

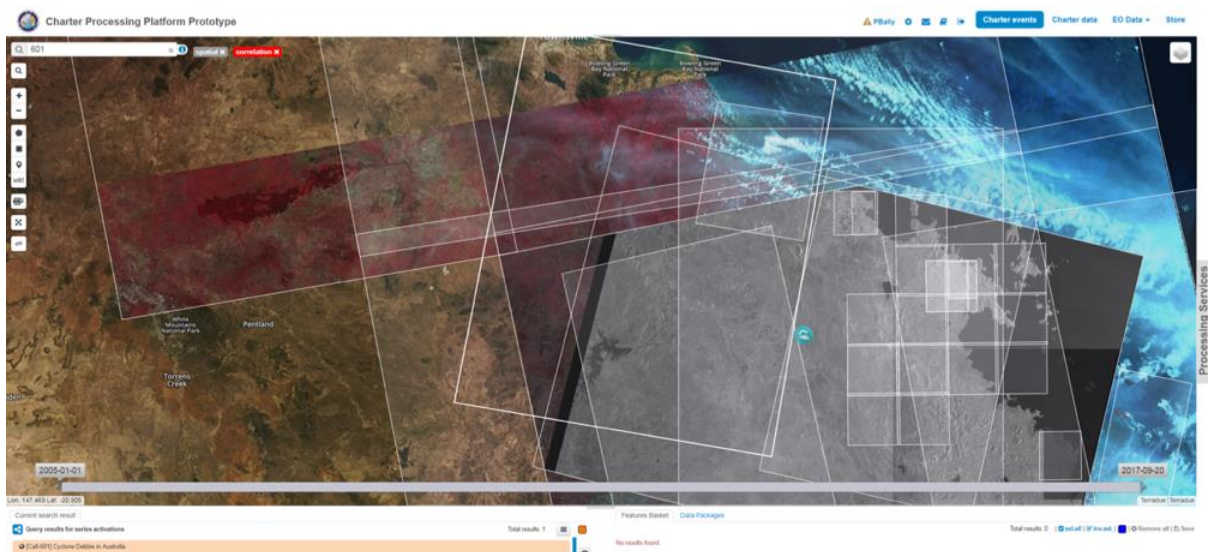
Charter Processing Platform Prototype

An initiative of the European Space Agency

Charter Platform prototype Trial

User Manual

Based on Terradue's EO processing environment



Document: User Manual

Version: 2.5, Date: 06/07/2018

Start of availability of Terradue's platform prototype:	19 September 2018
Point of contact for Terradue's prototype operations:	geohazards-tep@esa.int

Points of contact for Charter Platform Trial initiative: philippe.bally@esa.int, jolanda.patruno@esa.int

Table of Content

Table of figures	2
Acronyms	3
0. Introduction	4
• Purpose of the document	4
• Scope of the platform prototype:	5
• Accessing the platform prototype:	5
• The specific scope of the Trial:	6
1. Scenario A: Discovery, training and collaboration	7
2. Scenario B: EO data screening in a systematic fashion	9
2.1. Saving a data selection and downloading	10
2.2. Uploading data not available on COS-2	11
2.3. Uploading external geospatial data and products	13
3. Scenario C: multi-sensor EO data combined images (COMBI)	14
4. Additional services	16
4.1. Additional post processing service: SNAC - SNAP Sentinel-1 GRD Amplitude Change.	16
4.2. Additional post processing service: COIN – Coherence and Intensity chain for Sentinel-1	17

Table of figures

Figure 1. Access to the Charter Platform prototype in the Community area	5
Figure 2. Selection of Full Resolution imagery for the Activation 573 - Flood in Sri-Lanka	8
Figure 3. Multisensor systematic Full Resolution visualisation	9
Figure 3. Selected stack of EO data of an activation	10
Figure 4. Example of an EO data product uploaded by the PM on the platform prototype (Call 609. Flood in Chile, TERRASAR-X acquisition).	11
Figure 4. Call 605: Flood in Dominican Republic. VA product and EO data SPOT-6 based map (UNOSAT)	13
Figure 5a. Copernicus Sentinel-2 image combined (Bands: B4-B3-B2) product over Hawaii – Lava flowing to the sea	14
Figure 6. Image composite showing amplitude changes (red: radar signal increase; blue: radar signal decrease) using a pair of Sentinel-1 GRD acquisitions and the SNAC service, over the Mayon volcano in the Philippines.	16
Figure 7. On the left, coherence (red) and amplitude (cyan) image composite using a consecutive pair of Sentinel-1 SLC acquisitions and the COIN service over the Mayon volcano in the Philippines. On the right, same over Lake Manicouagan in Québec, Canada, with a coherence (red) and amplitude (green) image composite generated using COIN.	17

