D12.4 Report on Use Cases, Requirements, Metadata and Interoperability of WP 12

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SUMMARY

This document describes the TCS composition in terms of services, providers and involved organizations. Moreover, provides a detailed list of DDSS with their respective implementation priority and timeline. Finally, considerations on the TCS discussions on Data Management as well as descriptions of representative Use Cases are also given.

1. Introduction

TCS Satellite Data is composed by 5 technical partners (CNR, CNRS, UoL, CSIC and GFZ) that provide data product and services, 1 validation partner (INGV) and 2 Space Agencies (ESA and CNES).
Two levels of data products and services, mainly based on satellite Synthetic Aperture Radar (SAR) data, have been identified:

- **Standard** (Level-1), which relies on the provision of satellite products/tools (mainly interferograms, displacements maps, and deformation time-series);
- **Value-added** (Level-2/3), which provides Advanced satellite products/tools (3D displacements maps, source mechanisms, fault models, etc).

Moreover, services can also be differentiated according to their operational mode:

- **Surveillance** mode – systematic product generation;
- **On-demand** mode – product generation (processing) performed on-demand by the users.

The TCS has a unique interface towards the ICS. This interface is represented by the ESA Geohazards Exploitation Platform (GEP) that is able to provide interoperable access to data products and processing facilities.
The unique interface allows the TCS to have a common structure and standards for metadata, API and AAAI. In particular:

- the metadata follow the ISO 19115 standard;
- the main APIs are the OpenSearch and HTTPS for Data Products discovery and retrieval, respectively, and WPS 1.0 for services;
- the AAAI is managed directly by the GEP and uses a Shibboleth 2.x, with a local IDP (ESA-SSO IdP) and eduGAIN compatibility.

Several meetings (in person and virtual) and mail interactions have been held to carry out this activity.
Table 1.1 summarizes the provided services along with the respective host Organizations, Country, and Contact Persons, while Figure 1.1 summarizes the overall TCS structure and organization.

Table 1.1 – TCS Services and Organizations

Service Name	Provider	Country	Level-1	Level-2/-3	Surveillance	On-demand processing	Contact Persons
EPOSAR	CNR	IT	✔	✔	✔	✔	M. Manunta F. Casu
GDM	CNRS	FR	✔			✔	M. Mioara M. Diament E. Ostanciaux
COMET	UoL	UK	✔	✔	✔		T. Wright A. Hooper
3D-DEF	CSIC	ES		✔		✔	J. Fernandez A.G. Camacho
MOD	GFZ	DE		✔		✔	T. Walter

