→ 6th ESA ADVANCED TRAINING COURSE
ON LAND REMOTE SENSING

SNAP and Sentinel 2/3 Toolboxes

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14–18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania

Agenda

- Project Overview
- SNAP : SentiNel Application Platform
- Sentinel 2 Toolbox
- Sentinel 3 Toolbox
- Practical

Project Overview

- Free and Open Source Software
- Multi mission EO Data processing software
- Modular and Extensible
- Portable

Multi-mission

- Sentinel 1-2-3
- Envisat, MODIS, SeaWiFS,
  AVHRR, SMOS, Chris-PROBA, SPOT VGT, etc
- Landsat, RapidEye, SPOT
- NetCDF CF, GeoTIFF, HDF, ESRI Shapefile

Free and Open Source

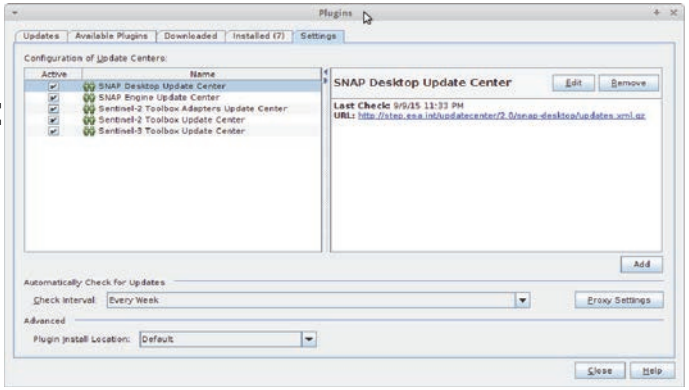
- “Free” as in free beer
  - SNAP does not cost you a dime
  - Free downloads on step.esa.int
- “Free” as in freedom

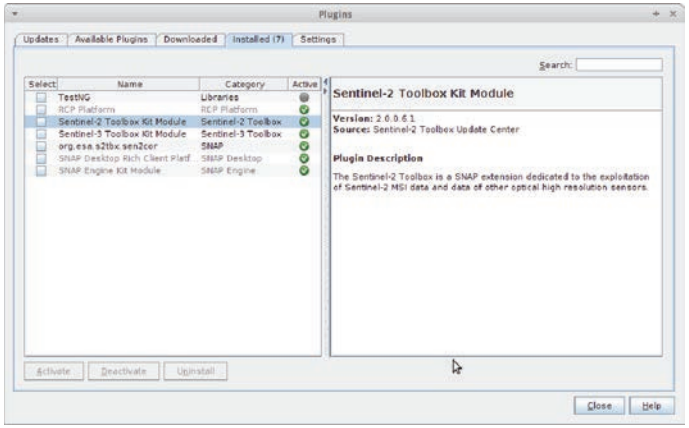
- Run
- Copy
- Distribute
- Study
- Change & Improve

- Source code :  https://github.com/senbox-org/

Modularity

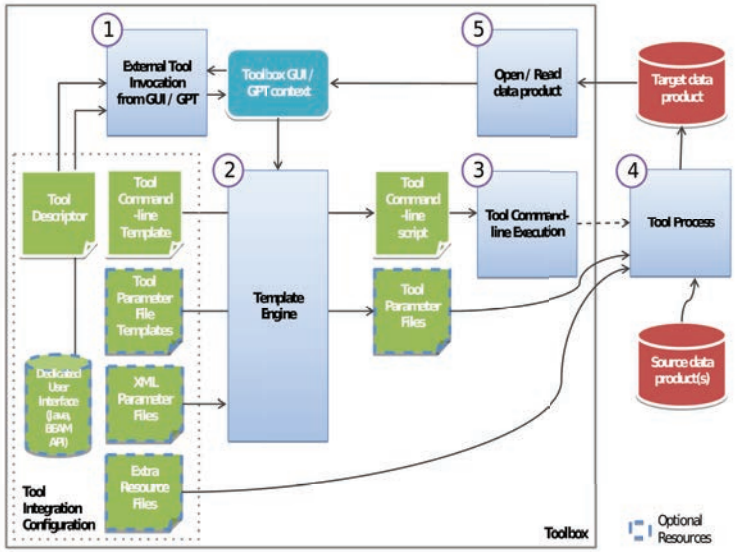
- Functionalities splitted in individual modules:
  - Readers, writers
  - Operators (data processing)
  - GUI functionalities
- Module manager
  - Updates
  - installation/removal of new modules
  - Notification
  - Any number of third party repository