Acronyms

Acronym	Definition
AOI	Area Of Interest
Charter	The International Charter Space and Major Disasters
COS-2	Charter Operational System
CGT	Charter Geobrowser Tool
EO	Earth Observation
ESA	European Space Agency
GRD	Ground Range Detected
L1	Level-1
PM	(Charter) Project Manager
SAR	Synthetic Aperture Radar
SLC	Single Look Complex
TEP	Thematic Exploitation Platform
VA	Value Adding provider
IW	Sentinel 1 Interferometric Wide swath acquisition mode
EW	Sentinel 1 Extra Wide swath mode acquisition

0. Introduction

- Purpose of the document

This document is a *User Manual* for the assessment of the Charter Processing Platform Prototype, a system linked to the Charter Operational System (COS-2) and aiming at improving Charter operations. The Trial activity is focused on the evaluation of the current functionalities of the Platform according to specific scenarios.

Trial users are invited to provide their feedback as well as comments and suggestions using the utility report (https://docs.google.com/forms/d/e/1FAIpQLSet7F44g9fMvKvIUG4Gup6oIIaB_I0KZvymnig9583HOcEn8g/viewform?usp=sf_link). The platform Trial users are Charter Project Managers (PMs) and members of the Charter Executive Secretariat, Board and Communications Group.

The outcome of this Trial is a first assessment to the Charter to be discussed at the meeting on Charter and Major Disasters at the Board meeting taking place in Quebec on April 2019.

The purpose of this document is to present how to try and evaluate the platform prototype provided by ESA's contractor Terradue. The prototype is focusing on basic functions dedicated to support PM operations. The long-term vision for the processing platform is described in the Technical Note addressed to the Board.

The present User Manual illustrates three different scenarios described in section 2, addressing the following needs:

1. Charter Trial users can perform "discovery & training" (outside Charter operations) on the platform prototype screening in full resolution EO data over areas where an activation is available, by visualising also open and free EO data (for the full list of available Charter activations see "Specific scope of the Trial" section). In the same context, they can perform some basic post processing multi-sensor change detection analysis.
2. A Charter PM, or Charter Trial users acting as a PM, can access full resolution screening of the EO data collection of a Charter activation, through the systematic feeding of Charter activations EO data directly connected to COS-2. In the same context, the Trial user can perform basic post processing analysis (e.g. create an RGB composite from a heterogeneous time series of EO data)

Before entering the Platform, simple authentication instructions have to be followed. Once logged in, the

A presentation of the functionalities of the Charter platform prototype is available in the form of a movie (without sound) at the following url:

<https://disasterscharter.org/documents/10180/833505/Charter-Platform-prototype-movie.wmv>

<https://www.dailymotion.com/video/x6mh68h>

Trial user can start to explore the basic features of the Platform.

- **Scope of the platform prototype:**

Today, COS-2 supports the Charter operations as a data workflow management system with a main focus to ensure that the operational steps of a Charter activation (triggering, running and closure of a Charter activation) are managed in an appropriate and timely fashion. COS-2 is dedicated to managing operations and not really exploiting satellite data. COS-2 has only two geospatial features:

- The COS-2 EO data repository where some Charter members upload EO data collections for a given Charter activation. Note that although COS-2 offers a unified EO data ordering system, not all EO data collections are available through the COS-2 data repository.
- The current Charter geo-browser (formerly called Charter Geographic Tool) is available at <https://cgt.disasterscharter.org/fr>. The Charter geo-browser only provides metadata of EO data collections (i.e. the EO data footprints and coarse thumbnails/quick looks).

