



ESA-MOST Dragon 4 Cooperation

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

“龙计划4”高级陆地遥感国际培训班

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云南师范大学, 中国, 昆明

SeNtinel Application Platform & Scientific Toolbox Exploitation Platform

Fabrizio Ramoino [SERCO c/o ESA-ESRIN]

SNAP/STEP

SNAP Overview

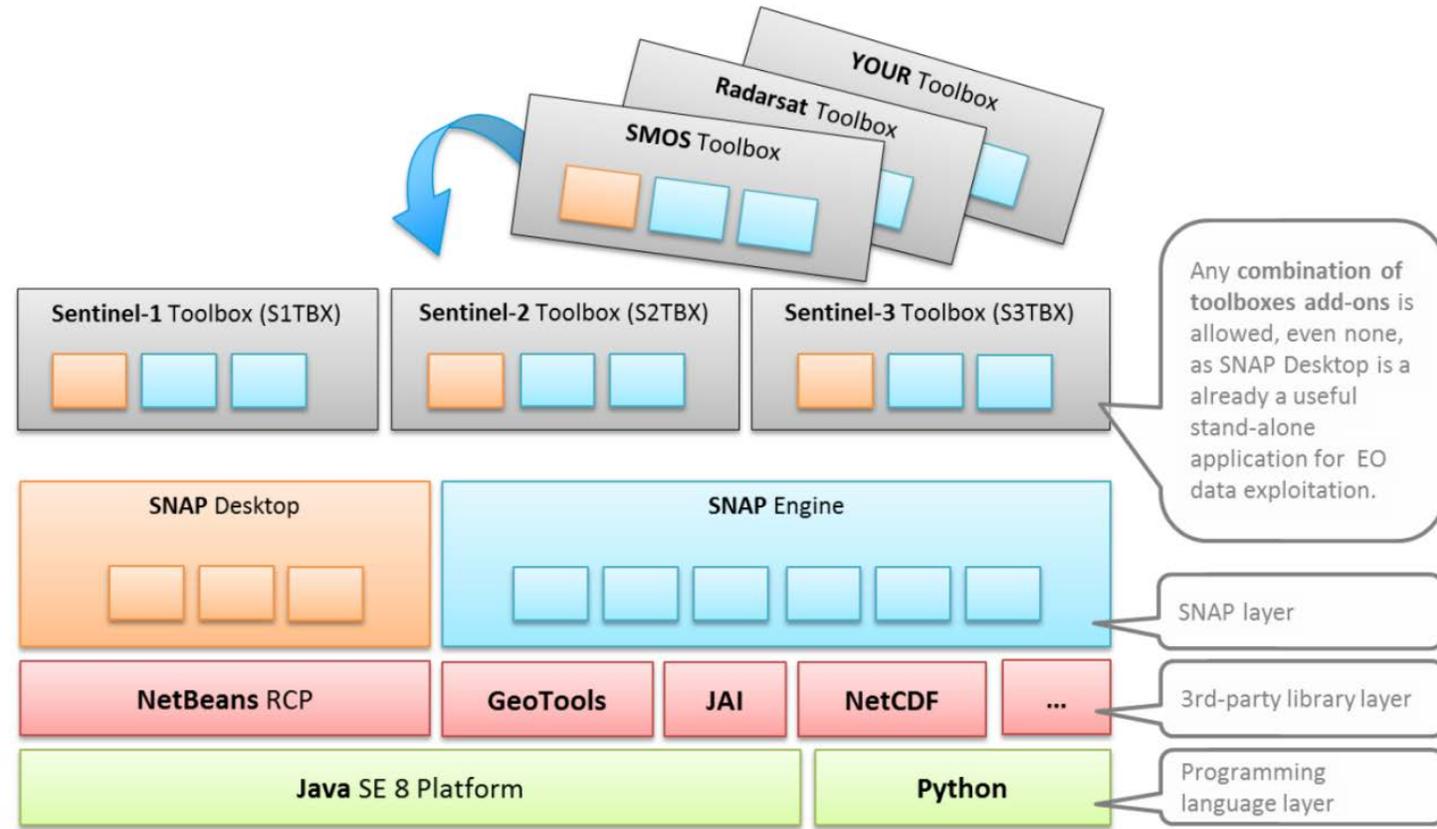
The common architecture for all Sentinel Toolboxes and SMOS Toolbox is called Sentinel Application Platform (SNAP)



SNAP/STEP

SNAP Benefits

- ✓ Developed as open source software
- ✓ Common Java core framework
- ✓ Joint development plan for Sentinel toolboxes
- ✓ Interchangeable Java/Python plugins
- ✓ Portable engine to Cloud infrastructure
- ✓ Single installer



SNAP/STEP

SNAP Free & Open Source

- ✓ Freely downloadable in **<http://step.esa.int/main/download>**
- ✓ **“Free as in Freedom”**
- ✓ *Run it anywhere you want*
- ✓ *Make copies*
- ✓ *Distribute it*
- ✓ *Study the code*
- ✓ *Change it, Improve it, Distribute your modifications*

SNAP/STEP

SNAP Cardinal Requirements

SNAP, the common architecture for all Sentinel Toolboxes, is ideal for EO data processing and analysis due the following technological innovations

- ✓ Open Source
- ✓ Extensibility & Modularity
- ✓ Portability
- ✓ Multi Mission Toolbox
- ✓ Generic EO Data Abstraction
- ✓ Tiled Memory Management
- ✓ Graph Processing Framework