Extensibility

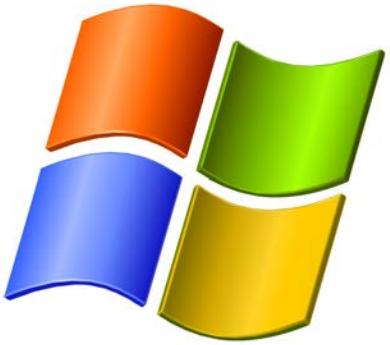
- Standalone tools adapter
  - Use your own tool directly from the toolbox
  - SEN2COR, OTB, GDAL...



- Java & Python interface
- C++ coming next (Orfeo Toolbox)

Portability

- Java as a basis language
- Installer provided for all standard platforms



Ready for the Cloud

- Modularity => Headless deployment possible
- The Developer Forum works on providing ready to use cloud images

A Coordinated project

- Common development platform for S1/S2/S3 toolbox
- Common release planning
- Common base platform, common set of modules
- The 3 toolboxes are fully interoperable

Follow us !

- Main web site : http://step.esa.int
- Forum : http://forum.step.esa.int
- Source code : https://github.com/senbox-org
- Issue tracker : https://senbox.atlassian.net

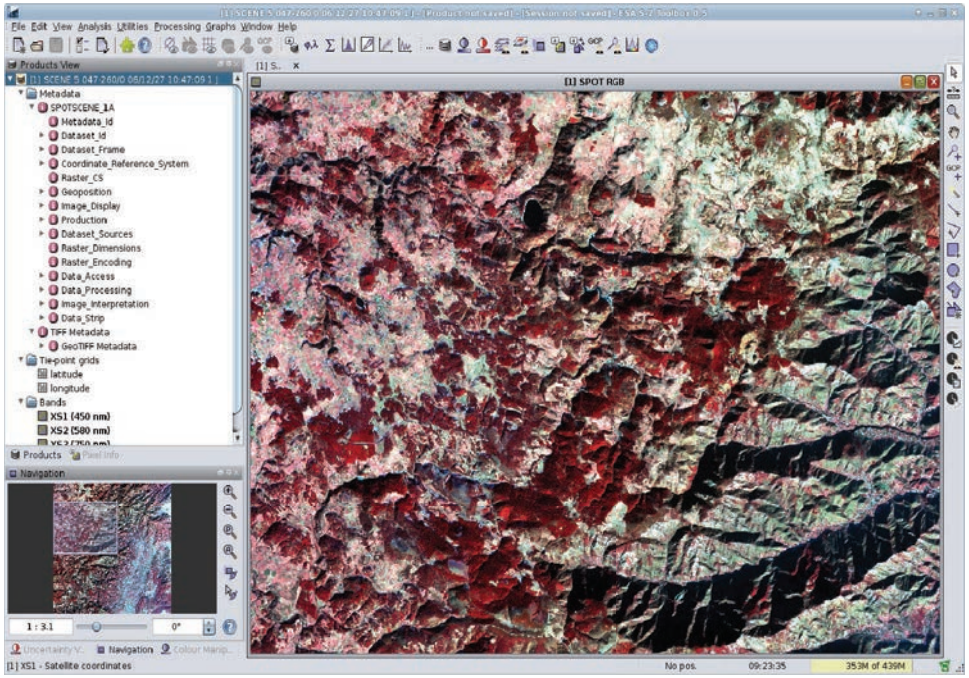
Register on the forum !