The Charter processing platform prototype aims to complement COS-2 with functions to gather, screen and process EO data by:

- Supporting/helping the PM work in a more efficient and in a faster fashion
- Supporting the PM or VA provider in managing or creating VA products in the same environment

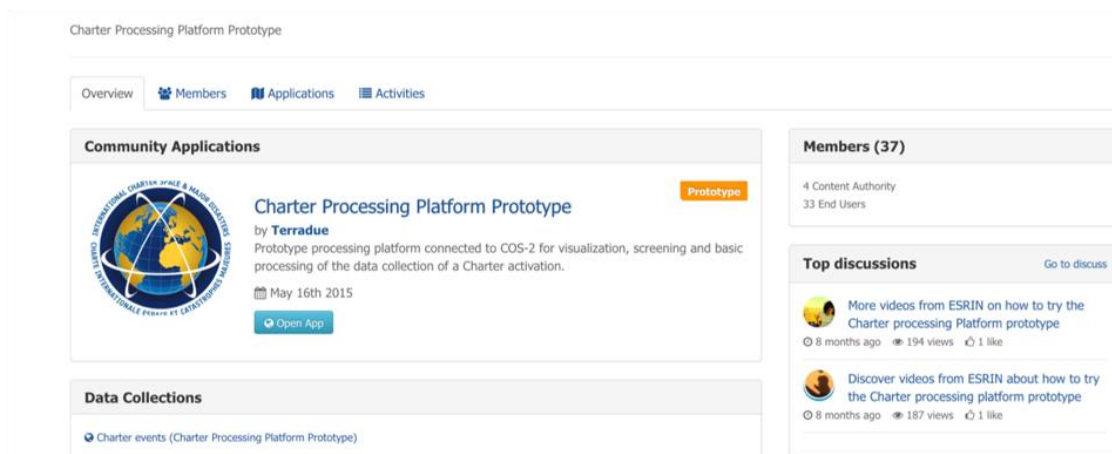


Figure 1. Access to the Charter Platform prototype in the Community area

- **Accessing the platform prototype:**

Before entering the Platform, simple authentication instructions have to be followed. Once logged in, the Trial user can start to explore the basic features of the Platform.

1. User Authentication instruction at: <https://disasterscharter.org/web/guest/charter-prototype-user-manual#authentication>
2. As a first step, the Trial user has to enter the Charter Platform Prototype at the following link:
<https://geohazards-tep.eo.esa.int/#!/communities/details/charter-trial>
3. Trial users can then start to explore the geobrowser and its basic features here:
<https://disasterscharter.org/web/guest/charter-prototype-user-manual#features>

- The specific scope of the Trial:

The Trial allows registered users to try the system against the three scenarios described in this document. While the system is able to access data collections from a broad range of Charter activations and data collections that aren't delivered in the framework of the Charter (such as with open and free data), the Trial is constrained to a pre-defined and limited set of activations. Thanks to the dynamic feed from the COS-2 system, the prototype is able to access the history of Charter activations and any new activation. However, the on-line platform services, such as the service transforming EO data into full resolution raster imagery supporting Scenario B, is dependent upon the delivery of data from data suppliers of the Charter and there remain issues, in particular there are instabilities due to data format and naming convention which can make on-line services fail.

The *live feed* is now active at <https://geohazards-tep.eo.esa.int/#!communities/details/charter-trial>
As a Trial User, you can access EO data in a rapid fashion for on-going Charter events!

A Trial user is able to access the output of the systematic on-line services of the platform over the collections of these activations. Moreover, the on-demand platform services supporting Scenario C can be applied to these data collections and to any other accessible data such as, for instance, Sentinel data without any constraints about the area or timespan.

1. Scenario A: Discovery, training and collaboration

Platform Trial users that are Charter Project Manager (PM) or Value Adding partner may directly go to sections 2, 3 and 4.

Scenario A is addressing Charter members' needs (Board, Executive Secretariat, Communications group, staff organizing training) and is not necessarily dedicated to the emergency response time like in scenarios B and C. The aim is to help them to inspect, verify, explain and promote the Charter by accessing imagery using both EO data collections from activations and EO data provided outside activations.

Scenario A uses the functions defined to support scenarios B and C (described in sections 2 & 3) with a broader scope for discovery and training purposes, showing how EO is used to support disaster response and for training partners and users. It can also be used in the frame of collaborations to inspect what other activities can be performed in terms of EO based services; in the longer term, beyond the current prototype, the platform could provide an aggregator of activations allowing to represent the EO products of different systems (e.g. Sentinel Asia, Copernicus EMS, etc.).

