

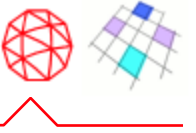


Making SAR Accessible with ENVI® SARscape SARscape® 5.6.2

May 2022

Megan Gallagher | Solutions Engineer

About Me!



Megan Gallagher

Solutions Engineer

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303-786-9900

Agenda

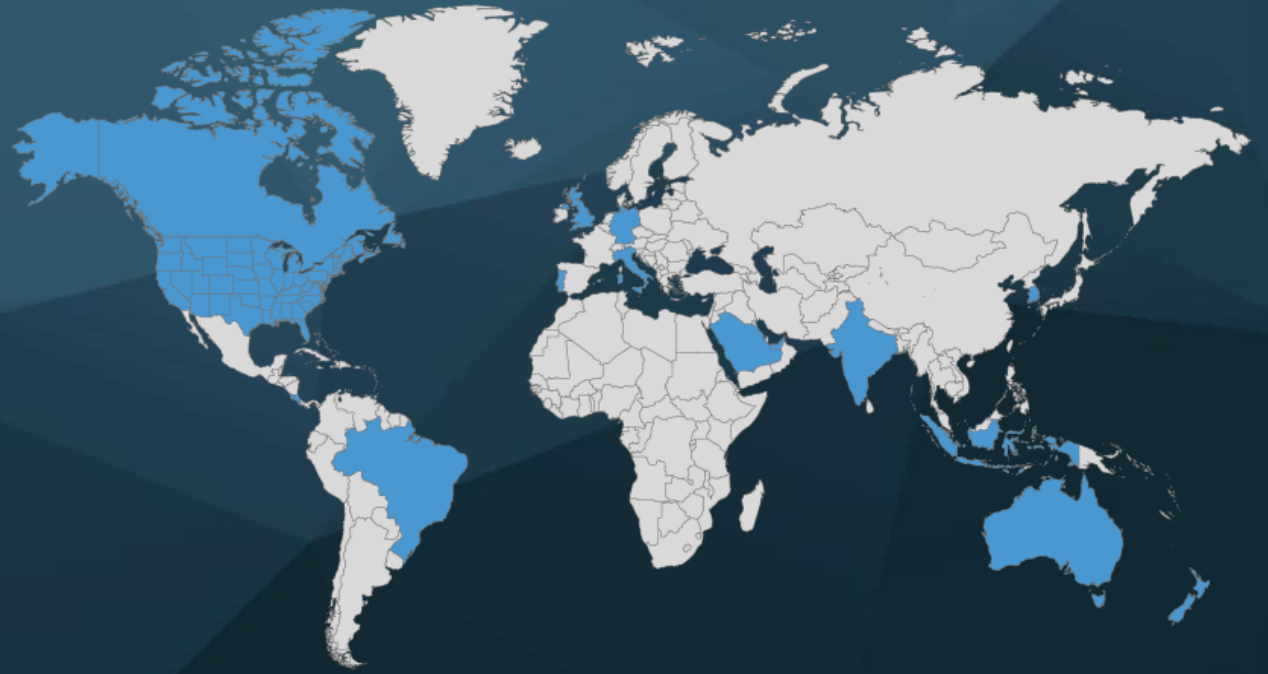


- Intro to L3Harris Geospatial
- How to make SAR more accessible
 - A look at SAR and optical
 - Vegetation analysis
 - Activity monitoring
 - Displacement
- Workflows and overall ease of access



L3HARRIS

L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs.



~400
LOCATIONS



CUSTOMERS IN
~130
COUNTRIES



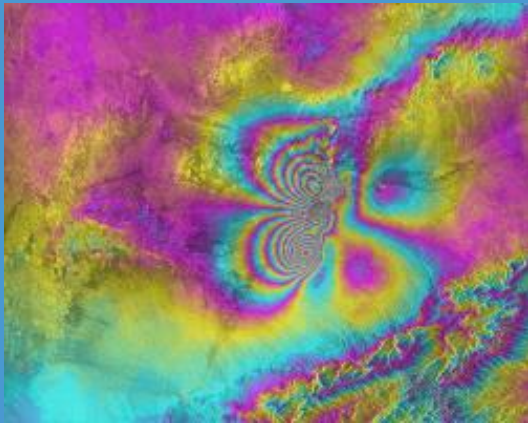
LOCATIONS IN
~30
COUNTRIES



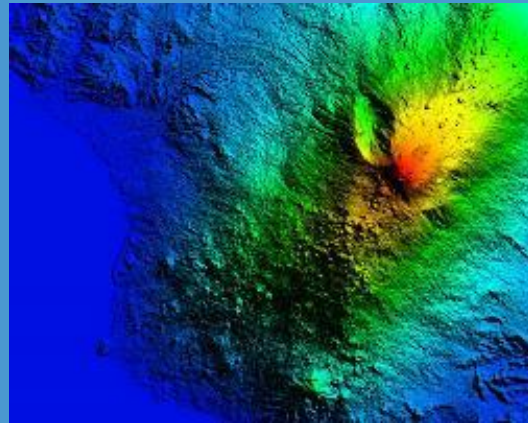
~50K
EMPLOYEES



Geospatial Solutions



Commercial
geospatial analytics



Off-the-shelf and
custom geospatial
products/services



Data and imagery



Machine learning
technologies

Core offerings



We have more than 30 years of experience developing scientifically proven solutions using cutting-edge technology. Today, organizations across industries use our in-depth knowledge of advanced geospatial analytics, machine learning and remotely sensed data to make better decisions.

ENVI®



ENVI® SARscape®



IDL®



Jagwire™



Amplify™



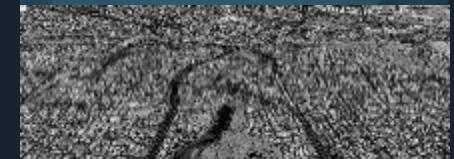
GSF



Helios®

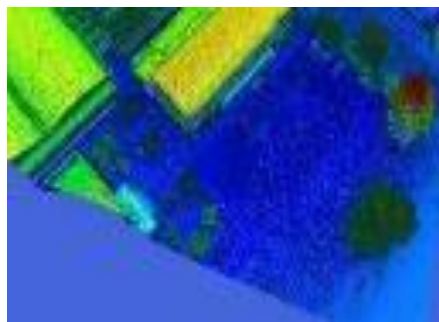


Data & Imagery





ENVI image analysis software uses scientifically-proven analytics to deliver expert-level results.



Data support

Hyperspectral, multispectral, SAR, LiDAR, radar, FMV, panchromatic and more



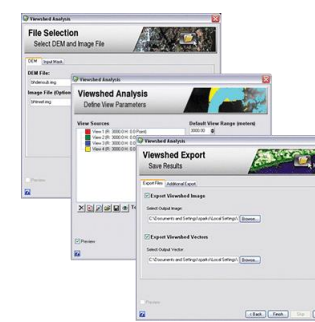
ArcGIS integration

Workflows and automated tools to execute ENVI analytics and access results within any ArcGIS environment



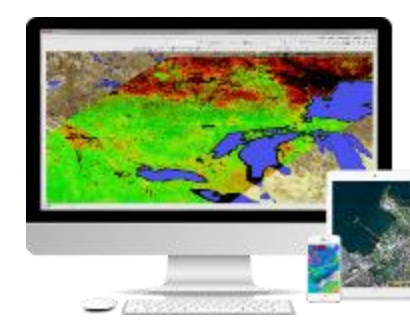
Automated workflows

Change detection, anomaly detection, viewshed analysis and more



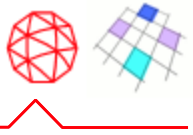
Extensible modules

Deep learning, SAR analytics, feature extraction, DEM extraction, atmospheric correction, photogrammetry and JITC compliant NITF



Accessible

Accessible when and where you need in enterprise, partner platforms and in the cloud

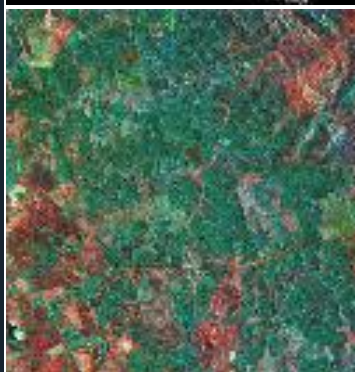
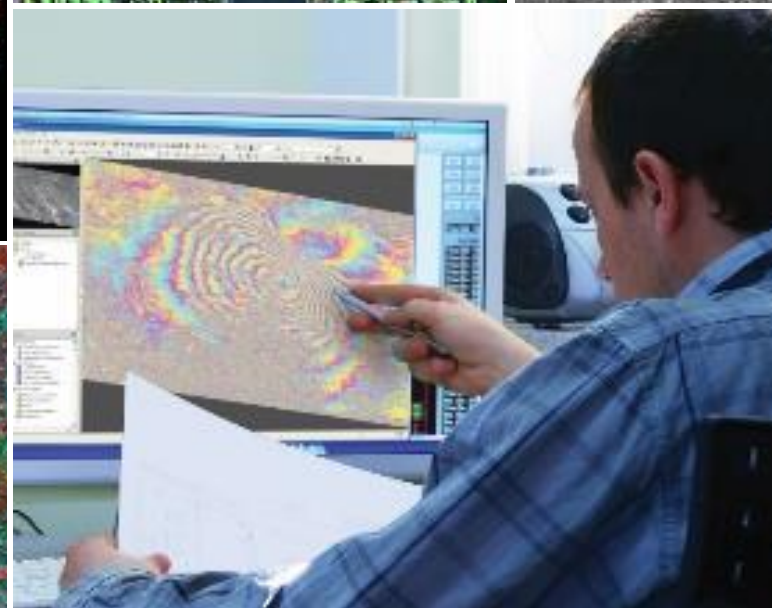
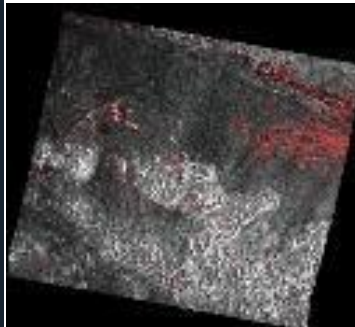
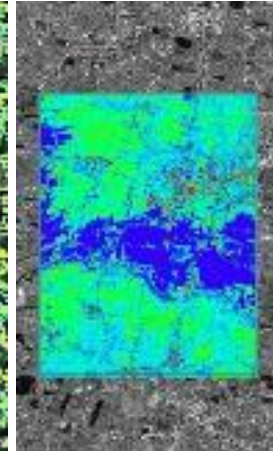
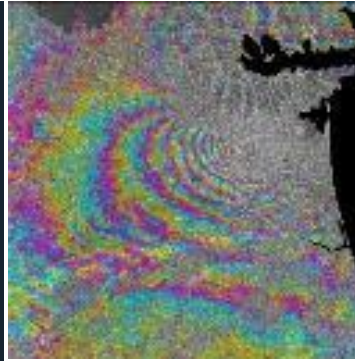


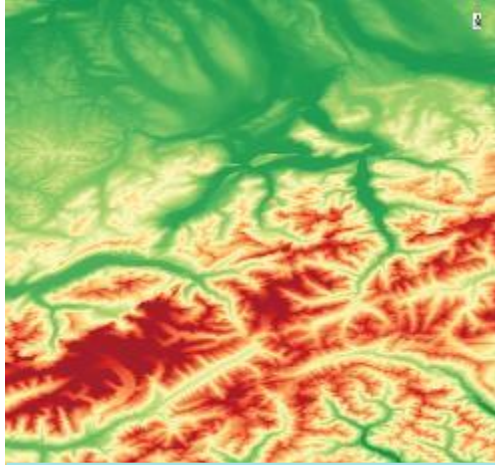
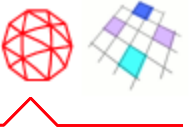
Easily process and analyze SAR data

Easily process and analyze SAR data and generate products like DEMs or surface deformation maps

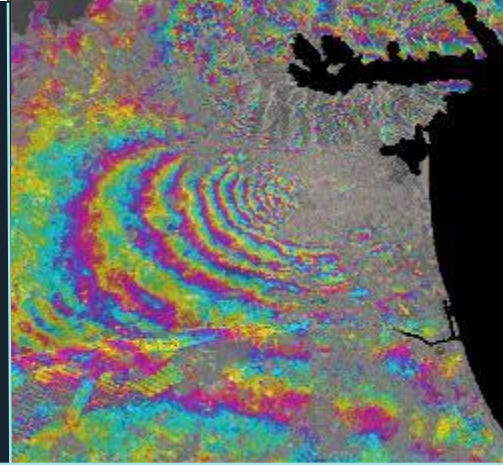
Built-in workflows and modules simplify processing and can be customized

ENVI integration brings advanced image and SAR processing and analysis together in one package

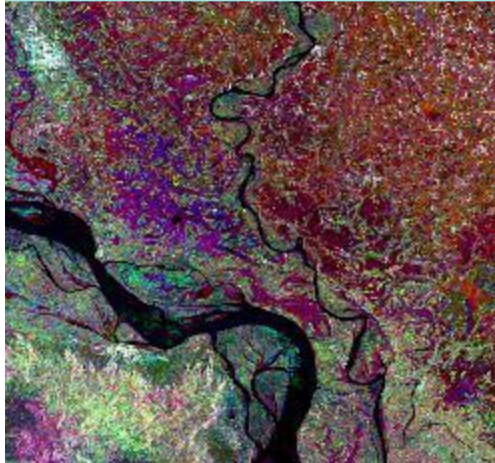




Perform common SAR processing applications regardless of skill level



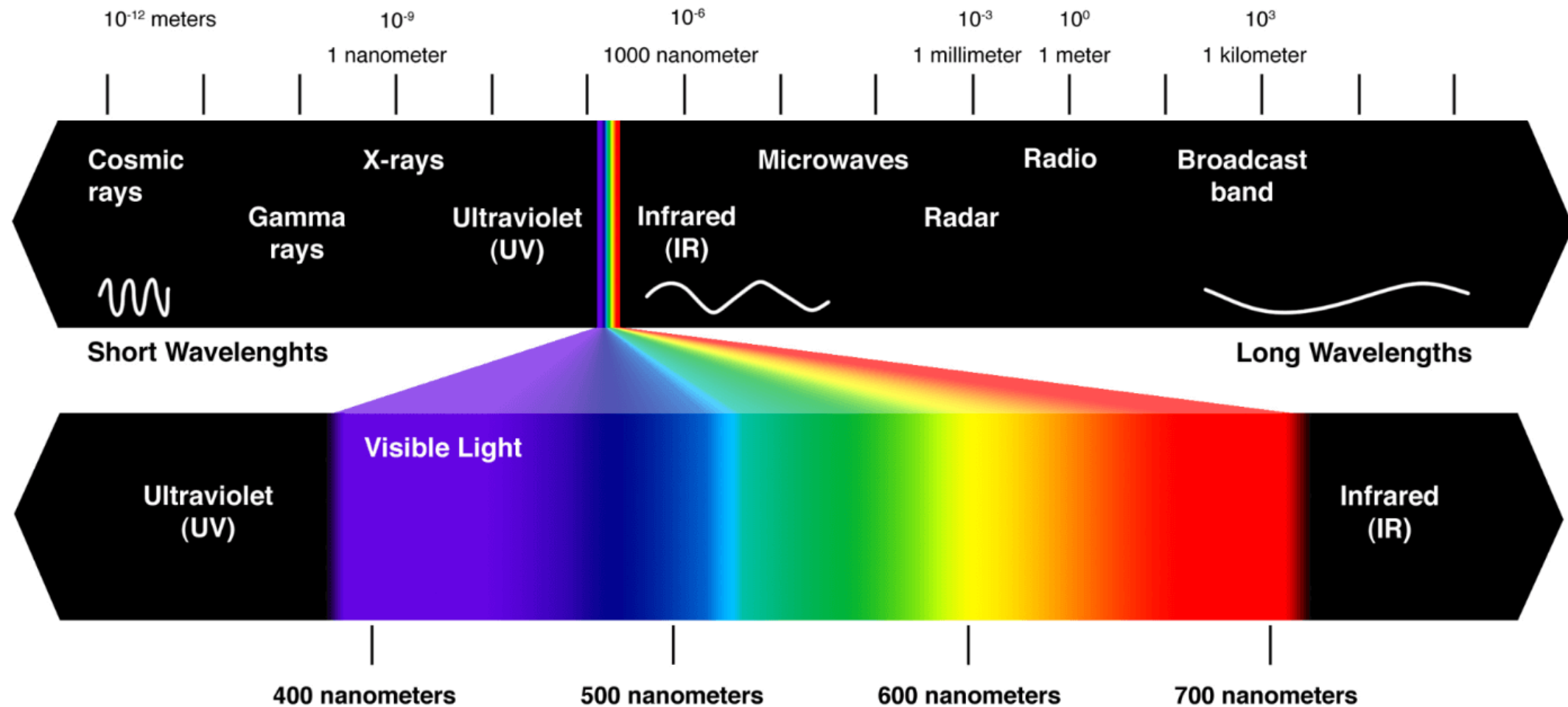
Easily process and analyze SAR data and generate products like DEMs or surface deformation maps



