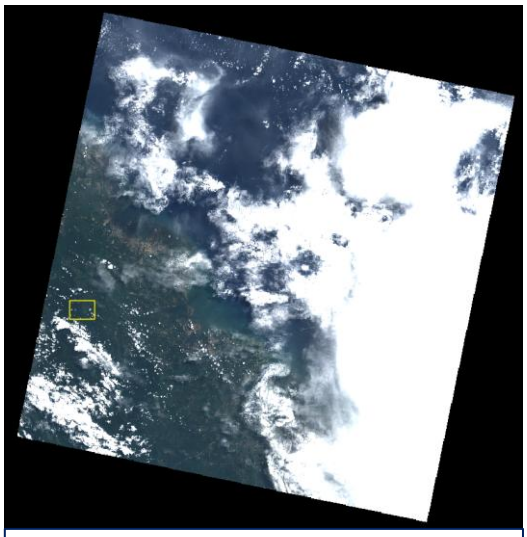
Landsat8 – 20160514 (Monitoring)

PART 1. IMAGE MANIPULATION / PHOTO-INTERPRETATION

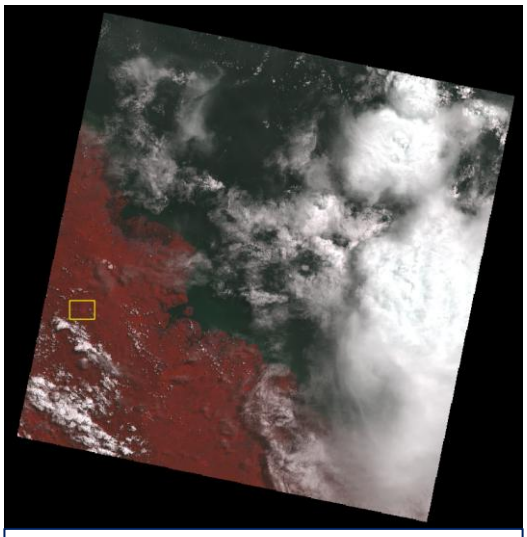
1. Visual analysis of optical image

- Open the QGIS project containing the images → double clic on *WP_Forest.qgs*

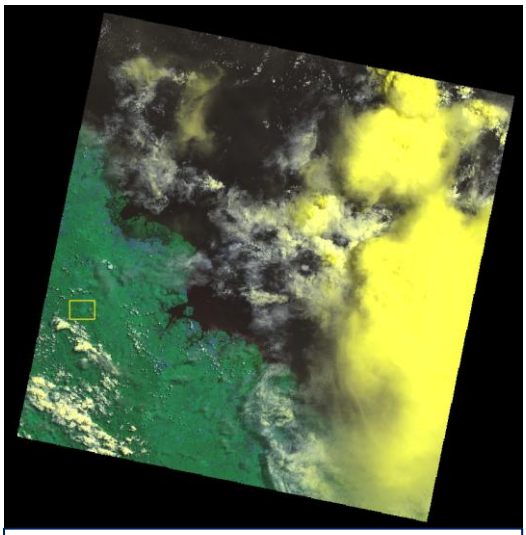
- Look at the different images RGB and other color rendering composition for SPOT and Landsat images



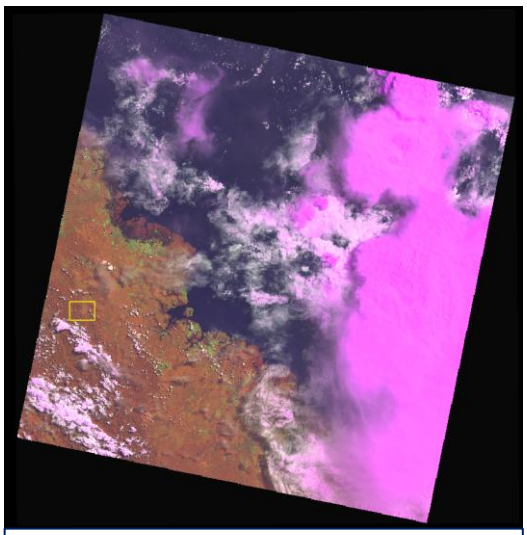
L8_20160514_034005_CC1
Red=Red / Green=Green / Blue=Blue
(also available on SPOT image)



L8_20160514_034005_CC2
Red=NIR / Green=Red / Blue=Green
(also available on SPOT image)



