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Coastal Waters Research Synergy Framework

System Requirements Document

Tools

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Acronyms and Abbreviations	
Co-ReSyF	Coastal Waters Research Synergy Framework
EO	Earth Observation
GUI	Graphical User Interface
SenSyF	Sentinel Synergy Framework

1. Introduction

The Co-ReSyF project will implement a dedicated data access and processing infrastructure, with automated tools, methods and standards to support research applications using Earth Observation (EO) data for monitoring of Coastal Waters, levering on the components deployed SenSyF (www.sensyf.eu). The main objective is to facilitate the access to Earth Observation data and pre-processing tools to the research community, towards the future provision of future Coastal Waters services based on EO data.

Through Co-ReSyF's collaborative front end, even inexperienced researchers in EO will be able to upload their applications to the system to compose and configure processing chains for easy deployment on the cloud infrastructure. They will be able to accelerate the development of high-performing applications taking full advantage of the scalability of resources available in the cloud framework. The system's facilities and tools, optimized for distributed processing, include EO data access catalogues, discovery and retrieval tools, as well as a number of pre-processing tools and toolboxes for manipulating EO data. Advanced users will also be able to go further and take full control of the processing chains and algorithms by having access to the cloud back-end, and to further optimize their applications for fast deployment for big data access and processing.

The Co-ReSyF capabilities will be supported and initially demonstrated by a series of early adopters who will develop new research applications on the coastal domain, guide the definition of requirements and serve as system beta testers. A competitive call will be issued within the project to further demonstrate and promote the usage of the Co-ReSyF release. These pioneering researchers in will be given access not only to the platform itself, but also to extensive training material on the system and on Coastal Waters research themes, as well as to the project's events, including the Summer School and Final Workshop.

1.1. Purpose and Scope

Define technical requirements for the system Tools, tracing the functional extent and feasibility defined in support of the Co-ReSyF Research Applications user stories.

Within the Co-ReSyF platform it can be identified two major components that support the operation of the research activities performed within the platform. One component is the Framework, which is composed of all the things that support the environment where the applications are defined and executed, and the other component are the Tools which are things that can be used to build an application and to analyse/visualize the results of the application.

The Framework includes the Cloud back-end, which is the infrastructure that runs the applications in the cloud and is in charge of coordinating and creating the VMs for distributed processing and collection of input and output data. It also includes the Data Access API which is a set of tools that allows the query and retrieval of the data within the Co-ReSyF catalogue and

also any open data catalogue available online. The other part of the framework is related to the user interaction and it is the part that directly interfaces with the user, this includes the Front-end (GUI that provides the connection to all the platform functionalities) and the Expert Centre and Knowledge Base (wiki with relevant information for newcomers of the platform to start using it).

The Tools live within the Framework and are a set of executables or libraries that can be used by the researchers to build and manage their applications or handle the data. It includes the Automated Orchestration which is a set of tools designed to configure and monitor the execution of the sequence of tasks that compose one application. The Image Inter-calibration, Atmospheric corrections, Data Co-registration and Fusion and Other tools, which are tools used to process the data commonly used by several applications and provided in a default tool-kit available to all users of the platform. Finally there is also a set of Visualisation tools, which are provided as default by the platform that allow the users to visualise and manipulate the data is commonly used data visualization tools (different from the main front-end data visualization provided with the platform).

This document focuses solely on the Tools part of the Co-ReSyF platform.