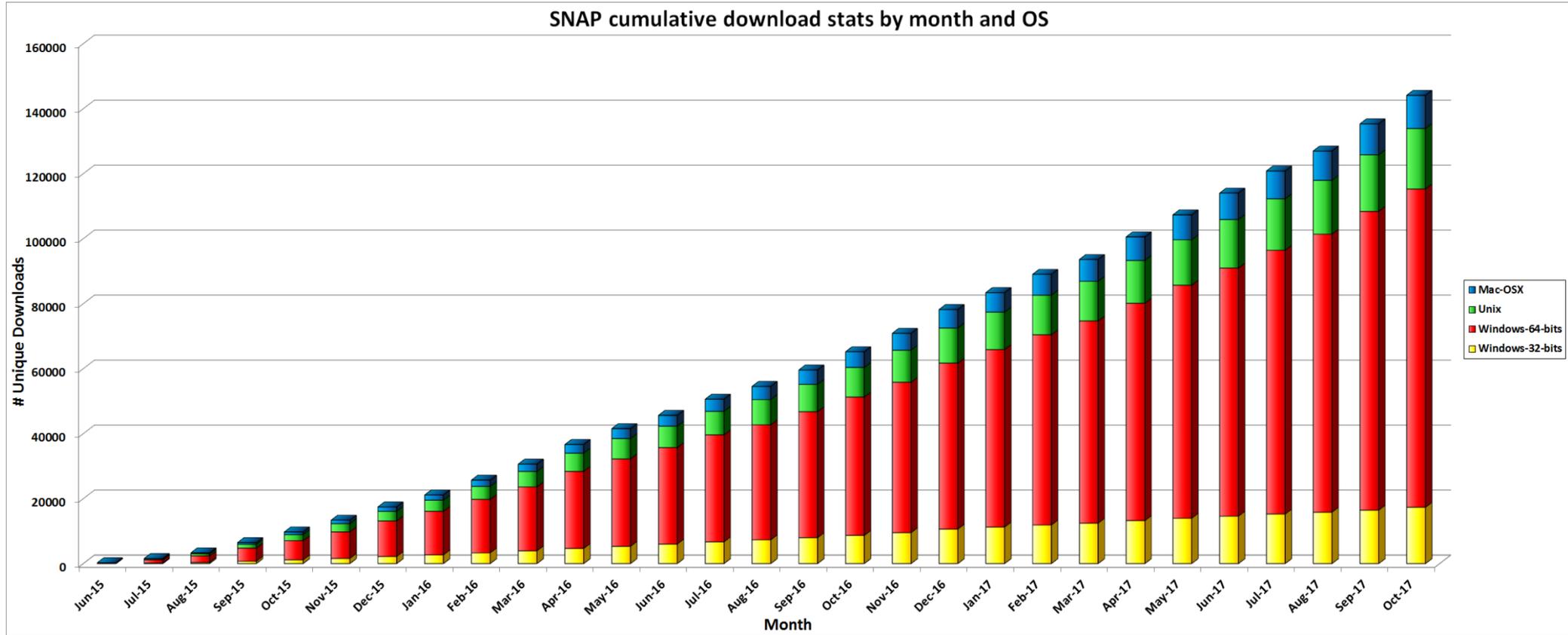
SNAP/STEP

SNAP Core Features

- **Common *architecture and data model* for all Toolboxes**
 - ✓ *Develop your own application (cli or gui)*
- **Very fast *image display and navigation* even of giga-pixel images**
 - ✓ *Advanced layer management allows adding and manipulation of new overlays such as images of other bands, images from WMS servers or ESRI shapefiles*
- **Graph Processing Framework (GPF)**
- **Generic Operators**
 - ✓ *Flexible **band arithmetic** using arbitrary mathematical expressions*
 - ✓ ***Reprojection** to common map projections*
 - ✓ ***Resampling***
 - ✓ ***Subset***
- **Supervised classification algorithms**
 - ✓ *Random Forrest, KNN, KDTree KNN, Maximum Likelihood, Minimum Distance*
- **Automatic SRTM *DEM* download and tile selection**
- **Multithreading and Multi-core processor support**

SNAP/STEP

SNAP Download Statistics



SNAP download exceeded 140.000 from June 2015 until today

Science Toolbox Exploitation Platform (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.

step.esa.int

Come and tell us:

- ✓ *What you need?*
- ✓ *How/for what you use it?*
- ✓ *Describe your use cases, showcase your results: we are happy to publish them on STEP Gallery*

SNAP/STEP

STEP Rational & Benefits

- ✓ *Evolving towards EO Science 2.0*
- ✓ *Using state of the art technology*
- ✓ *Gathering user feedback*
- ✓ *Having a forum*
- ✓ *Providing statistics*
- ✓ *Animating the community*
- ✓ *Facilitating the open source benefit and approach*
- ✓ *Raising the profile of the STBX*
- ✓ *Communicating on results*
- ✓ *Showcasing examples imagery (with S1, S2 and S3)*



SNAP/STEP

STEP Community



A number of resources are available for end users and developers to get their hands on SNAP and the Sentinel Toolboxes.

Forum - *is maintained by the Sentinel Toolboxes project teams who will answer your questions, if not done by other community members. Collaborate, share your knowledge and learn from other users.*

Blog - *here you will find the latest news about SNAP and the Sentinel Toolboxes software.*

Stay tuned!