L8_20160514_034005_CC3
Red=SWIR / Green=NIR / Blue=Red

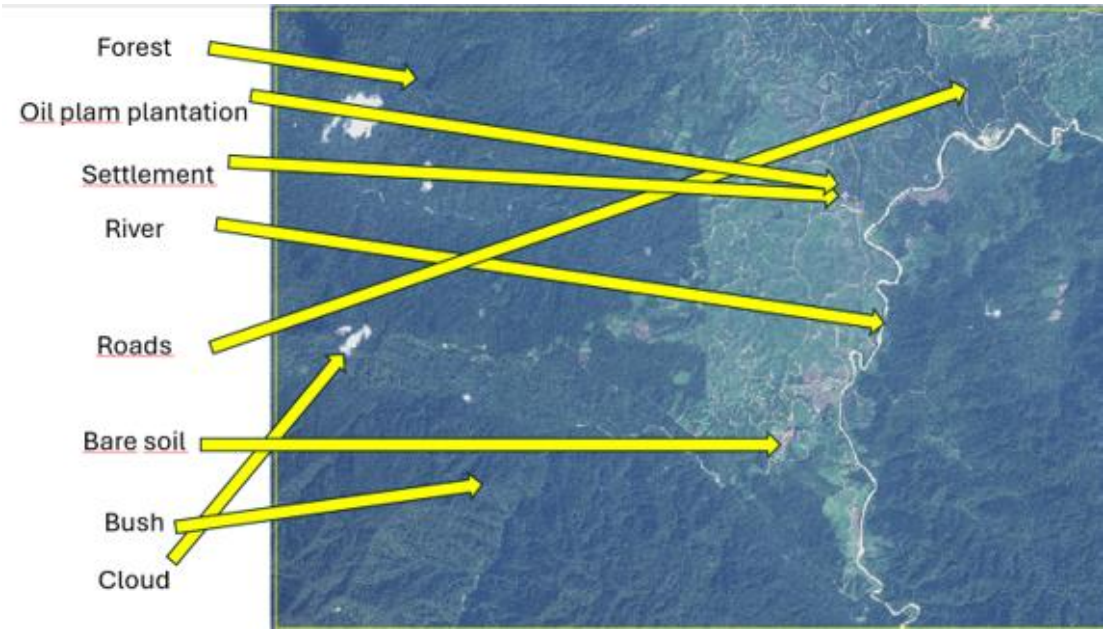


L8_20160514_034005_CC4
Red=NIR / Green=SWIR / Blue=Blue

Questions for **PART 1. PHOTO-INTERPRETATION**

⇨ Can you recognize some of the following landscape inside the Area of interest? *Forest, oil palm plantation, other tree plantation, settlements, river, mangrove, ocean, lakes, roads, cropland, bare soil, bush, cloud.*

It is actually really hard to recognize the different landcapes with only one spectral band but here is what I could have recognize:



⇨ Does the false color rendering help you identify some landscapes? If yes, how?

Yes

RED (CC2) → *better see rivers than in CC1.*

GREEN (CC3) → *better see shadows of clouds in CC1.*

(CC4) → *better see soils than CC1.*

⇨ Can you differentiate Forest and plantation on Landsat8 images (30m spatial resolution)? SPOT7 (1.50m spatial resolution)?

With this kind of resolution, it is impossible to see, maybe easier with different bands.

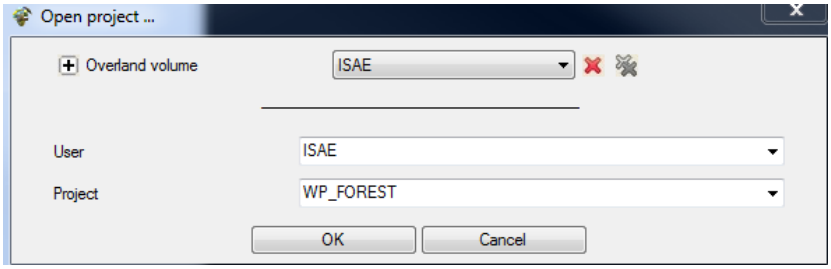
⇨ Conclusion: Suggest a list of classes to be mapped for the baseline map

So:

Clouds, shadows+ Settlements + Plantation + Baresoil +Roads + Forest + river,water

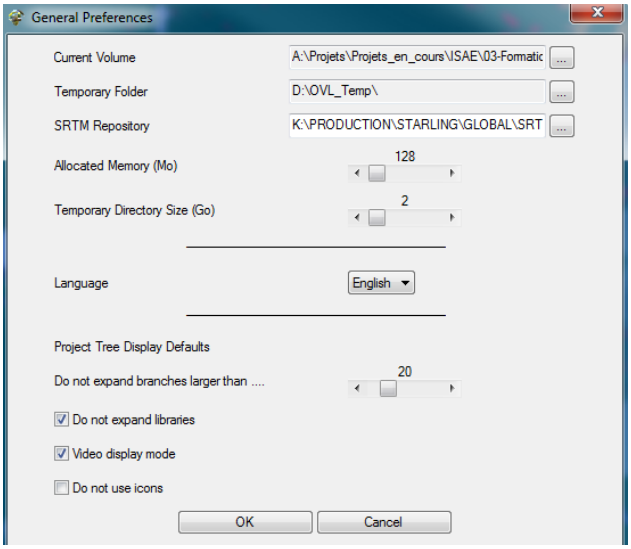
2. Visual analysis of the biophysical parameters on Overland

- Start OVERLAND software
- Open project : (Project\Open project\) and select user **ISAE** and project **WP_Foret**