1.2. Document Structure

The structure of the document is as follows:

- Chapter 2 describes the requirements
- Each subsection of Chapter 2 is dedicated to one different set of Tools
- Requirements are uniquely identified by the requirements code in the table at the start of each subsection and their respective number in the requirements table (e.g. CORESYF-TOOL-ORCH)
- Each requirement has a priority from one of the following assigned to it:
    - V1: meaning that functionality is to be implemented for first version of the platform (SAR-1)
    - V2: meaning that functionality is to be implemented for final version of the platform (SAR-2)
    - Nice to have: meaning that the functionality may or may not be

2. Requirements

2.1. Automated Orchestration Requirements

Designer	Paulo Traça
Requirements Code	CORESYF-TOOL-ORCH

2.1.1. Goals

- Provide a set of visual, automated search and orchestration tools to interact at higher level and command the interfaces with the data access API and the Orchestration Engine
- Develop an automation engine to handle the orchestration of the different tasks related to the data processing of an application

2.1.2. Background and strategic fit

The Co-ReSyF platform is envisaged to help researchers analysing EO data. One of the biggest advantages of using Co-ReSyF is when the data to be analyzed has a significant size, where the researcher will be able to access the cloud assets in order to process the data. This means that the data is not being processed locally and it can also take some time before the processing is complete. It then becomes important to have mechanisms that can provide feedback to the user of the current status of the processing and that also ensure that the processing is correctly executed.

2.1.3. Assumptions

- None

2.1.4. Requirements

Table 1: Automated Orchestration Requirements

#	Title	User Story	Importance	Notes
1	Identification of status of the processing	As a user I want to be able to see in a form of a diagram the current step at which my processing currently is in relation to the whole processing chain in order to quickly assess if I am at the beginning, middle or end of the processing.	v1	• Would be nice to have a diagram with all the boxes of the processing and a status for each one (green for executed, grey not yet executed and orange for currently executing)
2	Summary of applications status and history	As a user I want to be able to access the history of the applications that I have executed and the ones that are currently executing in order to see what is their status.	v2	• The status could be successful, failed, interrupted or executing
3	Failure notification	As a user I want to be notified if a step in the processing fails and my application is aborted in order to check as quickly as possible the error and re-execute my application.	Nice to have	• The notification would be done via e-mail or SMS in order to avoid having to login to the Co-ReSyF platform to check the status of the application.
4	Time-out	As a user I want to be able to	v2	• The time-out should be

	configuration	configure a time-out, in terms of hours, for the execution of my application in order to set a limit in the time that the application can be running in order to process the data.		configured at the time of the execution of the application since it is dependent on the amount of data being processed • By the default the time-out should be de-activated in order not to cause unwanted aborts
5	Abort of the application	As a user I want to be able to cancel an application that is being executed in the Co-ReSyF platform in order to correct for a mistake when launching an application.	v2	
6	Automatic setup of application	As the front end I want to be able to pass the configuration of the application done by the user to the orchestration engine so that the setup of the the VM can be done automatically by the orchestration engine.	v1	• This means that the engine is able to interpret the information from the front end and translate it in a set of files and commands that are used to generate the VM for the application and all the required configuration for the jobs

2.2. Image Inter-calibration Requirements

Designer	Stephen Emsley
Requirements Code	CORESYF-TOOL-INTCAL

2.2.1. Goals

- Develop generic tools to deal with the images inter-calibration tasks

2.2.2. Background and strategic fit

ARGANS background in remote sensing image inter-comparison and inter-calibration derives from involvement in radiometric calibration of medium resolution optical multi-spectral sensors (DIMITRI (https://dimitri.argans.co.uk)) and involvement with MERIS match-up in-situ database (MERMAID (http://mermaid.acri.fr/home/home.php)).

Inter-calibration is necessary when seeking to combine:

- multiple images from the same sensor acquired at differing datetimes
- multiple images of the same target acquired by different sensors.

Inter-calibration provide a practical means of identifying and correcting relative biases in radiometric calibration between instruments.

One approach to inter-calibration is to use a well-characterized instrument as a reference to compare with other instruments viewing the same target under near-simultaneous conditions. The technique uses invariant targets that are well-characterized and stable, such as pseudo-

invariant calibration sites (PICS), or targets that vary predictably, as in Rayleigh Scattering and sun glint. But there are problems for coastal Type II waters since PICS tend to be land sites, e.g. desert, salt lakes, snow; and both Rayleigh and glint procedures requires low chlorophyl and low aerosol. The coastal zone is dynamic and the marine signal measures by satellite sensors strongly affected by land contamination effects.