Sentinel 2 Toolbox

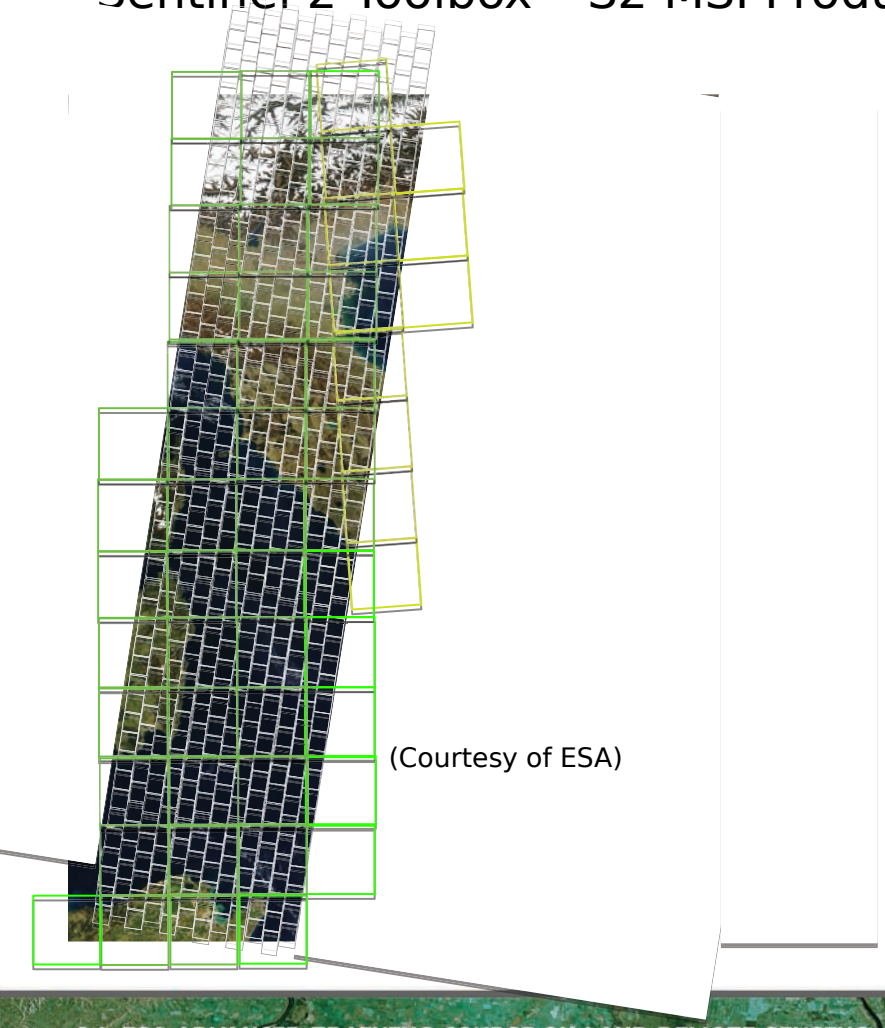
- Sentinel 2 data readers : L1B, L1C, L2A
  - Multi-mission : new land-products readers
  - Spot 1-7, RapidEye, UK-DMC, Deimos, Ingenio/SEOSAT, EnMAP
- Sentinel 2 scientific processors
  - Sen2Cor : Atmospheric correction for S2-MSI L1C
  - Reflectance to radiance converter
  - Level 3 processor : temporal synthesis
  - L2B processor : biophysical products
  - Water processors (to be defined)
  - Forest mapping processor

Sentinel 2 Toolbox – New land product readers

- SPOT 1-5 (6 and 7 planned)
- SPOT4 Take5 / SPOT5 Take5
- RapidEye
- DEIMOS
- Generic JPEG2000 reader