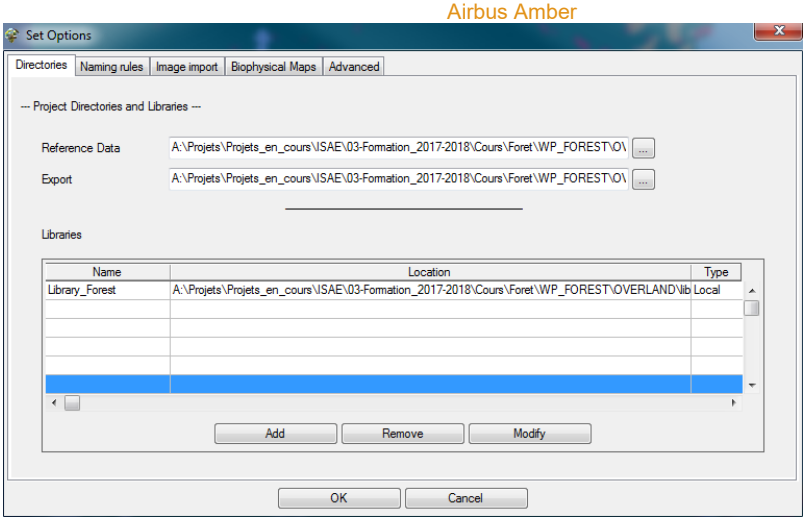


- Explore the following Overland menu (Project, Images, ROIs, Themes) to see the main functionalities. To have a complete description of this menu, go to ?\Help\ and open the User Manual and the Reference guide.

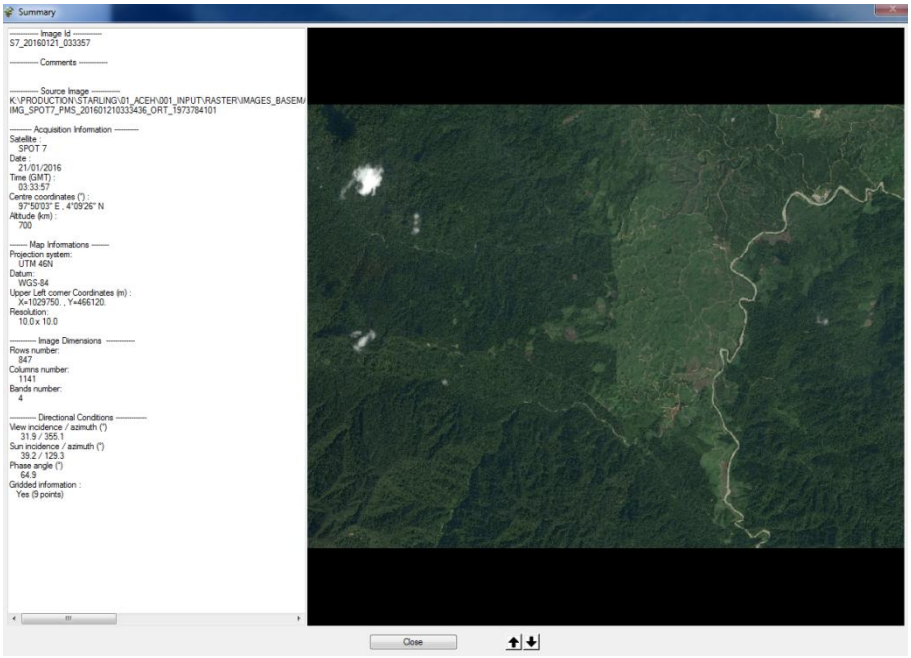
- Check the Project preferences (Project/Preferences).



- Check the Project set options (Project/Set Options)

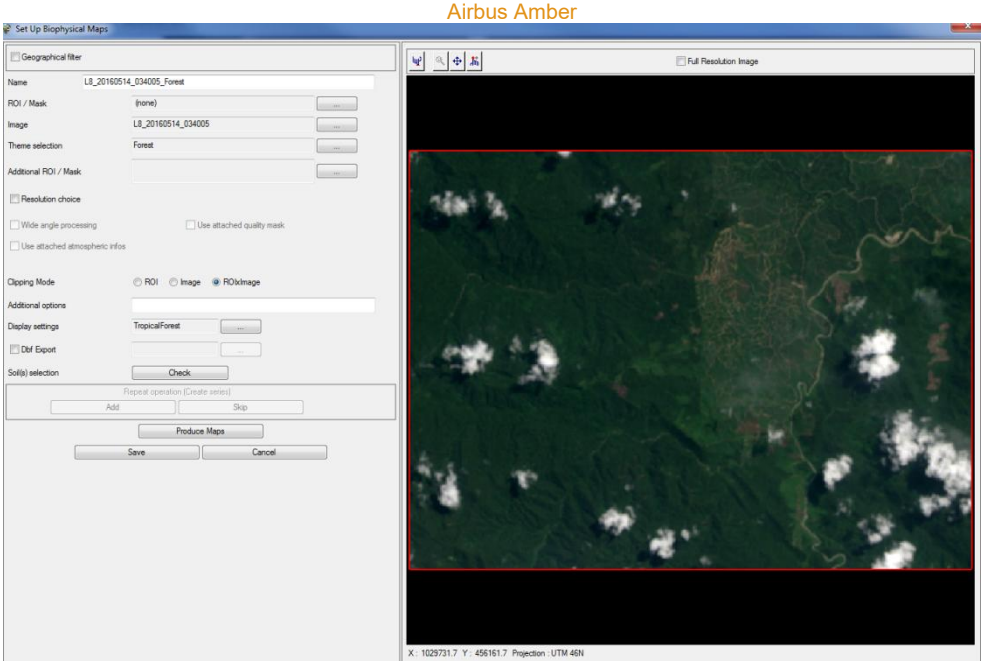


Open one of the images → right click on the image name and choose Open. You have a description of the main characteristics of the image. Click Close when you have finished.