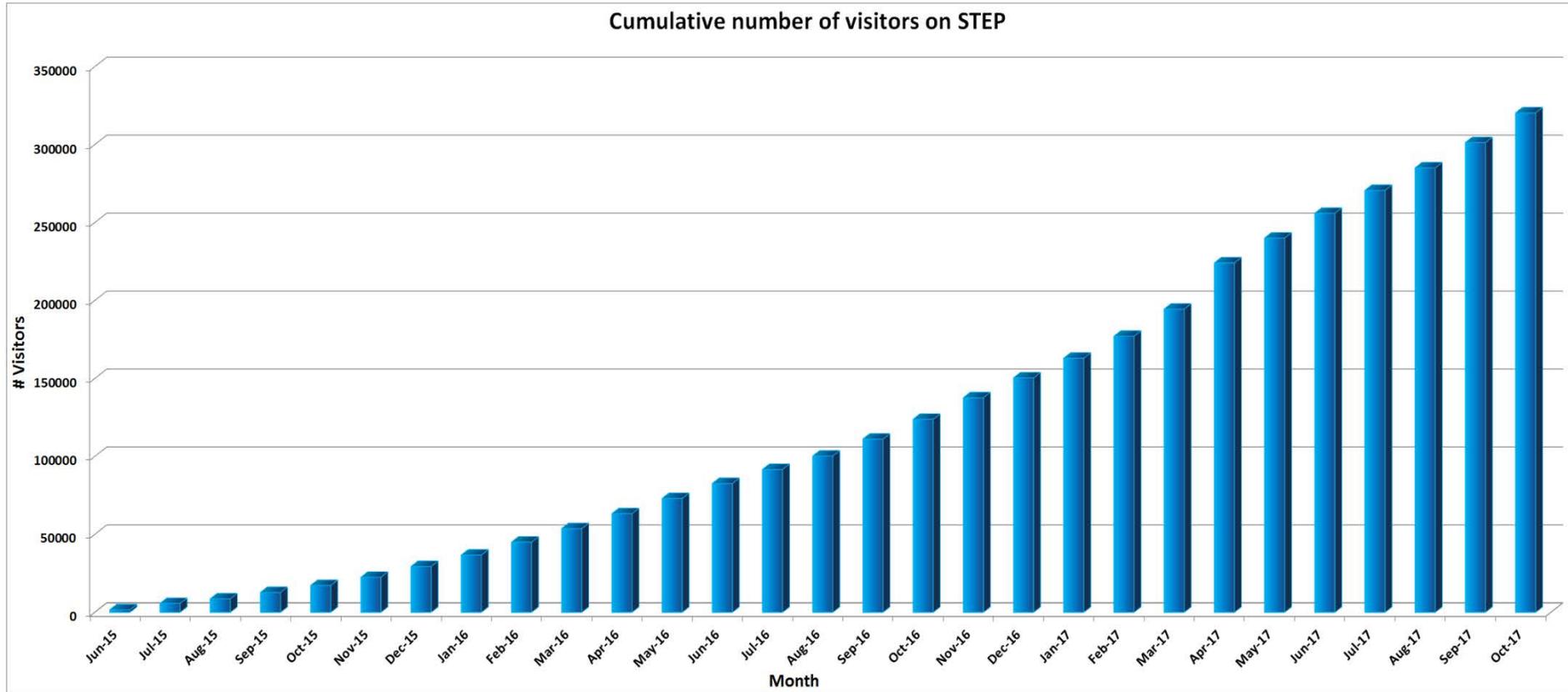
Developers - *As an open source software, the maintainers of SNAP and the Sentinel Toolboxes welcome code contribution and bug fixes.*

Issue Reporting - *You just found a bug? Or maybe you want to report about this excellent idea you just had for a future release? We welcome reports for issues and feature requests.*