Another approach is vicarious ground-based calibration in which surface measurements and radiative transfer models are used to estimate theoretical at-sensor radiance and correct biases in measured Top-of-Atmosphere (TOA) radiances, provides absolute calibration enabling direct inter-calibration of sensor images with relatively high accuracy. For this in-situ data is needed but unless the data is already available (see MERMAID (http://mermaid.acri.fr/home/home.php)) it is expensive and labour intensive to acquire. It also requires inversion of Radiative Transfer Models (RTMs) which is sensitive to climatological and atmospheric parameters.

A possible approximate solution would be to perform relative calibration between sensors based on a set of invariant sites: PICS, Rayleigh and sun glint; and generalise that the bias and correction applies to the
coastal test site. For Sentinel-2 Multi-spectral Imager (MSI) (https://sentinel.esa.int/web/sentinel/user-guides/sentinel-2-msi) these correction coefficients are not provided with the image metadata and would need to be generated within the framework. This may result in significant uncertainty since the spectral signature at the coast is not invariant.

A better approach would be to directly compare sensors by matching up images of the AOI based on viewing angle and illumination and normalise the images based on the sensor spectral response function (SRF). But this requires a long time series so that sufficient match-ups between images are available. And it does not consider that cross-sensor wavelength variations in SRF that can lead to measurement discrepencies between sensors.

A compensation for differences in SRF can be made by integrating the SRF of the sensor with the spectral signature of the target, the Spectral Band Adjustment Factor (SBAF) but as stated before the dynamic nature of the coastal spectral signature complicates the characterisation of the reference sensor simulated TOA reflectance.

In the wider context of the strategic fit to the framework it is important to be able to combine data from multiple satellite sensors and data from the same satellite sensor acquired over a period of time. It is possible to create a composite image simply by normalising the image set using an image manipulation package but if the aim is to derive geophysical measurements care is needed to ensure inter-calibration considers the differing spectral response of the sensors, the observing and environmental conditions, and the spectral signature of the target. In dynamic and heterogenous coastal zones absolute calibration and sensor inter-comparison is a challenging problem.

NOTE: Inter-calibration, e.g. normalizing multiple images to a common radiometric scale, is distinct from sensor calibration, a process performed during Ground Segment processing and monitoring to ensure baseline data quality requirements are met.

2.2.3. Assumptions

- Implicitly that quantifying and correcting relative bias between monitored and reference sensors for collocated data can be generalised to measurements by the same pair of satellites even when they are not being directly compared.
- Data retrieved from repositories will have been calibrated with respect to onboard sensor characteristics prior to delivery e.g. Sentinel-2 MSI L1 TOA radiometric calibration to remove dark-signal offset and absolute calibration using sun-diffuser images.
- Detector relative sensivities will have been corrected e.g. Sentinel-2 MSI radiometric equalisation for inter-pixel calibration will have been performed.
- Other radiometric correction tools for optical (illumination and view-angle effects) and SAR imagery will be provided by the framework [see CORESYF-TOOL-PREPROC]
- Geometrical calibration will have been performed on data retrieved from repositories. Co-registration of images will be provided by the framework [see CORESYF-TOOL-COREG].
- Atmospheric correction will be provided by the framework [see CORESYF-TOOL-ATCORR].
- A reference standard has been identified i.e. a stable well-calibrated satellite instrument that provide temporal, spatial, spectral and geometric collocation with the sensors to be inter-calibrated or an appropriate stable pseudo-invariant calibration site (PICS) or a well-characterised instrumented in situ site.

