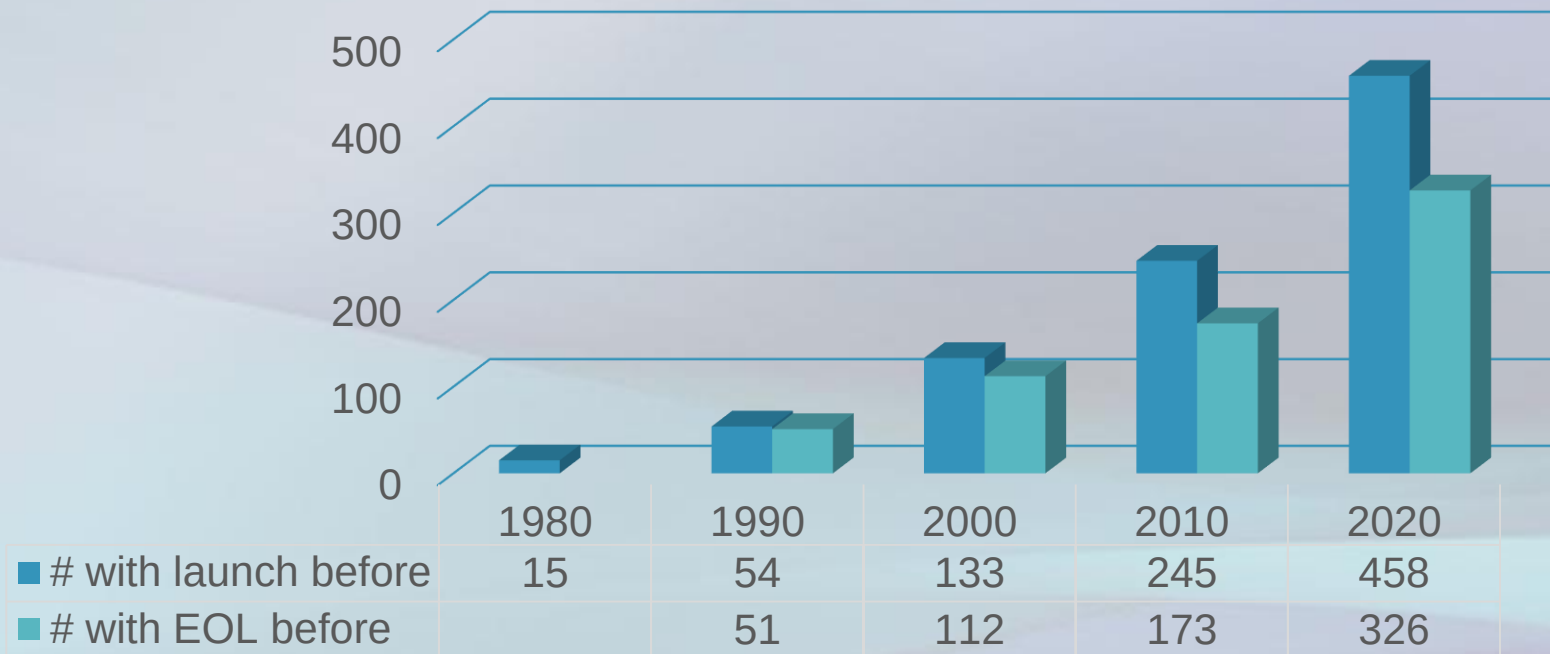




From rapid development to
operational processing:
Sentinel data user's support
provided by ESA's SNAP

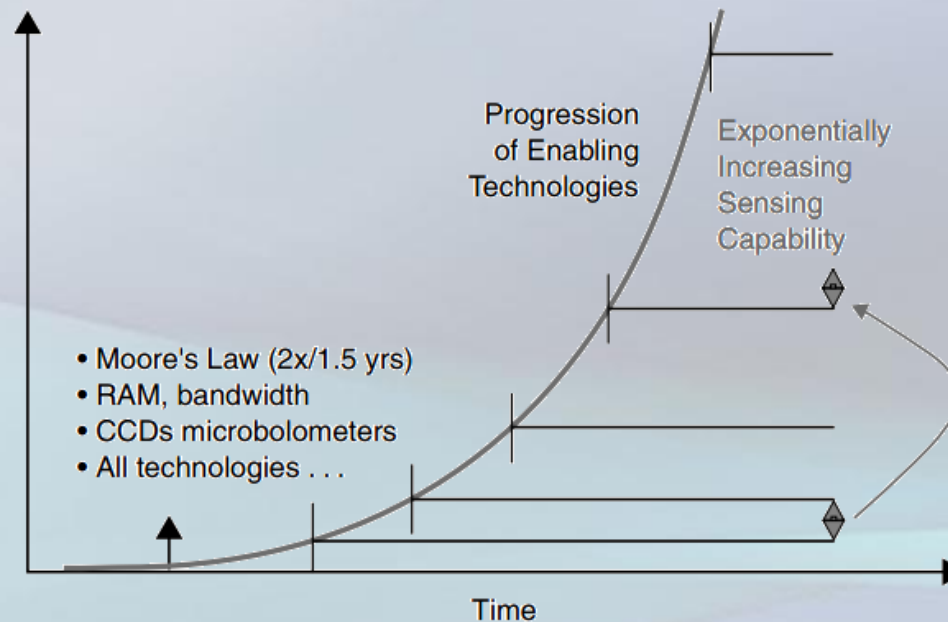
*Carsten Brockmann
Brockmann Consult GmbH*

Number of Satellite Missions



Source: CEOS Database

Sensing Capabilities & Enabling Technologies



*Source: Utilization of Operational Environmental Satellite Data,
Committee on Environmental Satellite Data Utilization, National Research Council*

History

- Early days
 - Data volumes: order of MBytes (Landsat 160MB)
 - Hardware: mainframe, UNIX workstation, image processing work station
 - Tools: own programmed code, FORTRAN, C
- Commercial support tools (list non exhaustive)
 - PVWave, IDL, matlab
 - ERDAS Imagine, ER Mapper, ENVI
 - ARC Info
 - all still successful on the market!
- Open source (list non exhaustive):
 - Image magic / GraphicsMagick
 - GRASS GIS
- Space Agencies provided tools for EO missions (list non exhaustive):
 - BEAM/NEST/BEAT/BRAT,
 - SeaDAS, Giovanni ...
- Education Tools

Data Access

Formats

System
corrections

Sensor specific
processing

Instrument
synergy

Data Access

Copernicus Data



→ SNAP | Sentinels Application Platform

Data Visualisation,
Analysis, Processing



In-situ Data

MerMAID
MERIS MATCHup In-situ Database

Welcome to MERMAID, the MERIS MATCHup In-situ Database

Purpose

The MERMAID project aims at making available an easy-to-use centralised database of merged in-situ optical measurements with concurrent MERIS acquisitions to Ocean Colour researchers involved in the MERIS mission.

The long-term objectives of this database are to:

- Enable the assessment of the MERIS marine Level 2 products delivered by the ENVISAT ground segment.
- Support the monitoring of these MERIS products over the lifetime of the mission by providing a complete temporal coverage of the mission.
- Provide support to atmospheric correction research.
- Support vicarious adjustment of the MERIS instrument.
- Provide a centralised validation resource to the ESA Optical Data Processor ODES.

Content

The database provides text files of in situ data, matched with concurrent and comparable MERIS L2 products (including flags, auxiliary information and the intermediate outputs of the processing). The extraction interface allows the users to select matchups according to their own requirements for site, parameters, flags and statistical screening, and produces validation statistics and plots.

Access

Read the data access and policy to request an access to the MERMAID facility.

About MERMAID

- Home
- In-situ data and protocols
- Data access & policy
- Data submission

MERMAID Tools

- Extract matchup
- Data format
- Version & history

ODESA Validation

- ODESA processing
- Download level1 matchups

Forum

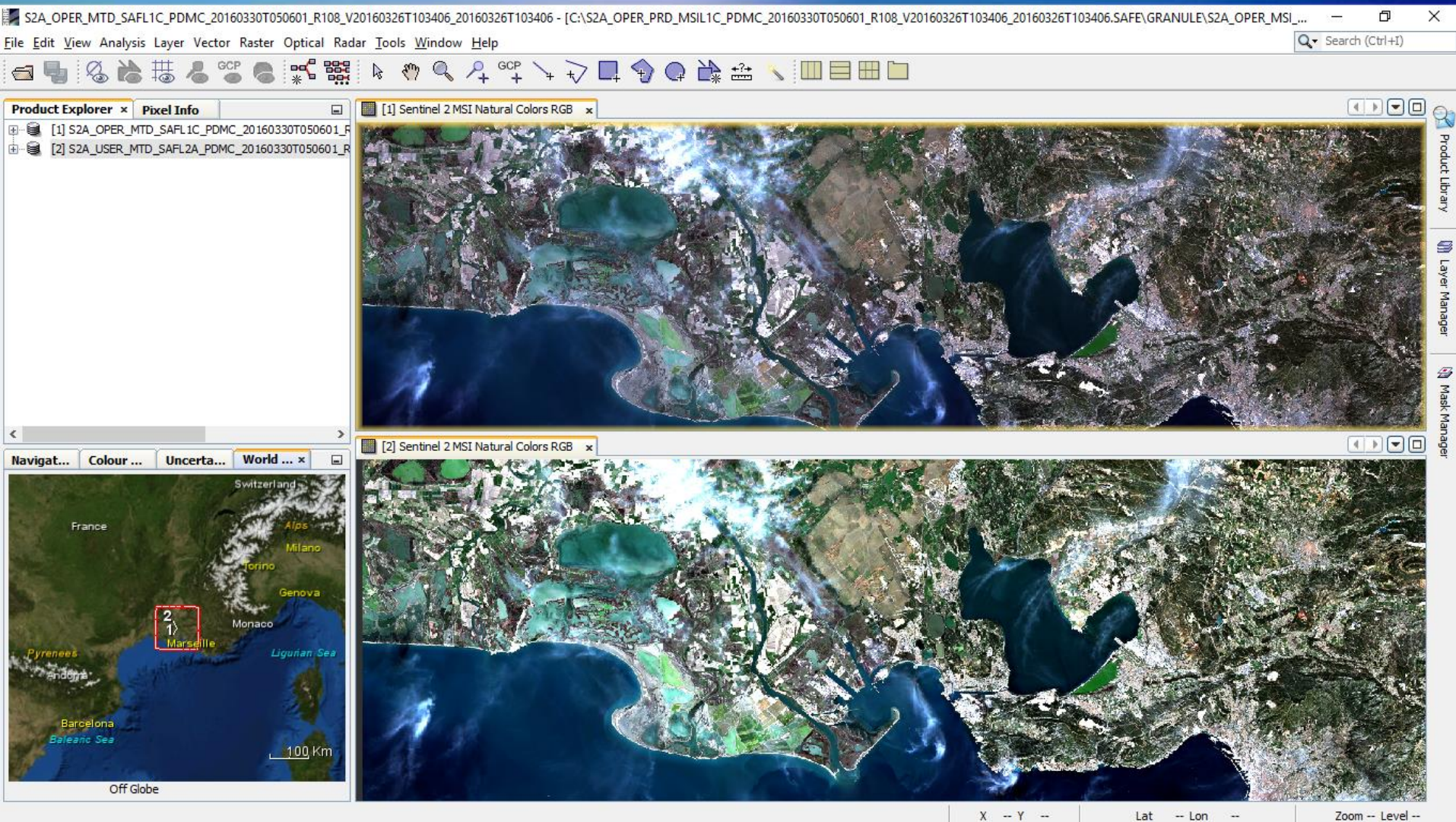
ESA's SNAP

→ SNAP | Sentinels Application Platform



- Generic tools
 - Data selection & access
 - Visualisation
 - Basic analysis (histograms, scatter plots, ...)
 - Processing (mosiacking, binning, ...)
 - Export (images, maps, data)
- Instrument specific tools
 - System corrections (e.g. noise reduction, smile correction)
 - Data processing (e.g. L1 -> L2)
 - Thematic processing, synergy
- Programming tools
 - Libraries / APIs
 - Scripting
 - Graphical model builder