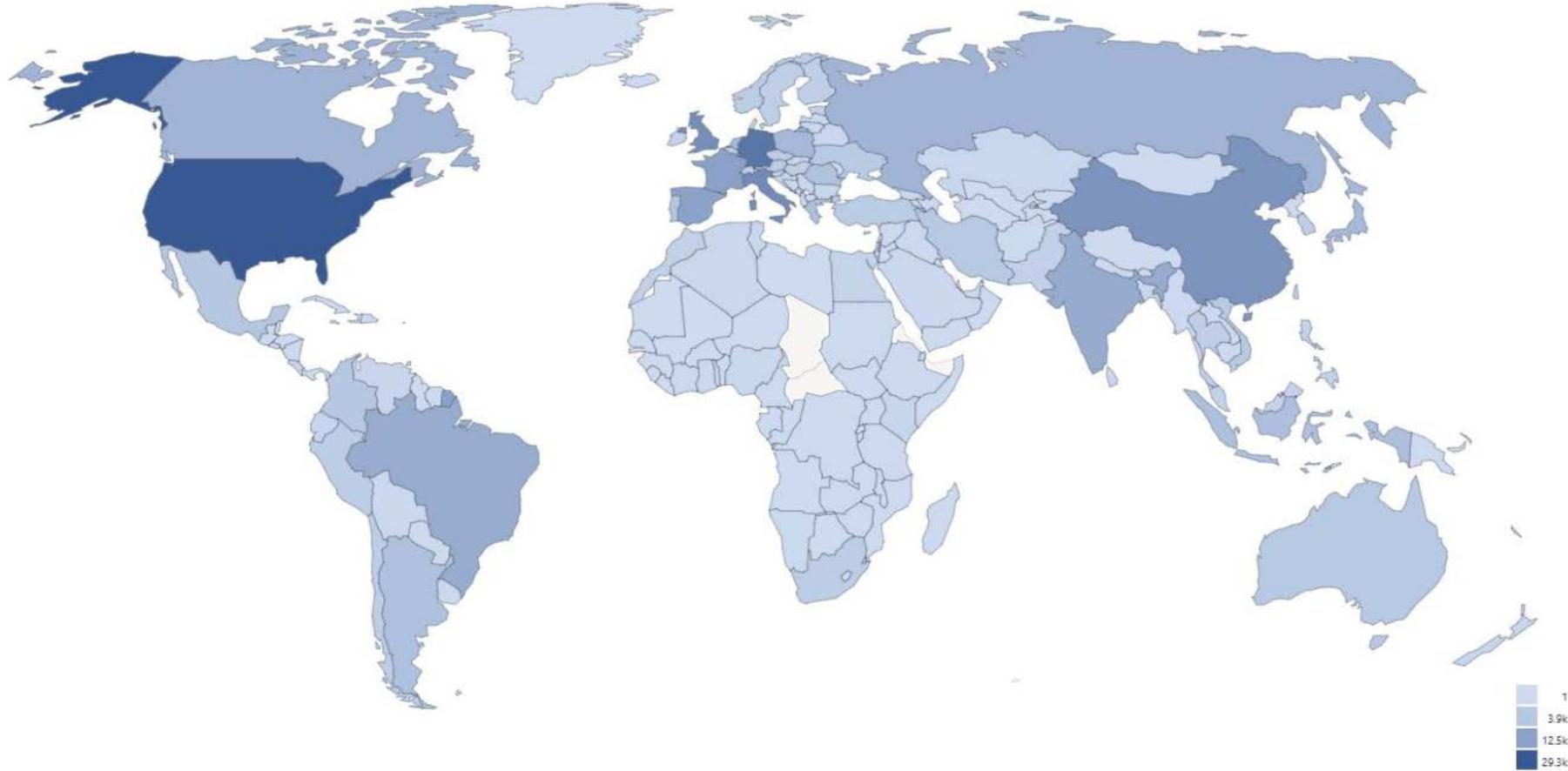


SNAP/STEP

STEP Statistics



STEP website reached more than 300.000 visit sessions from June 2015 until today





SNAP/STEP

STEP Overview



Sentinel-2 Toolbox

Fabrizio Ramoino [SERCO c/o ESA-ESRIN]



Sentinel-2 Toolbox

Overview

The SNAP extension for HR data

Sentinel-2 data readers: L1B, L1C, L2A

Multi-mission: new land-products readers

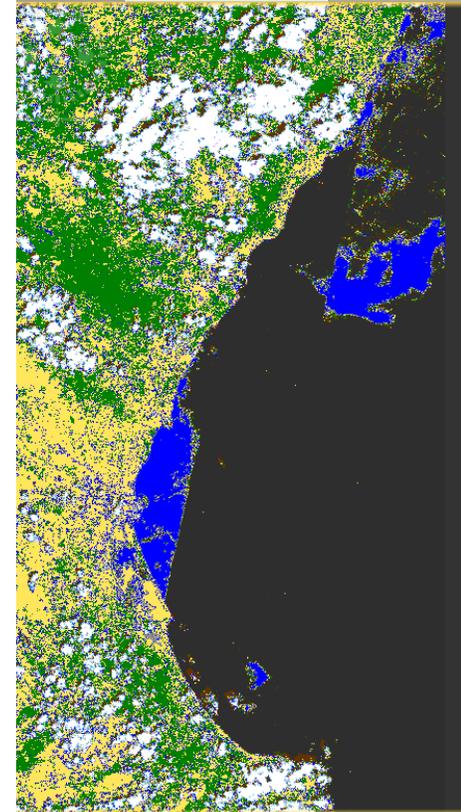
- ✓ Landsat, Spot 1-7, RapidEye, Deimos
- ✓ More to come in the future: UK-DMC, Pleiades, Ingenio/SEOSAT, EnMAP, ...

Sentinel-2 oriented scientific processors

- ✓ Sen2Cor: Atmospheric correction for S2-MSI L1C
- ✓ Sen2Three: multi-temporal synthesis of L1C/L2A
- ✓ L2B processor: biophysical products from L2A
- ✓ Reflectance to Radiance Processor
- ✓ IdePix Processor (pixel classification)
- ✓ Radiometric Indices (vegetation, soil and water)
- ✓ Water processors (FLH/MCI)
- ✓ Deforestation detection processor
- ✓ Maximum Chlorophyll Index Processor

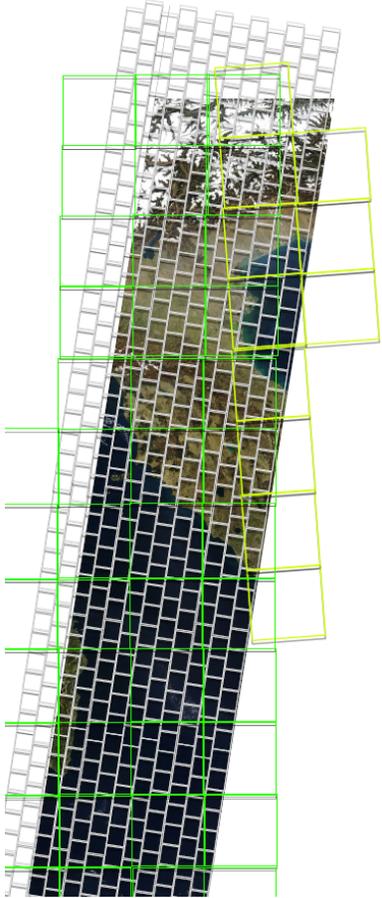
OTB Tools: Pansharpening, Rasterization, Segmentation, ...