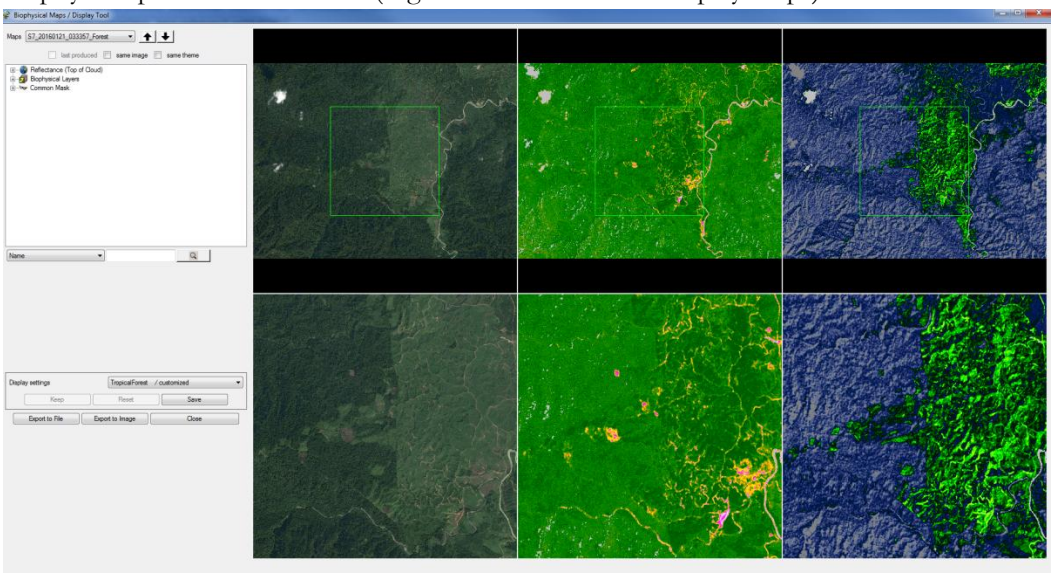


In Overland, processing the biophysical maps requires to define the soil spectral characteristics and the vegetation characteristics into Themes. These themes are used for the inversion of the soil/vegetation transfer models (PROSPECT and SAIL). As it is a specific work, for this study, we have already created the soil and vegetation themes and processed the biophysical maps.

- To see input parameters right-click on one of the biophysical map → Open/modify. Click on cancel when you are done.



- Then, open biophysical maps of the SPOT7 image from January 2016, and look at the different biophysical parameters available (Right-clic on the file → Display Maps)



Questions for **PART 1. BIOPHYSICAL DATA ANALYSIS**

⇨ Which biophysical parameters seem the most efficient to recognize the different classes you just defined? And Why?

The most efficient parameters to recognize Forest:

- The most important one would be the Leaf Chlorophyll Content (LCC) because it enables us to see where the vegetation is located, except for the early steps of a crop development
- Must be associated with other factors as Canopy Shadow Factor (CSF) to see the area where you still have LCC but without a big CSF value

In order to recognize the Road we could

⇨ Complete the table below

Landscape	**Biophysical parameters**
Forest	Canopy Shadow Factor
River	Water Fraction
Settlements	Leaf Chlorophyll Content
Plantation	Canopy Shadow Factor + potentially
Roads	Fsol + NDIF
Water	Water function
Clouds	Cloud Reflectance
Soil	Fsoil
Shadows	Cloud cast Shadows

⇨ Overland in script mode

Using the roadmap-template provided, create your own roadmap to automate the biophysical process of one of the two SPOT images over the ACEH AOI and export the resulting fraction of green cover in two modes (display for adding in report and image to be able to post-process this biophysical layer further in other processing environment).

To do so, your roadmap should contain the following steps:

- Create a new overland project named with your lastname in the users ISAE
- Specify the path to the libraries containing the models used for image visualization and the biophysical inversion: *Library_TrueColor, Library_SoilMaps, library_Forest*
- Specify the path to the folder containing export results
- Import shapefile *AOI-ACEH.shp* corresponding to the boundaries of the Area of Interest
- Import one of the two SPOT images and cropped to the AOI boundaries
- Process the SPOT image with the theme *Forest* and using the display settings named *TropicalForest*
- Export the fraction of green cover *glcv* in two mode display and image in tif format

⇨ As a result, provide your roadmap file together with your practical work report file.