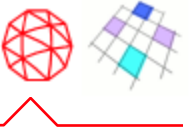
ENVI integration brings advanced image and SAR processing and analysis together in one package

- Flood mapping
- DEM extraction
- Sentinel download
- Sentinel auxiliary file download
- Time series
- Change detection
- Displacement map
- Ship detection
- Persistent scatterers
- Image geocoding

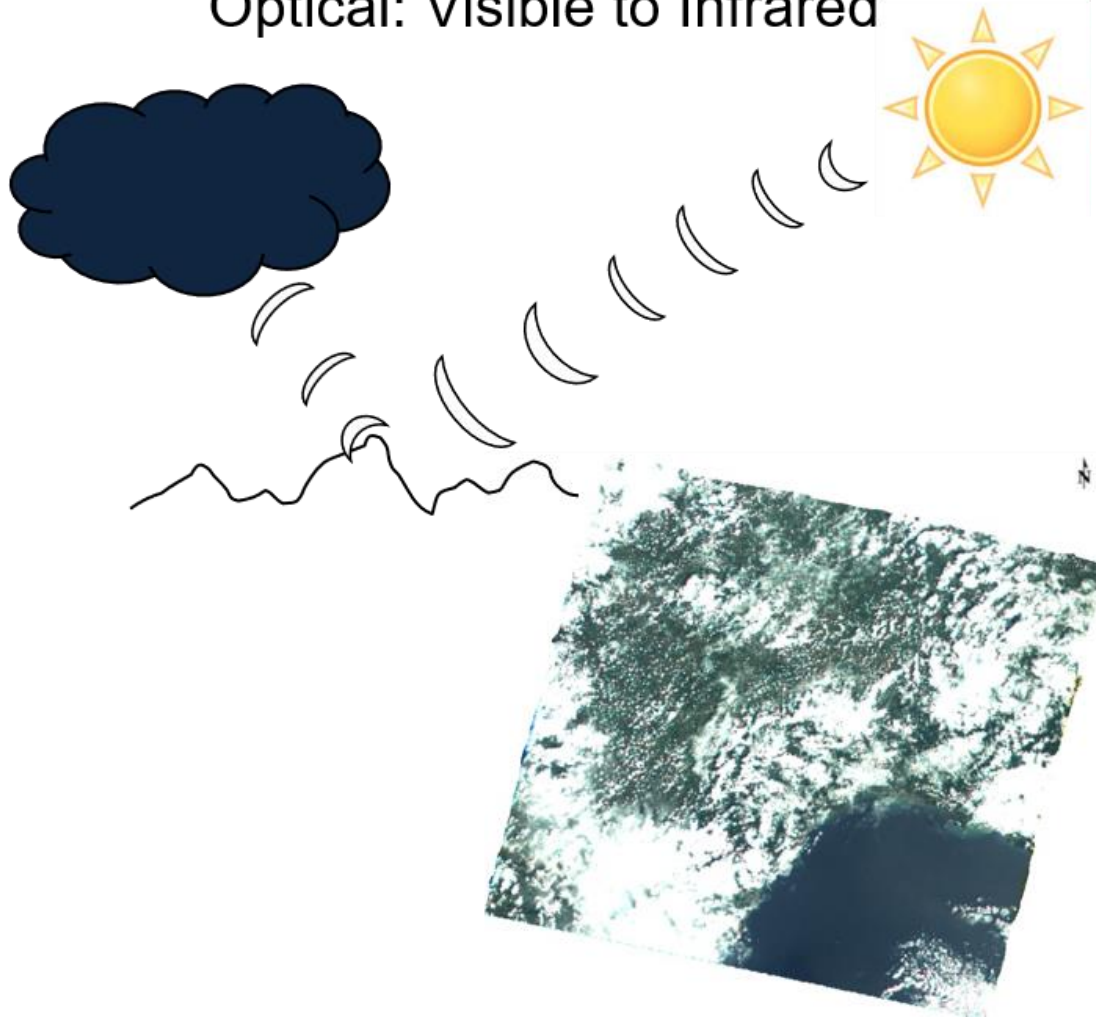
SAR and Optical – What we see, and what we don't



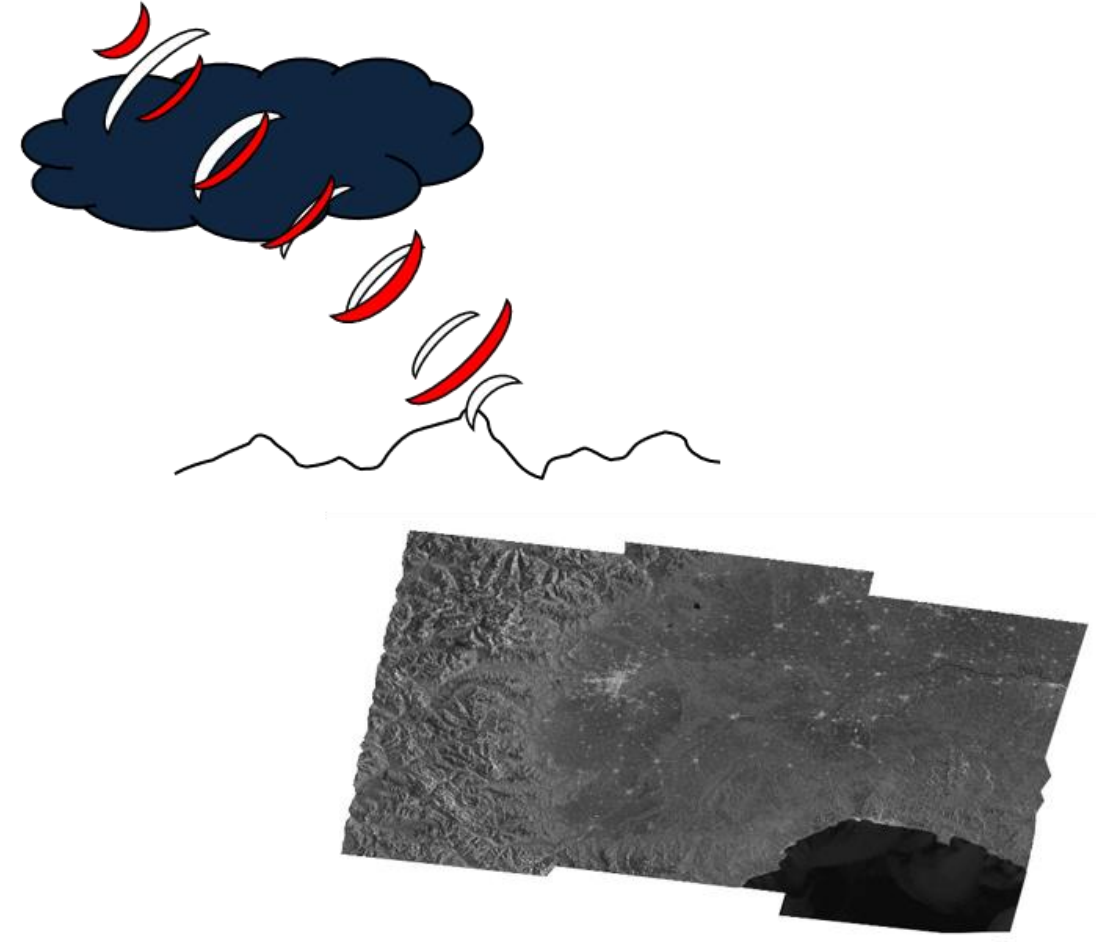
SAR and Optical – What we see, and what we don't