Example 1:

A representative from a Charter member is preparing a training about the contribution of satellite EO to DRM; data of Charter activations can be visualized one by one (for supported EO missions); activations can be selected by hazard type through the "Free text search" (to do queries in the list of activations), by date, or according to geographic location using the "Spatial filter" (to create a Bounding Box to constrain a query). Thanks to the systematic rasterization service, any supported EO mission has a full resolution raster that can be displayed in full resolution on the screen and can be downloaded to be used in training presentations.

Example 2:

A representative from a Charter member is inspecting EO data of a Charter activation to verify which EO mission products are really useful and what data have effectively been used by the PM. Thanks to the systematic rasterization service, any supported EO mission has a full resolution raster that can be displayed in full resolution on the screen. This allows to easily filter imagery according to specific parameters (cloud coverage percentage, evidence of hazard impact, etc.) and compare the selected data to the list of EO data used in a particular Value Adding product on the Charter website based on the map annotations. Useful images can be then downloaded to be used in reports or presentations.

Example 3:

A representative from a Charter member is going to meet a Disaster Risk Management user to explain and promote Universal Access. In countries where Charter activations have never been activated, the platform can be used to retrieve and process images to show what satellite can do. Processing services can be used to generate simple images over a specific region of interest. This can be done with open and free data as illustrated in section 4.

The Trial user can visualise EO data in full resolution over areas where an activation is available. This is in place also for open and free EO data (see sections 4.1 and 4.2). For commercial data imagery that isn't from a Charter activation might be accessible as 'Data as a Service' on a case by case basis provided an agreement is in place with the supplier: the platform functions already support it, however it is not implemented in this prototype.

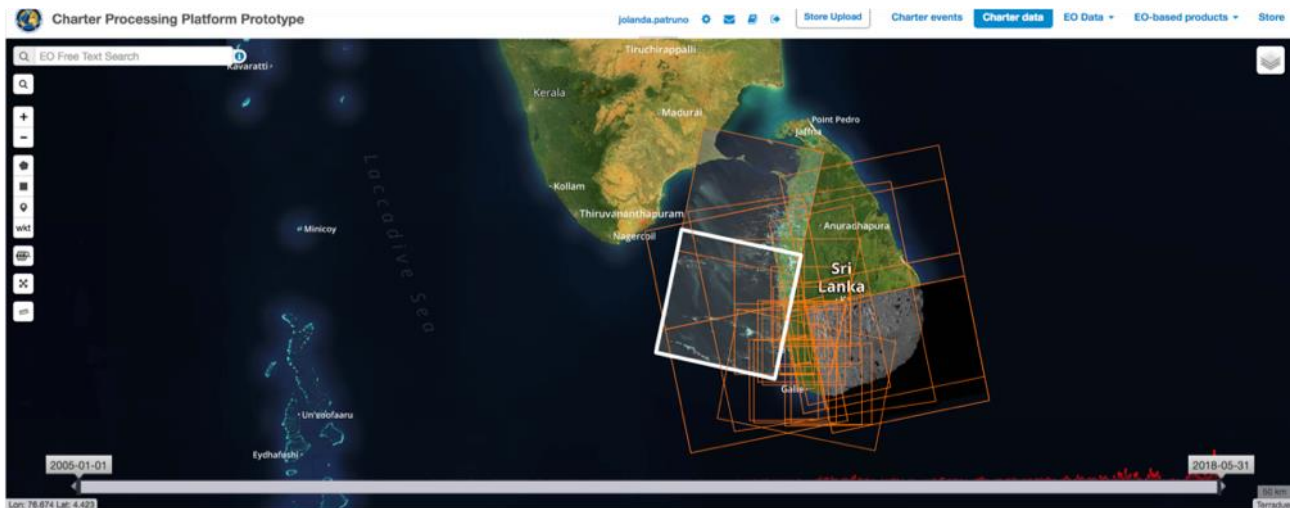


Figure 2. Selection of Full Resolution imagery for the Activation 573 - Flood in Sri-Lanka

Scenario A offers the services of Scenarios B and C such as:

1. Access, select and download EO data
2. Multi-sensor visualization of EO data footprint
3. Query/Filter EO data
4. Visualise single EO data product in Full Resolution
5. Multi-sensor Visualisation of EO data in Full Resolution
6. Multi-sensor EO data combination
7. Other basic post-processing of EO data

2. Scenario B: EO data screening in a systematic fashion

This scenario provides on-line full resolution visualisation and download of EO data linked to a Charter activation through a systematic service triggered automatically by the platform when new data are available on COS-2. This systematic ‘rasterization’ is creating full resolution rasters for on-line viewing purposes.