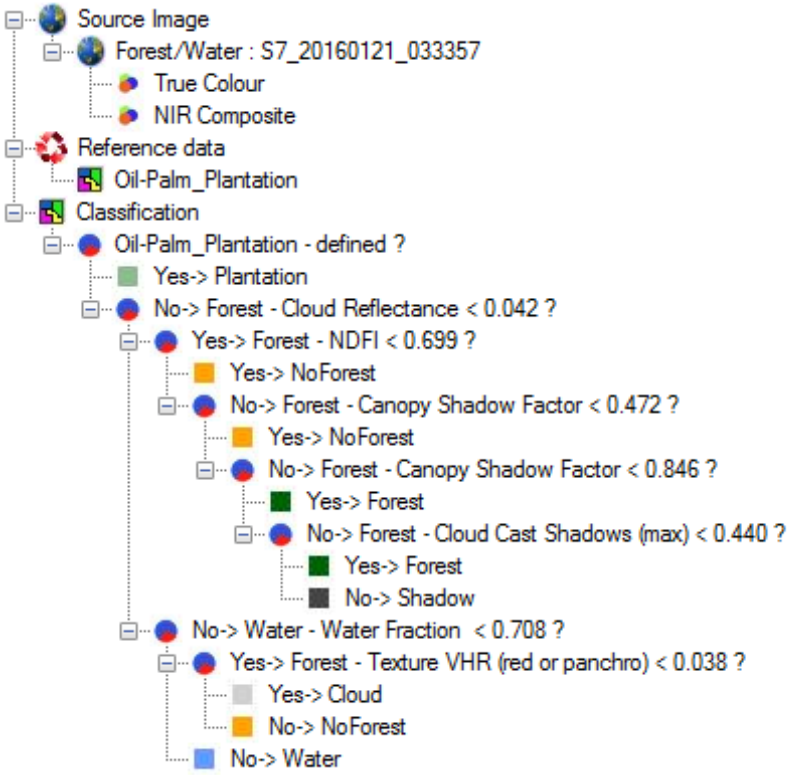
PART 2. OVERLAND CLASSIFICATION

1 Basemap

The Basemap is a land-use map derived from satellites images and used as a reference to monitor deforestation.

a. Pixel-based classification by decision tree

- Open the classification *S7_20160121_033357_Basemap* and look at the decision tree

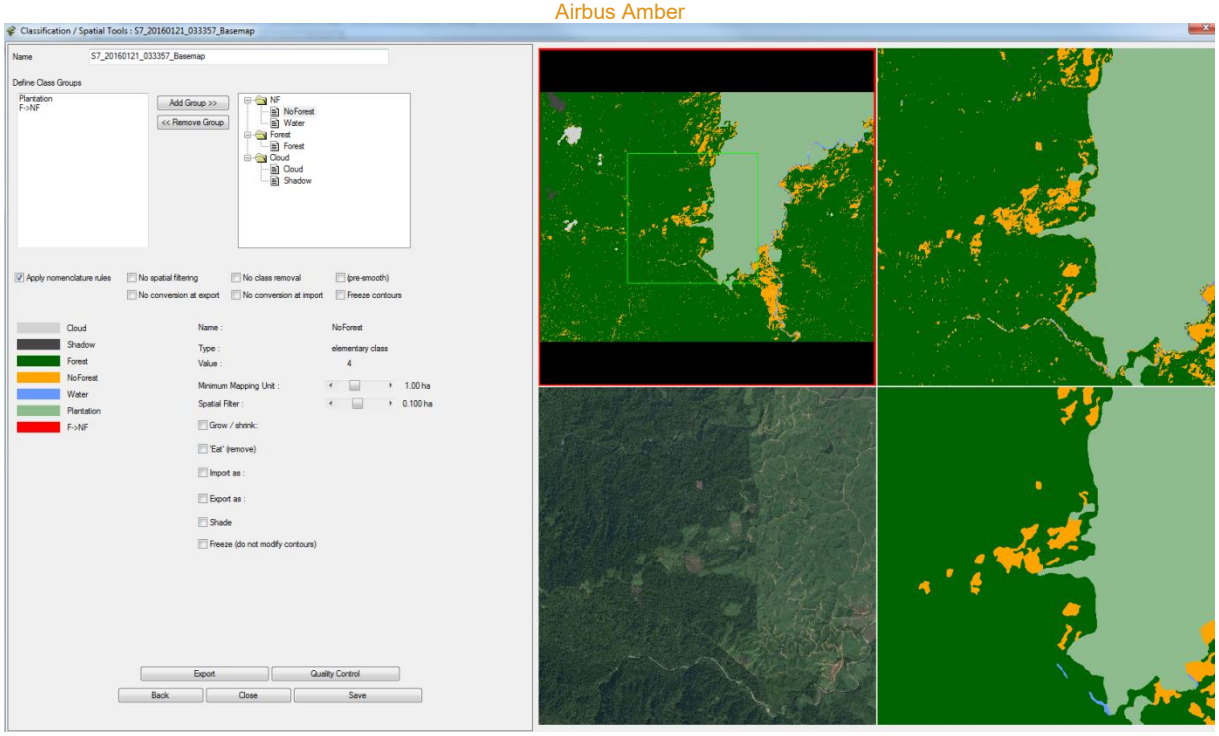


⇨ Go on each branch of the tree and analyze which parameter is used for.

b. From pixel to object

On the last window, you can work with all the export parameters, and "clean" the final classification by adding some rules of neighborhood.