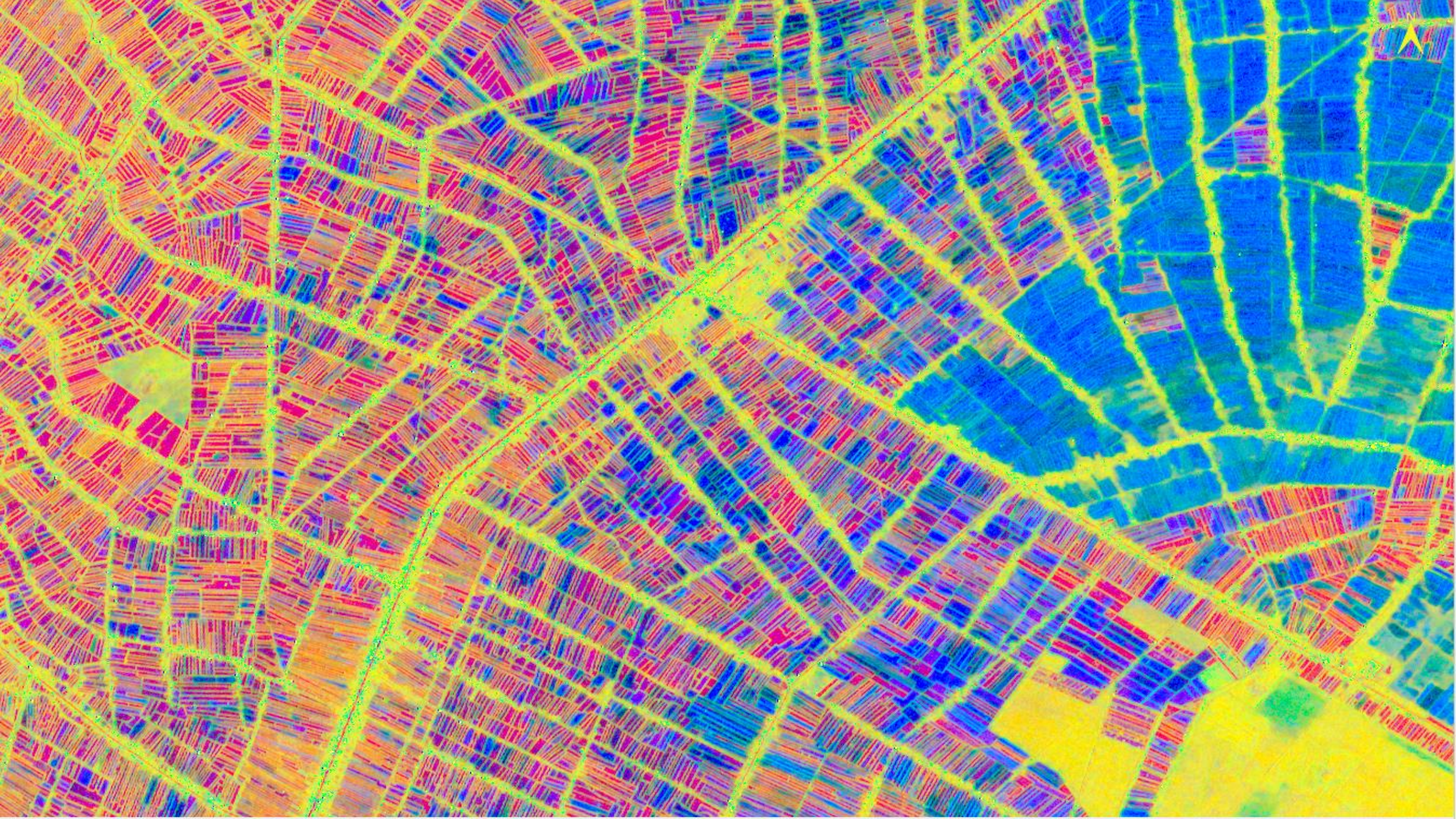


Optical: Visible to Infrared

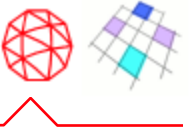


SAR: Active Microwave

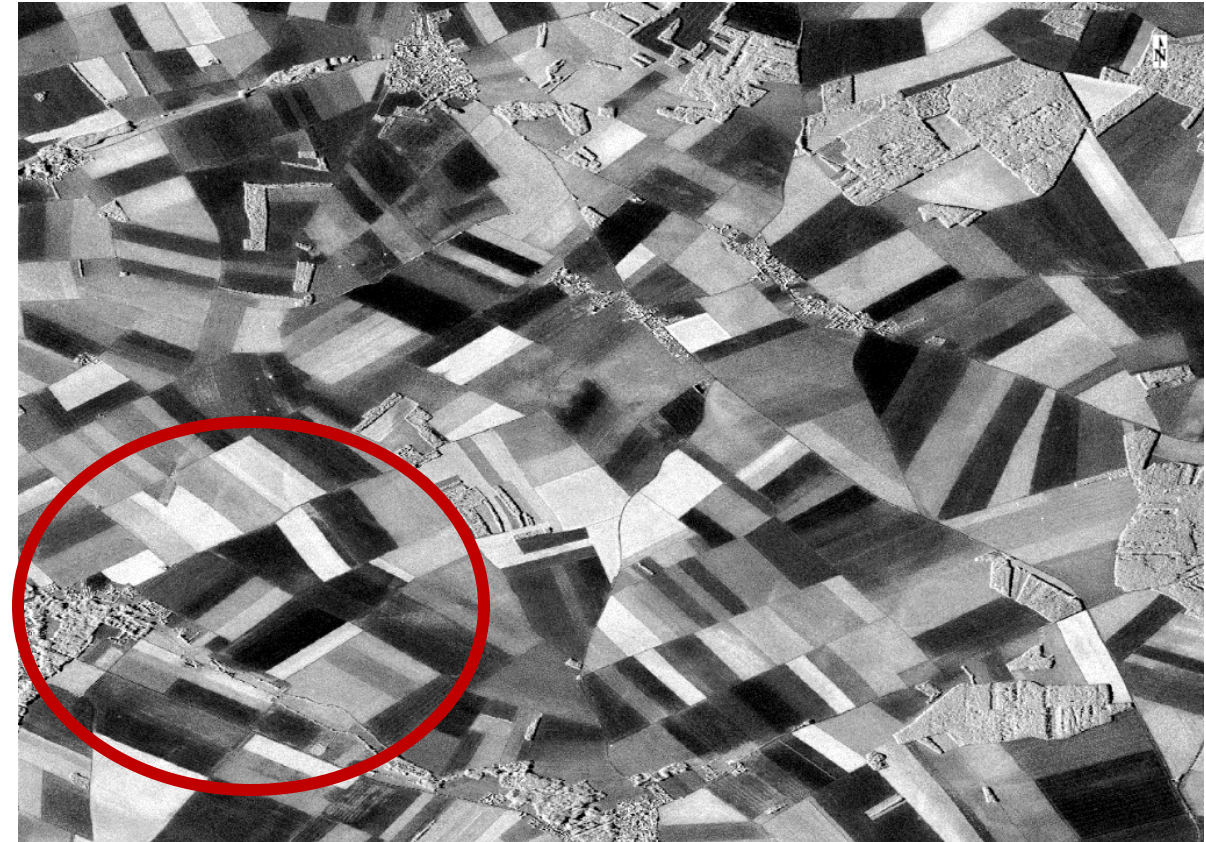




Optical and SAR



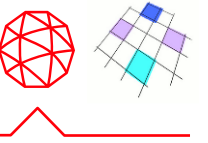
Sentinel-2, June 20, 2018



TerraSAR-X, June 18, 2018

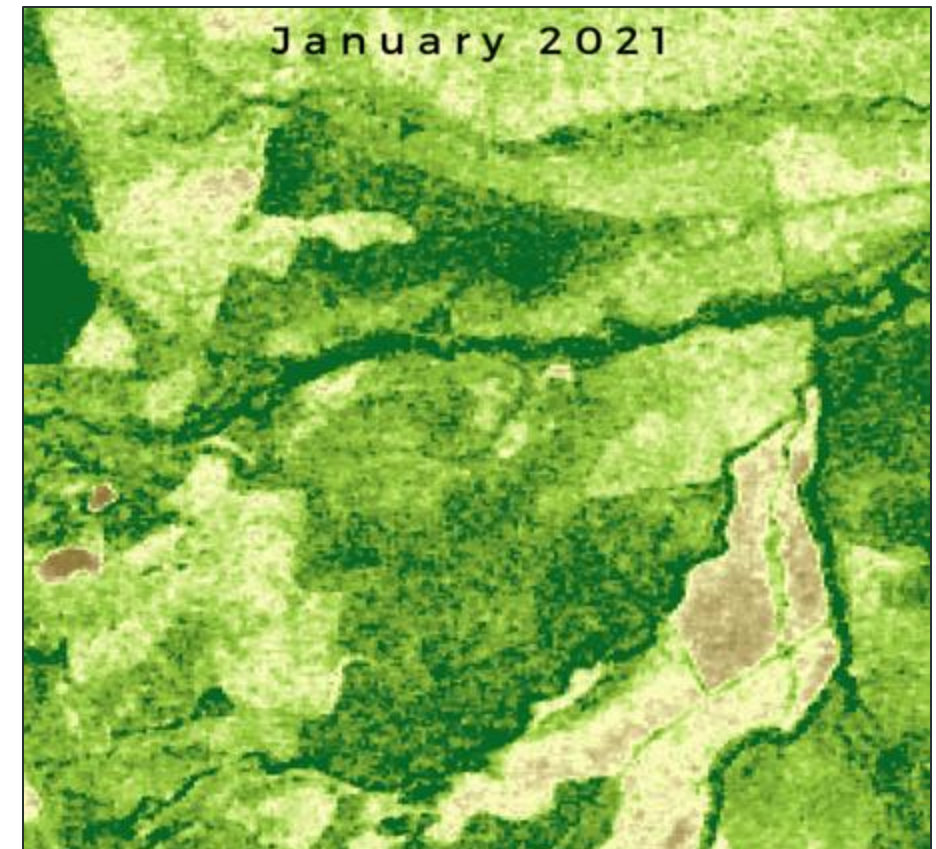
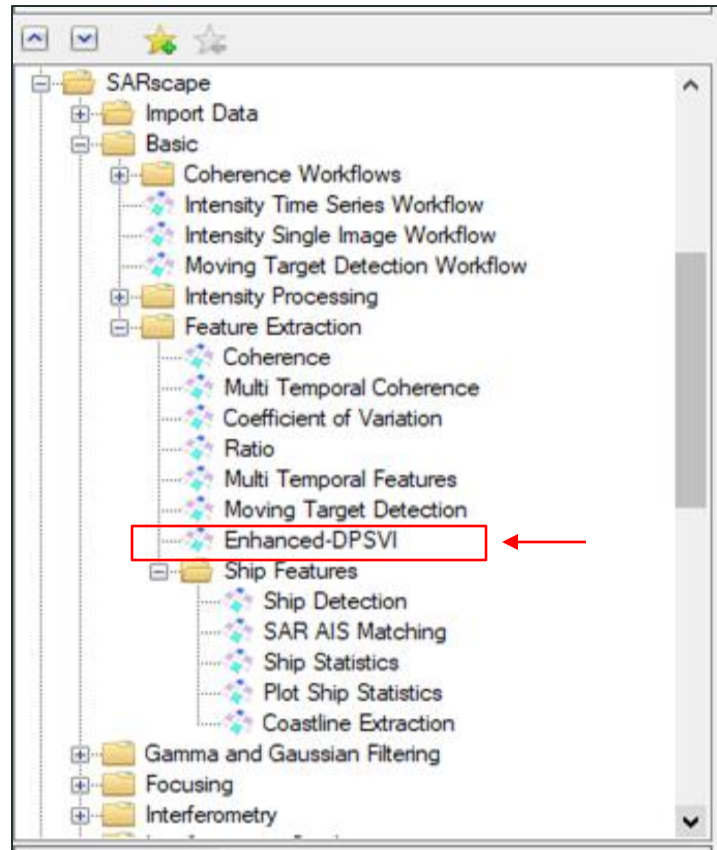
AIRBUS

Enhanced Dual Polarization SAR Vegetation Index



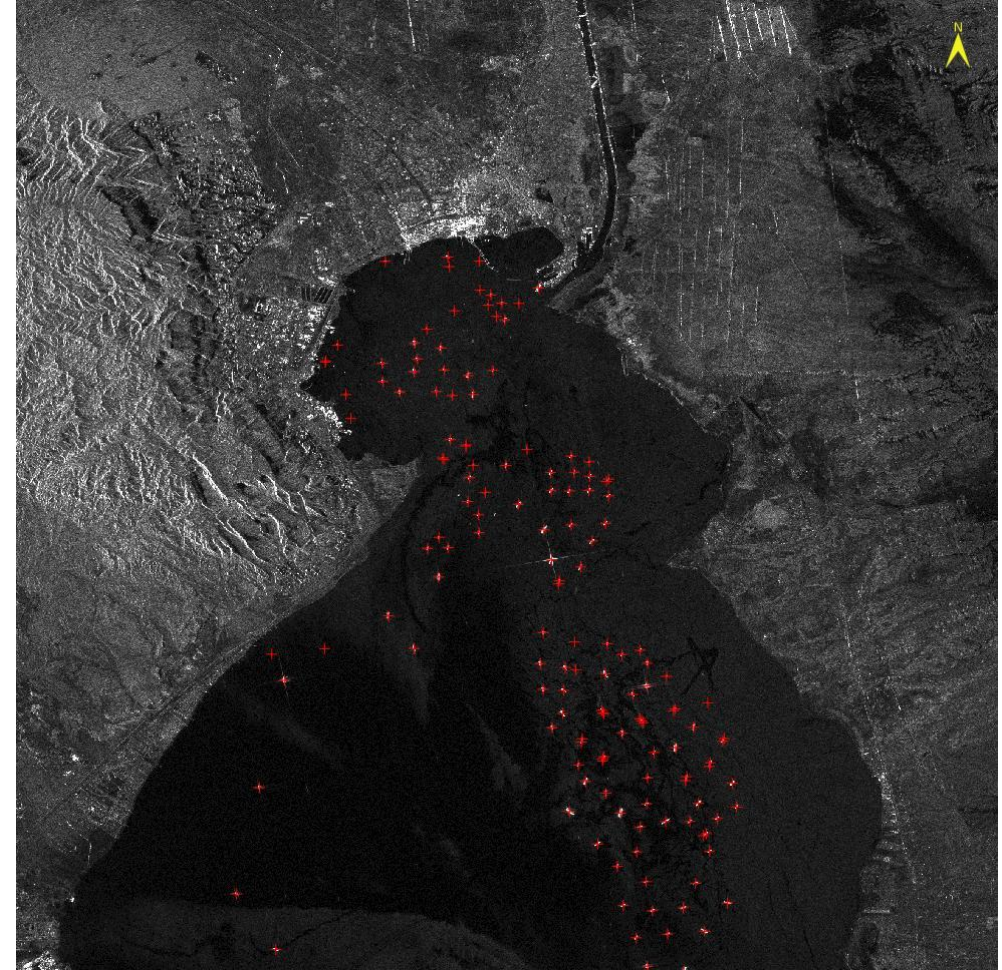
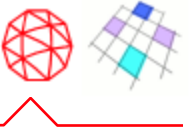
Enhanced-DPSVI

The tool computes an Enhanced Dual Polarization SAR Vegetation Index (EDPSVI) using Co-Pol coherence and Dual-Pol intensity data. It estimates the land cover based on the amount of vegetation (like the NDVI index on optical data).



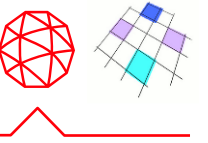
Example of EDPSVI output, this sequence shows how the vegetation density and distribution changes across the year.

Activity Monitoring



151 ships detected from Sentinel-1 data 25th March 2021

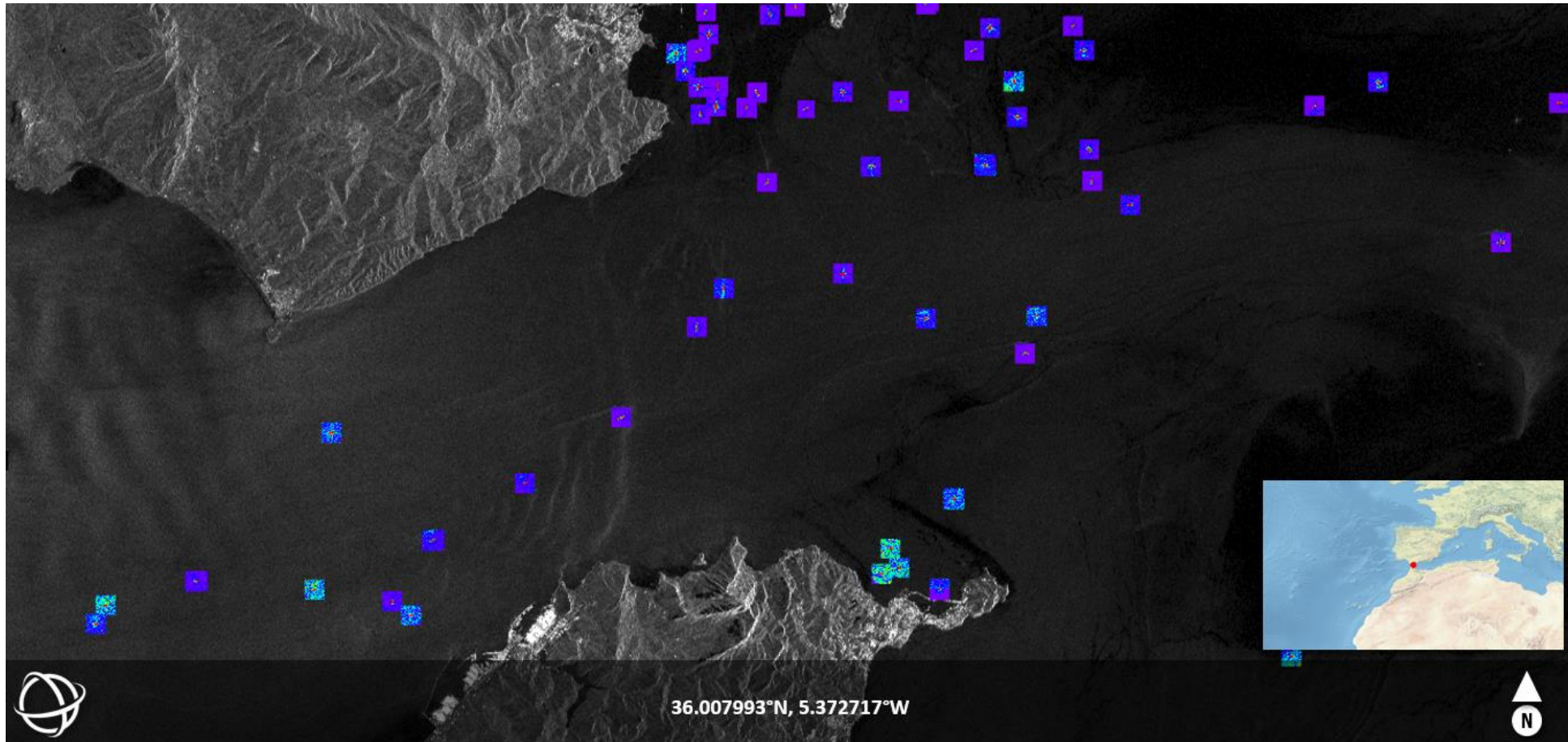
Ship Detection



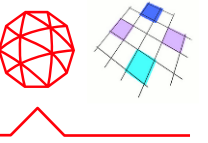
Ship Detection

- Compensation of the doppler effect to improve the matching between the AIS signal and the detected radar target
- Classification of the identified ships using a neural network trained on Sentinel-1 VV data.

Valid only for Sentinel-1 data with a resolution of 10 meters.