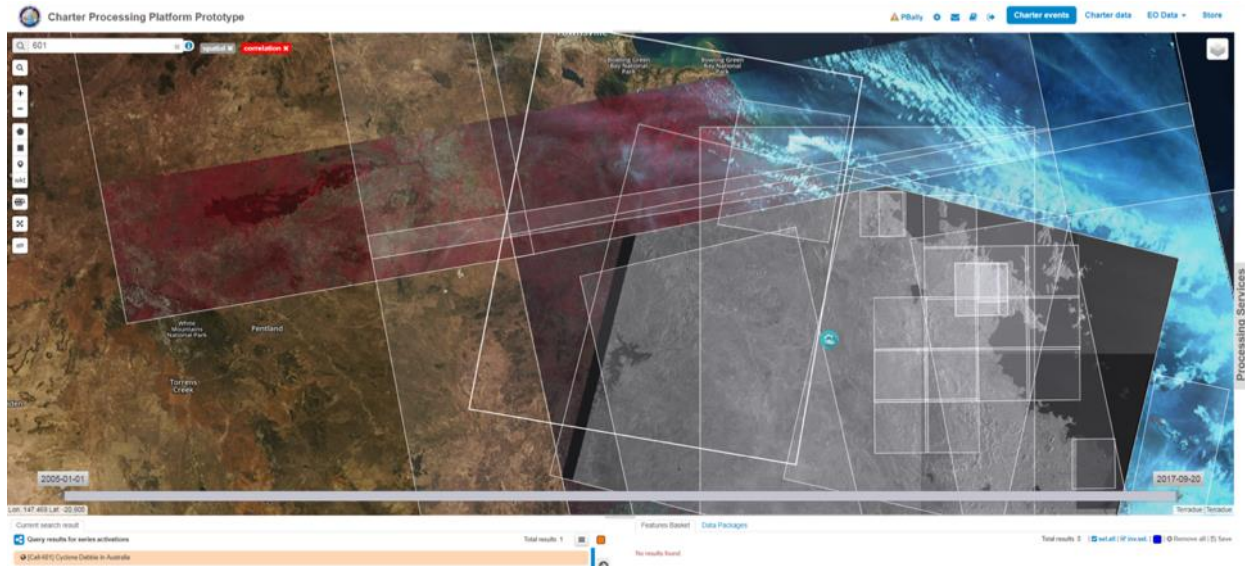


Figure 3. Multisensor systematic Full Resolution visualisation

The Trial user can view the imagery of an activation on the platform map (the geobrowser) by following two different methods:

1. Clicking on the “Charter events” button at the top right of the window: all Charter activations are displayed in the bottom left frame and the Trial user can select the Activation of interest. Full Resolution visualization of the related data is done by clicking “Call acquisitions” in the bottom right of the pop-up window associated to the activation icon.

This is a methodic way to inspect the data collection of an activation; in the current prototype this method does not optimize query functions to sort data within the collection.