SNAP with Sentinel 2



SNAP with Sentinel 2

The screenshot displays the SNAP software interface with the following components:

- Product Explorer:** A tree view on the left showing the loaded data. It includes 'Metadata', 'Vector Data', and 'Bands'. Under 'Bands', there is a 'sun' folder and a 'view' folder containing a list of bands: B1 (443 nm), B2 (490 nm), B3 (560 nm), B4 (665 nm), B5 (705 nm), B6 (740 nm), B7 (783 nm), B8 (842 nm), B8A (865 nm), and B9 (945 nm).
- Pixel Info:** A panel next to the Product Explorer showing the selected band and its properties.
- Main View:** The central area displaying two panels of Sentinel 2 MSI Natural Colors RGB imagery. The top panel is labeled '[1] Sentinel 2 MSI Natural Colors RGB' and the bottom panel is labeled '[2] Sentinel 2 MSI Natural Colors RGB'. Both panels show a detailed view of a coastal area with water, land, and vegetation.
- Map:** A small map in the bottom-left corner titled 'World ...' showing the location of the imagery. It highlights the Mediterranean region, with labels for Switzerland, France, Alps, Milano, Torino, Genova, Monaco, Marseille, Pyrenees, Barcelona, Balearic Sea, and Ligurian Sea. A red box indicates the area of interest, and a scale bar shows 100 km.
- Toolbar:** A horizontal toolbar at the top with various icons for file operations, navigation, and analysis.
- Status Bar:** A horizontal bar at the bottom with fields for 'X -- Y --', 'Lat -- Lon --', and 'Zoom -- Level --'.

Working in native resolution

Reflectance in band B1, 443.0 nm, +/-29.0 nm, 1830 x 1830 pixels, (dl)

Reflectance in band B2, 490.0 nm, +/-65.0 nm, 10980 x 10980 pixels, (dl)

SNAP with Sentinel 2

Masks

(decoding binary flag information)

S2A_USER_MTD_SAF2A_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406 - [C:\S2A_USER_PRD_MSIL2A_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406]

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info x

[1] S2A_OPER_MTD_SAF2A_PDMC_20160330T050601

- Metadata
- Vector Data
- Bands
 - sun
 - view
 - B1 (443 nm)
 - B2 (490 nm)
 - B3 (560 nm)
 - B4 (665 nm)
 - B5 (705 nm)
 - B6 (740 nm)
 - B7 (783 nm)
 - B8 (842 nm)
 - B8A (865 nm)
 - B9 (945 nm)

[1] Sentinel 2 MSI Natural Colors RGB x

[2] Sentinel 2 MSI Natural Colors RGB x

Mask Manager

Name	Type	Colour	Tra...
☐ msi_lost_B5	Geometry		0.!
☐ msi_lost_B6	Geometry		0.!
☐ msi_lost_B7	Geometry		0.!
☐ msi_lost_B8A	Geometry		0.!
☐ msi_lost_B11	Geometry		0.!
☐ msi_lost_B12	Geometry		0.!
☐ msi_degraded_B2	Geometry		0.!
☐ msi_degraded_B3	Geometry		0.!
☐ msi_degraded_B4	Geometry		0.!
☐ msi_degraded_B5	Geometry		0.!
☐ msi_degraded_B6	Geometry		0.!
☐ msi_degraded_B7	Geometry		0.!
☐ msi_degraded_B8A	Geometry		0.!
☐ msi_degraded_B11	Geometry		0.!
☐ msi_degraded_B12	Geometry		0.!
☐ opaque_clouds_20m	Geometry		0.!
☐ cirrus_clouds_20m	Geometry		0.!
☐ sd_nodata	Maths		0.!
☐ sd_saturated_defective	Maths		0.!
☐ sd_dark_feature_shadow	Maths		0.!
☐ sd_cloud_shadow	Maths		0.!
☐ sd_vegetation	Maths		0.!
☐ sd_bare_soil_desert	Maths		0.!
☐ sd_water	Maths		0.!
☒ sd_cloud_low_proba	Maths		0.!
☒ sd_cloud_medium_proba	Maths		0.!
☒ sd_cloud_high_proba	Maths		0.!
☒ sd_thin_cirrus	Maths		0.!
☒ sd_snow_ice	Maths		0.!

Product Library Layer Manager Mask Manager

Off Globe

100 Km

Switzerland Alps Milano Torino Genova Monaco Ligurian Sea Barcelona Balearic Sea

France Pyrenees

2 1

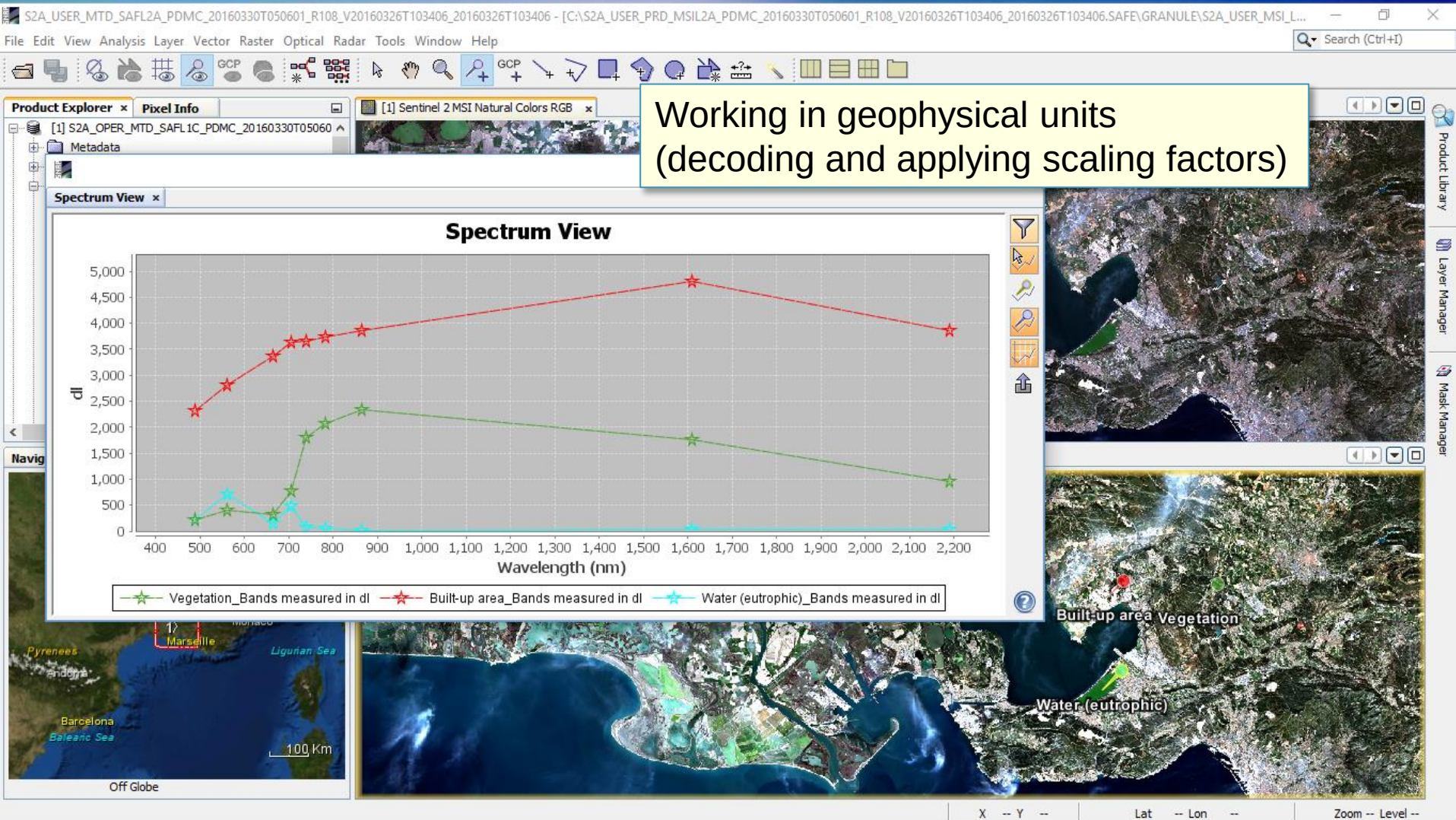
Marseille

World ... x

Zoom -- Level --

X -- Y -- Lat -- Lon --

SNAP with Sentinel 2



Sentinel 2 in SNAP

S2A_USER_MTD_SAF_L2A_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406 - [C:\S2A_USER_PRD_MSIL2A_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406.SAFE\GRANULE\S2A_USER_MSI_L...