Generic Region Merging segmentation processor



Sentinel-2 Toolbox

Sentinel-2 Reader

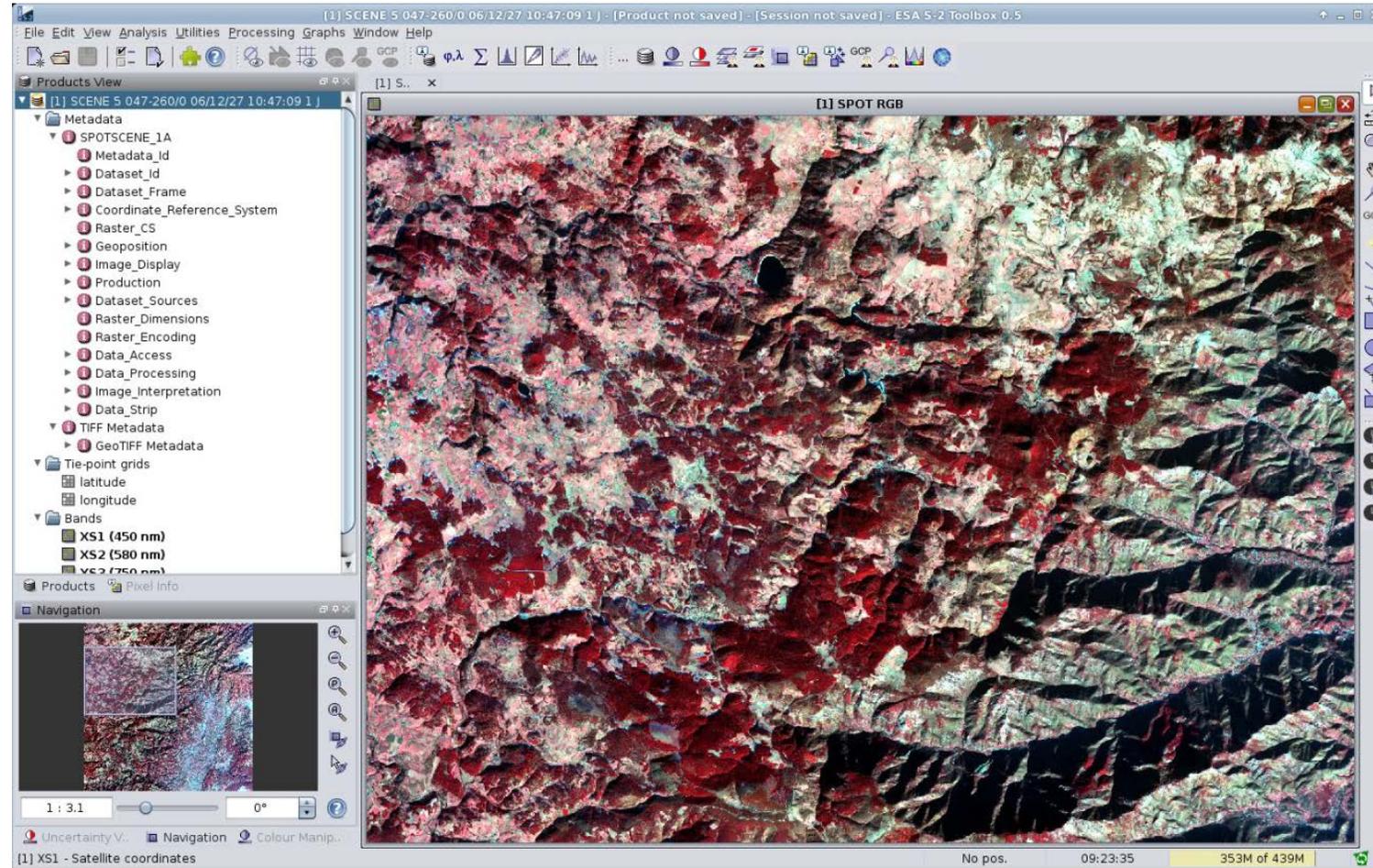


- ✓ Optimized multi-resolution viewing/processing
- ✓ JPEG2000 decoding through OpenJPEG library
- ✓ GDAL readers / writers
- ✓ Internal cache of JP2 decoded tiles for performance
- ✓ Exploitation of high resolution optical data

Sentinel-2 Toolbox

New Land-Oriented Products Reader

- ✓ Landsat
- ✓ SPOT 1-7
- ✓ RapidEye
- ✓ Deimos
- ✓ SPOT4/5 Take5
- ✓ ALOS AVNIR
- ✓ ...



Sentinel-2 Toolbox

Level-2A Processor – Sen2Cor

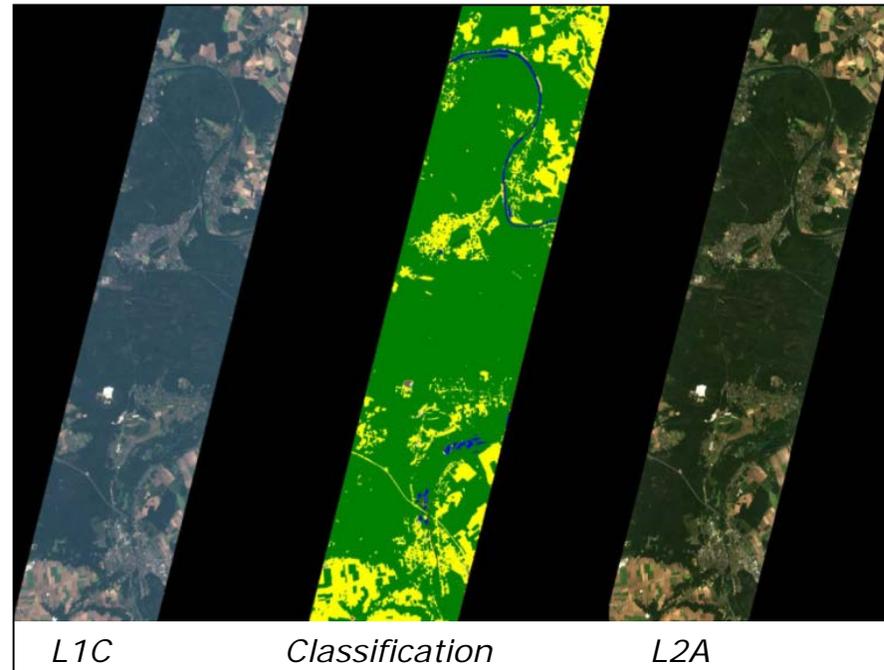
- BOA reflectance in cartographic projection developed by Telespazio Vega
- Integration in SNAP via the Standalone Tool Adapter

- Additional data

- ✓ Scene Classification Map
- ✓ Water Vapour Map
- ✓ Aerosols Optical Thickness Map