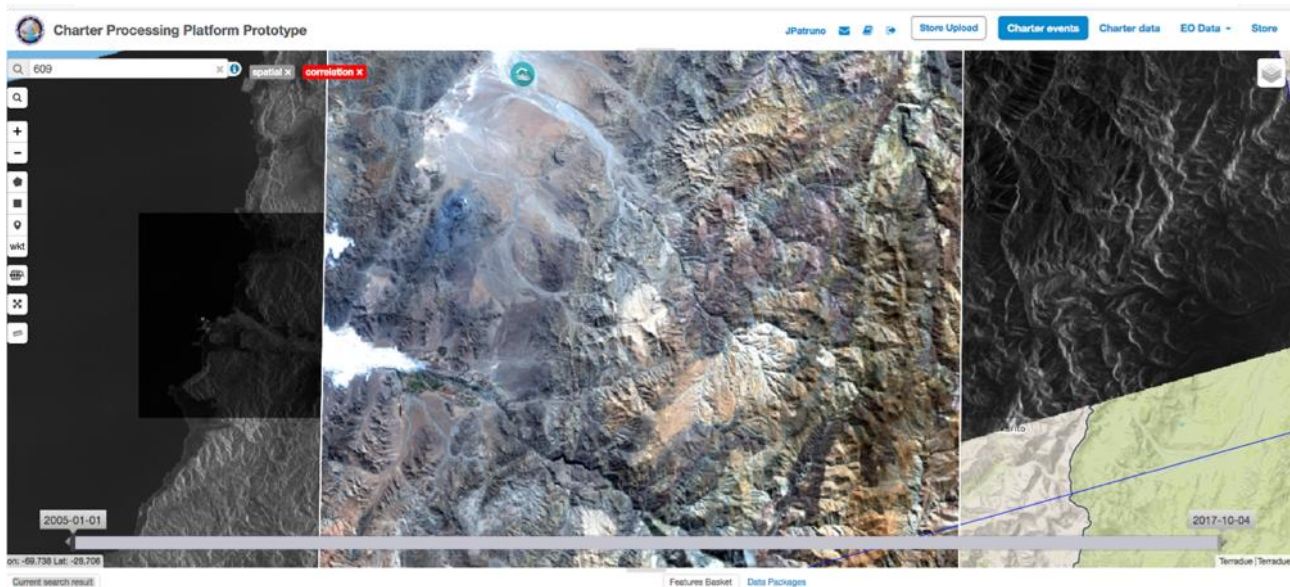
2. Clicking on the “Charter data” button at the top right of the window, the Trial user can screen all the available EO data from all the activations. Typing the name of the disaster area of interest (“Free text search bar”) or drawing the area of interest (bounding box) and setting a specific time range allows to filter out the data of the desired activation.

This method makes it easy to quickly perform queries to filter into the data collection. Queries on the sensor name can be run on the fly using the “Free text search” bar.

A detailed description of these steps can be found at <https://disasterscharter.org/web/guest/charter-prototype-user-manual#case-1>

2.1. Saving a data selection and downloading

Once the Trial user has visualised the available EO data of an activation, he/she can select and save some of them as a 'data package' and then retrieve them when needed. A group of EO data can be downloaded.



User-friendly additional functions allow the Trial user to screen groups of EO imagery of an activation:

1. Select specific acquisitions and then drag and drop them in the Features basket
2. These acquisitions can be saved as a "Data Package" and can be loaded every time and set as a current search in the Geobrowser
3. The original EO data can be downloaded by clicking on the given download link in metadata pop up window

A detailed description of the steps listed above can be found at

<https://disasterscharter.org/web/guest/charter-prototype-user-manual#selection>

The complete list of EO missions' supported by the systematic Full Resolution service is available here:

<https://disasterscharter.org/web/guest/charter-prototype-user-manual#service>

Figure 4. Selected stack of EO data of an activation

2.2. Uploading data not available on COS-2

This Platform function allows the Trial user to upload on the geobrowser external EO data product that are not available on COS-2. Operational feeding of EO data by COS-2 is the baseline for an activation with data are available either on COS-2 or through an external repository which access link is known to COS-2. Some EO data products are not included, due to permission issues for instance. The platform can however help the PM upload such products in a private and secure area.