File Edit View Analysis Layer Vector Raster Optical Radar Tools W Meta Data

Product Explorer x Pixel Info

- [1] S2A_OPER_MTD_SAF_L1C_PDMC_20160330T050601
 - Metadata
 - Abstracted_Metadata
 - Level-1C_User_Product
 - Level-1C_DataStrip_ID
 - Granules
 - Vector Data
 - Bands
 - sun
 - view
 - B1 (443 nm)
 - B2 (490 nm)
 - B3 (560 nm)
 - B4 (665 nm)
 - B5 (705 nm)
 - B6 (740 nm)

[1] Level-1C_User_Product

Name	Value	
Technical_Quality_Assessment		
DEGRADED Anc DATA PERCENTAGE	0	a:
DEGRADED MSI DATA PERCENTAGE	0	a:
Quality_Control_Checks		
Quality_Inspections		
SENSOR_QUALITY_FLAG	PASSED	a:
GEOMETRIC_QUALITY_FLAG	FAILED	a:
GENERAL_QUALITY_FLAG	PASSED	a:
FORMAT_CORRECTNESS_FLAG	PASSED	a:
RADIOMETRIC_QUALITY_FLAG	PASSED	a:
Failed_Inspections		
SCHEMALOCATION	https://psd	a:

[1] Sentinel 2 MSI Natural Colors RGB

[2] Level-2A_User_Product

Name	Value	
Image_Content_QI		
NODATA_PIXEL_PERCENTAGE	28.376011	a:
SATURATED_DEFECTIVE_PIXEL_F	0.001273	a:
DARK_FEATURES_PERCENTAGE	3.273746	a:
CLOUD_SHADOW_PERCENTAGE	1.344226	a:
VEGETATION_PERCENTAGE	36.241497	a:
BARE_SOILS_PERCENTAGE	22.122206	a:
WATER_PERCENTAGE	12.900599	a:
LOW_PROBA_CLOUDS_PERCENTAGE	4.453860	a:
MEDIUM_PROBA_CLOUDS_PERCENTAGE	5.457364	a:
HIGH_PROBA_CLOUDS_PERCENTAGE	0.467178	a:
THIN_CIRRUS_PERCENTAGE	4.166847	a:
SNOW_ICE_PERCENTAGE	9.571198	a:

[2] Sentinel 2 MSI Natural Colors RGB

Switzerland France Alps Milano Torino Genova Monaco Ligurian Sea Pyrenees Barcelona Balearic Sea 100 Km Off Globe

Product Library Layer Manager Mask Manager

X -- Y -- Lat -- Lon -- Zoom -- Level --

SNAP with Sentinel 2

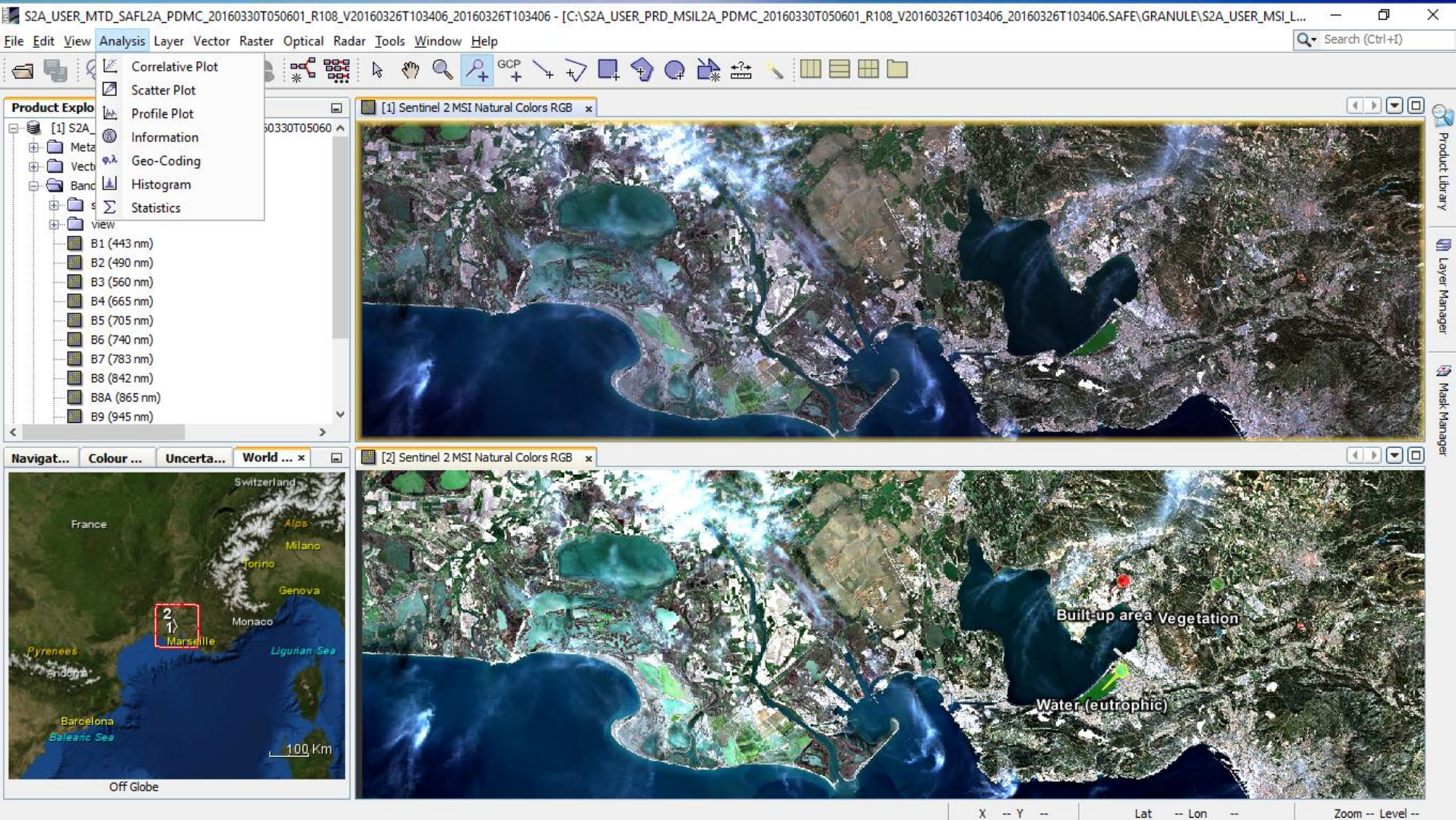
The screenshot displays the SNAP software interface with the following components:

- Product Explorer:** Lists the loaded data, including metadata, vector data, and Sentinel 2 bands (B1 to B9).
- Layer Manager:** Shows the active layers: "[1] Sentinel 2 MSI Natural Colors RGB" and "[2] Sentinel 2 MSI Natural Colors RGB".
- Add Layer Dialog:** A pop-up window titled "Add Layer" with the "Select Layer Source" tab active. It lists available sources: ESRI Shapefile, Image from Web Map Server (WMS), Image of Band / Tie-Point Grid, Layer Group, Mapping Tools, and RGB Image from File.
- Main View:** Displays two maps. The top map is a satellite image of a coastal area. The bottom map is a map of Europe with a red box highlighting the area around Marseille, France, which is the source of the satellite data.
- Bottom Panel:** Includes navigation controls (X, Y, Lat, Lon, Zoom, Level) and a scale bar (100 km).