- Algorithm

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



- ✓ Seamless integration in SNAP
- ✓ GUI provided
- ✓ Level-2A product reader

Sentinel-2 Toolbox

Level-2B Processor – Biophysical Products

Automatic generation of L2B products from L1C/L2A

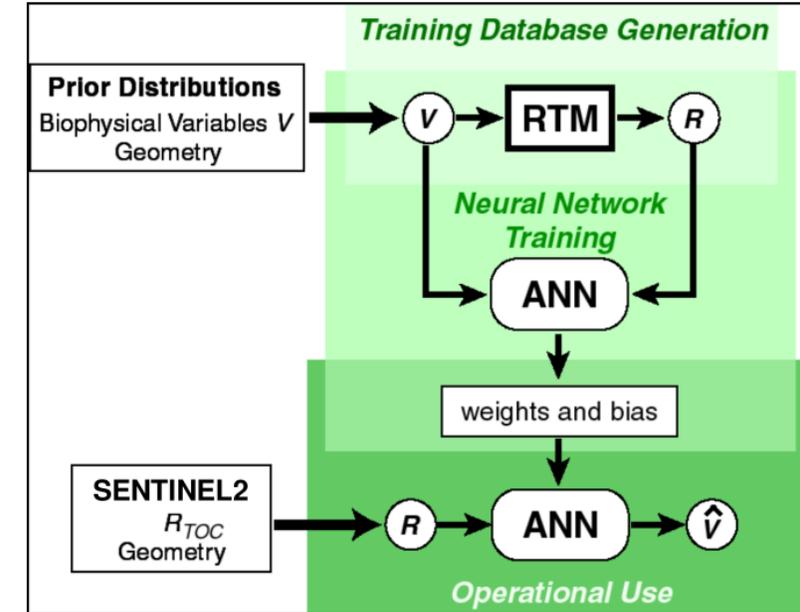
LAI - Leaf Area Index

fAPAR - fraction of photosynthetically active radiation absorbed by the green elements of the canopy

FVC - the Cover Fraction, used to separate vegetation and soil in energy balance process

CCC - the Canopy Chlorophyll Content, good indicator of stresses including nitrogen deficiencies

CWC - the Canopy Water Content used also as a proxy for the water status of the plant