2.2.4. Requirements

Table 2: Image Inter-calibration Requirements

#	Title	User Story	Importance	Notes
1	Inter-comparison of optical images (same sensor)	A user has a set of images from the same sensor and seeks to produce a set or images normalised/equalised to a reference image, assumed to have a fixed absolute calibration.	v1	• Image manipulation assuming that variations in images are influenced more by variations in illumination and viewing angles than by variations in the target or variations (drift) in the sensor. • Histogram equalisation routines available in open source tools e.g. ImageMagick, Python

				Image Library (PIL). • DOES NOT INCLUDE image fusion which is considered in CORESYF-TOOL-COREG
2	Inter-calibration optical sensor images (same/different sensor): relative calibration	The user has a set of images e.g. a multi-temporal 'data stack' of optical images covering a target site, either from the same sensor or from a collection of sensors, and wishes to use these images as samples from the same population i.e. a set of data sharing common properties but is satisfied with relative inter-calibration.	v2	• Coastal zone is a challenging environment for sensor inter-calibration because dynamic and heterogeneous spectral signature. • This is relative inter-calibration and requires one sensor to be stable and well-characterised i.e. absolute calibration
3	Inter-calibration optical sensor images (same/different sensor): absolute calibration	The user has a set of images e.g. a multi-temporal 'data stack' of optical images covering a target site, either from the same sensor or from a collection of sensors, and wishes to use these images as samples from the same population i.e. a set of data sharing common properties and that the images are absolutely calibrated with respect to the target scene.	Nice to have	• Considering the coastal zone target this is a non-trivial undertaking for the reasons specified above. Perhaps more appropriate for a research application.

2.2.5. User interaction and design

2.2.5.1. Inter-calibrate Optical Sensor Images

From a series of data from a reference sensor and target sensor(s) derive calibration coefficients to align the radiometry of the target sensors with the reference sensor. By re-scaling all sensors to the same radiometric scale a consistent set of acquisitions over a given site, covering a broad range of geometries, is generated.

```
     foreach sensor to be calibrated to the reference sensor
         foreach reference sensor band
            if recalibration sensor has band within 10nm of reference
band
               find measurements with comparable geometry, datetime,
location
               fit polynomial to these "doublets"
               use polynomial to recalibrate all of the target sensor
data
               store recalibrated data in an array
```

```
        endif
      endfor
    endfor
    combine all recalibrated sensor data
    convert to a multi-dimensional GeoTiff file
    save to filesystem
```

2.2.6. Not Doing

- Absolute calibration of images is probably out-of-scope considering the resources allocated to this tool (5 months) and the requirement for a reasonably long time series of Sentinel-2 data to ensure there are a significant number of matchup images sharing geometrical and temporal viewing and illumination characteristics.

- ARGANS in has been involved with passive optical sensors and not the calibration and/or inter-comparison of active radar sensors e.g. SAR. If there is a necessity for inter-calibration of SAR images input is required from another partner with the relevant knowledge.

2.2.7. Questions

Below is a list of questions to be addressed as a result of this requirements document:

Question	Outcome
Which of the partners need this tool and what do they require: • Create an image composite (same sensor) • Perform an image fusion (different sensors) • Perform relative inter-calibration (same/different sensors) • Perform absolute inter-calibration (same/different sensors)	
What is needed for SAR?	

2.3. Atmospheric Corrections and Flagging Requirements

Designer	Romain Serra
Requirements Code	CORESYF-TOOL-ATCORR

2.3.1. Goals

- Develop generic tools to deal with the images atmospheric corrections and flagging

2.3.2. Background and strategic fit

Detection using remote sensing is based on geometry and radiometry. Using radiometry often requires to apply a solid atmospheric correction algorithm, especially regarding water colour as the signal is quite low. Indeed, up to 90% of the signal sensed by the satellite can be related to the atmosphere so it is primordial to correct that in order to clear any noise affecting the water colour.