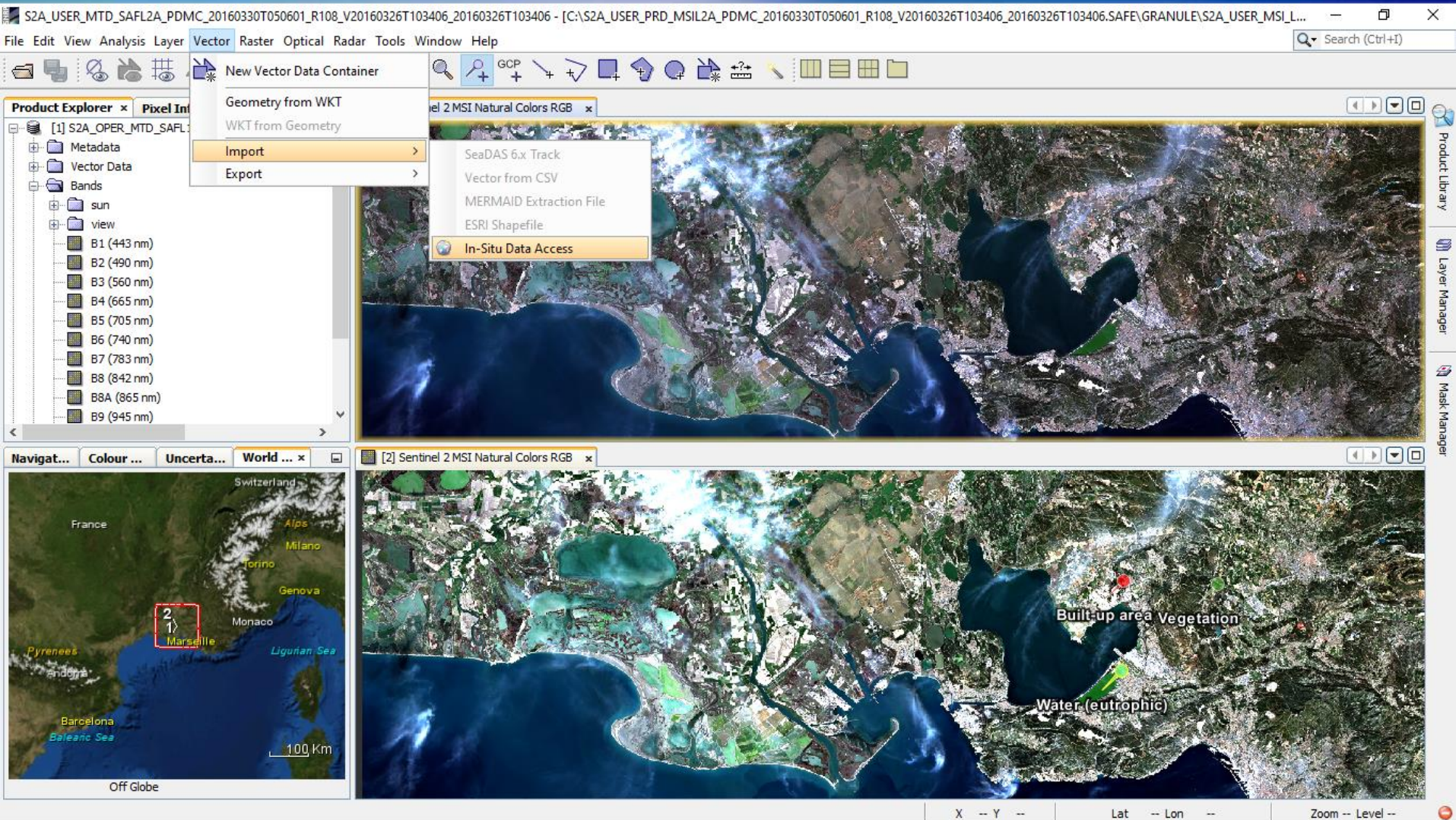
Combining information

- From single image
- Across multiple images
- From external sources

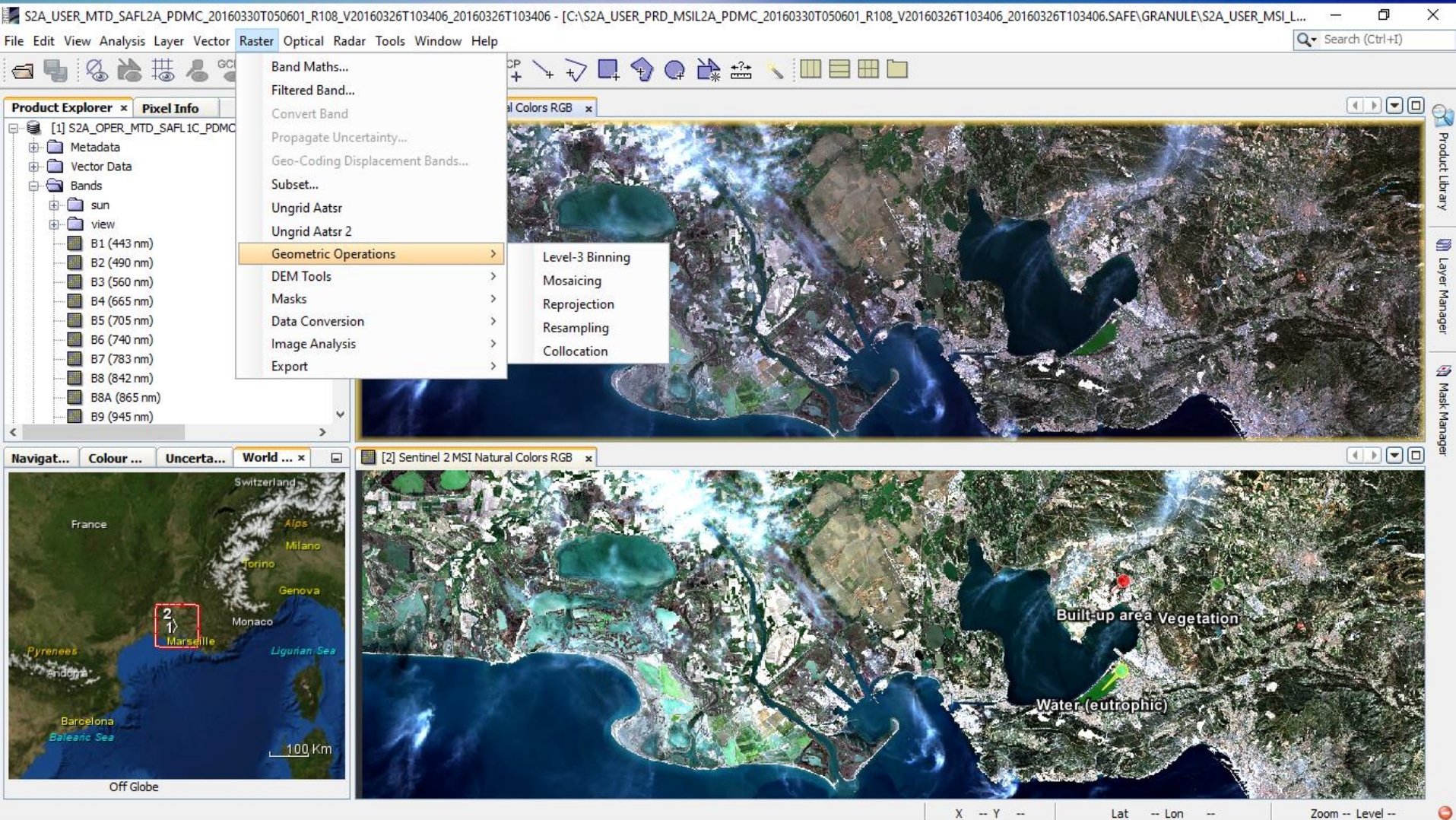
Toolbox



Toolbox



Toolbox



Toolbox

The screenshot displays the Sentinel2 Toolbox software interface. The main window shows a satellite image of a coastal area. The menu path is: **Optical** > **Thematic Land Processing** > **Radiometric Indices** > **Vegetation Indices**. The **Vegetation Indices** sub-menu is open, listing various indices: SAVI Processor, TSAVI Processor, MSAVI Processor, MSAVI2 Processor, DVI Processor, RVI Processor, PVI Processor, IPVI Processor, WDVI Processor, TNDVI Processor, GNDVI Processor, GEMI Processor, ARVI Processor, NDI45 Processor, MTCI Processor, MCARI Processor, REIP Processor, S2REP Processor, IRECI Processor, and PSSRa Processor. The **Product Explorer** on the left shows the file structure, including metadata, vector data, and bands (B1 to B9). The **World** map at the bottom left shows the location of the study area in the Mediterranean region, near Marseille. The status bar at the bottom indicates coordinates (X, Y, Lat, Lon) and zoom/level settings.

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Product Explorer x Pixel Info

[1] S2A_OPER_MTD_SAF1C_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406 - [C:\S2A_USER_PRD_MSIL2A_PDMC_20160330T050601_R108_V20160326T103406_20160326T103406.SAFE\GRANULE\S2A_USER_MSI_L...

Metadata

Vector Data

Bands

sun

view

B1 (443 nm)

B2 (490 nm)

B3 (560 nm)

B4 (665 nm)

B5 (705 nm)

B6 (740 nm)

B7 (783 nm)

B8 (842 nm)

B8A (865 nm)

B9 (945 nm)

Optical

Spectrum View

Spectral Unmixing

Geometric

Preprocessing

Thematic Land Processing

Thematic Water Processing

Radiometric Indices

Sen2Cor

NDVI Processor

MERIS/(A)TSTR SMAC Atmospheric Correction

Soil Indices

Vegetation Indices

Water Indices

SAVI Processor

TSAVI Processor

MSAVI Processor

MSAVI2 Processor

DVI Processor

RVI Processor

PVI Processor

IPVI Processor

WDVI Processor

TNDVI Processor

GNDVI Processor

GEMI Processor

ARVI Processor

NDI45 Processor

MTCI Processor

MCARI Processor

REIP Processor

S2REP Processor

IRECI Processor

PSSRa Processor

Colors RGB x

[2] Sentinel 2 MSI Natural Colors RGB x

World ... x

Off Globe

Switzerland

France

Alps

Milano

Torino

Genova

Monaco

Marseille

Pyrenees

Ligurian Sea

Barcelona

Balearic Sea

100 km

X -- Y --

Lat -- Lon --

Zoom -- Level --

Toolbox

The screenshot displays the SNAP software interface with the Sentinel-2 Toolbox Kit Module installed. The main window shows a map of the Mediterranean region with a red box highlighting the area around Marseille, France. The 'Product Explorer' on the left lists the loaded data products, including the Sentinel-2 image. The 'Tools' menu is open, showing options like 'Attach Pixel Geo-Coding...' and 'Detach Pixel Geo-Coding...'. The 'Plugins' window is open, showing a list of installed plugins, including the Sentinel-2 Toolbox Kit Module. The 'Sentinel-2 Toolbox Kit Module' is selected, and its details are shown on the right, including its version (4.0.0) and source (SNAP Extensions). The 'Plugin Description' states that the Sentinel-2 Toolbox is a SNAP extension dedicated to the exploitation of Sentinel-2 MSI data and data of other optical high resolution sensors.

Product Explorer

- [1] S2A_OPER_MTD_SAF1C_PDMC_20160330T050601
- Metadata
- Vector Data
- Bands
 - sun
 - view
 - B1 (443 nm)
 - B2 (490 nm)
 - B3 (560 nm)
 - B4 (665 nm)
 - B5 (705 nm)
 - B6 (740 nm)
 - B7 (783 nm)
 - B8 (842 nm)
 - B8A (865 nm)
 - B9 (945 nm)

Tools

- Metadata
- Attach Pixel Geo-Coding...
- Detach Pixel Geo-Coding...
- GraphBuilder
- Batch Processor
- Manage
- Plugins**
- Options
- External

Plugins

Select	Name	Category	Active
☒	Sentinel-2 Toolbox Kit Module	org.esa.s2tbx	✓
☐	Radarsat-2 Polarimetric Toolkit Module	Radarsat-2 Toolbox	✓
☐	RCP Platform	RCP Platform	✓
☐	Sentinel-1 Toolbox Kit Module	Sentinel-1 Toolbox	✓
☐	Radiometric Indices Bundle	Sentinel-2 Toolbox	✓
☐	Case 2 Regional / CoastColour Proc...	Sentinel-3 Toolbox	✓
☐	Sentinel-3 Toolbox Kit Module	Sentinel-3 Toolbox	✓
☐	SNAP Desktop Rich Client Platform	SNAP Desktop	✓
☐	SNAP Engine Kit Module	SNAP Engine	✓

Sentinel-2 Toolbox Kit Module

Version: 4.0.0
Source: SNAP Extensions

Plugin Description

The Sentinel-2 Toolbox is a SNAP extension dedicated to the exploitation of Sentinel-2 MSI data and data of other optical high resolution sensors.

Activate Deactivate Uninstall

Close Help

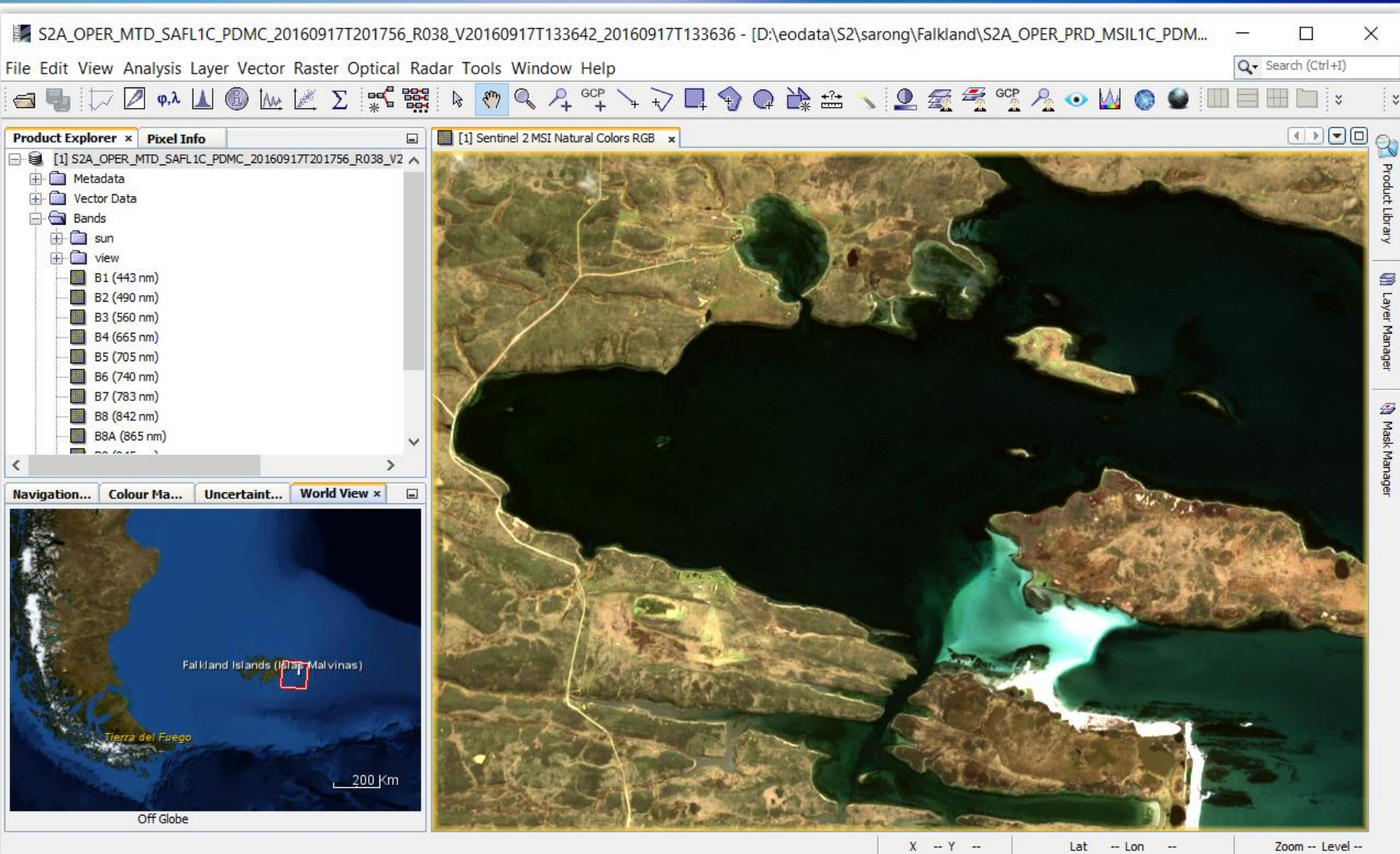
SNAP Architecture



Main Subsystems

- SNAP Desktop
 - Modern, intuitive and rich user interface
 - Fast display of giga-pixel images
 - Large portfolio of analysis and visualisation functions
 - Operator interfaces and graph builder for processing
- SNAP Engine
 - SNAP core code base
 - EO data model, I/O & operator APIs
 - Python API allowing to use also numpy, scipy, pandas, etc with SNAP
 - Common, generic I/O formats: NetCDF, HDF, GeoTIFF, Shapefiles, ...
 - Common, generic functions: reprojection, subset, geo-coding, collocation, band maths, image filters, masking tools, ...
 - Command-line interface, no GUI
 - Various uses: library, service implementation