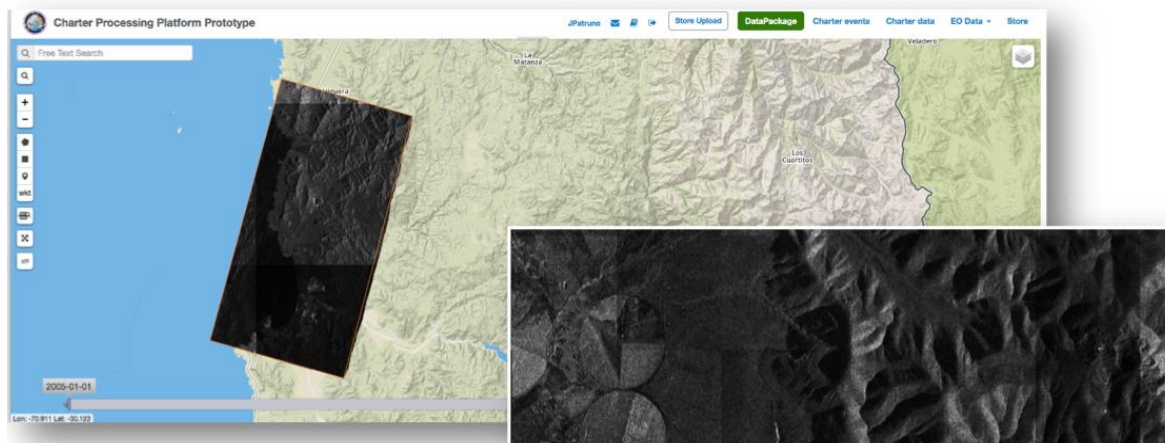


Figure 5. Example of an EO data product uploaded by the PM on the platform prototype (Call 609. Flood in Chile, TERRASAR-X)

EO data product from a Charter activation that aren't available on COS-2 (and not using the COS-2 operational feeding) can be uploaded following the steps below:

1. using the "Upload data" button, upload data into the platform by dragging and dropping the needed files. Once the upload is completed, by clicking on "Close and update" button, the uploaded files will appear in the Current search results.
2. Select the on-demand rasterization service RASTER to transform EO data products into a raster Geotiff image that can be visualised on-line at full resolution as a result of this job.
3. Screening, inspection, selection and download of rasterized EO data products can be performed alongside any already 'rasterized' EO data of the activation (as explained at the start of section 3)

A detailed description of the steps listed above can be found at <https://disasterscharter.org/web/guest/charter-prototype-user-manual#external>

acquisition).

2.3. Uploading external geospatial data and products

This Platform function allows the Trial user to upload on the geobrowser a range of external data and products such as:

- vectors such as GIS features (e.g. a new AOI not yet declared in COS-2)
- a Value Adding product (e.g. a thematic map) from the private collection of the PM or Value Adder (or shared by a third party Value Adding provider) that can be uploaded to support analysis in the framework of the activation. Typically, the PM can upload historical Value Adding maps from past activations over the same area.

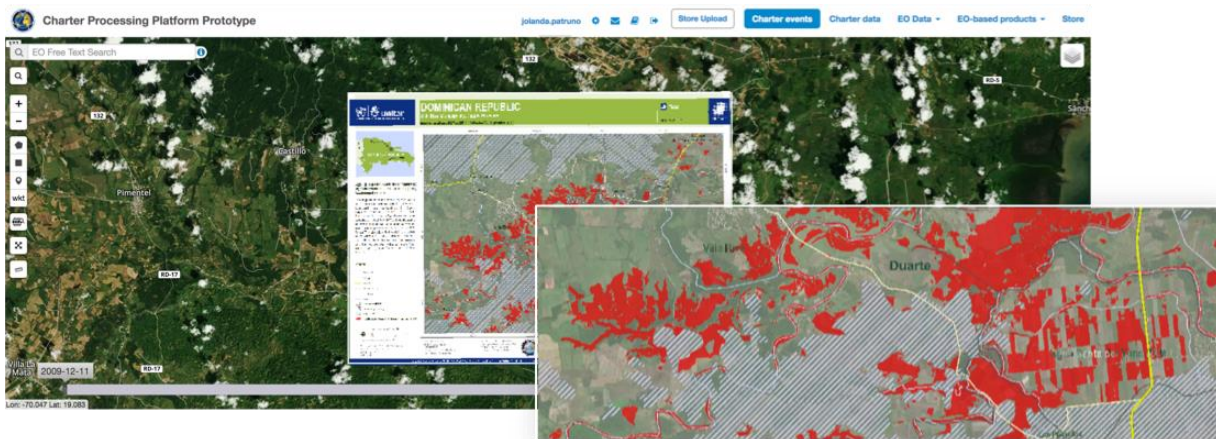


Figure 6. Call 605: Flood in Dominican Republic. VA product and EO data SPOT-6 based map (UNOSAT)

External data (raster and vector) including Value Adding products can be uploaded following the steps below:

1. Geospatial data can be imported into the platform. As an example, the user can import a particular area of interest (vector data, shapefile file) as well as Value Adding products (with raster data in GeoTIFF format)
4. Using the “Upload data” button, upload data into the platform by dragging and dropping the needed files. Once the upload is completed, by clicking on “Close and update” button, the uploaded files will appear in the Current search results.