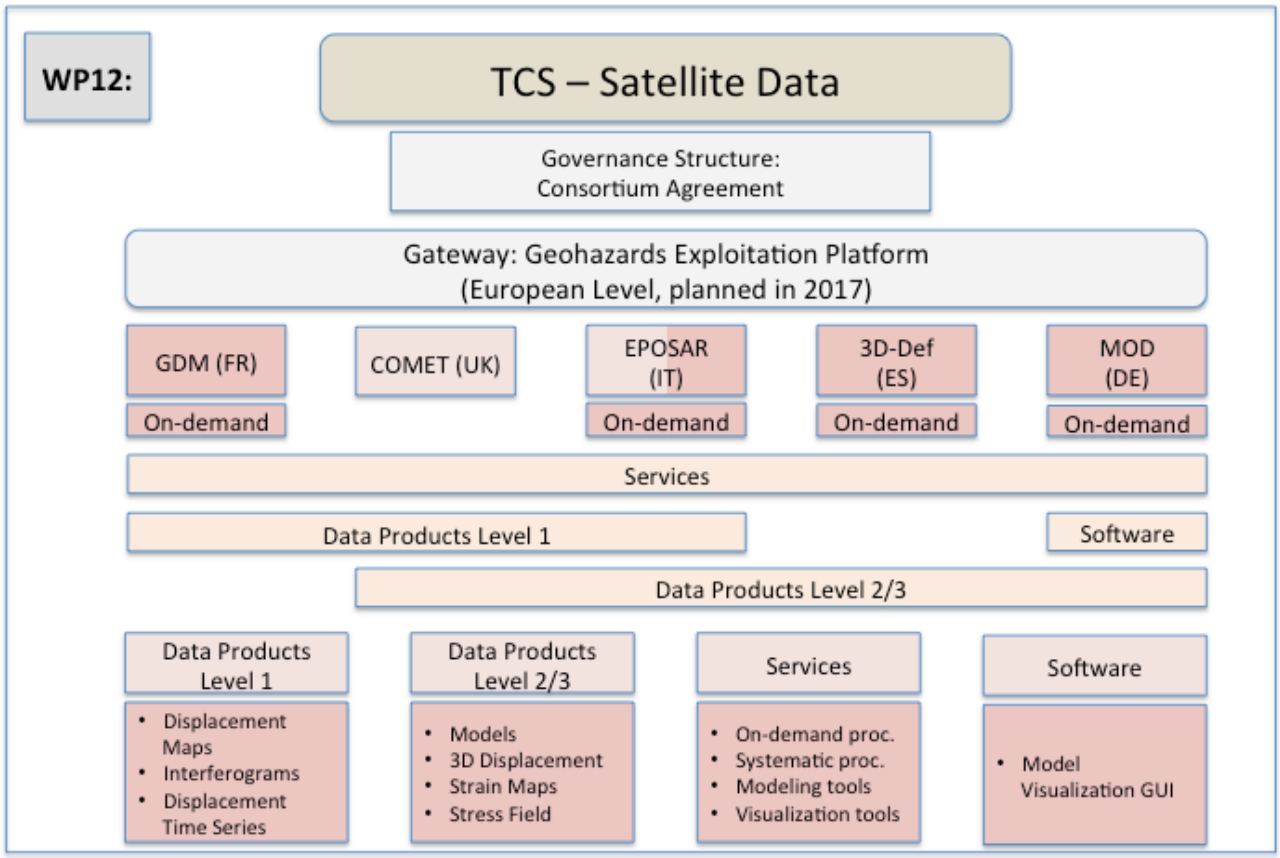

Figure 1.1 – TCS structure and organization

2. Priority List of DDSS

In this Section, the list and description of the DDSS relevant to the TCS is provided. The updated DDSS Master Table is reported in Annex 1.

The main effort was put on the internal harmonization of the formats and metadata of Data Products among different service providers. Selected formats for Data Products are *geotiff* and CSV (ASCII), depending on the product.
Another outcome of the harmonization work was to converge toward a unique interface for the TCS. The proposed solution is, as already mentioned, the ESA GEP.
The internal harmonization activities resulted in a list of DDSS as detailed in the following subsections. An important achievement of the TCS work was the capacity to reduce the granularity of the initial DDSS list. This was basically achieved by moving to the metadata some specific information, as for instance the geometry projection (e.g. WGS84 or "radar") or the service used for the generation of the DDSS.
At the present status, the TCS provides 23 (13) Data Products, 12 (6) Services and 1 Software (in brackets DDSS with high priority that have been delivered at M24).

2.1 Data Product

To simplify the presentation, Data Products are grouped according to their respective DDSS Level and exploited sensor (Radar and Optical).

2.1.1 Level 1 Radar

DDSS generated from radar data are divided into two groups: Static Maps and Multitemporal, being the former used to describe the phenomena on a defined time interval, while the latter is devoted to provide information on the temporal evolution of the observed phenomena themselves. All the radar-based Data Products have high priority (integration at M24).

2.1.1.1 Static Map

Table 2.1 – Static Map radar Data Product

Data Product	Radar	Geo	Priority	Data Org.	Metadata	Format	CNRS	CNR	UoL
Wrapped Differential Interferograms	✔	✔	High	2D raster	ISO 19115	geotiff	✔	✔	✔
Spatial coherence	✔	✔	High	2D raster	ISO 19115	geotiff	✔	✔	✔
Unwrapped Differential Interferograms	✔	✔	High	2D raster	ISO 19115	geotiff	✔	✔	✔
Map of LOS vector (NEU coefficient)	✔	✔	High	2D raster	ISO 19115	geotiff	✔	✔	✔
Interferogram Atmospheric Phase Screen	✔		High	2D raster	ISO 19115	geotiff	✔		
DEM in radar geometry	✔		High	2D raster	ISO 19115	geotiff	✔		
Lookup table from radar coordinates to ground coordinates	✔		High	2D raster	ISO 19115	geotiff	✔		

In the following a detailed description of the **Static Map** Data Product is provided.

DDSS type *Data Product Group:* ***Static Map (Level 1 Radar)*** - *Wrapped Differential Interferograms* - *Spatial Coherence* - *Unwrapped Differential Interferograms* - *Map of LOS vector (NEU coefficient)* - *Interferogram Atmospheric Phase Screen* - *DEM in radar geometry* - *Lookup table from radar coordinates to ground coordinates*
Format(s) of the data / data products (if applicable) *geotiff*
Metadata standard used *ISO 19115*
APIs used to provide discovery and access to the DDSS For discovery: *- OpenSearch (set of several standards, as defined in http://ceos.org/document_management/Working_Groups/WGISS/Projects/OpenSearch/CEOS_OpenSearch_Best_Practice_Doc-v.1.0.1_Jun2015.pdf)* For access and download: *- HTTP(s).*
Authentication, Authorization, Accounting Infrastructure (AAAI) *eduGAIN compatible, Shibboleth 2.x, local IDP (ESA-SSO IdP)*
Data policy Open
Other technical details *None*
Roadmap for implementation (Section 3) *M12: First Release* *M24: Final Release*

2.1.1.2 Multitemporal

Table 2.2 – Multitemporal radar Data Product

Data Product	Radar	Geo	Priority	Data Org.	Metadata	Format	CNRS	CNR	UoL
LOS Displacement Time Series	✔	✔	High	Table / 3D	ISO 19115	CSV / SHP / geotiff	✔	✔	✔
Temporal Coherence (Quality of measure)	✔	✔	High	Table / 2D	ISO 19115	CSV / geotiff	✔	✔	✔
Network misclosure (Quality of times series inversion)	✔		High	2D raster	ISO 19115	geotiff	✔		
Average Scatterer Elevation (Topography)		✔	High	Table / 2D	ISO 19115	CSV / geotiff		✔	✔
Mean LOS velocity		✔	High	Table / 2D	ISO 19115	CSV / geotiff		✔	✔

Stack of coregistered Interferograms	✔		High	3D raster	ISO 19115	geotiff	✔		

Note that CNR and UoL provide products in Geographic coordinates only, while CNRS also in Radar coordinates. Moreover, the "Format" column indicates that at least one of the listed formats is used by the Data Product providers.
In the following a detailed description of the **Multitemporal** Data Product is provided.