SNAP Desktop



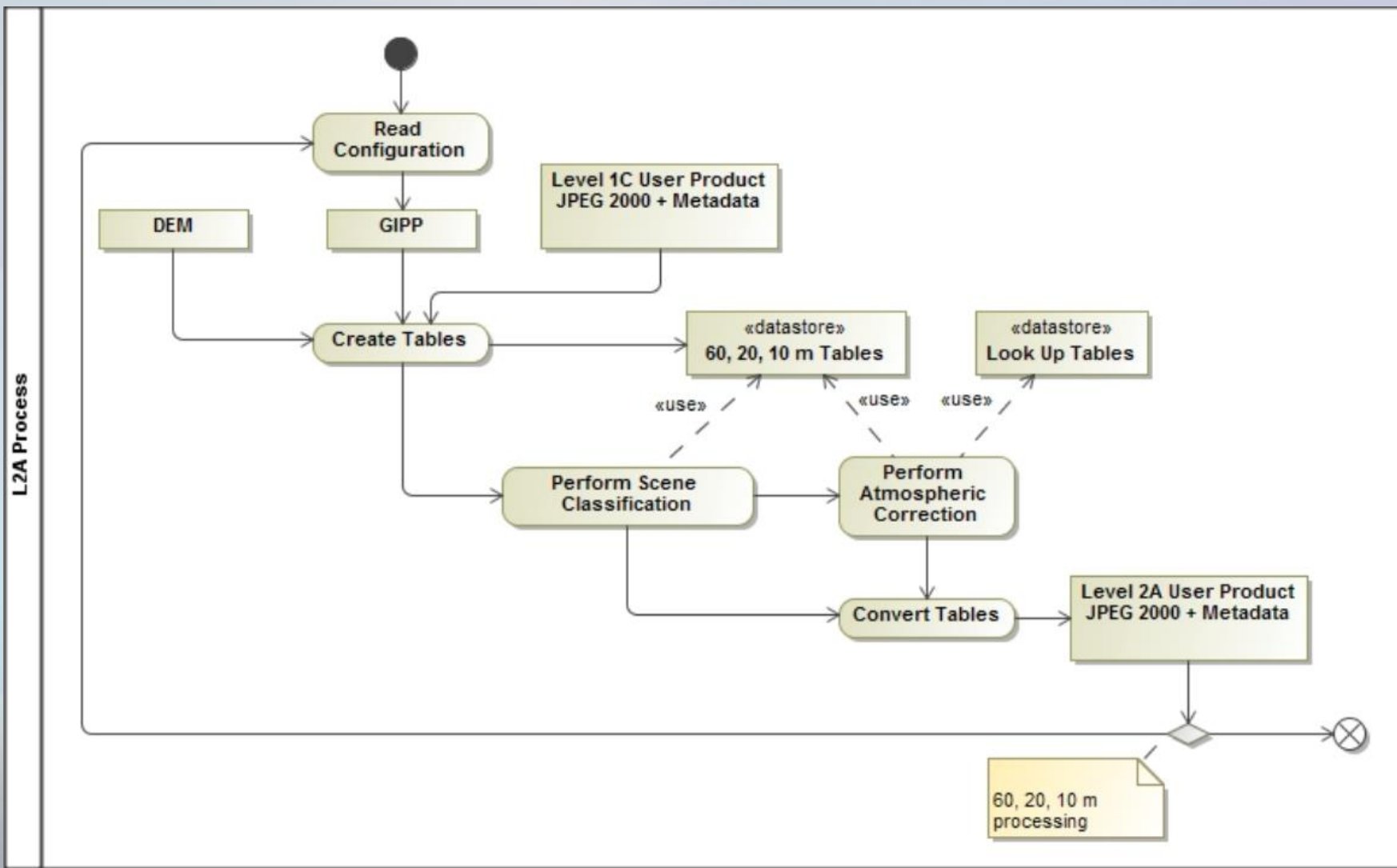
Sentinel 2 Specific Tools

- S2 Radiometric Uncertainty Tool
 - radiometric uncertainty propagation for optical level-1 radiance data
- sen2cor
 - performs atmospheric correction on Sentinel 2 L1C products, thereby creating L2A products
- sen2three
 - Sen2Three is a level 3 processor for the spatio temporal synthesis of bottom atmospheric corrected level 2A (or alternatively) uncorrected top of atmosphere level 1C images, retrieved by the Sentinel 2 Multi Spectral Instrument (MSI)
- Radiometric indices
 - radiometric Indices calculus.

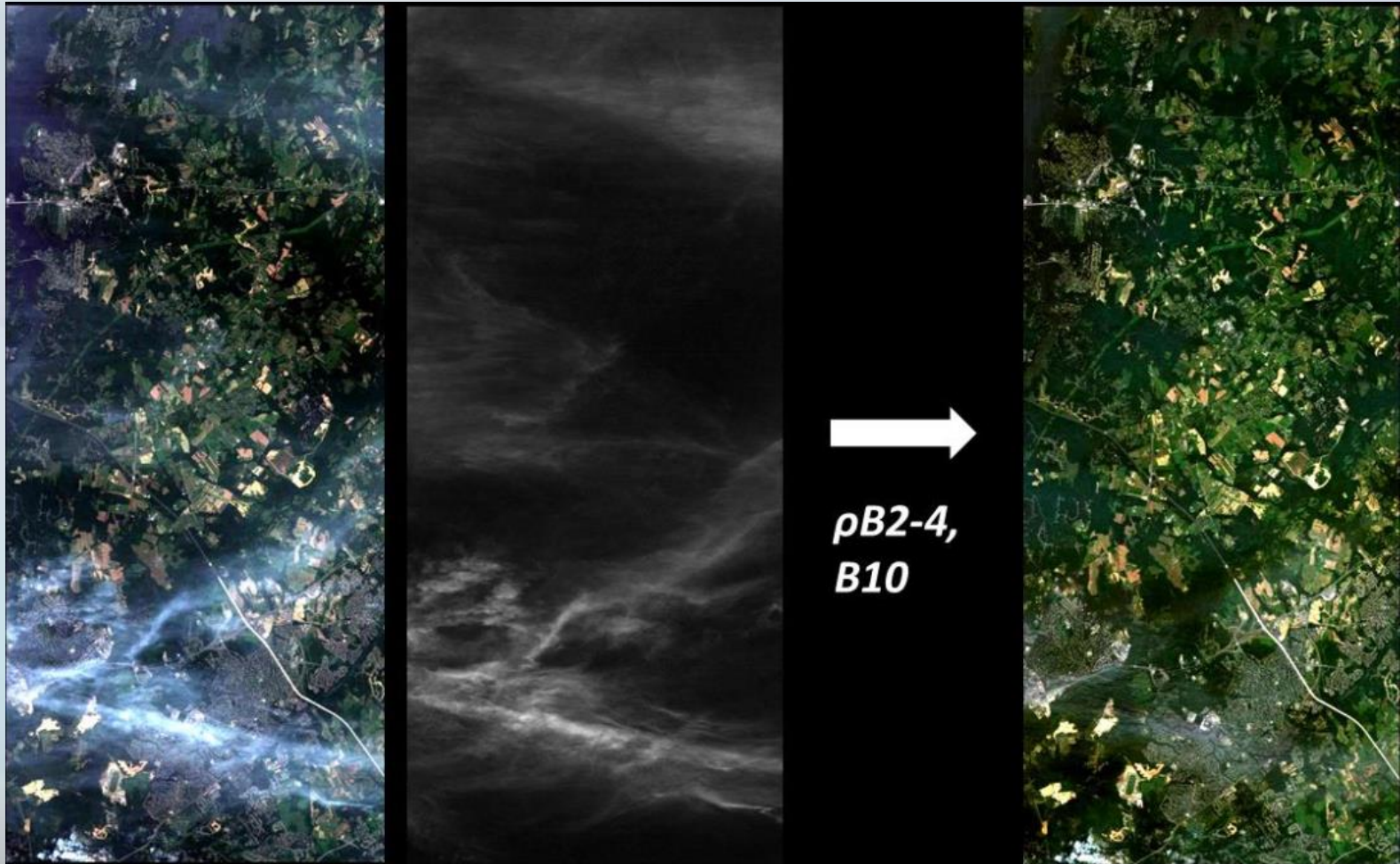
sen2cor

- Processor for S2 L2A product generation and formatting
- Comprises atmospheric-, terrain and cirrus correction
- Creates bottom of atmosphere corrected reflectance images in all S2 bands
 - Additional aerosol optical thickness, water vapour, scene classification maps, and quality indicators for cloud and snow probabilities
- Product format equivalent to L1C, all bands in their native spatial resolution
- Written in python