2.3.3. Assumptions

- The users do not have any background knowledge about atmospheric corrections so the algorithm must be autonomous (no input required from the users)

2.3.4. Requirements

Table 3: Atmospheric Corrections and Flagging Requirements

#	Title	User Story	Importance	Notes
1	Optical data atmospheric correction	The platform shall support atmospheric correction methods for some sensors (e.g. Sentinel-2 and Landsat)	V1	• Some Research Applications identified examples, namely: ATCOR (https://www.rese-apps.com/software/atcor-4-airborne/index.html) (in IDL, paid) or BEAM VISAT 5 (http://www.brockmann-consult.de/cms/web/beam/) Atmospheric correction (based on SMAC algorithm freely available in Python here (http://www.cesbio.ups-tlse.fr/multitemp/?p=2956)) • Another atmospheric correction algorithm will be developed and applied for this task
2	Flagging	Clouds and glint are obstacles for the detection over coastal area. They must be flagged in order to avoid any calculation over these areas which may lead to inconsistent outputs.Thin clouds can be difficult to retrieve so it can be useful for the user to have a "confidence index" relating the likeliness for a pixel to be a cloud.	V1	• SEN2COR can assess the cloud cover • Several bands are required to determine cloud and glint masks some sensors may not be compatible for such calculations.
3	Optical data atmospheric correction	The platform shall support atmospheric correction methods for other optical multispectral data of different resolutions (e.g. MODIS, MERIS, WorldView)	V2	

2.4. Data Co-registration and Fusion Requirements

Designer	Nuno Grosso
Requirements Code	CORESYF-TOOL-COREG

2.4.1. Goals

- Develop generic tools to deal with the co-registration and fusion of data from different sources

2.4.2. Background and strategic fit

For the second version of the Co-ReSyF platform it is envisaged to explore the potential of synergies between the different applications. In order to be able to exploit these synergies, the applications that will combine the data from other applications, will need generic tools for co-registration and fusion of the data.

2.4.3. Assumptions

- None

2.4.4. Requirements

Table 4: Data Co-registration and Fusion Requirements

#	Title	User Story	Importance	Notes
1	Image co-registration	The platform shall allow the co-registration of images covering an area that partially or completely overlap (e.g image time series, mosaic of images from the same date)	v2	• this requirement applies for instance to the co-registration necessary to merge bathymetry maps coming from both LNEC/IH and ACRI applications but it can also apply to other applications such as the vessel and oil spill detection. The co-registration can be done manually or automatically. The need to automate this process will be accessed later on.
2	Data/information fusion	The platform shall enable the fusion of both raw data coming the different sensors or information coming from the different applications outputs to either confirm or refine the information we want to extract	v2	• this requirement can apply, for instance, to the fusion of the bathymetry given by LNEC/IH and ACRI applications to improve bathymetry estimation or increase the area covered. But this ca also be used to, for instance, confirm vessel and oil spill detection using outputs of the respective applications for different sensors

2.5. Other Tools Requirements

Designer	Nuno Grosso
Requirements Code	CORESYF-TOOL-PREPROC

2.5.1. Goals

- Develop generic tools which are common to several applications and are not covered by the image inter-calibration, data co-registration and fusion, and atmospheric corrections

2.5.2. Background and strategic fit

For the development of the Co-ReSyF applications several tools are identified as needed for the data processing that are useful to many other applications and are generic enough to be applied to a certain type of data in many use cases. These tools should then be provided as a default

tool-kit to any user of the platform in order to avoid the duplication of work when the user is doing its research.

2.5.3. Assumptions

- None

2.5.4. Requirements

Table 5: Other Tools Requirements

#	Title	User Story	Importance	Notes

1	Radiometric correction	The platform shall support radiometric correction tools of both optical and SAR tools	v1	• Radiometric correction tools in this context mean:
				  ○ Optical imagery
				  ▪ Procedures to pass from DN to reflectance (sun angle and sensor sensitivity correction)
				  ○ SAR imagery
				  ▪ σo,βo and γo calibrations
				• It excludes:
				  ○ geometry correction
				  ○ radiometric inter-calibration between different sensors that will be included in the Image Inter-calibration Requirements document.
				  ○ atmospheric correction that will be included in the Atmospheric Corrections and Flagging Requirements document.