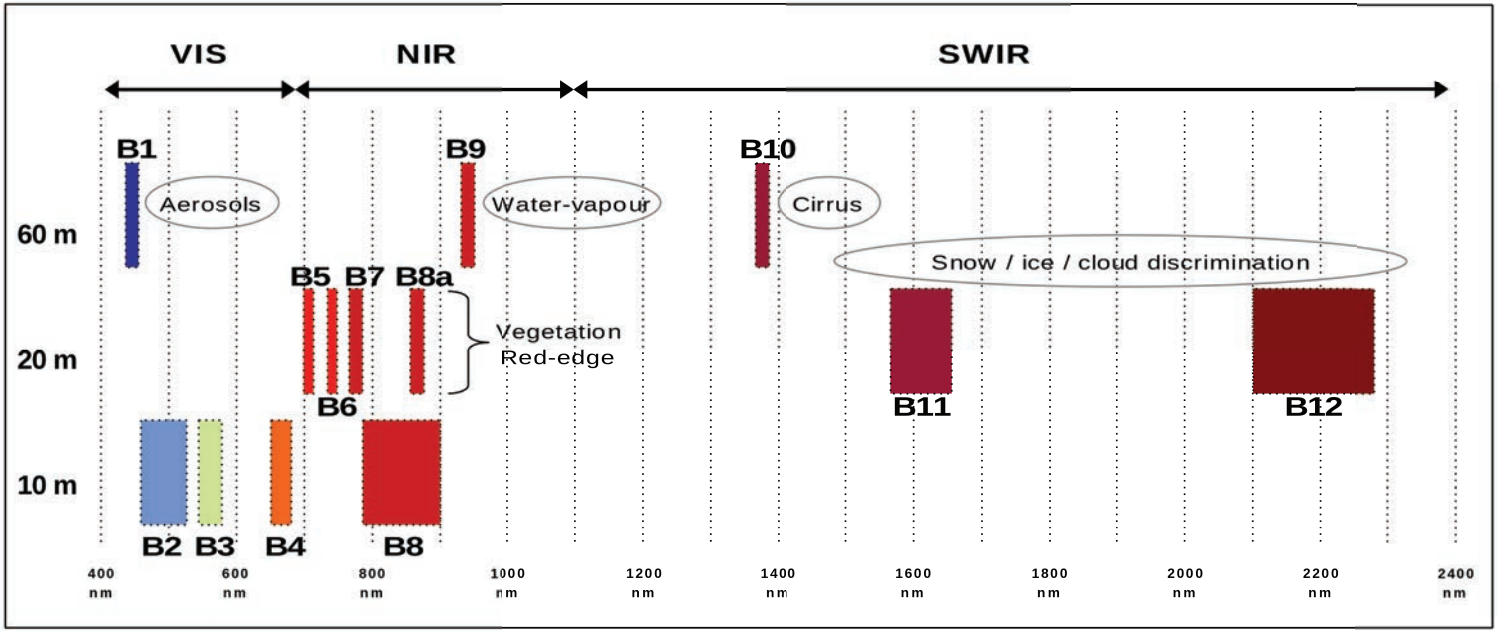
Sentinel 2 Toolbox – S2 MSI Product



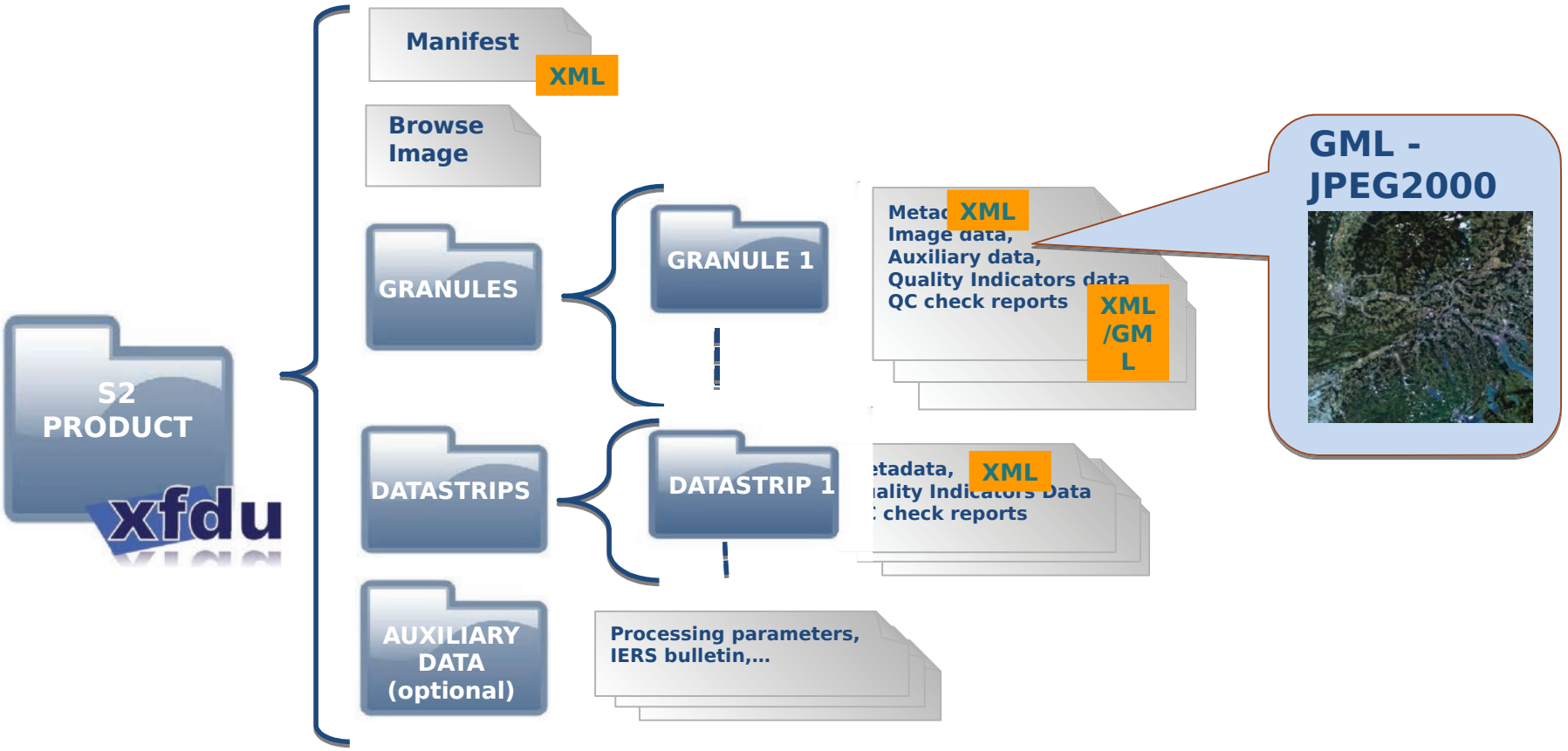
(Courtesy of ESA)