sen2cor

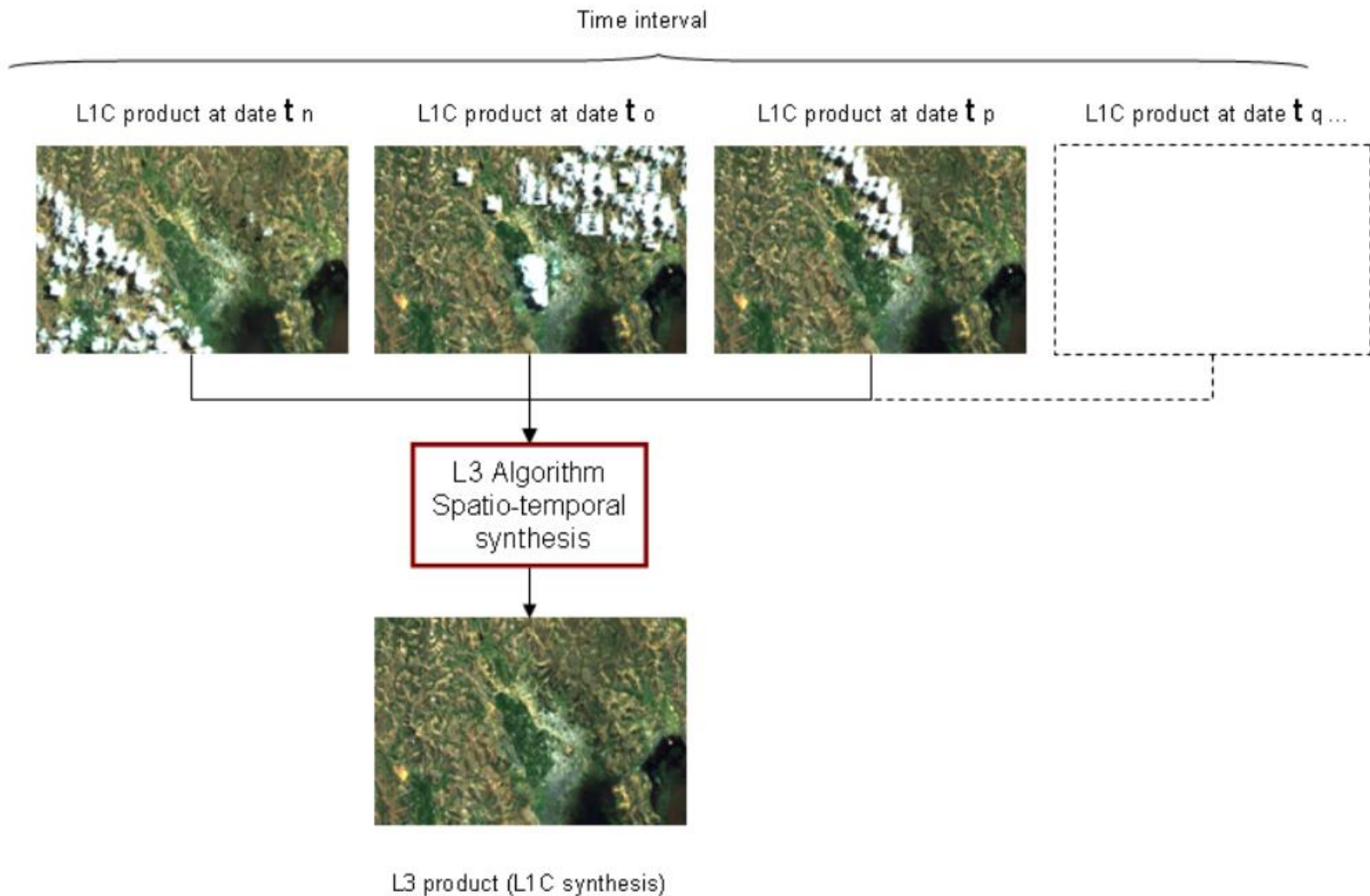


Example



<http://step.esa.int/thirdparties/sen2cor/2.2.1/S2PAD-VEGA-SUM-0001-2.2.pdf>

sen2three



Example



L2 Input



Temporal Homogeneity



Average

Radiometric Uncertainty



in preparation



Article

A radiometric uncertainty tool for the Sentinel 2 mission

Javier Gorroño^{1,4,*}, Norman Fomferra², Marco Peters², Ferran Gascon³, Craig Underwood⁴, Nigel Fox¹, Grit Kirches² and Carsten Brockmann²

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² Brockmann Consult, Max-Planck-Str. 2, 21502 Geesthacht, Germany; norman.fomferra@brockmann-consult.de; marco.peters@brockmann-consult.de; grit.kirches@brockmann-consult.de; carsten.brockmann@brockmann-consult.de

³ European Space Agency, Via Galileo Galilei, Casella Postale 64, 00044 Frascati, Italy; ferran.gascon@esa.int

⁴ Surrey Space Centre, University of Surrey, Guildford, Surrey, GU2 7XH, UK; c.underwood@surrey.ac.uk

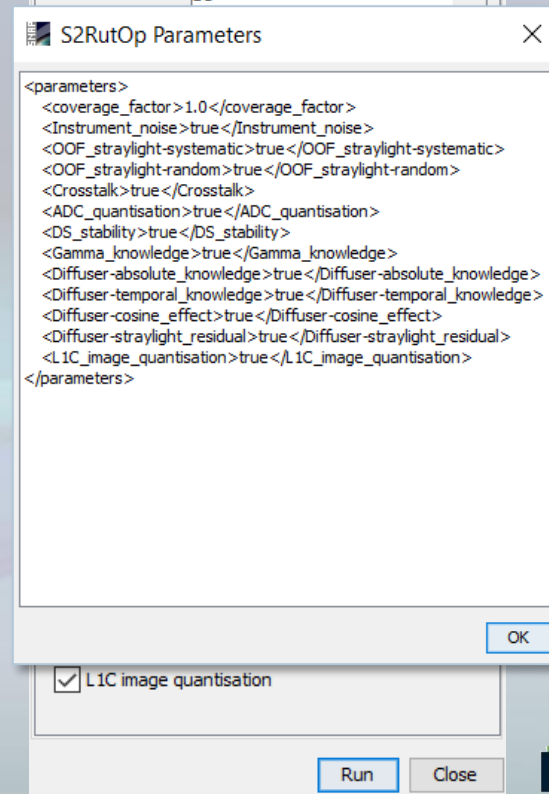
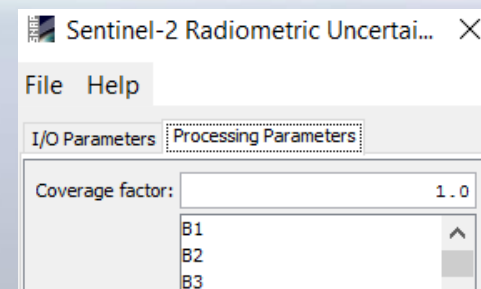
* Correspondence: javier.gorrono@npl.co.uk; Tel.: +44-(0)-20-8943-6155

Academic Editor: name

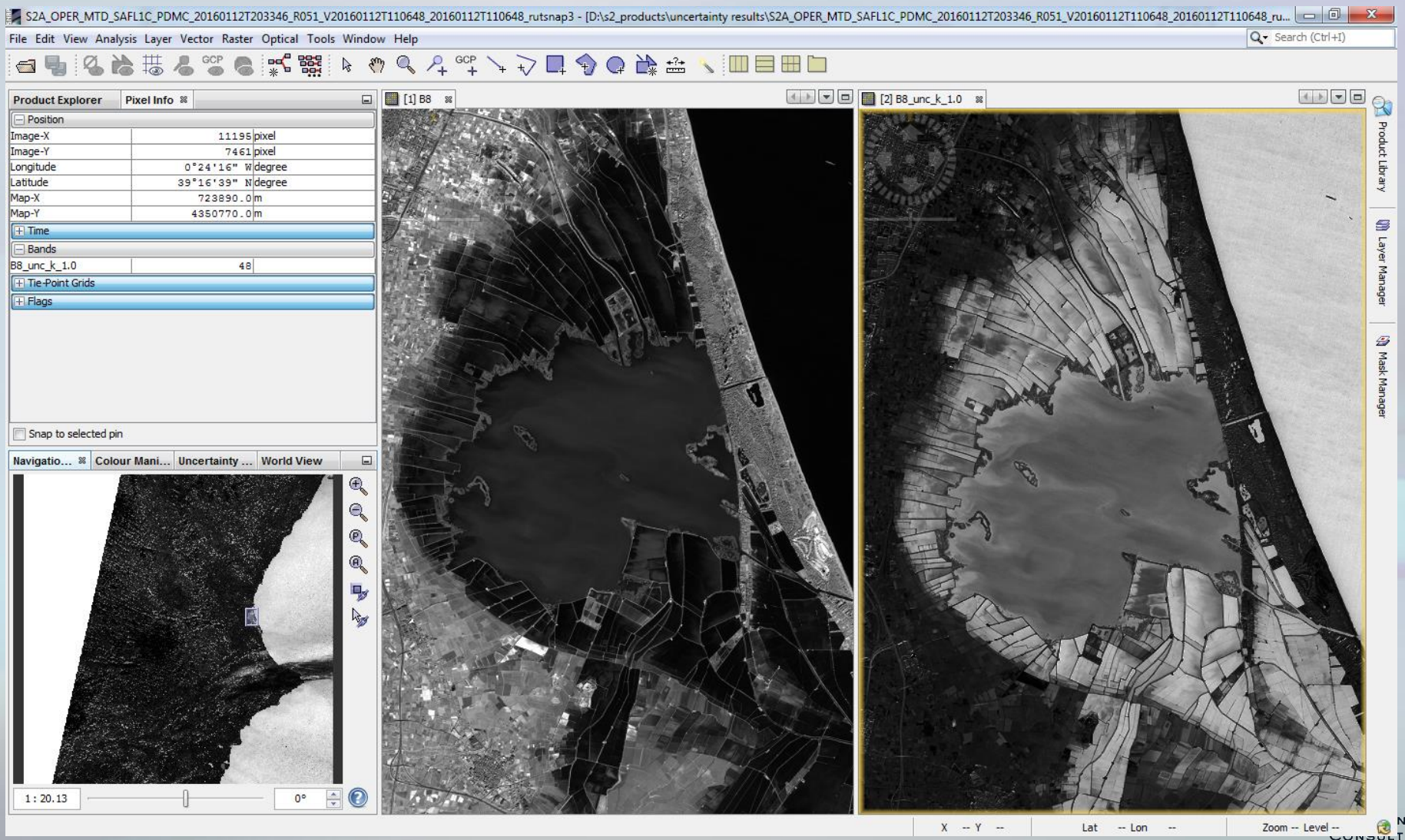
Received: date; Accepted: date; Published: date

Abstract: In the framework of the European Copernicus programme, the European Space Agency (ESA) has launched the Sentinel-2 (S2) Earth Observation (EO) mission which provides optical high spatial -resolution imagery over land and coastal areas. As part of this mission, a tool (named S2-RUT, from Sentinel-2 Radiometric Uncertainty Tool) estimates the radiometric uncertainties

Javier Gorroño ; Ferran Gascon ; Nigel P. Fox; Radiometric uncertainty per pixel for the Sentinel-2 L1C products. Proc. SPIE 9639, Sensors, Systems, and Next-Generation Satellites XIX, 96391G (October 12, 2015)



Radiometric Uncertainty Example



User Support

<http://step.esa.int/main/doc/tutorials/sentinel-2-toolbox-tutorials/>

Sentinel-2 Toolbox Tutorials

[Overall presentation](#) of the Sentinel-2 Toolbox project and application

Video Tutorials

Exploring a Sentinel-2 Product with SNAP



This tutorial will guide you through the first application, by opening a Sentinel-2 product in the product (product tree, metadata, vector data, etc.) and apply an RGB profile to the product, use the RGB view.

Sen2Cor installation on Windows 10



This tutorial follows the installation steps for version 2.0.6 on WINDOWS platform. The tutorial also shows how to integrate SEN2COR in the SNAP application. It also shows how to integrate SEN2COR in the SNAP application.

Sen2Cor installation on CentOS 7



This tutorial follows the installation steps for version 2.0.6 on LINUX platform. The tutorial also shows how to integrate SEN2COR in the SNAP application. It also shows how to integrate SEN2COR in the SNAP application.

<http://forum.step.esa.int/>

step forum

all categories ▾

Categories

Latest

Top

Category

Topics

Latest



s1tbx

650

The S1 Toolbox category regroupes all threads about the Sentinel-1 Toolbox, as SAR readers or processors.