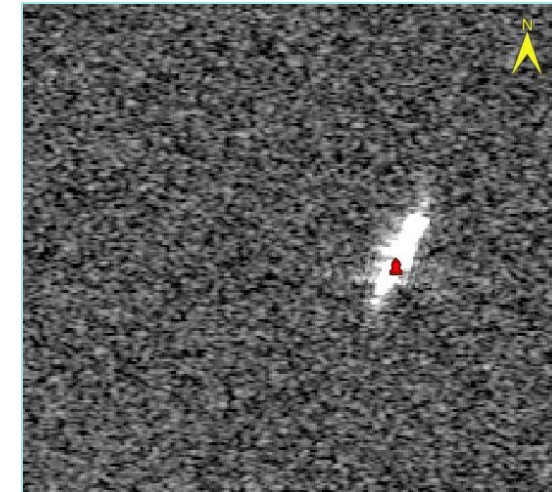
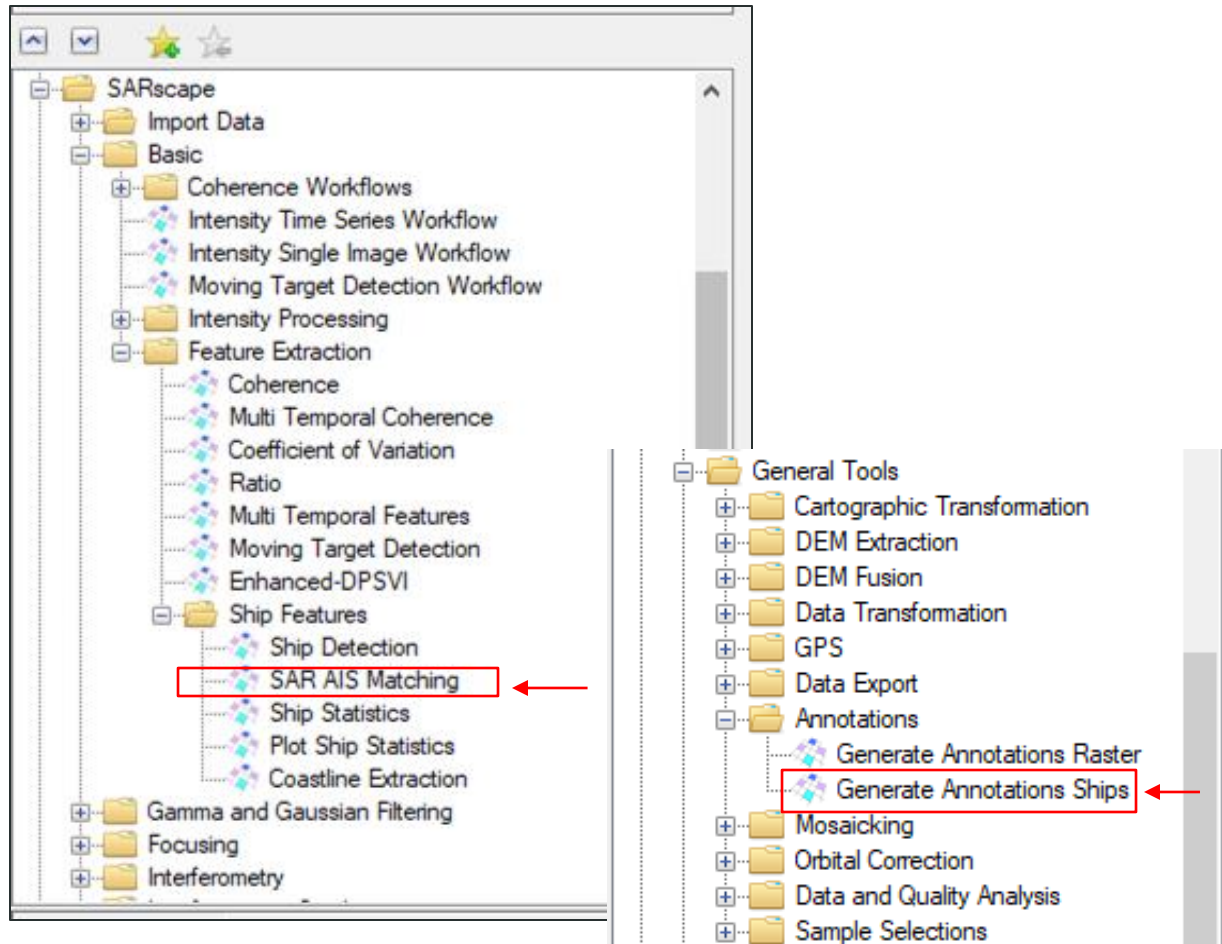


Ship Detection

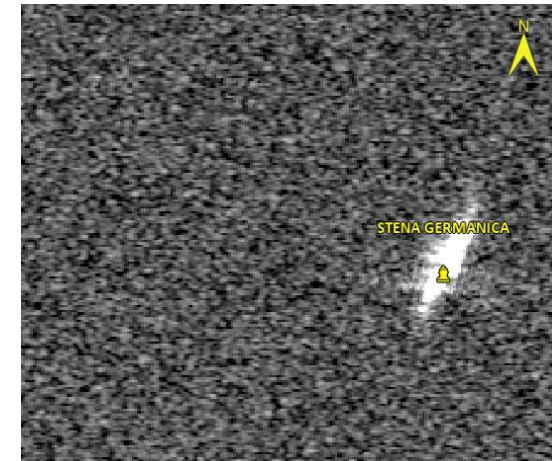


The Ship Detection workflow has been enhanced by adding new tools and new features to enrich the outcomes.

AIS (Automatic Identification System) Matching and Annotation

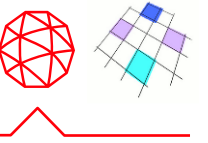


Symbols retrieved from the Ship detection tool



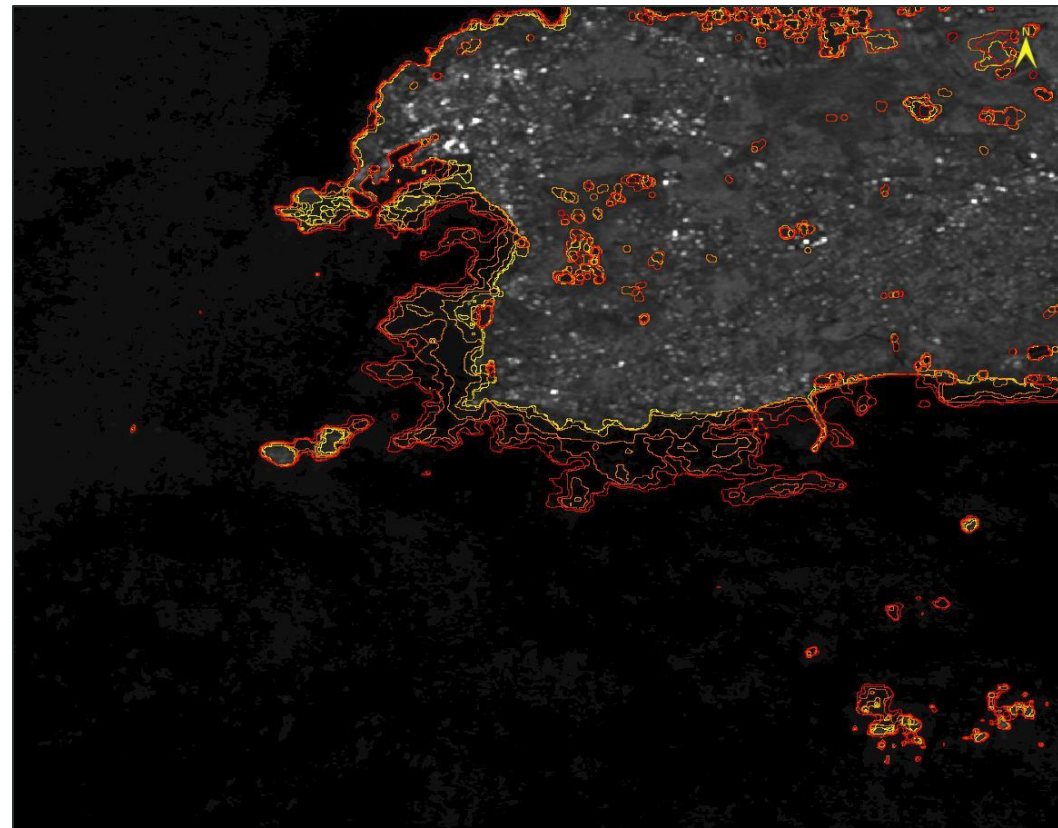
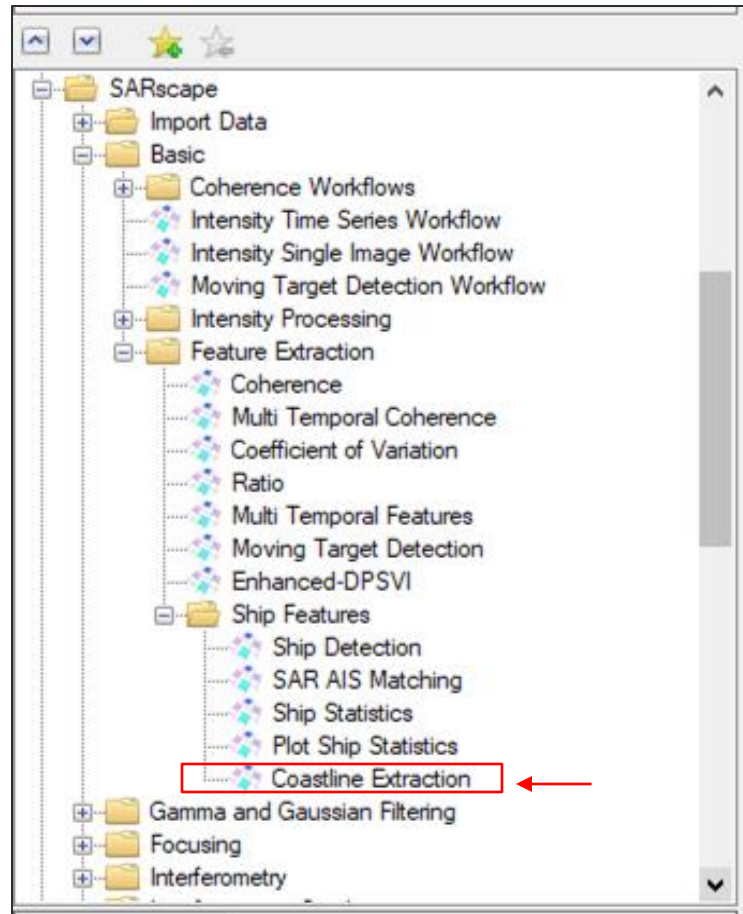
Names retrieved from the SAR AIS Matching tool

Ship Detection



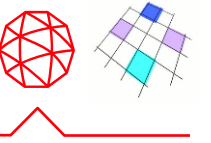
The Ship Detection workflow has been enhanced by adding new tools and new features to enrich the outcomes.

Coastline Extraction



Coastline extraction, different color lines refer to the coastline **according to the different tide levels.**

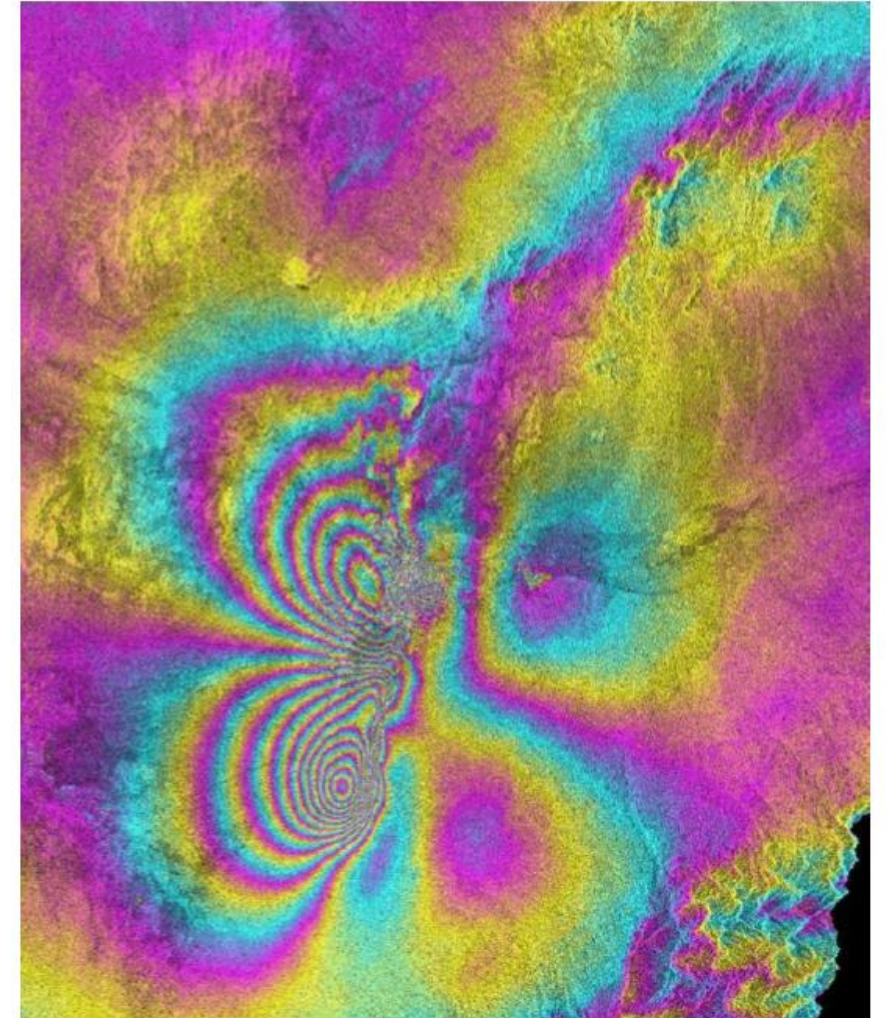
Displacement



SAR can be used to monitor and track displacement by using the phase that is collected alongside its amplitude.

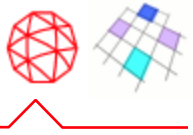
The phase change shows minor shifts on the ground surface related to when a specific part of the wave hits the ground at what time.

The change in time can be tracked in between images and used to find ground surface change!

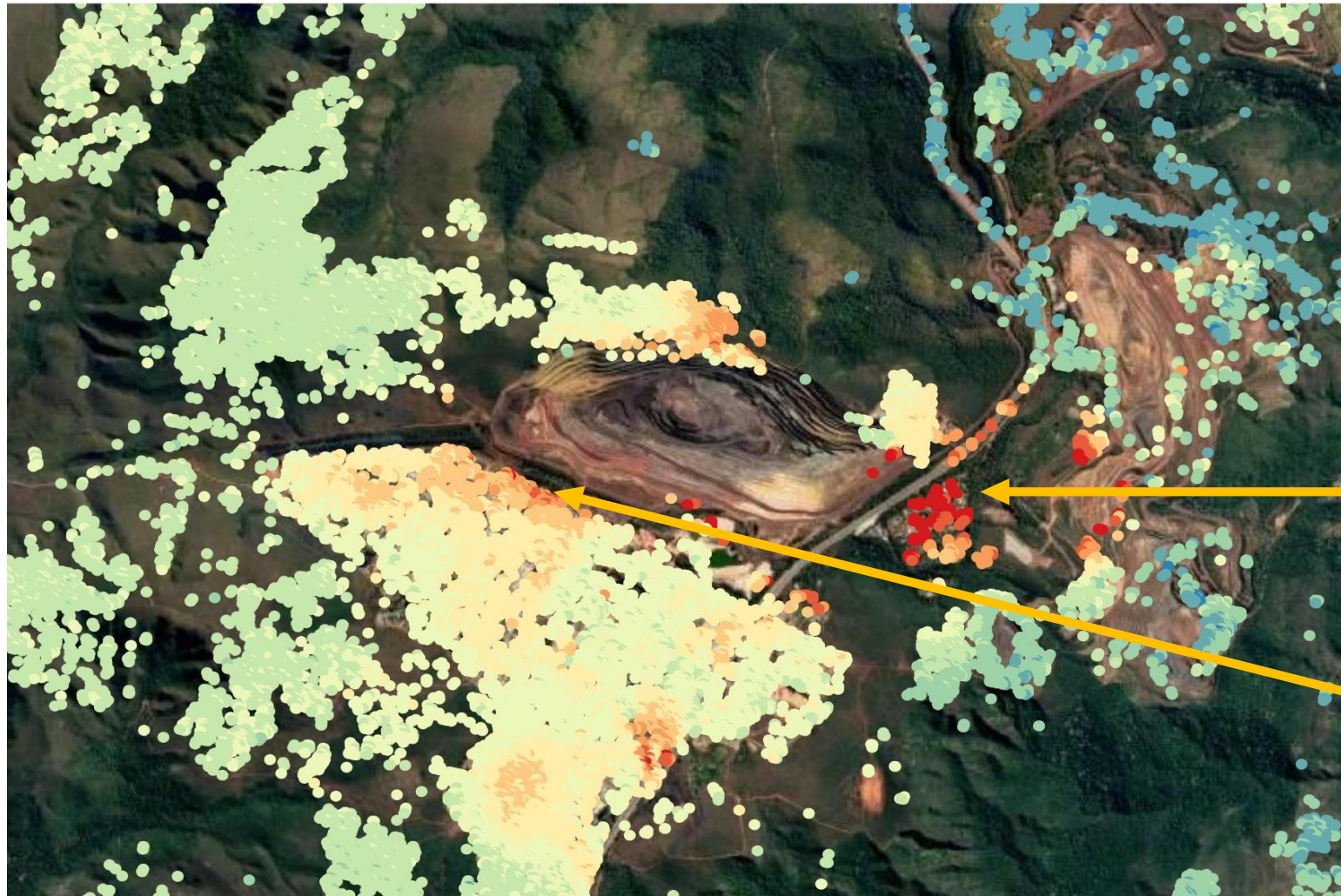


Composite of filtered interferogram
and primary intensity image

PSI - Mina Mar Azul (Vale)