DDSS type *Data Product Group:* ***Multitemporal (Level 1 Radar)*** - *LOS Displacement Time Series* - *Temporal Coherence* - *Network Misclosure* - *Average Scatterer Elevation* - *Mean LOS Velocity* - *Stack of coregistered Interferograms*
Format(s) of the data / data products (if applicable) *2D map: CSV (ASCII) or geotiff* *3D time series: CSV (ASCII) or stack of geotiff*
Metadata standard used *ISO 19115*
APIs used to provide discovery and access to the DDSS For discovery, access and download: *- SOS 2.0 (OGC 12-006)*
Authentication, Authorization, Accounting Infrastructure (AAAI) *eduGAIN compatible, Shibboleth 2.x, local IDP (ESA-SSO IdP)*
Data policy Open
Other technical details *None*
Roadmap for implementation (Section 3) *M12: First Release* *M24: Final Release*

2.1.2 Level 1 Optical

Optical Data Products are generated by CNRS only and basically consist of Digital Surface Models (DSM) and horizontal displacement maps. Priority for Optical Data Products has been set to medium (integration at M36), accordingly metadata and formats are still under definition.

Table 2.3 – Optical Data Product

Data Product	Priority	Data Org.	Metadata	Format	CNRS
Digital Surface Model	Medium	TBD	TBD	TBD	✔
Horizontal Surface Deformation Maps - Map of the disparity along the lines (X component) - Map of the disparity along the columns (Y component)	Medium	TBD	TBD	TBD	✔

2.1.3 Level 2 and Level 3

Level 2 and Level 3 Data Product add values on the Data Products listed in Tables 2.1 and 2.2, and consist on modelled and 3D displacement maps, Strain Rate Maps and Stress field computation. Even if Level 2/3 Data Product have a medium priority (integration at M36), data format have been mostly harmonized. Some discussion is still ongoing on the metadata definition.

Table 2.4 – Level 2/3 Data Product

Data Products	Priority	Data Org.	Metadata	Format	CSIC	CNR	UoL	GFZ
Model Parameters	Medium	Table	TBD	CSV	✔	✔	✔	✔
Modelled LOS Displacement	Medium	Table	TBD	CSV	✔	✔	✔	✔
Inversion Statistical Analysis	Medium	2D raster (Image)	TBD	JPG, PNG, etc	✔	✔	✔	✔
3-D Displacement maps	Medium	2D / Table	TBD	geotiff / CSV	✔			✔
3-D Displacement Time Series	Medium	2D / Table	TBD	geotiff / CSV	✔			✔
Strain Rate Maps	Medium	2D raster	TBD	TBD			✔	✔
Stress field computation and Visualization	Medium	2D / Table	TBD	geotiff / CSV				✔
Seismic Hazard Maps	Medium	2D raster	TBD	TBD			✔	

2.2 Services

The TCS provides two kind of services groups: **On-demand** and **Surveillance**.

2.2.1 On-demand (Level 1 and Level 2)

On-demand group includes those services that can be run on-demand by the user through a web interface. Therefore processing services as well as remote viewing tools are present. In Table 2.5 the list of on-demand services is provided, highlighting in bold those ones with high priority.

Table 2.5 – On-demand Services

Services	Priority	Metadata	API	CNRS	CNR	CSIC	GFZ
GDM-SAR processing on demand	High	ISO 19115	WPS 1.0	✔			
GDM-SAR visualization	High	ISO 19115	WPS 1.0	✔			
GDM-optical processing	Medium	TBD	WPS 1.0	✔			
Sentinel-1 SBAS Processing on demand (L1)	High	ISO 19115	WPS 1.0		✔		
ERS-ENVISAT SBAS Processing on demand (L1)	High	ISO 19115	WPS 1.0		✔		

Displacement Analytical Modelling - Displacement Maps (L2)	Medium	TBD	WPS 1.0		✔	✔	✔
Displacement Analytical Modelling - Displacement Time Series (L2)	Medium	TBD	WPS 1.0		✔	✔	✔
Modelling toolbox with User Interface	Medium	TBD	Custom web interface			✔	✔
Data fusion (InSAR , GNSS,...) to obtain 3D displacement maps	Medium	TBD	Custom web interface			✔	
Joint Displacement and Gravity data Modeling	Medium	TBD	Custom web interface			✔	

In the following a detailed description of the **On-demand** Services is provided.