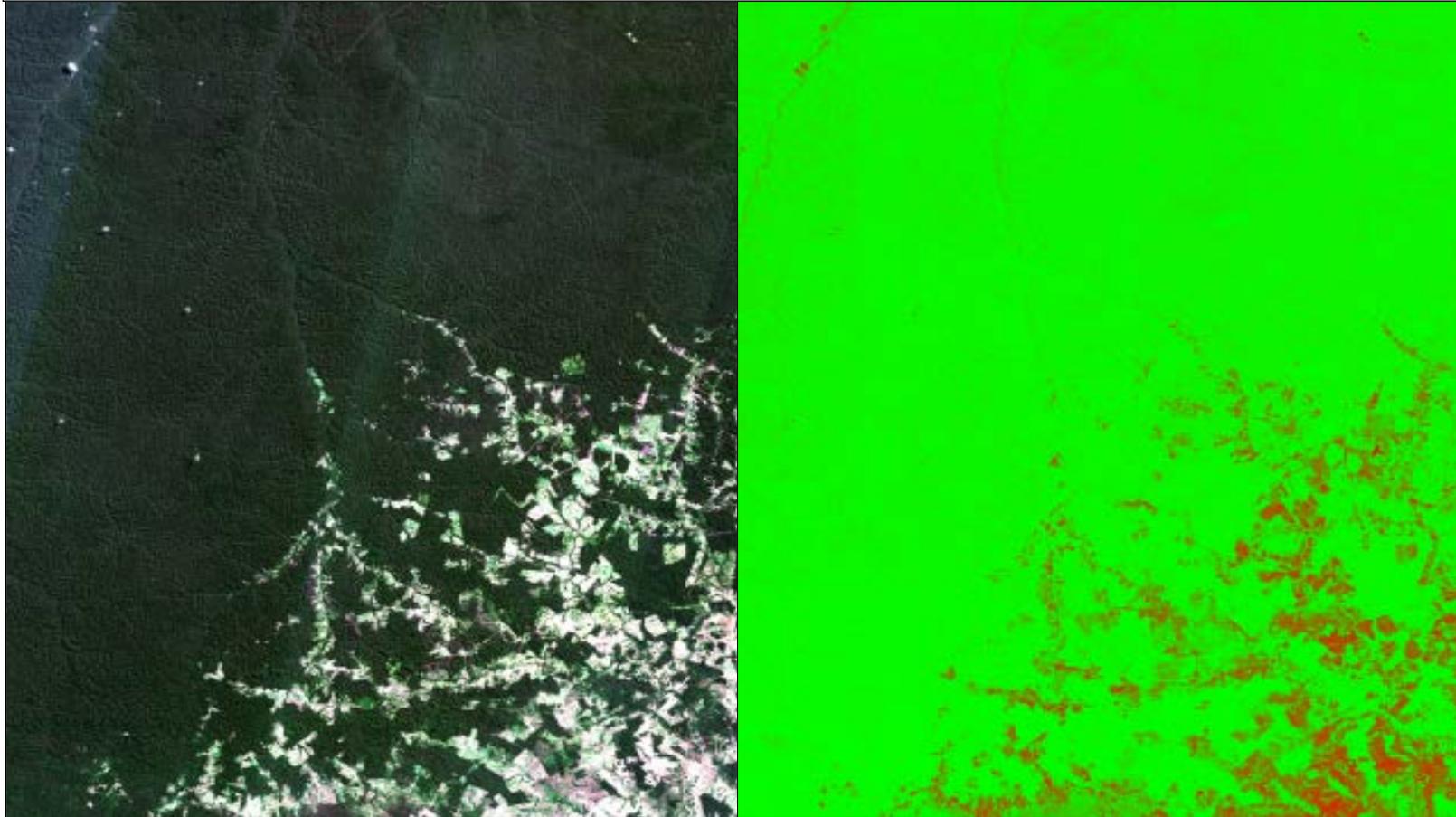


Algorithm developed by INRA

Sentinel-2 Toolbox

LAI – Amazon Forest

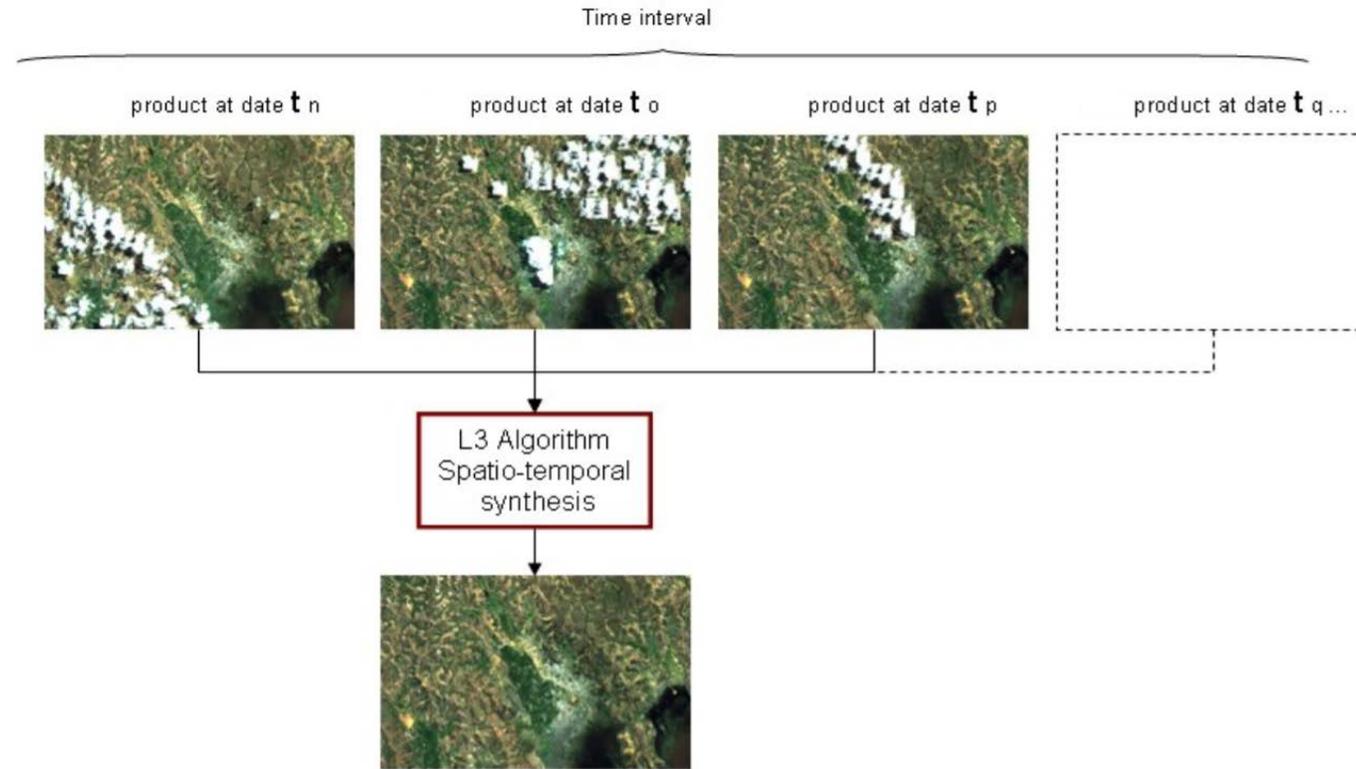
Sentinel-2A Leaf Area Index (LAI) over Amazon Forest



Sentinel-2 Toolbox

Level-3 Processor – Sen2Three

Multi-temporal cloud-free composites generation from Sentinel-2 data



Sentinel-2 Toolbox

Radiometric Indices Processor – Sen2Rad

Radiometric indices are quantitative measures of features that are obtained by combining several spectral bands

Vegetation indices

- DVI, RVI, PVI
- NDVI, WDV, TNDVI, GNDVI
- SAVI, TSAVI, MSAVI, MSAVI2
- GEMI
- ARVI
- NDI45
- MTCI, MCARI, PSSRa
- S2REP, REIP, IRECI