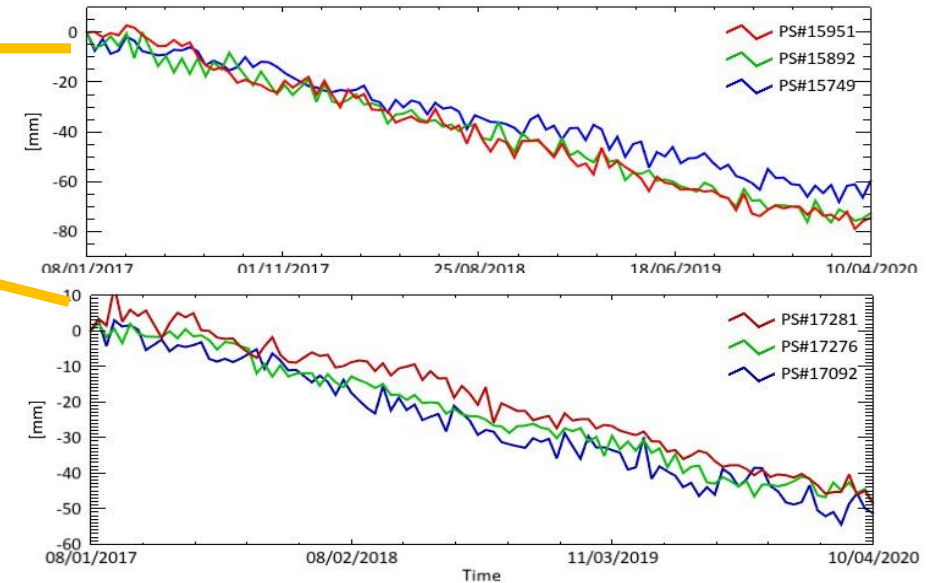
Mina Mar Azul (Vela)



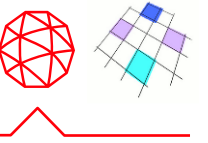
PSI (Jan/2017 - Mar 2020)

Velocity (mm/year)

- [-24,2 ; -20,1]
- [-20,1 ; -16,1]
- [-16,1 ; -12,0]
- [-12,0 ; -7,90]
- [-7,90 ; -3,90]
- [-3,90 ; 0,20]
- [0,20 ; 4,20]
- [4,20 ; 8,30]
- [8,30 ; 12,4]
- [12,4 ; 16,5]

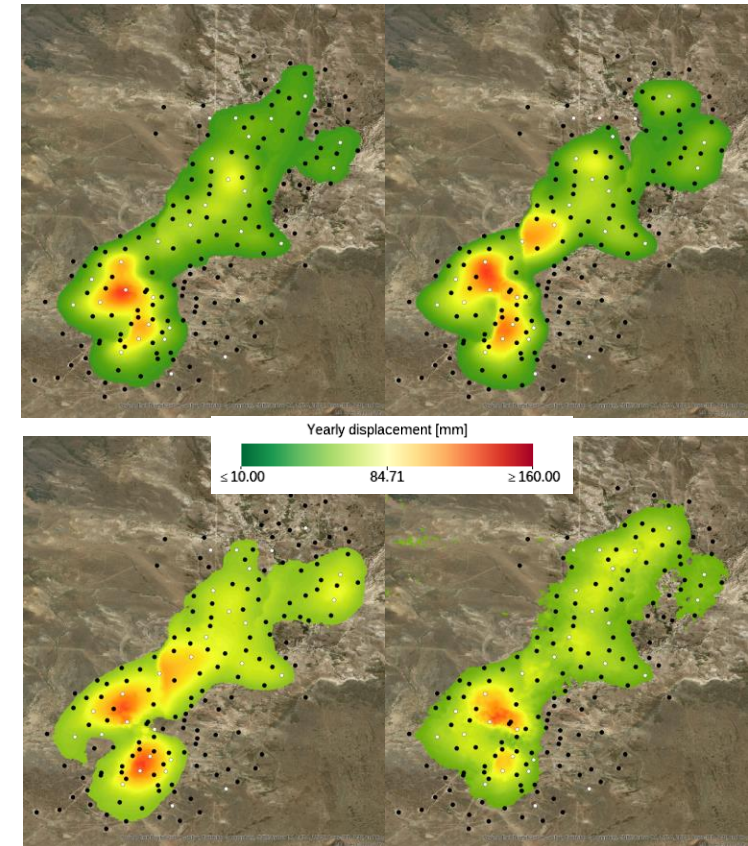
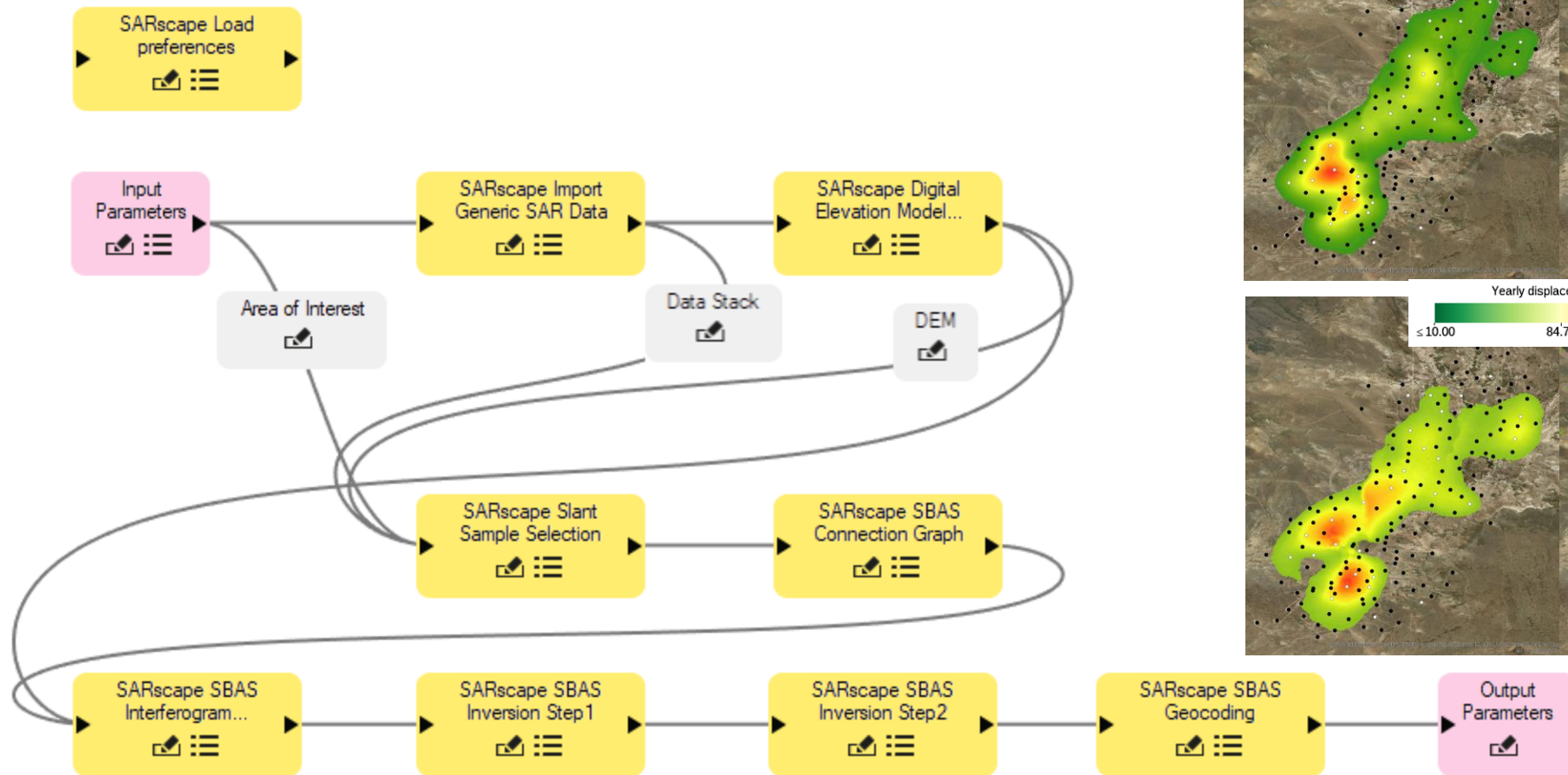


SBAS in ENVI Tasks

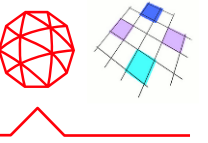


SBAS – Automatic processing

A new set of SARscape tasks enables the automatic execution of the SBAS processing chain, allowing the monitoring of the temporal evolution of surface deformations.

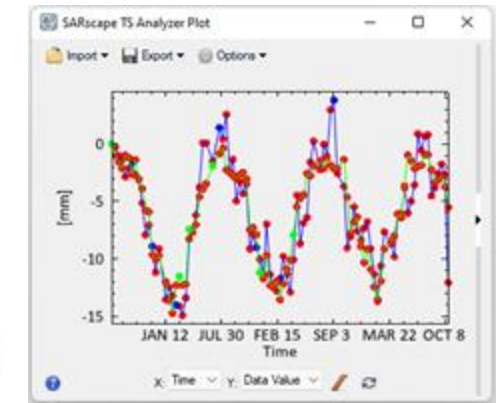
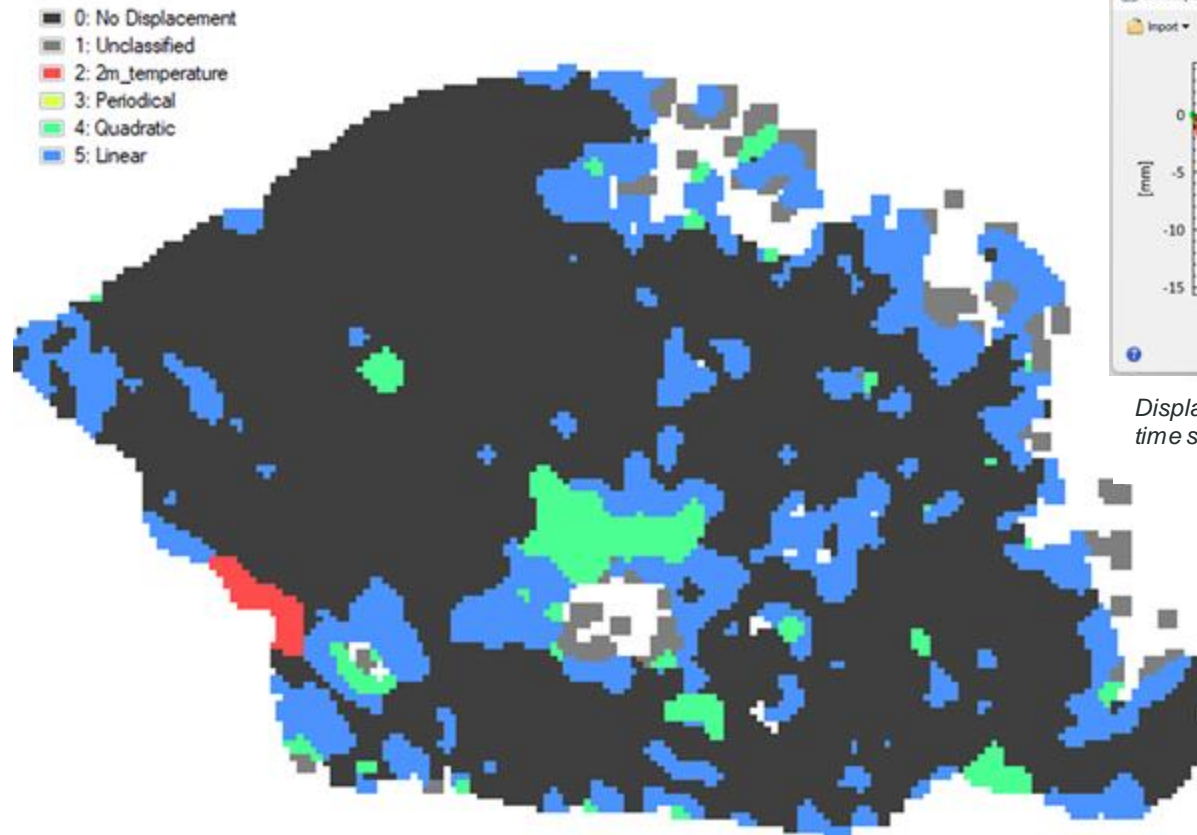
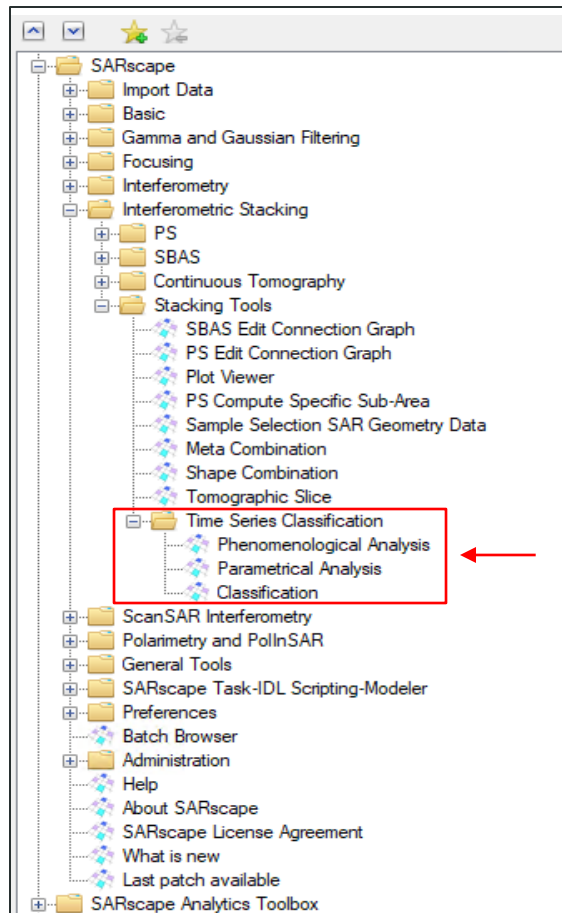


Displacement Time Series Classification



Time Series Classification

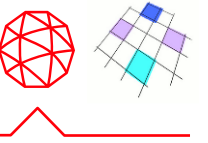
Performs the classification of a displacement time series by means of external temporal phenomenological data (rain, temperatures, etc.) or analytical displacement models (linear, quadratic and sinusoidal).