2	Speckle filtering	The platform shall support speckle filtering tools for SAR imagery	v1	
3	Geo-referencing	The platform shall support geo-referencing tools for optical and SAR imagery	v1	
4	Image masking	The platform shall support the application of masks to raster imagery	v1	
5	Image statistics	The platform shall support the calculation of image statistics (histogram, average, standard deviation, percentiles, etc)	v1	
6	Image crop	The platform shall support the	v1	

		possibility of cropping an image for a specific AOI		
7	Calculation of error metrics	The platform shall support the calculation of different error metrics	v1	• Although not very specific regarding the error metrics the platform shall provide some are mentioned in the User Stories: error difference, root-mean-square error and bias and in specific for the vessel and oil spill application: number of objects correctly detected (true positive), number of correctly classified false alarms (true negative), number of false positive, number of false negative and missed objects • Those error metrics can be calculated against gridded or point observations
8	Calculation of uncertainty metrics	The platform shall support the calculation of different uncertainty metrics	v2	• User stories are not very specific about these metrics but say that the platform should be able, for instance: a) in case of bathymetry to calculate the variation of products derived for different days and the same region or for the same day using different algorithms (ensemble averaging); b) estimate the uncertainty associated with sea level estimations derived from sar altimetry (some methods are mentioned associated with either robust statistics applied to the algorithm of sar altimetry estimation or ordinary least squares computation of sea level rise, namely, OLS and Newey-West technique).
9	Cluster algorithms	The platform shall provide the capability to apply clustering algorithms such as K-means or ISODATA	v2	• These clustering algorithms are part of the operational applications of ACRI and UCC but both referred that it would be good to have them provided by the platform
10		The platform shall provide a raster calculator tool to provide basic arithmetic and logical operations between different rasters	v2	• This tool is requested by some Research Applications and some specific examples are given were this capability is needed (masking, ensemble averaging, error calculation) • This tool will necessarily include the capabilities necessary to the land masking operations, NDVI calculation or error metrics/uncertainty estimation referred in other points of these requirements
11	NDVI calculation	The platform shall provide the ability to calculate NDVI values	v2	• This requirement is only identified by ACCRI's application associated with the definition of a land mask
12	Image	The platform shall	v2	• This requirement is only identified by UCC

	reclassification	allow raster images to be reclassified		hypertemporal data ACCRI's bathymetry applications associated with the definition of a land or error mask based on value thresholds
13	Vector creation and edition	The platform shall provide vector (shapefile) creation and edition capabilities (adding of modifying attributes, delete features, automated add column and populate with values)	v1	• This is required by both UCC applications and by ACRI to manually identify features within the image (e.g. vessels, oil spills, clouds) or add IDs
14	Random raster generation	The platform shall be able to calculate a random raster based on the value distribution of a specific image	v2	• identified in UCC's hypertemporal application
15	Curve fitting and seasonality modelling	The platform shall provide curve fitting and seasonality modelling capabilities	v2	• identified in UCC's hypertemporal application. should be similar or based on similar to TIMESAT (needs a MATLAB license
16	Image stacking	The platform shall provide the ability to stack images into one multi-layer file sorted in the order in which they are inserted by the user or by any other user specific parameter (e.g. time)	v1	• identified in UCC's hypertemporal application
17	Conversion betwen raster and vector formats	The platform shall support the conversion between raster and vector formats namely: a) raster to polygon conversion; b)	v2	• identified in UCC's hypertemporal application