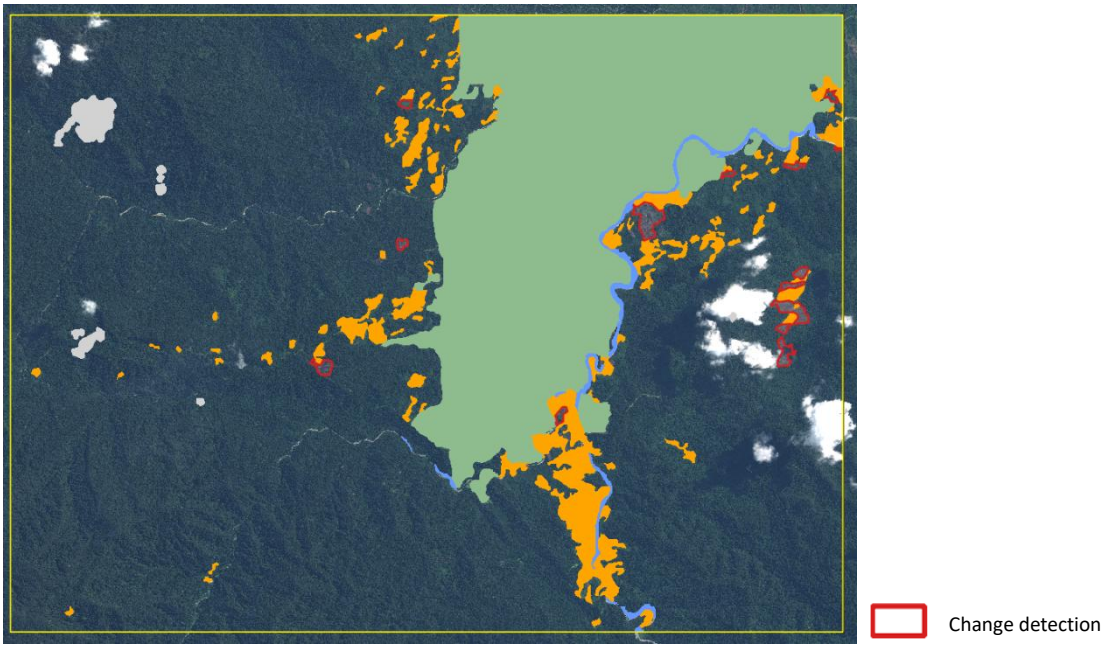
- Minimum mapping unit
- Spatial filters
- Grow/shrink function
- Export format



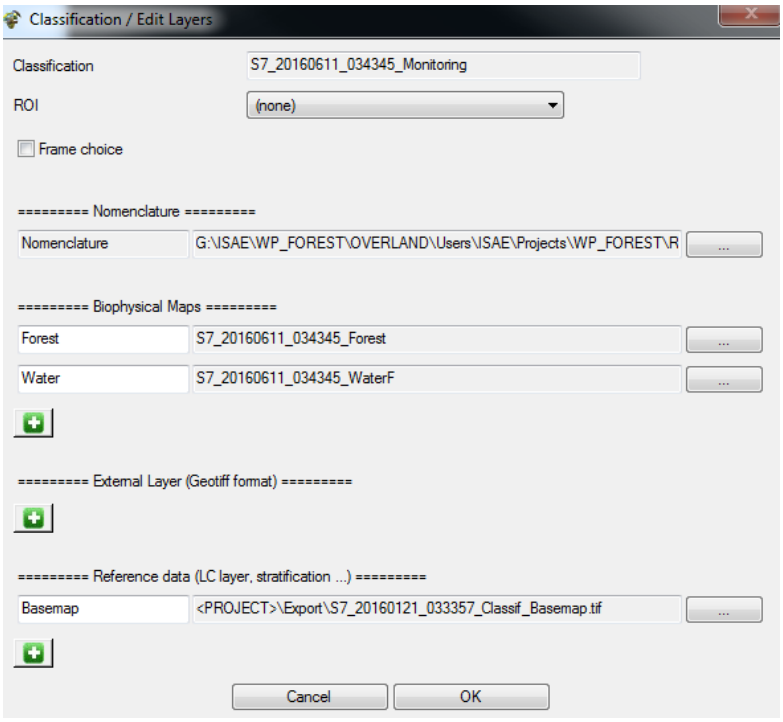
- ⇨ On QGIS, open the basemap in Geotif format under: WP_FOREST\OVERLAND\Users\ISAE\Projects\WP_FOREST\Export
- ⇨ Control the results. The QGIS plug-in "MapSwipeTool" can be useful.

2 Monitoring

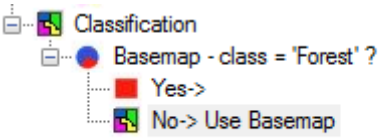
The monitoring is a measurement of landscape change from the Forest class to a non-forest class (Bare soil, plantation, settlements…)



- On Overland interface, add a classification map→ Right-clic on Classification Maps → New
- Add the Basemap as a reference data and a nomenclature file *(Nomenclature_Monitoring.xml)*
- Add the Forest and water biophysical maps