DDSS type *Service Group:* ***On-demand (Level 1)*** - *GDM-SAR processing on demand* - *GDM-SAR visualization* - *Sentinel-1 SBAS processing* - *ERS-ENVISAT SBAS processing*
Format(s) of the data / data products (if applicable) *N/A*
Metadata standard used *ISO 19115*
APIs used to provide discovery and access to the DDSS *WPS 1.0*
Authentication, Authorization, Accounting Infrastructure (AAAI) *eduGAIN compatible, Shibboleth 2.x, local IDP (ESA-SSO IdP)*
Data policy Open
Other technical details *None*
Roadmap for implementation (Section 3) *M12: First Release* *M24: Final Release*

2.2.2 Surveillance (Level 1)

Surveillance services continuously provide Data Products on a systematic basis and on defined areas on Earth. Data Products generated by the available Surveillance services are of Level 1, as those identified within Tables 2.1 and 2.2. Metadata structure for describing the services has been finalized before the integration within ICS at M24.

Table 2.6 – Surveillance Services

Services	Priority	Metadata	API	CNR	UoL
Systematic Sentinel-1 SBAS Processing	High	ISO 19115	WPS 1.0	✔	
Systematic Generation of Interferograms and Displacement Time Series	High	ISO 19115	WPS 1.0		✔

In the following, the **Surveillance** Services are described in more details.

DDSS type *Service Group:* ***Surveillance (Level 1)*** - *Systematic Sentinel-1 SBAS processing* - *Systematic Generation of Interferograms and Displacement Time Series*
Format(s) of the data / data products (if applicable) *N/A*
Metadata standard used *ISO 19115*
APIs used to provide discovery and access to the DDSS *WPS 1.0*
Authentication, Authorization, Accounting Infrastructure (AAAI) *eduGAIN compatible, Shibboleth 2.x, local IDP (ESA-SSO IdP)*
Data policy Open
Other technical details *None*
Roadmap for implementation (Section 3) *M12: First Release* *M24: Final Release*

2.3 Software

TCS provides also a downloadable software package for the visualization and computation of models retrieved by the MOD service.

Table 2.7 – Software

Data Products	Priority	Data Org.	Metadata	Format	GFZ
Data and model visualization GUI	Medium	TBD	TBD	C++ executable	✔

3. TCS roadmap

Implementation of DDSS is scheduled according the following Figure 3.1. A First release of the High Priority DDSS was provided at M12, subsequently updated at M24. For instance the on-demand EPOSAR service is available on the GEP platform [1], while the COMET one is available on-line through the LiCS portal [2]. The final release of High-Priority DDSS has been completed at M24, together with the first release of Medium Priority DDSS.

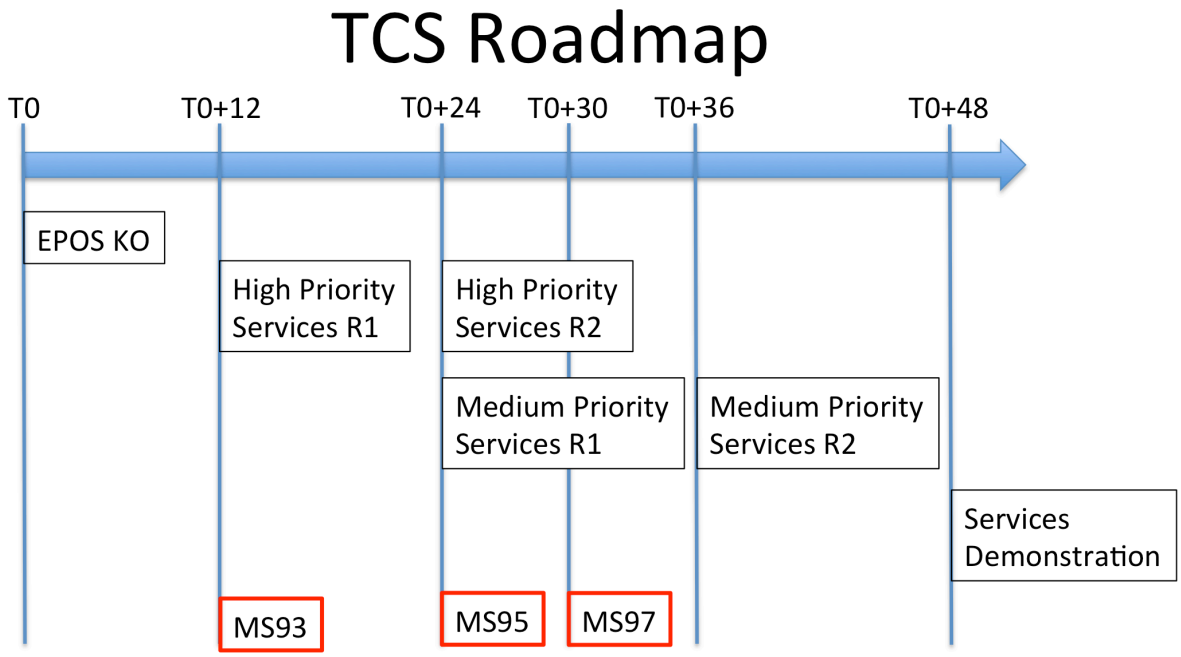

Figure 3.1 – TCS Roadmap

In the following the list of the priority DDSS is provided (the top-priority elements have been already integrated and ready for validation).