- L1B : 25km x 25km granules
- L1C : 100km x 100km tiles
- Several tiles/granules per product
- Each tile/granule contains 1 JPEG2000 file per band
- Mosaicking is done automatically by Sentinel 2 Toolbox
  - Optimized for multi-resolution
  - Decoded thanks to OpenJPEG

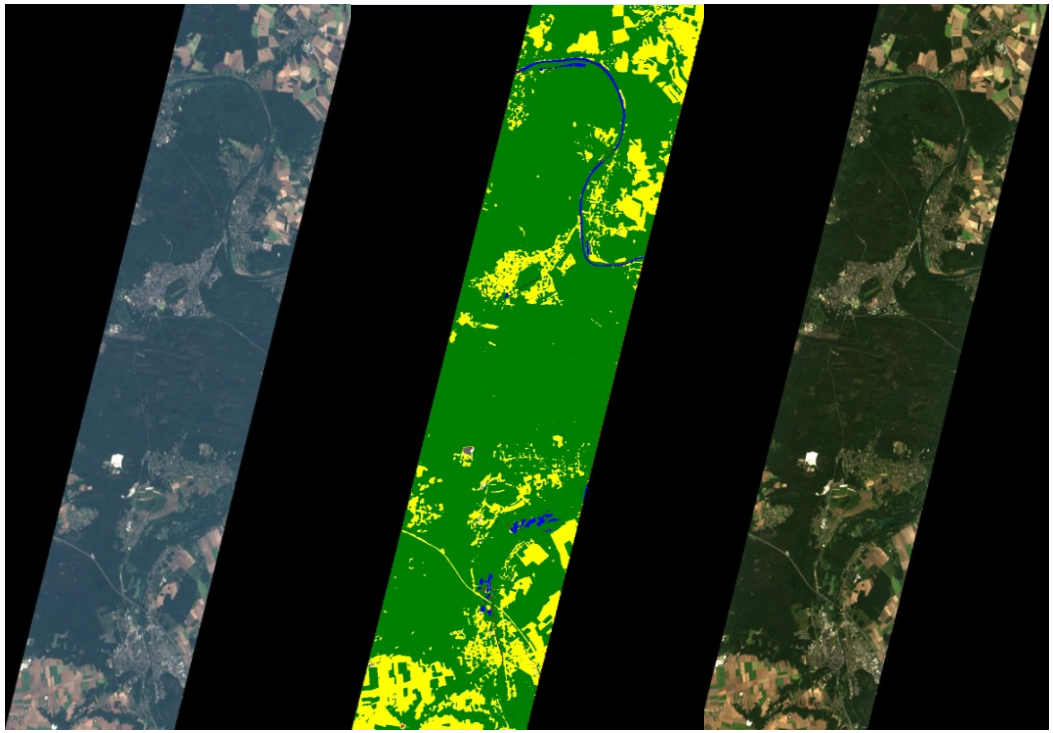
Sent


VIS
NIR
SWIR
B1
Aerosols
B9
Water-vapour
B10
Cirrus
Snow / ice / cloud discrimination
60 m
B5 B7 B8a
Vegetation
Red-edge
20 m
B6
B11
B12
10 m
B2 B3 B4
B8
400 nm
600 nm
800 nm
1000 nm
1200 nm
1400 nm
1600 nm
1800 nm
2000 nm
2200 nm
2400 nm