Soil indices

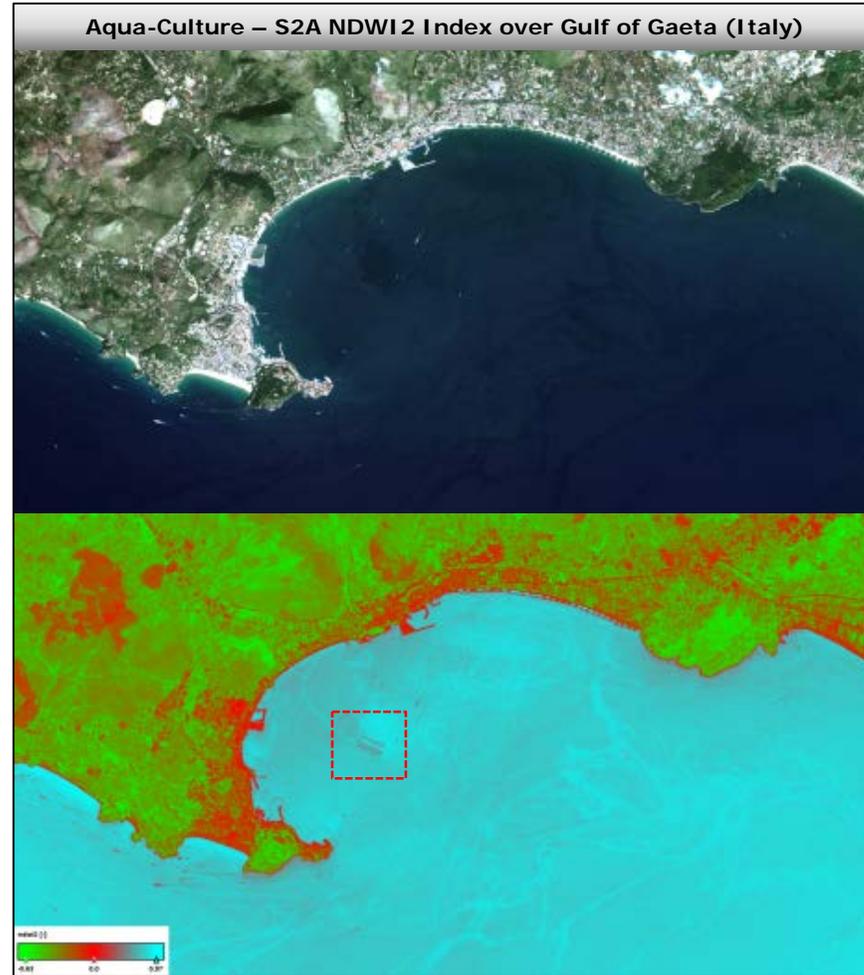
- BI
- BI2
- RI
- GEMI

Water indices

- NDWI
- NDWI2
- MNDWI
- NDPI
- NDTI

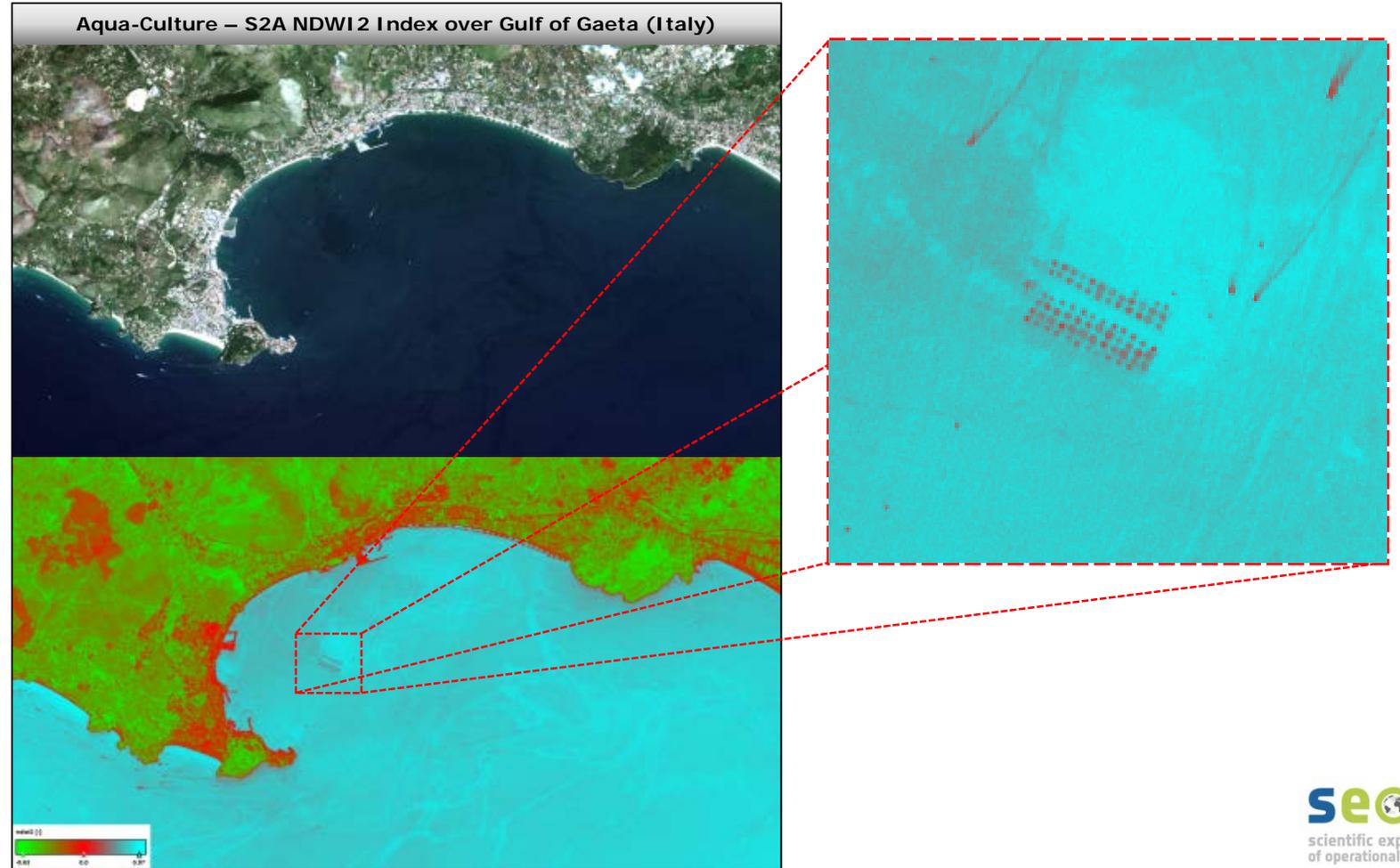
Sentinel-2 Toolbox

NDWI2 – Gulf of Gaeta



Sentinel-2 Toolbox

NDWI2 – Gulf of Gaeta





*Thank you
for your attention*

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