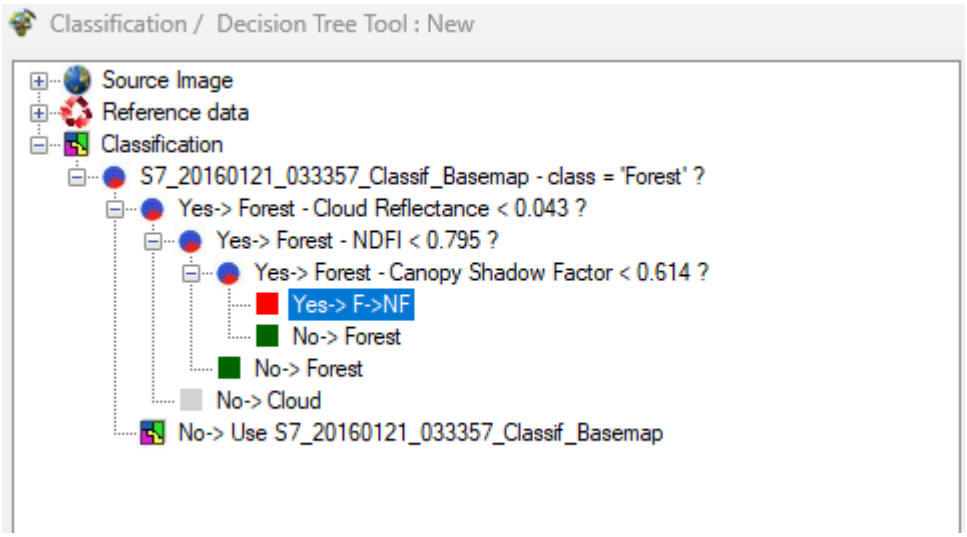
- Add the Basemap in the decision tree to work only on the forest class
  - Right click on "enter criteria"
  - Select "Add criteria"
  - Select the Forest Class on the Basemap
  - On the "No" branch→ right-click →select "Use value" and "Basemap"



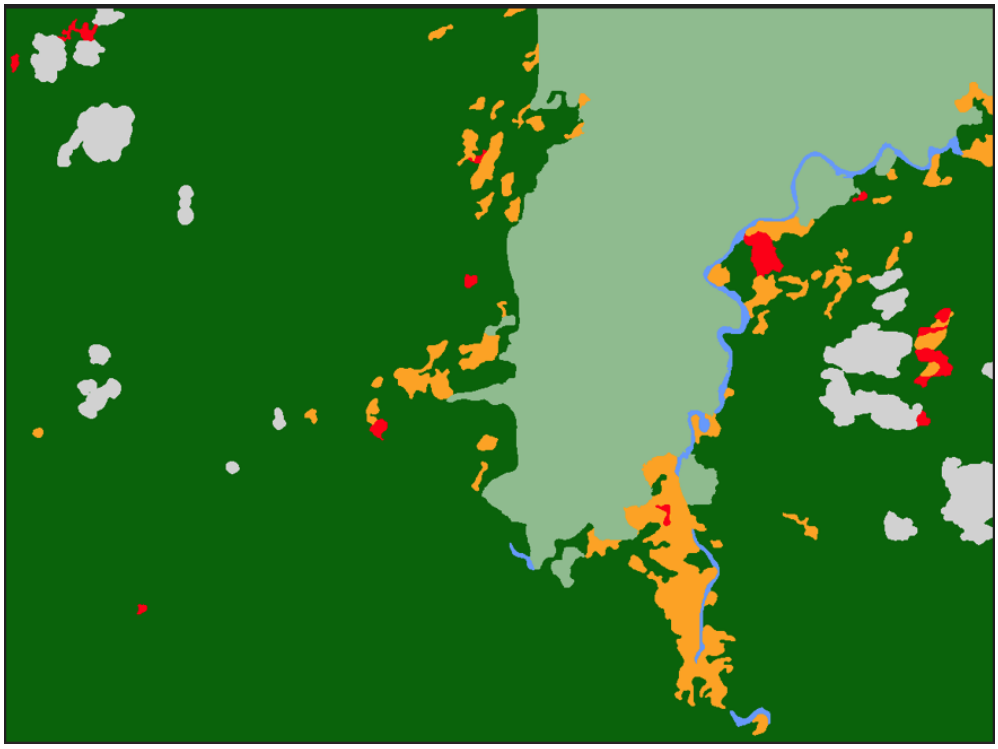
- Work on the Yes branch to discriminate deforested areas in the forest class
- Export and verify your results on QGIS

Questions for **PART 2. OVERLAND CLASSIFICATION**

⇨ Provide an image of your decision tree for the change detection classification *(screenshot from Overland is sufficient).*



⇨ Provide an image over the study area of your change detection classification result *(screenshot from Overland is sufficient).*



⇨ How do you assess your classification results to detect deforestation? Explain in a few words the different steps that allowed you to obtain these results and how you could improve them.