Problem Reports



Interferometry



Polarimetry



s2tbx

248

The S2 Toolbox category regroupes all threads about the Sentinel-2 Toolbox as Sentinel-2 product readers and product manipulation, Sentinel-2 processors as L2A processor for atmospheric correction, L3 processor for temporal synthesis, etc.



sen2cor



sen2three



s3tbx

30

The S3 Toolbox category regroupes all threads about the Sentinel-3 Toolbox as readers and processors for Sentinel-3 OLCI & SLSTR L1 & L2.



snap

264

This category contains all topic about the Sentinel Toolbox Application (SNAP) not related to a specific Sentinel Toolbox.



Welcome to the Sentinel Toolbox Forum

snap



Read this before posting

s1tbx



Export spectra from spectrum viewer

s2tbx



“high coherence” and “low coherence”

s1tbx



SNAPHU Unwrapping

Interferometry



Topography and displacement

s1tbx



Mistakes in Sentinel 1 Toolbox

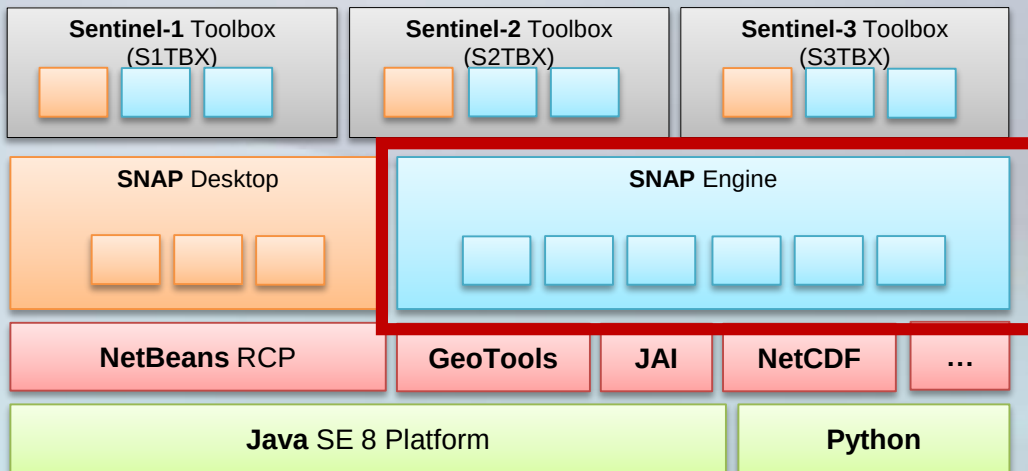
s1tbx



How to uninstall sen2cor2.2.1 from Windows

s2tbx

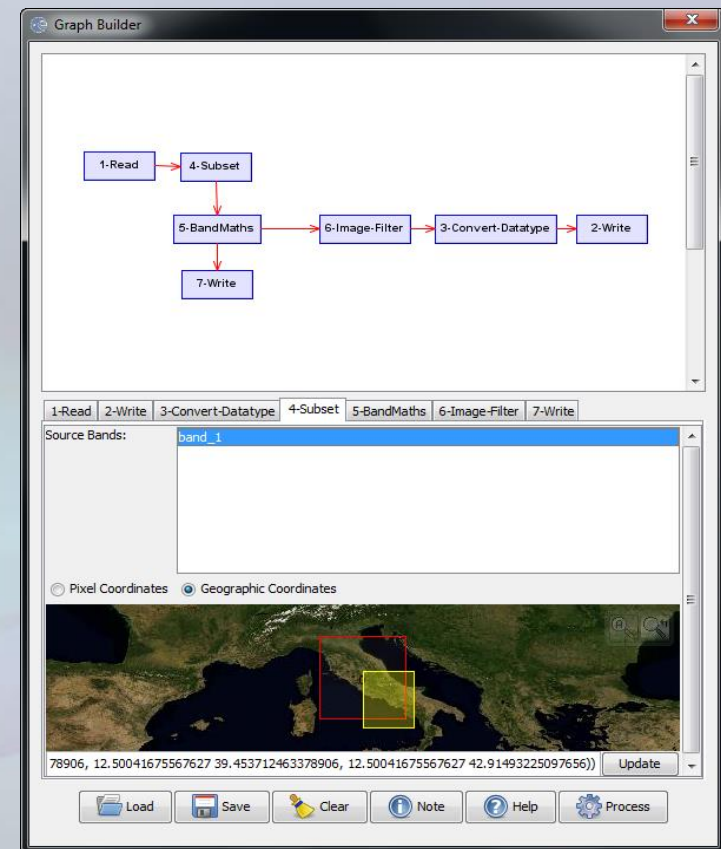
SNAP Engine API & CLI



Application Programming Interface
Command Line Interface

Graph Processing Framework

- Majority of SNAP „functions“ are implemented as operators
- Each operator can be invoked from SNAP Desktop and from the command line
- Processing chains („graphs“) are configured in XML files
- Graphical Graph Builder
- Graph Processing Tool (gpt) for executing of graphs (chains)
>gpt -help



Adding own Operators

- Majority of SNAP „functions“ are implemented as operators
- Implementing own operators using the python or Java API

```
import numpy as np
from snappy import Product
from snappy import ProductData
from snappy import ProductIO
from snappy import ProductUtils
from snappy import FlagCoding
from snappy import jpy
```

```
def main(args=sys.argv[1:]):
```

```
    print("Reading...")
```

```
    inProduct = ProductIO.readProduct
```

```
    width = inProduct.getSceneRasterW
```

```
    height = inProduct.getSceneRaster
```

```
    name = inProduct.getName()
```

```
    description = inProduct.getDescri
```

```
    band_names = inProduct.getBandNam
```

```
    print("Input Product:%s, %s" % (n
```

```
    print("Raster size:  %d x %d pixe
```

```
    print("Start time:   " + str(inPr
```

```
    print("End time:     " + str(inPr
```

```
    print("Bands:       %s" % (list(
```

```
    arwProduct = Product('ARW', 'ARW
```

```
    writer = ProductIO.getProductWriter('DEAM-DIRAP')
```

```
    arwProduct.setProductWriter(writer)
```

Overview (SNAP Engine API)

step.esa.int/docs/v4.0/apidoc/engine/

Meistbesucht Commerzbank BC Wiki Google Kalender BCS NDR Info Webmail Google Drive WebEx Uncertainties Weather Nützliches EO Data Remote Sensing | Free ...

All Classes

Packages

- com.bc.ceres.binding
- com.bc.ceres.binding.accessors
- com.bc.ceres.binding.converters
- com.bc.ceres.binding.dom
- com.bc.ceres.binding.validators
- com.bc.ceres.binio
- com.bc.ceres.binio.bin
- com.bc.ceres.binio.expr

All Classes

- AbstractBand
- AbstractElevationModelDescriptor
- AbstractExpression
- AbstractFigureDomConverter
- AbstractGeoCoding
- AbstractLayerListener
- AbstractMultiLevelSource
- AbstractPlacemarkDescriptor
- AbstractProductBuilder
- AbstractProductReader
- AbstractProductWriter
- AbstractPropertyMap
- AbstractTermTransformer
- AbstractTransform2D
- AdjustableView
- AdjustableViewScrollPane
- AffineTransform2D
- AffineTransformConverter
- AggregationType
- Aggregator
- AggregatorFactory
- AndFilter
- AngularDirection
- AnnotationOperatorDescriptor

OVERVIEW PACKAGE CLASS USE TREE DEPRECATED INDEX HELP

PREV NEXT FRAMES NO FRAMES

SNAP Engine API

Most important API

Package	Description
org.esa.snap.core.dataio	Contains the SNAP product I/O framework.
org.esa.snap.core.datamodel	Contains SNAP's central classes and interfaces used for an in-memory presentation of remote sensing data products.
org.esa.snap.core.gpf	SNAP's <i>Graph Processing Framework</i> GPF used for developing and executing raster data operators and graphs of such operators.
org.esa.snap.core.gpf.annotations	Provides annotations for GPF Operator implementations.
org.esa.snap.core.gpf.pointop	Provides special support for raster data operations that transforms each source pixel into a corresponding target pixel at the same position.

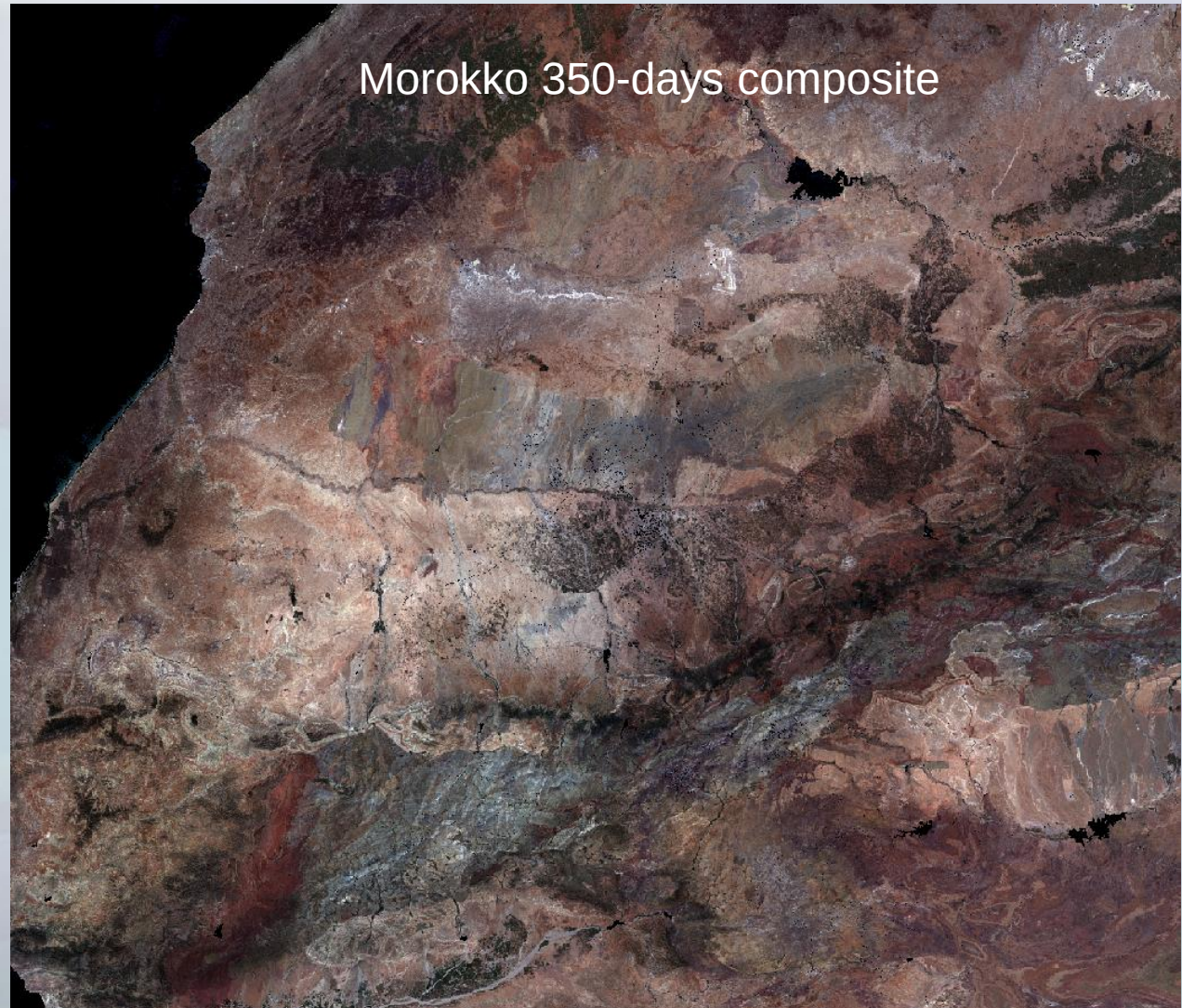
Frequently used API

Package	Description
org.esa.snap.core.image	Provides frequently used JAI OpImage implementations and the ImageManager utility class.
org.esa.snap.core.jexp	The JEXP API (JEXP = Java Expression Parser).
org.esa.snap.core.layer	Provides frequently used LayerType implementations.
org.esa.snap.core.util	Provides several utility classes used throughout SNAP.