Displacement time series VS temperature time series.

Displacement classification map.
The different colors represent the best fitting trend for a specific criteria.

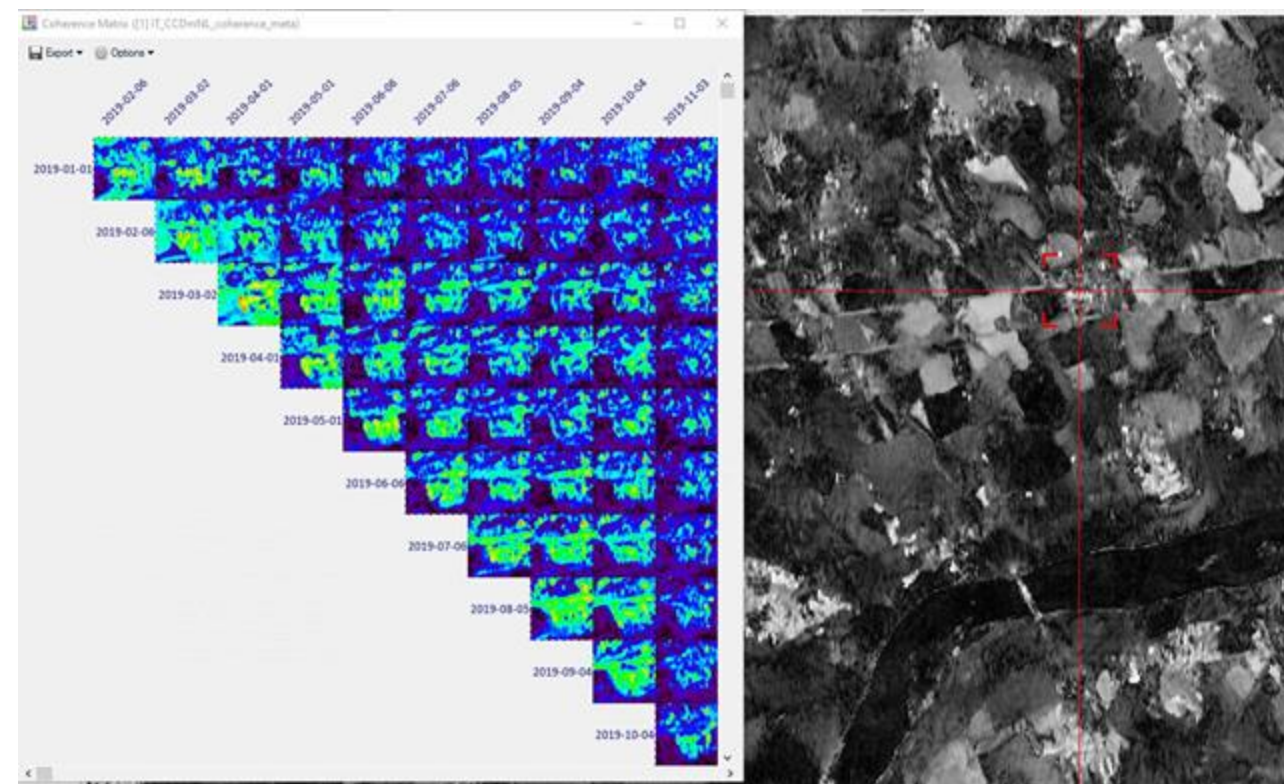
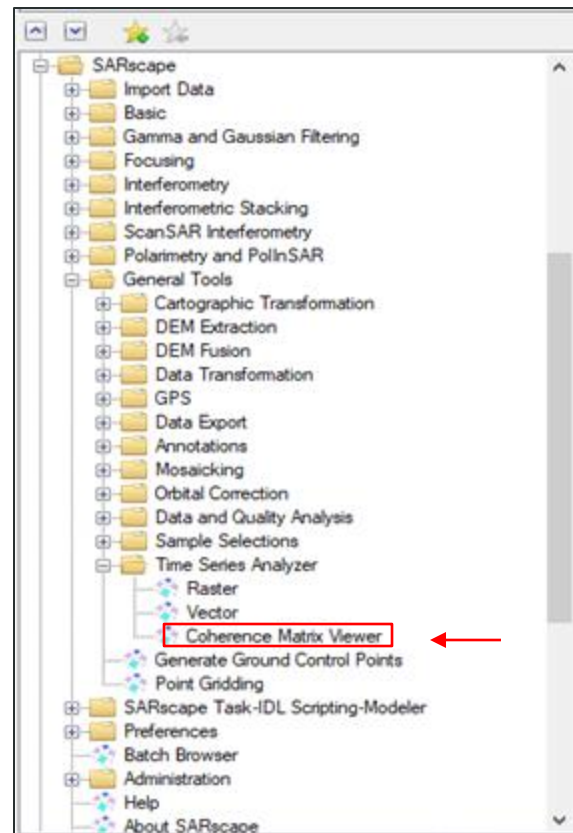
Coherence Matrix Viewer



Coherence Matrix Viewer

Enables the literal analysis of the coherence behaviors in time series, where rows and columns represent the acquisition days.

- Used to analyze the coherence behavior in time series (e.g., Target Detection or growing season for crop monitoring)
- Facilitate the configuration of the SBAS parameters (e.g., Connection Graph filtering parameters, First and Second inversion parameters).



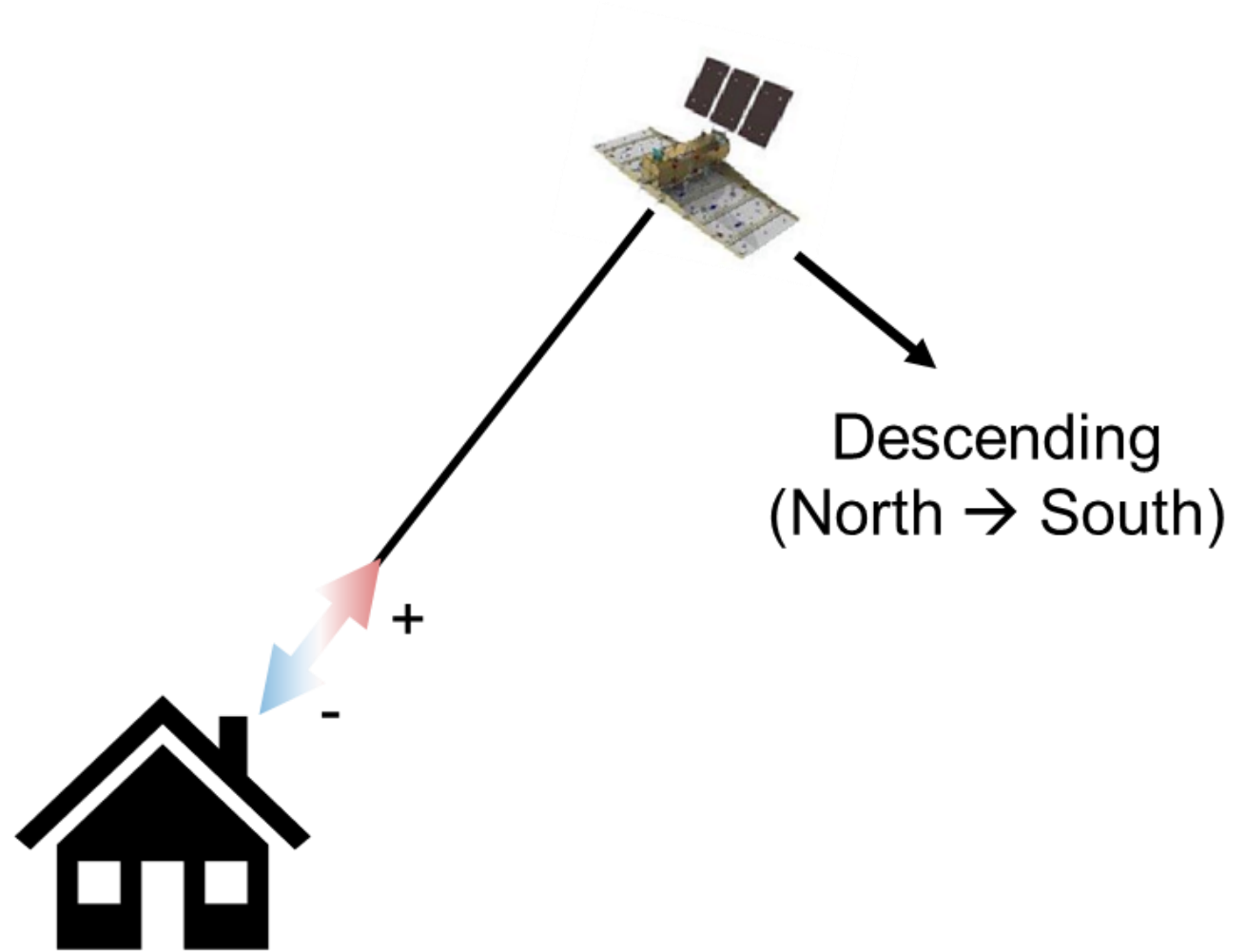
Coherence matrix on the left relevant to the area within the red box; Coherence image on the right

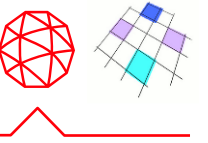
Line of Sight



SAR does not see things from directly on top, or nadir, like we do with most optical sensors.

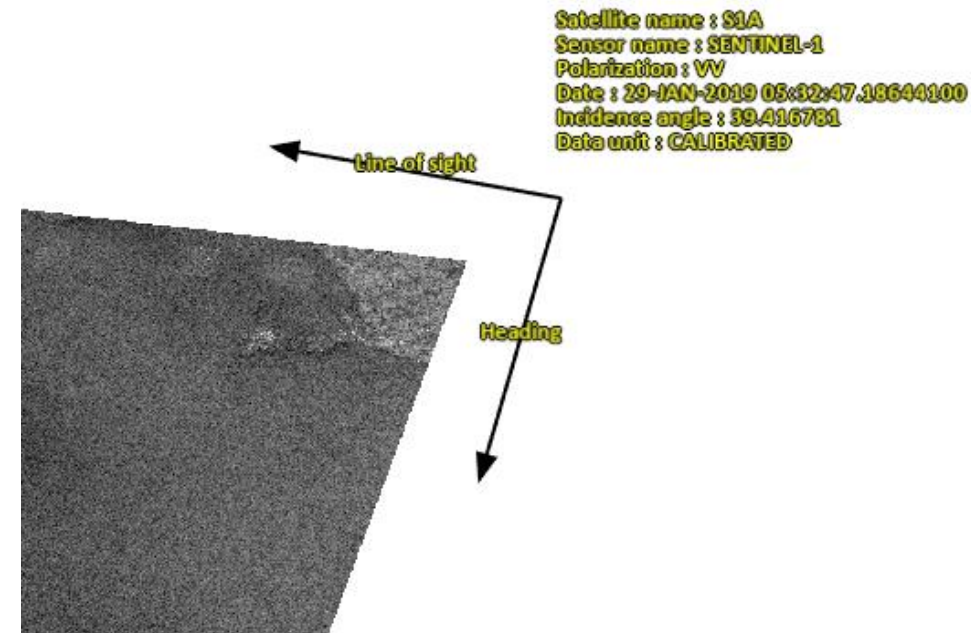
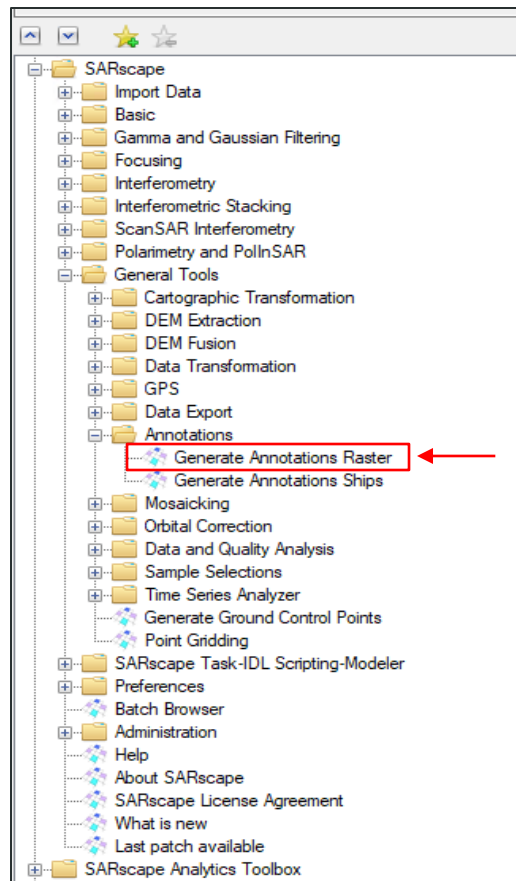
We view things from an angle on the side, also known as line of sight, or LOS.





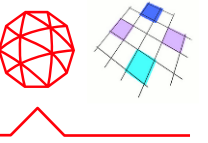
Generate Annotations Raster

The tool enables to create the annotations in ENVI View of the geocoded files derived from the following tools: Geocoding and Radiometric Calibration, Phase to Height Conversion and Geocoding, Phase to Displacement, Conversion and Geocoding, SBAS – Geocoding and PS – Geocoding.