DDSS-ID	Name	Priority
WP12-DDSS-001	**Wrapped Differential Interferogram (Phase and Amplitude)**	**Top-priority**
WP12-DDSS-003	**Unwrapped Differential Interferogram (Phase and Amplitude)**	**Top-priority**
WP12-DDSS-008	**LOS Displacement Time Series**	**Top-priority**
WP12-DDSS-002	Spatial coherence	High-priority
WP12-DDSS-004	Map of LOS vector (NEU coefficient)	High-priority*
WP12-DDSS-005	Interferogram Atmospheric Phase Screen	High-priority
WP12-DDSS-006	DEM in radar geometry	High-priority
WP12-DDSS-007	Lookup table from radar coordinates to ground coordinates	High-priority
WP12-DDSS-009	Temporal Coherence (Quality of measure)	High-priority*
WP12-DDSS-010	Network misclosure (Quality of times series inversion)	High-priority
WP12-DDSS-011	Average scatterer elevation (Topography)	High-priority*
WP12-DDSS-012	Mean LOS velocity	High-priority*
WP12-DDSS-013	Stack of coregistered Interferograms	High-priority
WP12-DDSS-027	Sentinel-1 SBAS Processing on demand (L1)	High-priority
WP12-DDSS-028	ERS-ENVISAT SBAS Processing on demand (L1)	High-priority
WP12-DDSS-034	Systematic Sentinel-1 SBAS Processing	High-priority

WP12-DDSS-035	Systematic Generation of Interferograms and Displacement Time Series	High-priority
WP12-DDSS-014	Digital Surface Model	Medium-priority
WP12-DDSS-015	Horizontal Surface Deformation Maps	Medium-priority
WP12-DDSS-016	Model Parameters	Medium-priority
WP12-DDSS-017	Modelled LOS Displacement	Medium-priority
WP12-DDSS-018	Inversion Statistical Analysis	Medium-priority
WP12-DDSS-019	3-D Displacement maps	Medium-priority
WP12-DDSS-020	3-D Displacement Time series	Medium-priority
WP12-DDSS-021	Strain Rate Maps	Medium-priority
WP12-DDSS-022	Stress field computation and Visualization	Medium-priority
WP12-DDSS-023	Seismic Hazard Maps	Medium-priority
WP12-DDSS-025	GDM-SAR visualization	Medium-priority
WP12-DDSS-026	GDM-optical processing	Medium-priority
WP12-DDSS-029	Displacement Analytical Modelling - Displacement Maps (L2)	Medium-priority
WP12-DDSS-030	Displacement Analytical Modelling - Displacement Time Series (L2)	Medium-priority
WP12-DDSS-031	Modelling Toolbox with User Interface	Medium-priority
WP12-DDSS-032	Data fusion (InSAR, GNSS, ...) to obtain 3D displacement maps	Medium-priority
WP12-DDSS-033	Joint Displacement and Gravity data Modelling	Medium-priority
WP12-DDSS-036	Data and model visualization GUI	Medium-priority

DDSS implementation roadmap:

- Top-priority DDSS have been integrated in September 2017 and are ready for validation;
- High-priority DDSS will be integrated in the EPOS infrastructure by June 2018, but some of them (indicated with * in the previous table) are already available together with top-priority DDSS through the Geohazards Exploitation Platform (see section 1.5 of the tutorial https://github.com/Terradue/doc-tep-geohazards/blob/develop/source/tutorials/gep-sbas-s1.rst for information on the format of products);
- Medium-priority DDSS will be integrated by the end of 2018 even if some of them (Model Parameters and Modelled LOS Displacement) will be already available by June 2018 together with High-priority DDSS.

4. Data Management Plan (DMP)

The Data Management Plan activities focused on the evaluation of two different approaches for managing the TCS data. In particular, a Federated and a Centralized approach for data storage, maintenance and curation have been considered. The Federated approach implies that each TCS partner is responsible of their own DDSS. The Centralised approach implies that part of the responsibility is assigned to a third authority (e.g. a TCS hub) that takes care of some action on the data. Finally, the Federated approach was selected, being evaluated as the more effective at TCS level. In particular, this approach has effect on the following aspects, included in the DMP released in January 2018 (M28).

i. Data Access Policy

The TCS Satellite Data will make large use of open satellite images, mainly acquired within the Copernicus Programme and scientific missions distributed by ESA or other national space agencies.

The TCS carefully addressed the aspects related to the use, reuse, modification and distribution of the images provided by the data suppliers (space agencies).
Concerning the Copernicus data, the EU law grants free access to Copernicus Sentinel Data and Service Information for the purpose of the following use in so far as it is lawful:

a) reproduction;

b) distribution;

c) communication to the public;

d) adaptation, modification and combination with other data and information;

e) any combination of points (a) to (d).

The data coming from other sources not included in the Copernicus Programme will be managed according to the specific licenses signed by the EPOS Service Providers with the space agencies owner of the data, by guaranteeing the free and open access to the derivative DDSS.