1) Remove cloud repair

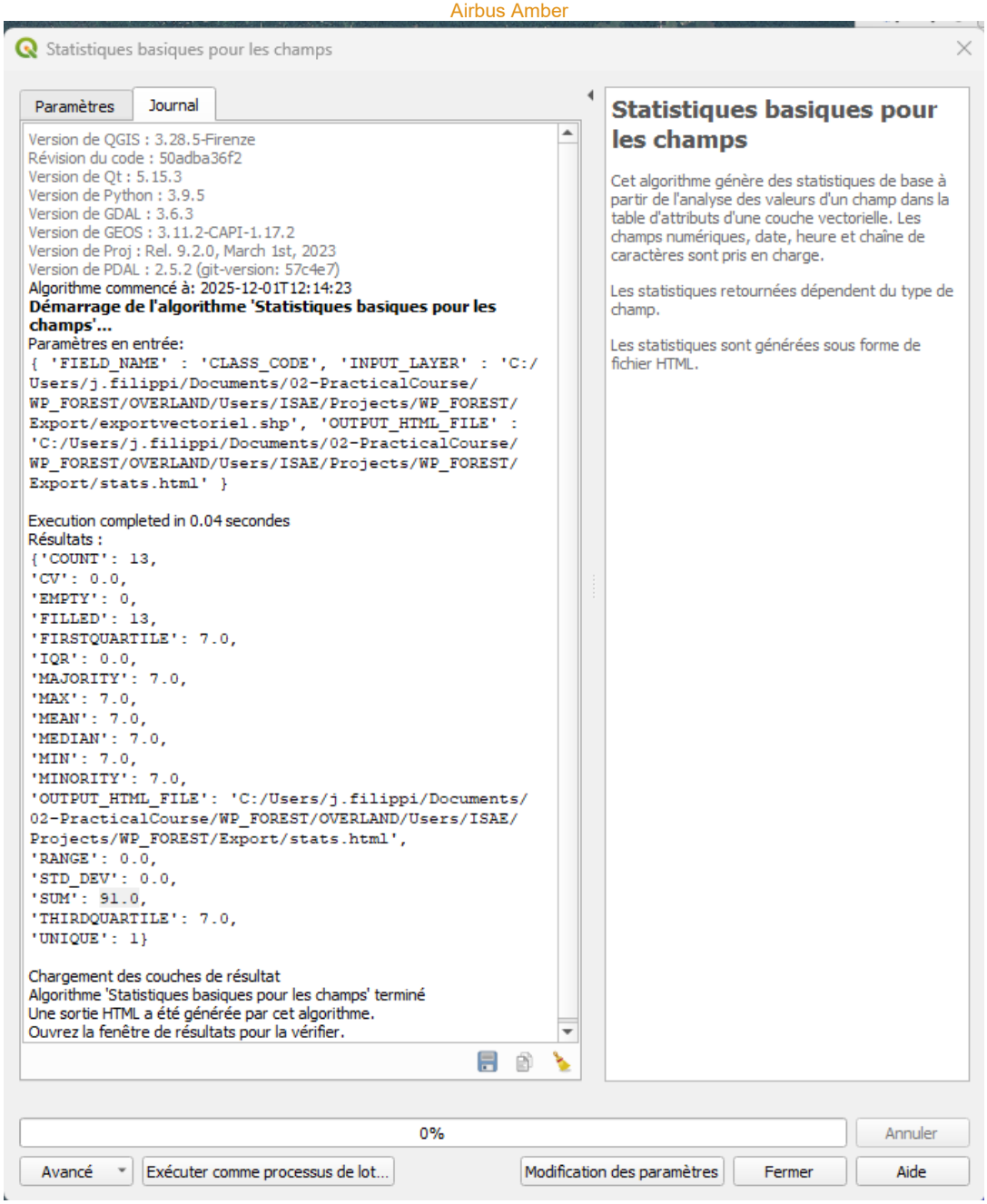
2) Initial forest discrimination using the NDFI indicator

3) Then, using the canopy shadow factor, we will be able to detect what used to be forest but is no longer forest in more recent images

4) This gives us an initial overview of the location of the forest, and then the canopy shadow factor will be useful for capturing the density of the forest

5) Bonus: estimate the surface area of the deforested areas

91 hectares maybe due to over-estimation, which seems to be coherent but a bit too much, we could maybe adjust the canopy factor threshold in order to see a more delimited deforestation monitoring.


Statistiques basiques pour les champs
Paramètres
Journal
Version de QGIS : 3.28.5-Firenze
Révision du code : 50adba36f2
Version de Qt : 5.15.3
Version de Python : 3.9.5
Version de GDAL : 3.6.3
Version de GEOS : 3.11.2-CAPI-1.17.2
Version de Proj : Rel. 9.2.0, March 1st, 2023
Version de PDAL : 2.5.2 (git-version: 57c4e7)
Algorithme commencé à: 2025-12-01T12:14:23
Démarrage de l'algorithme 'Statistiques basiques pour les champs'...
Paramètres en entrée:
{ 'FIELD_NAME' : 'CLASS_CODE', 'INPUT_LAYER' : 'C:/Users/j.filippi/Documents/02-PracticalCourse/WP_FOREST/OVERLAND/Users/ISAE/Projects/WP_FOREST/Export/exportvectoriel.shp', 'OUTPUT_HTML_FILE' : 'C:/Users/j.filippi/Documents/02-PracticalCourse/WP_FOREST/OVERLAND/Users/ISAE/Projects/WP_FOREST/Export/stats.html' }
Execution completed in 0.04 secondes
Résultats :
{'COUNT': 13,
'CV': 0.0,
'EMPTY': 0,
'FILLED': 13,
'FIRSTQUARTILE': 7.0,
'IQR': 0.0,
'MAJORITY': 7.0,
'MAX': 7.0,
'MEAN': 7.0,
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'MINORITY': 7.0,
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'SUM': 91.0,
'THIRDQUARTILE': 7.0,
'UNIQUE': 1}
Chargement des couches de résultat
Algorithme 'Statistiques basiques pour les champs' terminé
Une sortie HTML a été générée par cet algorithme.
Ouvrez la fenêtre de résultats pour la vérifier.
Statistiques basiques pour les champs
Cet algorithme génère des statistiques de base à partir de l'analyse des valeurs d'un champ dans la table d'attributs d'une couche vectorielle. Les champs numériques, date, heure et chaîne de caractères sont pris en charge.
Les statistiques retournées dépendent du type de champ.
Les statistiques sont générées sous forme de fichier HTML.
0%
Annuler
Avancé
Exécuter comme processus de lot...
Modification des paramètres
Fermer
Aide