Sentinel 2 Toolbox – S2 MSI Product



Sentinel 2 Toolbox – L2A Processor



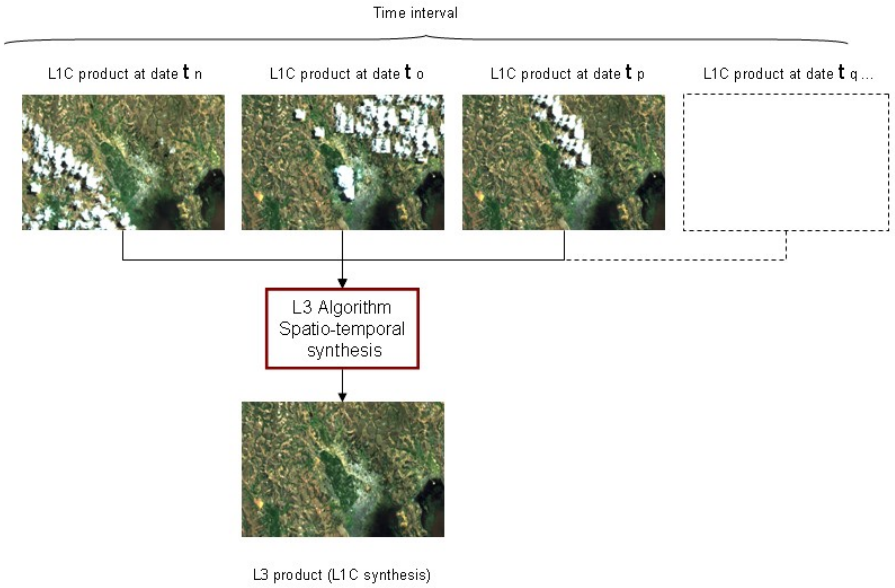
Outputs :

- Bottom of atmosphere reflectance in cartographic projection
- Scene Classification Map
- Water Vapour Map
- Aerosols Optical Thickness Map

Algorithm

- Cloud/Cloud shadow detection
- Cirrus correction
- Slope effect correction
- BRDF effect correction

Sentinel 2 Toolbox – L3 Processor



Outputs :

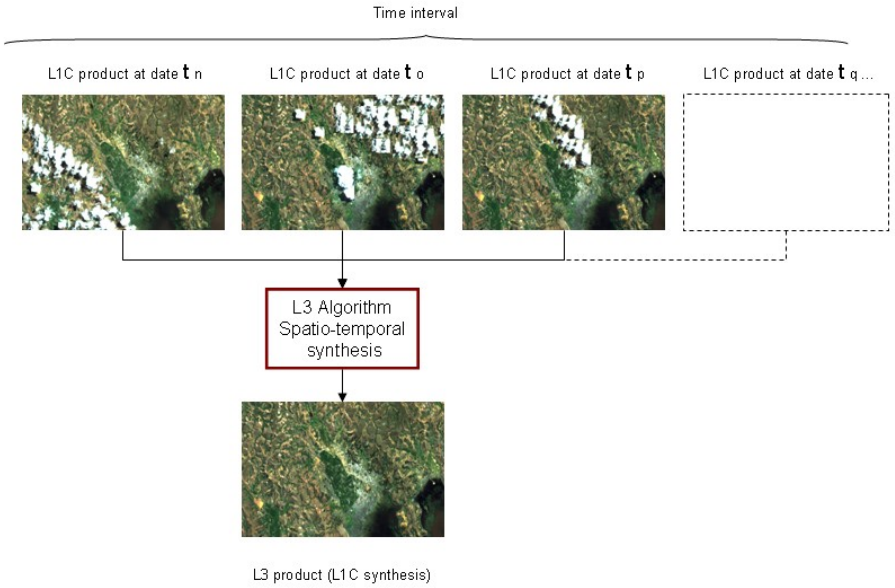
- Cloud-free temporal synthesis of several L1C or L2A products

Synthesis Algorithms

- Most recent
- Temporal Homogeneity
- Radiometric Quality
- Average

http://s2tbx.telespazio-vega.de/sen2three

Sentinel 2 Toolbox – L2B Biophysical Products



Outputs :