All DDSS provided by the TCS Satellite Data will be available under an open data policy. In addition, the large majority will be made available without embargo periods, which will be take into account only for very particular and specific cases. Data providers are free to set up the access policy of their own DDSS. By the way, TCS participants agreed to follow the same policy of EPOS. The default licence type for Data Products will be the Creative Commons 4.0 BY (with the NC extension in some cases).

The TCS Satellite Data products will be accessible through GEP, developed by ESA. GEP represents the main interface for the connection between the TCS and EPOS ICS. Among its features, GEP is a Cloud-based platform that enables systematic and on-demand processing services, processor integration, data visualization, collaboration, and sharing.

In particular, within the TCS, GEP deals with:

- metadata catalogue;
- access to data products;
- AAAI;
- machine-to-machine interfaces toward the ICS;
- support to data production within the platform;
- promotion and dissemination.

ii. *Data storage and maintenance responsibility*

According to the proposed federated approach, data providers are in charge of storing and maintain their own DDSS. Each data provider will design its data center capacity according to the available financial commitment/resources. Cooperation among different providers is also possible. Only some products, produced directly in the GEP, will be stored by the platform.

iii. *Data curation responsibility*

Each data provider is responsible of the curation of the provided DDSS.

5. Use cases

Within the framework of TCS Satellite Data we identified two main Use Cases, which are related to the retrieval and visualization of data products (Figure 5.1), and execution of on-demand processing services (Figure 5.2).

5.1 Visualization Use Case

Use case name/topic: Viewing and retrieving Earth surface Displacement Time Series on deforming areas.
Use case domain This use case is: o multidisciplinary, namely focusing on the disciplines of: volcanology, seismicity, geodesy, geophysics
Use case description *As a <geoscientist> I want to <view and retrieve SAR Displacement Time Series of an area of study in a defined time span> so that I can <correlate it with the phenomena under study>.*
Actors involved in the use case ● <researcher> ● <geoscientist>
Priority: High
Pre-conditions: User must have logged in
Flow of events – user view 1. <geoscientist> performs a query for Displacement Time Series by imposing the area of interest (AoI) and time span related to the phenomena under investigation. 2. <geoscientist> selects among the query results the data product to be visualized 3. <geoscientist> visualizes and analyses all the retrieved data product provided by the TCS
System workflow - system view 1. The user interface receives the location, time interval and other query input 2. The system searches the database for the SAR Displacement Time Series 3. Query results are exposed to the user that selects the data product to be visualized 4. The system retrieve the required data product from the TCS 5. The data product is visualized
Post-conditions Search parameters have to be saved
Extension Points None
« Used » Use Cases None
Other Requirements None
(to be filled in by WP7) After the interview: create class and sequence diagram for each use case. Class diagram and sequence diagram.