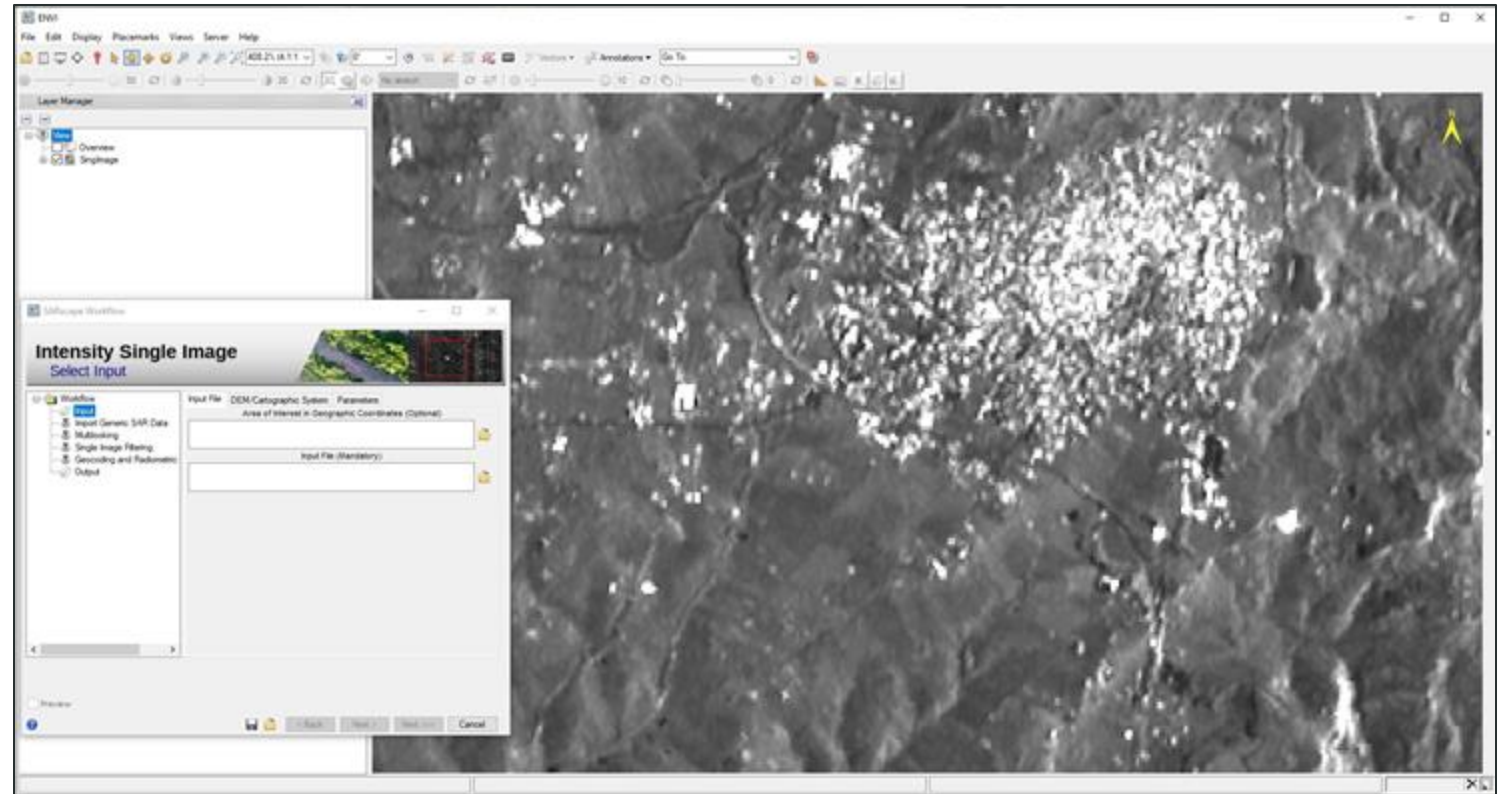
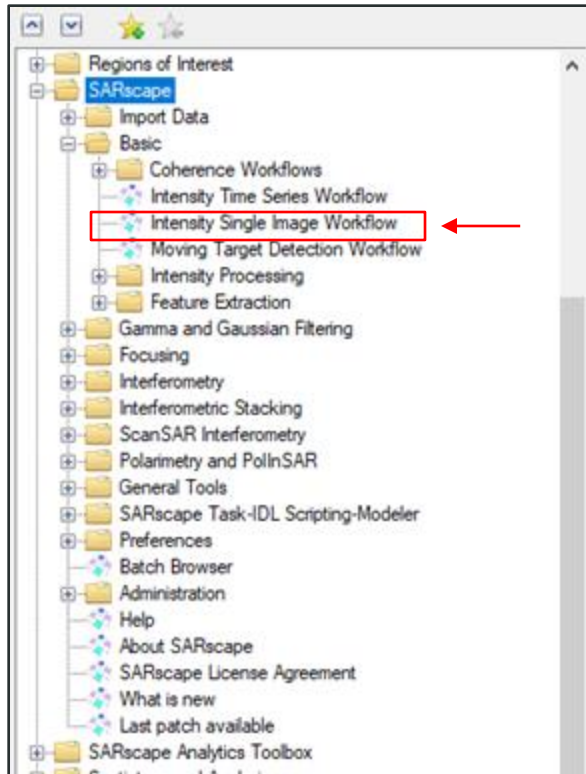
Annotations generated with the "Generate Annotations Raster" tool

New Workflows



Intensity Single Image Workflow

Enables the guided generation of a geocoded filtered image

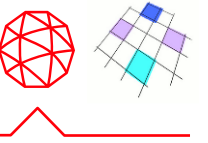


Geocoded and Calibrated power image



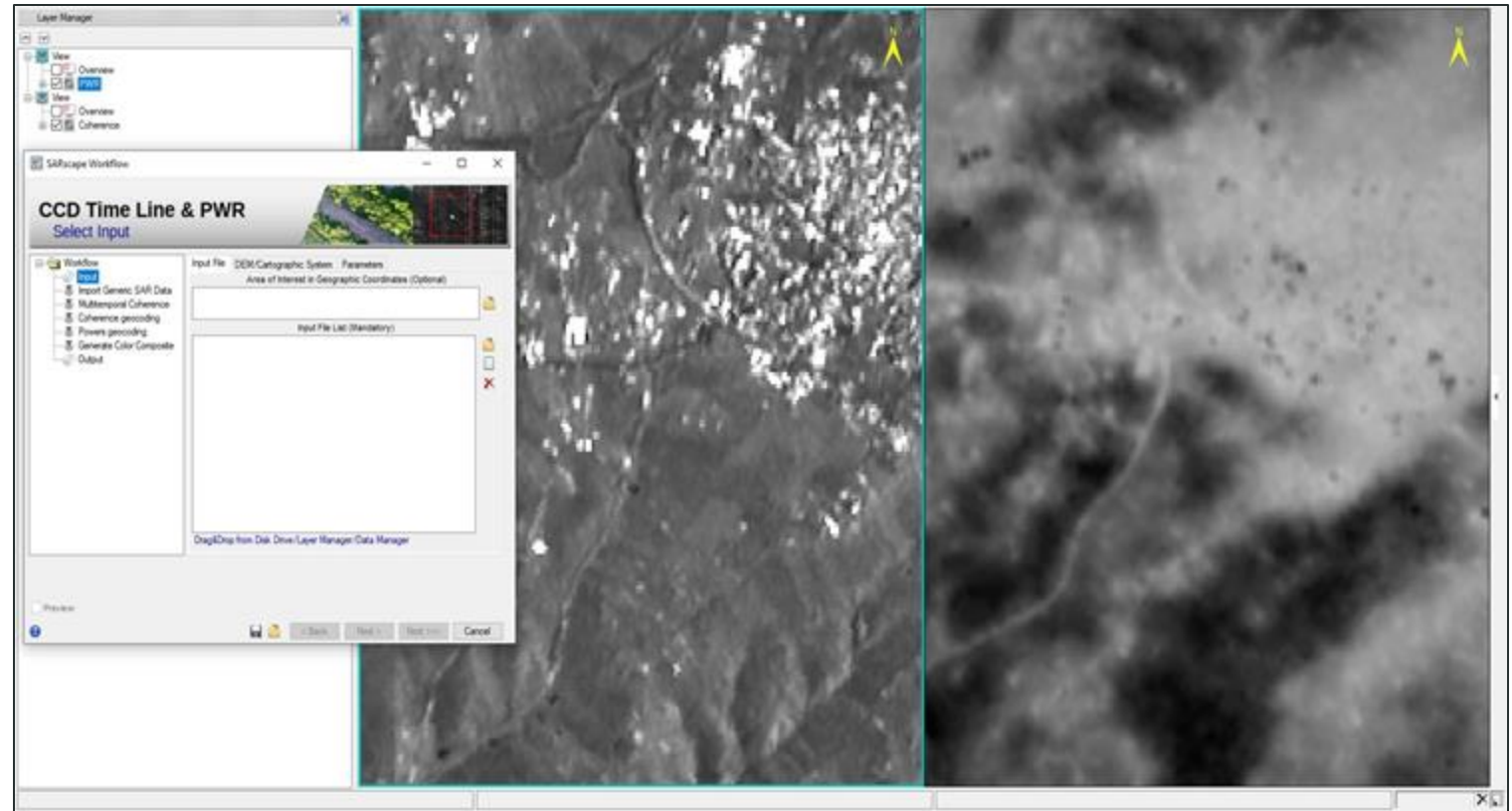
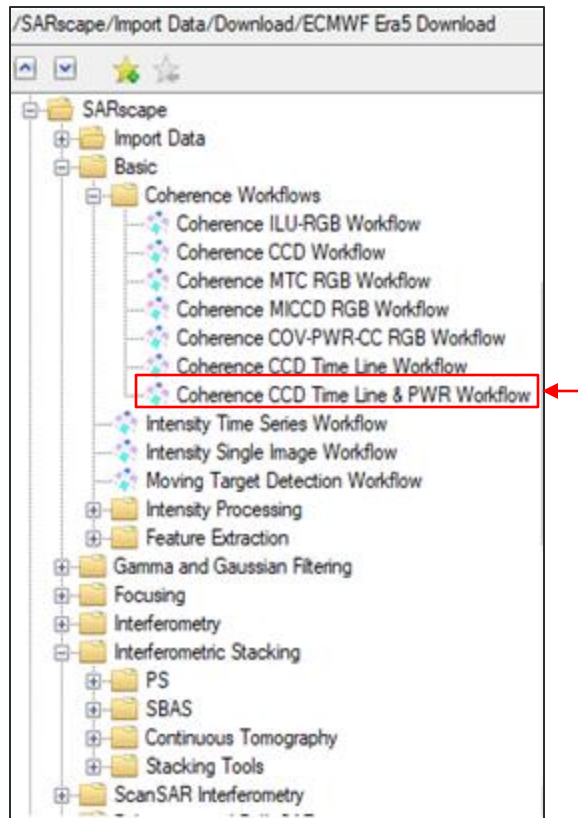
- GPU is required in case of “Non Local” filter.
- Gamma filters are bound to the relative license, without the license the user can select Non Local, Frost, Lee and Refined Lee filters only.

New Workflows



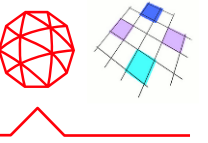
Coherence CCD Time Line & Power

It enables the generation of geocoded power and coherence images



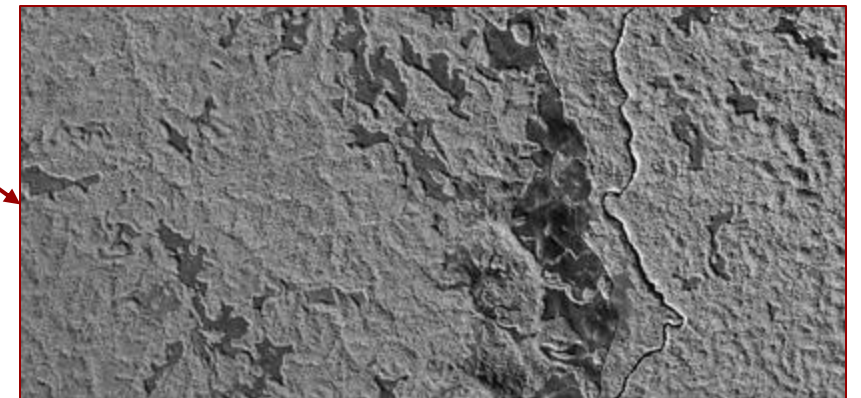
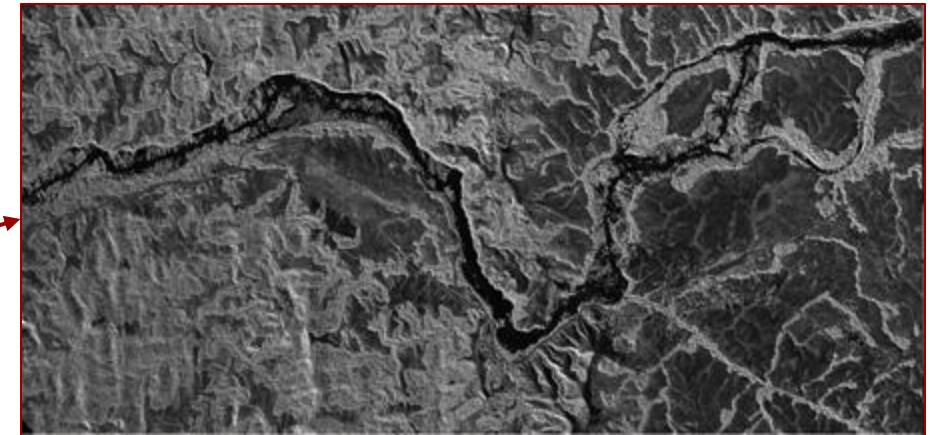
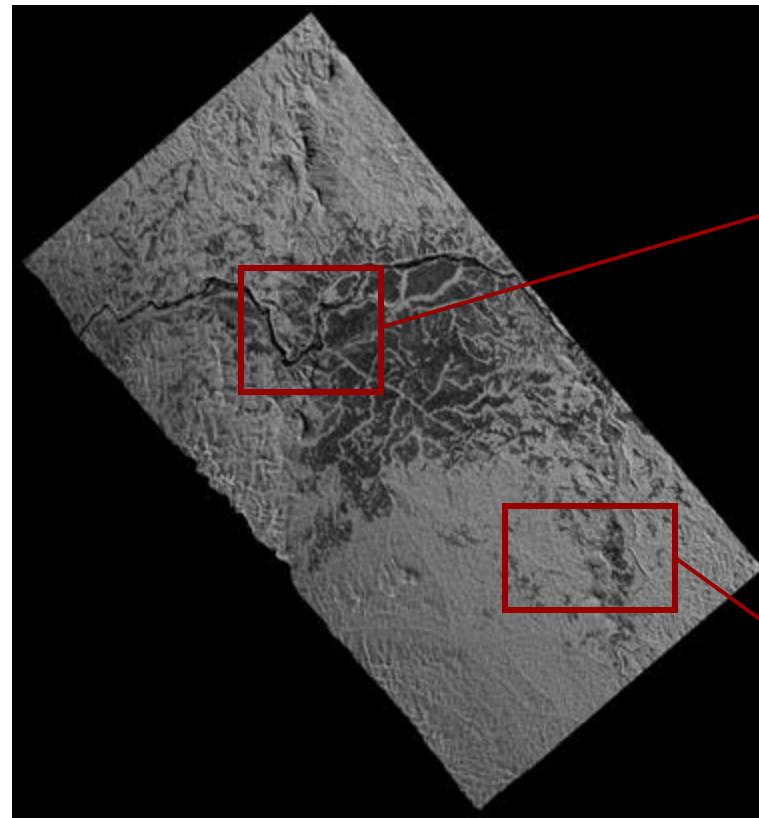
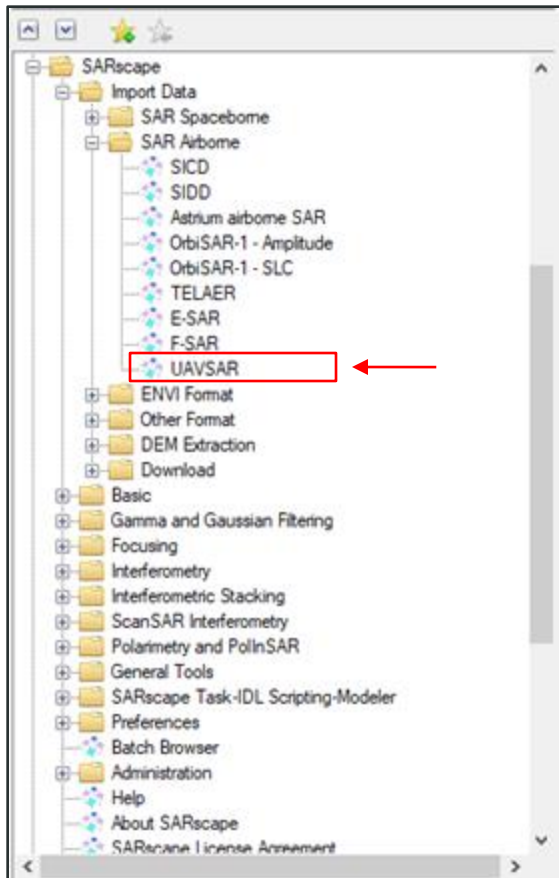
Coherence and Power geocoded image

New Missions - New Sensors and more...