- LAI : Leaf Area index
- FAPAR : fraction of photosynthetically active radiation absorbed by the green elements of the canopy
- CCC, the Canopy Chlorophyll Content used as a proxy of the nitrogen status of the plant
- CWC, the Canopy Water Content used also as a proxy for the water status of the plant

Part 2 : Practical – S2 data

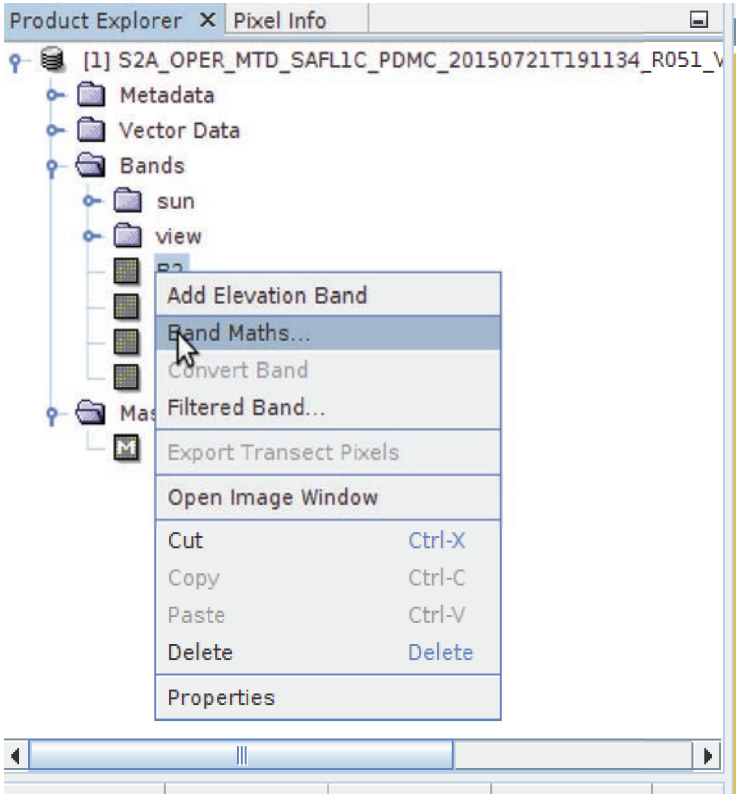
- Ex1 : Browse a S2 product
- Ex2 : Band Math
- Ex3 : Colour manipulation
- Ex4 : Vector Data
- Ex5 : Analysis Tools
- Ex6 : Uncertainty Visualisation

Practical – Exercise 1 – Browse a S2 product

- Open the Sentinel 2 product
- Display band properties
- Display a band contents in image view
- Display an RGB composite
  - Natural color (Red Green Blue)
  - False color infrared composition (NIR Red Green)
- Open another band
- Tile window
- Use the navigation view to spatially link both window
- Discover the Pixel Info View

Practical – Exercise 2 – Band Maths

- Create a new band by applying Band Maths
- Create a NDVI band
  - Near Infrared : B8
  - Red : B4
- Create a Water index mask
  - Green : B3
  - NIR : B8



Practical – Exercise 3 – Color manipulation

- Display the newly created bands
- Open the color manipulation tab
- Choose a color ramp to display NDVI
- Open the “Sliders” or “Table” mode and modify the ramp
- Find a suitable threshold to delineate vegetation areas
- Find a suitable threshold to delineate water areas
- Apply thresholds with band properties
- Use the Layer Manager to display NDVI on top of a band
- Use the Mask Manager to create a new vegetation mask

Practical – Exercise 4 – Vector Data

- Delineate an area of interest
  - Choose between rectangle/ellipse/polygon
- Use the Layer Manager to display the vector or hide it
- Use the Mask Manager to combine it with vegetation or water mask
- Add a new Vector data container
  - Click on “Vector Data” in the product explorer
  - Click on “Vector>New vector data container”
  - Draw a line
- Visualize the geometry WKT

Practical – Exercise 5 – Analysis Tool

- Open “Profile Plot” tool
  - Select a band
  - Select a geometry. Yes it works with any geometry, not just lines !
  - Play with the “Box size” parameter to smooth results
- Open the “Scatter Plot”
- Open the “Histogram”
- Open the “Statistics”

Practical – Exercise – Graph Builder

- TODO Fabrizio presents it ?

Part 3 : Practical – S3 data

- Ex7 : Explore SLSTR product
- Ex8 : Visualize Uncertainty Information
- Ex9 : Explore an OLCI product