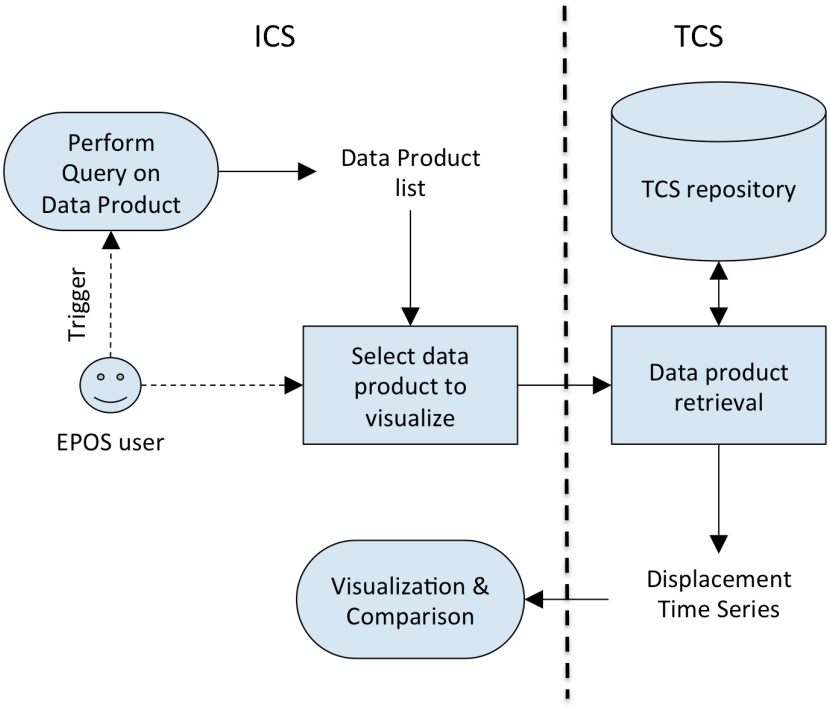

Figure 5.1 – Visualization Use Case

5.2 Processing on-demand Use Case

Use case name/topic: Running on-demand processing/services
Use case domain This use case is: o discipline-oriented, namely focusing on the discipline of: remote sensing
Use case description *As a <remote sensing expert> I want to <run an on-demand Senitnel-1 SBAS processing> so that I can <analyse the Displacement Time Series of an area of my interest occurred during a defined time interval>.*
Actors involved in the use case ● <researcher> ● <expert on remote sensing>
Priority: High
Pre-conditions: User must have logged in
Flow of events – user view 1. <researcher> performs a query for available services able to process Sentinel-1 data. 2. <researcher> selects among the query results the SBAS processing tool 3. <researcher> by imposing the area of interest (AoI) and time span related to the phenomena under investigation, identifies the Sentinel-1 data and defines the SBAS parameters for the processing (baseline thresholds, applied filtering, ...) 4. <researcher> run the SBAS processing 5. once ready, <researcher> visualizes and analyses the generated SBAS results
System workflow - system view 1. The user interface receives the user input on the available services able ot process Sentinel-1 data; 2. Query results are exposed to the user that proceed with a selection 3. The user interface receives the EO data type, location, time interval as well as the list of EO data to be used as input for the SBAS processing 4. The processing starts at the TCS level after an operator trigger (button) 5. The system retrieve the generated Displacement Time Series from the TCS 6. The data product is visualized
Post-conditions Search and input parameters have to be saved
Extension Points *œ* None
« Used » Use Cases None
Other Requirements None
(to be filled in by WP7) After the interview: create class and sequence diagram for each use case. Class diagram and sequence diagram.

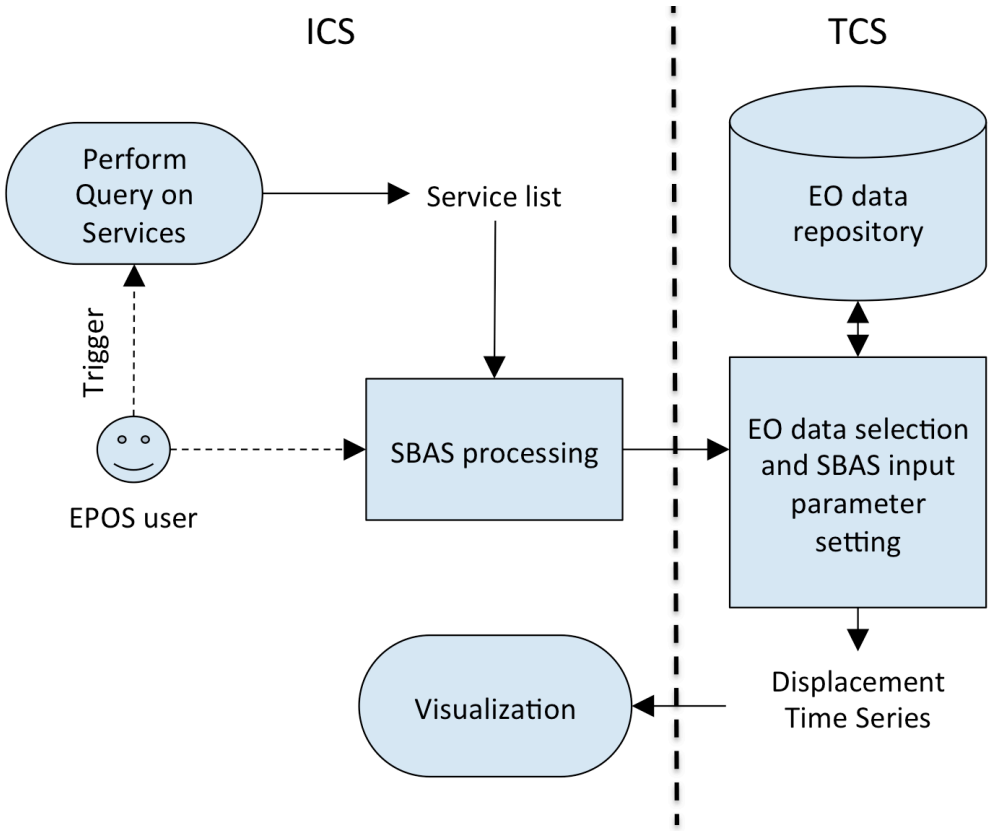

Figure 5.2 – Processing on-demand Use Case

6. Conclusion

The first 30 months of activity permitted to clearly identify the TCS DDSS, thus highlighting implementation priorities, formats and metadata. Moreover, a concrete solution (the ESA GEP) has been proposed as main TCS interface. A strategy for data access, storage and maintenance has also been defined. DDSS harmonization has been performed at TCS and EPOS level.
Next steps will focus on the:

- Integration of the high-priority DDSS into the ICS;
- Consolidation of medium priority Metadata list;
- Starting the integration of the medium priority DDSS.

7. References

[1.] EPOSAR on GEP, http://geohazards-tep.tumblr.com/post/142889599766/on-demand-sentinel-1-insar-processing-service
[2.] COMET-LiCS, http://comet.nerc.ac.uk/COMET-LiCS-portal

Annex 1 – WP12 DDSS Master Table

The following Table lists:

- the DDSS-IDs and names
- the DDSS sub-domain names (3 sub-domains have been identified: InSAR, Optical, Modelling)
- the key-words relevant to each DDSS element.