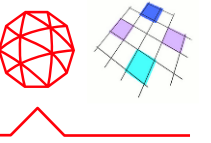
UAVSAR

Support of JPL SLC airborne images, in L-Band, freely available at <https://uavsar.jpl.nasa.gov/>.



UAVSAR data courtesy NASA/JPL-Caltech.

New Missions - New Sensors and more...



SIDD format

StriX by Synspective (X-band)

- SLC Single Look Complex (only for image geometry type slant-plane).

Observation modes:

- Sliding Spotlight
- SM Stripmap

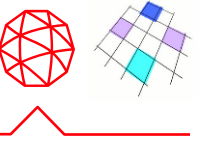
HISEA-1 by Spacety, (C-band)

- SP SLC Spotlight Mode. Slant Range, Single-Look, Complex Products (SLC)
- SM SLC Stripmap Mode. Slant Range, Single-Look, Complex Products (SLC)
- NS SLC Narrow ScanSAR Mode
- ES SLC Extra ScanSAR Mode.



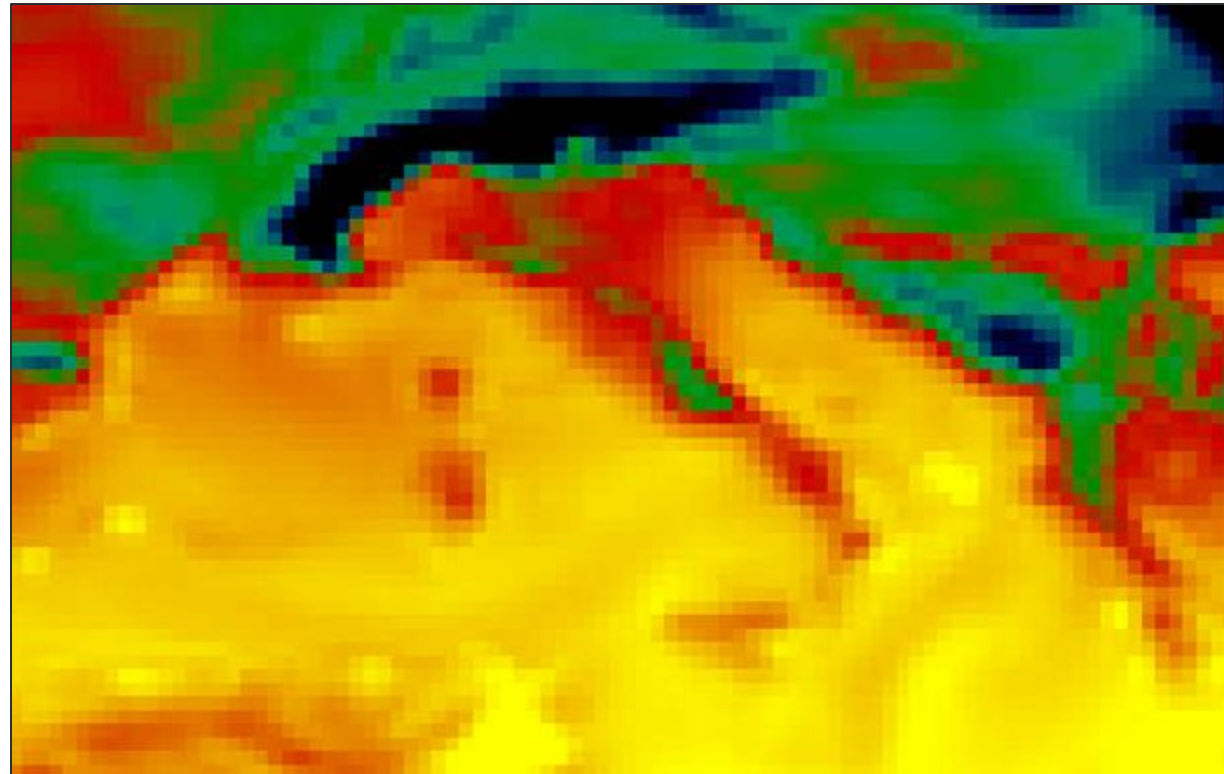
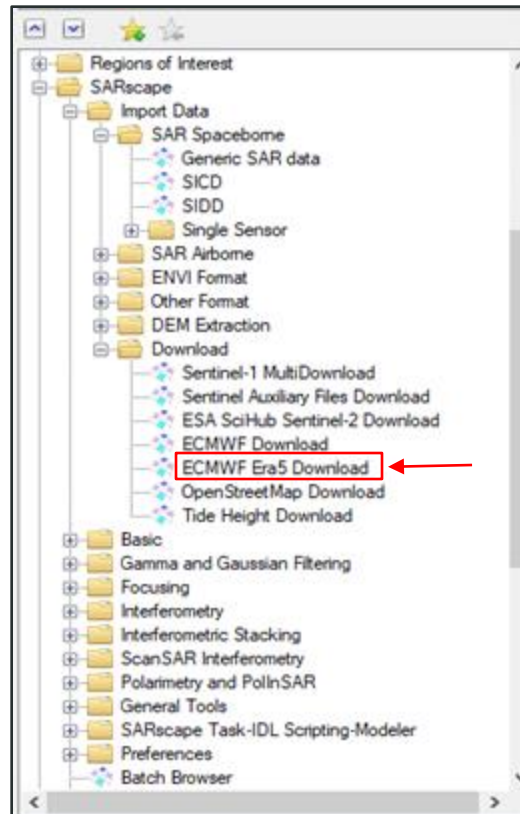
- The import process has been validated using a small dataset. For this reason, radiometric calibration and absolute geolocation have issues
- Ground Control Points (GCP) may be necessary to improve the quality of the Geocoding.

New Missions - New Sensors and more...



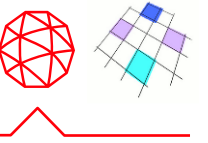
ECMWF Era5 Download

Querying and downloading of meteorological data provided by the European Center Medium Weather Forecast (ECMWF). The tool uses the "ERA5" dataset, which contains global reanalysis data from January 1979 to present, computed each hour and with a granularity of about 30km.



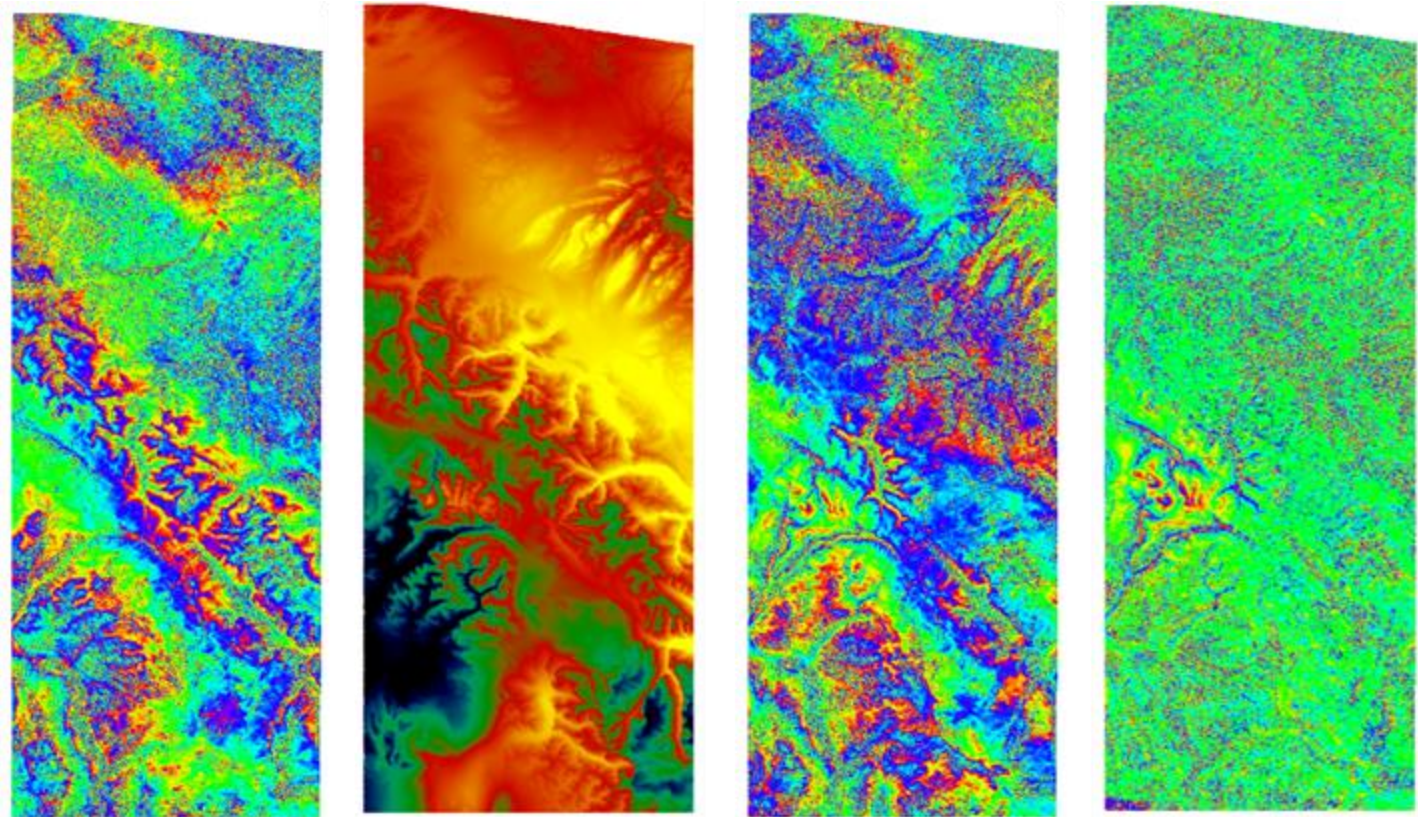
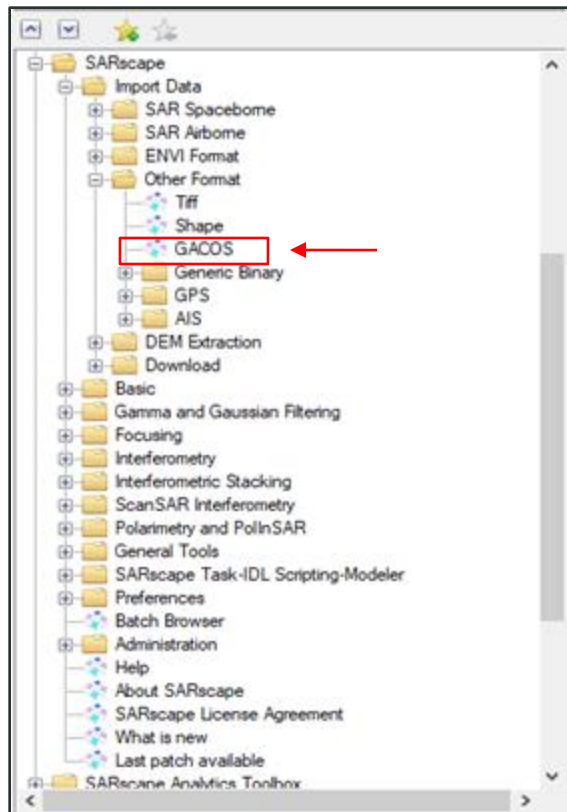
2 metre temperature parameter over Italy and Mediterranean Sea

New Missions - New Sensors and more...



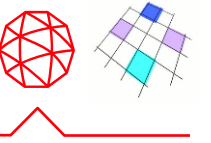
GACOS

This tool allows importing Generic Atmospheric Correction Online Service (GACOS) for InSAR and Interferometric Stacking processing (<http://www.gacos.net/>).



From left to right: Original wrapped interferogram; GACOS model; wrapped interferogram with GACOS model applied; wrapped interferogram with the application of the GACOS model + height correlated atmospheric phase distortion filter.

Improvements and much more



Persistent Scatterers

- Atmospheric pattern removal through the usage of external data (GACOS)
- Faster interferometry, first inversion, and second inversion

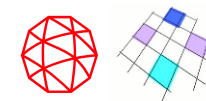
SBAS

- Automatic refinement and re-flattening: GCPs are not required anymore.
- Atmospheric pattern removal through the usage of external data (GACOS)
- Topography-related atmospheric pattern removal based on unwrapped interferograms
- Mask areas in layover/shadowing from interferograms
- Other masks available to remove low coherence areas
- Faster refinement and interferometry (multiple parallel unwrapping and parallel k-factor computation)

Point Cloud DEM fusion

- Point Cloud Dem Fusion and gridding renewal which now include Point Cloud Registration for fusion, Point Cloud Filtering, and Interpolation Distance Constraint.

Improvements and much more



Multilooking

Multilooking option available for Ground Range data

Single Image Filtering and Gamma and Gaussian Filtering

Automatic ENL (Equivalent Number of Looks) calculation

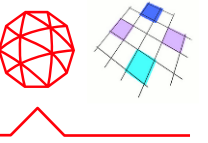
Interferometric Multilooking

Multilooking option available for all the interferometric output files

Palsar2 Spotlight Interferometry

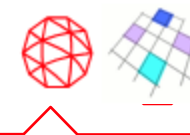
The ALOS Palsar2 spotlight data can now be used for interferometric purposes

New Tasks



- [SARsImportSpacetyFormat] Import Spacety
- [SARsImportSynspectiveStrixFormat] Import Synspective
- [SARsImportSidd] Import SIDD
- [SARsToolEra5Download] Download ERA5
- [SARsImportUavsarFormat] Import UAVSAR
- [SARsImportGacos] Import GACOS
- [SARsToolsDEMExtractionReferenceHeight] Reference Height DEM
- [SARsWF_ToolsGenericFilterSingleImage] Intensity Single Image Workflow
- [SARsBasicFeEDPSVI] Enhanced DPSVI
- [SARsToolCoastlineExtraction] Coastline Extraction
- [SARsstackingUtilityTSPModeling] Process TS Parametrical Analysis
- [SARsstackingUtilityTSPModeling] Process TS Phenomenological Analysis
- [SARsstackingUtilityTSclassification] Process TS Classification
- [SARscapeDataToAnnotation] Annotation Creation
- [SARsShapeToTile] Convert point shapes to tiles
- [SARsToolsSentinel1Mosaic] Sentinel-1 Ground-Slant Range mosaic
- [SARsInSARStackSBASGenerateConnectionGraph] Index SBAS Generate Connection Graph
- [SARsInSARStackSBASGeocode] SBAS Geocoding
- [SARsInSARStackSBASInterferogramGeneration] SBAS Interferogram Generation and Unwrapping
- [SARsInSARStackSBASInversionStep1] SBAS Inversion Step1
- [SARsInSARStackSBASInversionStep2] SBAS Inversion Step2
- [SARsInsarMultilooking] Insar Multilooking

Questions?



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