		polygon to polyline conversion; c) polyline to raster conversion (allowing for selection of pixel size)		
18	Resampling	The platform shall be able to perform image resampling to increase or decrease image resolution	v2	• identified in NOC's altimetry application
19	Optimal interpolation	The platform shall support the implementation of optimal interpolation methods to obtain gridded maps from point measurements	v2	• identified in NOC's altimetry application
20	Python libraries	The platform shall support the inclusion of Python 2.7 and ideally Python 3.4 libraries	v1	• identified in most Research Applications. LNEC's application identifies the specific libraries used: python-osgeo, python-GDAL, pyproj, python-opencv, matplotlib, numpy, scipy, python scikits-image, Pillow, netCDF4, HDF5
21	SNAP	The platform shall support access to ESA's SNAP funcionalities	v2	• identified in LNEC's and UCC's SAR related applications
22	S1 toolbox	The platform shall support access to ESA's S1 toolbox funcionalities	v2	• identified in LNEC's and UCC's SAR related applications
23	ILWIS	The platform shall support access to the ILWIS funcionalities	Nice to have	• identified in LNEC's application
24	QGIS	The platform shall support access to the QGIS funcionalities	v2	• identified in LNEC's and ACRI's applications
25	ENVI and IDL	The platform shall provide access to ENVI 5.3 & IDL 8.5 funcionalities	Nice to have	• identified in UCC's Vessel and Oil Spill detection
26	MS Office	The platform shall	Nice to	• identified in UCC's applications

	Excel	provide access to MS Office Excel funcionalities	have	
27	ESRI ArcGIS	The platform shall provide access to ESRI ArcGIS funcionalities	Nice to have	• identified in UCC's applications (version 10.2 Advanced is identified in the Vessel and Oil Spill Detection)
28	SPSS or R	The platform shall provide access to SPSS or R funcionalities	Nice to have	• identified in UCC's hypertemporal application
29	MATLAB	The platform shall provide access to MATLAB funcionalities	Nice to have	• identified in NOC's altimetry application (8.1 (r2013a) or following)

2.6. Visualisation Tool Requirements

Designer	Nuno Grosso
Requirements Code	CORESYF-TOOL-VISUAL

2.6.1. Goals

- Develop generic tool which can display the results from all the different research applications

- The requirements for the main visualization interface will be included in the "Front-End Requirements" document. In this document the objective is to complement that interface by developing more specialized visualization tools customized to each application needs

2.6.2. Background and strategic fit

When analysing the data, either output or input data, the users may need some tools for data visualization and manipulation that are generic enough to consider them as useful to all users of the platform. These tools are then identified as being tools for visualization that should be included in the Co-ReSyF default tool-kit.

2.6.3. Assumptions

- None

2.6.4. Requirements

Table 6: Visualisation Tools Requirements

#	Title	User Story	Importance	Notes
1	Visualization COTS	The platform shall provide access to the visualization GUI of external COTS such as SNAP, S1 toolbox or QGIS	Nice to have	• Some Research Applications mention that the platform should provide visualization capabilities similar to these software's but they all say that they don't have a preference between them and the

				development of a common visualization platform tool so it goes into the "nice to have" requirements
2	Visualization libraries	The platform shall provide access to visualization libraries such as Python's matplotlib	Nice to have	• Some Research Applications identify this library when mentioning the visualization capabilities required or currently used in their applications but no preference was given in the user stories.
3	Gridded data generation	As a user I want to be able to generate data on a regular grid with certain configuration parameters in order to convert data from a along track data format or from an irregular grid into data on a regular grid interpolating over the regions where no data is available.	V1	• Input data should be a collection of input files with geo-located data • The user will configure the regular grid by setting the lat/lon bound box and the sampling step in degrees independently in lat and lon directions • The user shall be able to choose from different interpolation methods

3. Reference Documents

- Co-ReSyF. (2016). *GRANT AGREEMENT-687289*. European Commission, Research Executive Agency.

END OF DOCUMENT