DDSS-ID	Name	Sub-domain	keywords
WP12-DDSS-001	Wrapped Differential Interferogram (Phase and Amplitude)	InSAR	Remote Sensing, Interferometry, DInSAR, interferogram, phase, fringes, SAR, InSAR, wrapped, LOS, deformation, displacement, map, ascending, descending, range change
WP12-DDSS-003	Unwrapped Differential Interferogram (Phase and Amplitude)	InSAR	Remote Sensing, Interferometry, DInSAR, interferogram, phase, unwrapped, SAR, InSAR, LOS, deformation, displacement, map, ascending, descending, range change
WP12-DDSS-008	LOS Displacement Time Series	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitmporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, PS
WP12-DDSS-002	Spatial coherence	InSAR	Remote Sensing, Interferometry, DInSAR, interferogram, phase, fringes, coherence, multilook, SAR, InSAR, LOS, deformation, displacement, map, ascending, descending
WP12-DDSS-004	Map of LOS vector (NEU coefficient)	InSAR	Remote Sensing, Interferometry, DInSAR, interferogram, phase, fringes, coherence, multilook, SAR, InSAR, LOS, map, ascending, descending, LOS versor
WP12-DDSS-005	Interferogram Atmospheric Phase Screen	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, PS
WP12-DDSS-006	DEM in radar geometry	InSAR	Remote Sensing, Interferometry, DInSAR, topography, SAR, InSAR, LOS, radar geometry
WP12-DDSS-007	Lookup table from radar coordinates to ground coordinates	InSAR	Remote Sensing, Interferometry, DInSAR, system geometry conversion, SAR, InSAR, LOS, radar geometry, geolocation
WP12-DDSS-009	Temporal Coherence (Quality of measure)	InSAR	Remote Sensing, Interferometry, DInSAR, velocity, mean velocity, displacement, timeseries, multitemporal, measurement quality, SAR, InSAR, LOS, deformation, SBAS, PS
WP12-DDSS-010	Network misclosure (Quality of times series inversion)	InSAR	Remote Sensing, Interferometry, DInSAR, velocity, mean velocity, displacement, timeseries, multitemporal, measurement quality, SAR, InSAR, LOS, deformation, SBAS, PS
WP12-DDSS-011	Average scatterer elevation (Topography)	InSAR	Remote Sensing, Interferometry, DInSAR, topography, timeseries, multitemporal, SAR, InSAR, LOS, deformation, SBAS, PS
WP12-DDSS-012	Mean LOS velocity	InSAR	Remote Sensing, Interferometry, DInSAR, velocity, mean velocity, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, PS
WP12-DDSS-013	Stack of coregistered Interferograms	InSAR	Remote Sensing, Interferometry, DInSAR, interferogram, stack, phase, fringes, SAR, InSAR, wrapped, unwrapped, multitemporal, LOS, deformation, displacement, map,

			ascending, descending, range change, single master geometry
WP12-DDSS-014	Digital Surface Model	Optical	TBD
WP12-DDSS-015	Horizontal Surface Deformation Maps	Optical	TBD
WP12-DDSS-016	Model Parameters	Modelling	TBD
WP12-DDSS-017	Modelled LOS Displacement	Modelling	TBD
WP12-DDSS-018	Inversion Statistical Analysis	Modelling	TBD
WP12-DDSS-019	3-D Displacement maps	Modelling	TBD
WP12-DDSS-020	3-D Displacement Time series	Modelling	TBD
WP12-DDSS-021	Strain Rate Maps	Modelling	TBD
WP12-DDSS-022	Stress field computation and Visualization	Modelling	TBD
WP12-DDSS-023	Seismic Hazard Maps	Modelling	TBD
WP12-DDSS-025	GDM-SAR visualization	InSAR	TBD
WP12-DDSS-026	GDM-optical processing	Optical	TBD
WP12-DDSS-027	Sentinel-1 SBAS Processing on demand (L1)	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, processing on-demand, Sentinel-1, TOPS
WP12-DDSS-028	ERS-ENVISAT SBAS Processing on demand (L1)	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, processing on-demand, ERS-1, ERS-2, ENVISAT, ASAR, Stripmap
WP12-DDSS-029	Displacement Analytical Modelling - Displacement Maps (L2)	Modelling	TBD
WP12-DDSS-030	Displacement Analytical Modelling - Displacement Time Series (L2)	Modelling	TBD
WP12-DDSS-031	Modelling Toolbox with User Interface	Modelling	TBD
WP12-DDSS-032	Data fusion (InSAR, GNSS, ...) to obtain 3D displacement maps	Modelling	TBD
WP12-DDSS-033	Joint Displacement and Gravity data Modelling	Modelling	TBD
WP12-DDSS-034	Systematic Sentinel-1 SBAS Processing	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, SBAS, Sentinel-1, TOPS
WP12-DDSS-035	Systematic Generation of Interferograms and Displacement Time Series	InSAR	Remote Sensing, Interferometry, DInSAR, phase, displacement, timeseries, multitemporal, SAR, InSAR, LOS, deformation, ascending, descending, range change, Sentinel-1, TOPS
WP12-DDSS-036	Data and model	Modelling	TBD

	visualization GUI		

Note that all the DDSS will respect an open data policy. The AAAI is managed directly by the GEP and uses a Shibboleth 2.x, with a local IDP (ESA-SSO IdP) and eduGAIN compatibility.