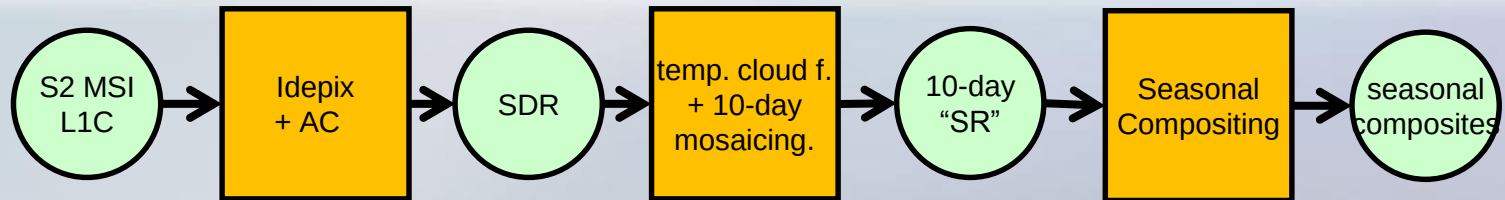
Low-Level API

Production Example

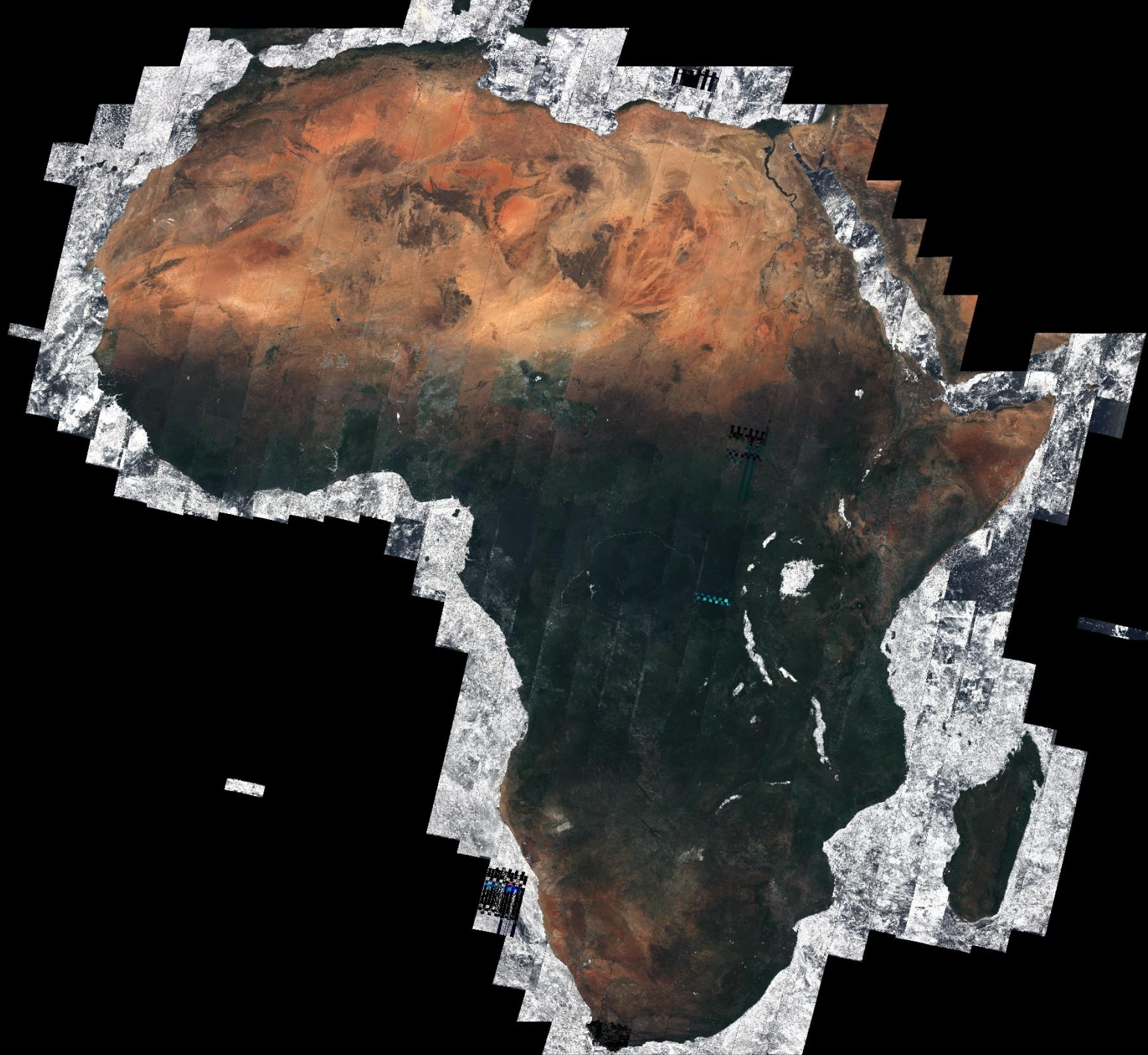
- ESA Land Cover CCI Project
- New operators for Preprocessing & AC
- Sentinel2, 1 year Africa time series
 - Pixel identification (clouds, land, water, snow, ...)
 - Atmospheric correction
 - BRDF correction
 - Compositing
- Deployed on Calvalus (Hadoop) for massive parallel processing



Full Africa coverage Production using SNAP Calvalus Cluster @ BC

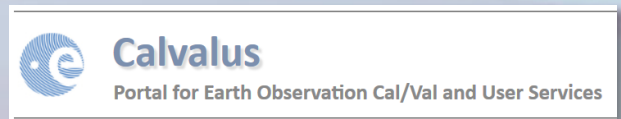


Step	# Inputs per data month	Processing time per input	Core hours per data month	Concurrency (90 nodes)	Production time per data month	Output size per data month
SDR processing	18000	1.3	23400	225	104	10 TB
Temp. cloud filter	90000	0.033	2970	225	13	
SR mosaicing	18000	0.33	5940	225	27	4.5 TB
Seasonal compositing	1800			450		1.5 TB per composite
					144 (6 days)	



SNAP and the Cloud

- SNAP Engine (and Desktop) is truly platform independent and can be used in various environments
- Distributed Computing using Virtual Machines
- Implementation of Web Processing Services
- Integrates perfectly with Apache Yarn/Hadoop, e.g. the Calvalus processing system



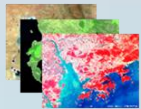
SNAP Application Modes

rapid development

operational processing

I

Interactive
Exploration



PC, notebook, tablet

II

bulk / NRT
processing



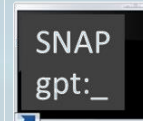
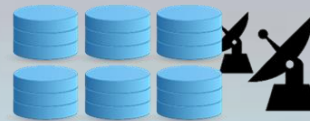
SNAP Graph
Processing
Framework



PC, notebook
server

III

EO data
processing centre



SNAP Graph
Processing
Framework



cluster, cloud

IV

Cloud Exploitation
Platform



PC, notebook, tablet

User Support - STEP

- step.esa.int
- Science Toolbox Exploitation Platform
- EO Science collaborative platform
- Technical forum and community animation
- Gathering user feedback and usage
- SNAP tutorials and documentation
- SNAP software download

The screenshot shows the STEP website with a dark blue header. The header includes the 'step' logo and the text 'science toolbox exploitation platform', followed by the ESA logo. A navigation bar contains links for 'ESA', 'STEP' (highlighted), 'TOOLBOXES', 'DOWNLOAD', 'GALLERY', 'DOCUMENTATION', and 'COMMUNITY'. A sidebar on the left lists: '• SNAP', '• Sentinel 1 Toolbox', '• Sentinel 2 Toolbox', '• Sentinel 3 Toolbox', '• Download', and '• Community'. The main content area features a banner for 'multimission scientific toolboxes' with satellite icons. Below the banner, text states: 'ESA is developing **free open source toolboxes** for the scientific exploitation of **Earth Observation missions** under the the Scientific Exploitation of Operational Missions (SEOM) programme element. **STEP** is the ESA **community platform** for accessing the software and its documentation, communicating with the developers, dialoguing within the science community, promoting results and achievements as well as providing tutorials and material for training scientists using the Toolboxes.'

The ESA toolboxes support the **scientific exploitation** for the **ERS-ENVISAT** missions, the **Sentinels 1/2/3** missions and a range of **National** and **Third Party** missions. The three toolboxes are called respectively Sentinel 1, 2 and 3 Toolboxes and share a common architecture called **SNAP**. They contain some functionalities of historical toolboxes such as BEAM, NEST and Orfeo Toolbox that were developed over the last years.

A grid of icons represents various features: SNAP Features, Download, Tutorials, Community, Documentation, Developers, Gallery, and Blog.

On the right side, there is a search bar and a section for 'seom scientific exploitation of operational missions'. Below this, there are two course announcements: '6th ESA Advanced Training Course on Land Remote Sensing' and '4th ESA Advanced Training Course on Ocean Remote Sensing', each with a corresponding image and dates.

At the bottom, a line of text reads: 'The following results have been obtained thanks to the Sentinel Toolboxes :'

Training

Tool training (SNAP)

- What is SNAP?
- SNAP: ESA Sentinel Application Platform
 - A common software platform and host for the Sentinel Toolboxes and others
 - One application, one installation on end-user's computer
 - Synergistic use of various EO data with common and specific tools
 - Fully open-source, GPL 3
 - Joint, collaborative development of the primes running the Sentinel Toolbox projects
 - It's a ESA SEOM funded activity

Thematic training
(land, ocean, ...)

Programming
Hackathon

Instrument & sensor
data training



Summary

- SNAP is ESA's toolbox supporting scientific and operational work with Sentinel 1-2-3 data
 - Open source
 - Collaborative community approach
- SNAP comprises
 - Generic tools for data selection & access, visualisation, analysis and processing
 - Instrument specific tools, such as uncertainties and atmospheric correction for S2
 - Programming tools
- SNAP Desktop supports interactive workflows
- SNAP Engine enables operational activities and cloud processing
- SNAP will be long term sustained by ESA

step.esa.int