A detailed description of the steps listed above can be found at

<https://disasterscharter.org/web/guest/charter-prototype-user-manual#external>

3. Scenario C: multi-sensor EO data combined images (COMBI)

The purpose of this scenario is to help the PM inspect the content of different EO data products by running preliminary change detection analysis. Thanks to the COMBI service, the Trial user can derive user-defined band combinations from multi-mission Optical and SAR data.

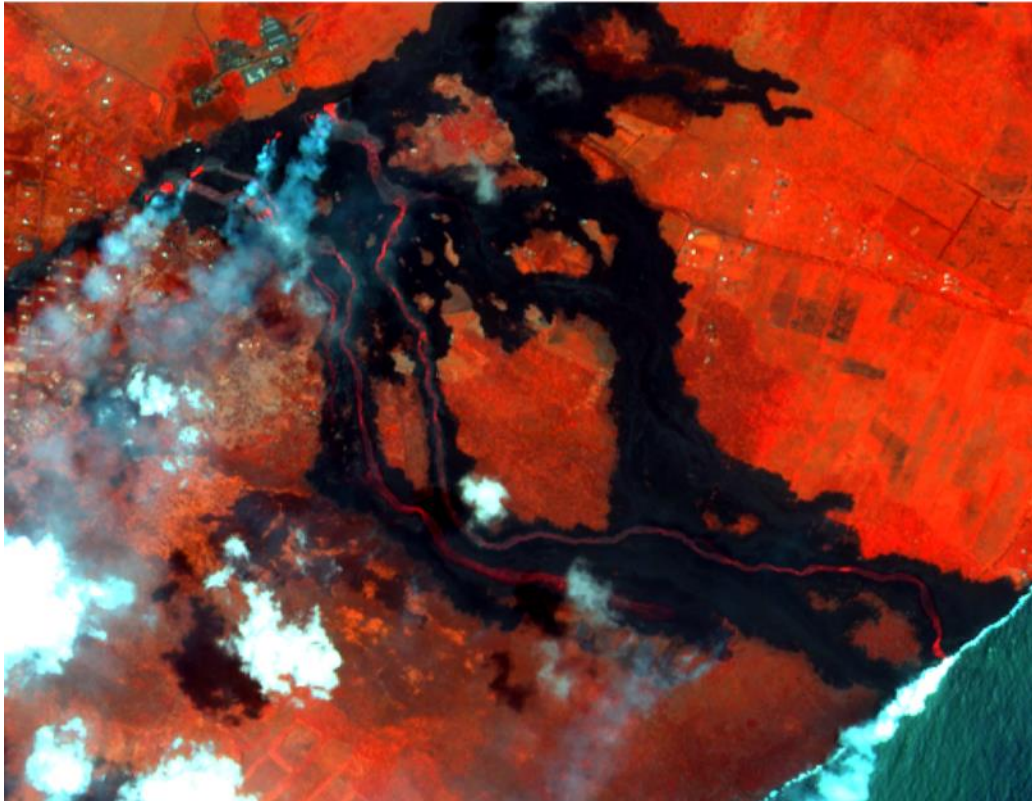


Figure 7. Copernicus Sentinel-2 image combined (Bands: B4-B3-B2) product over Hawaii – Lava flowing to the sea

The service “COMBI” allows to create a Red Green Blue colour composite (RGB band combination) from user defined bands of single or multiple (e.g. different sensors) EO data products:

1. Select an AOI of a Charter activation and select two or three EO data acquisition
2. Open the processing services panel and select COMBI service
3. Drag and drop each acquisition and the desired band in the RGB channels
4. Process and display the resulting band combination product
5. The RGB product can be downloaded as GeoTIFF file

A more detailed description of the steps listed above can be found at <https://disasterscharter.org/web/guest/charter-prototype-user-manual#multisensor>

The complete list of EO missions supported by the COMBI on-demand service is available here: <https://disasterscharter.org/web/guest/charter-prototype-user-manual#combi>

An illustration of the COMBI service is provided in the case of Activation-576 (Call-657, Call-658) - Volcanic eruptions in GUATEMALA: a Sentinel-2 scene of 4 June 2018 (acquisition time 16:18:59) had been used by the Copernicus EMS to create a delineation map showing the pyroclastic flow from the Fuego volcano. Sentinel-2 images have 13 Bands in different parts of the spectral domain.

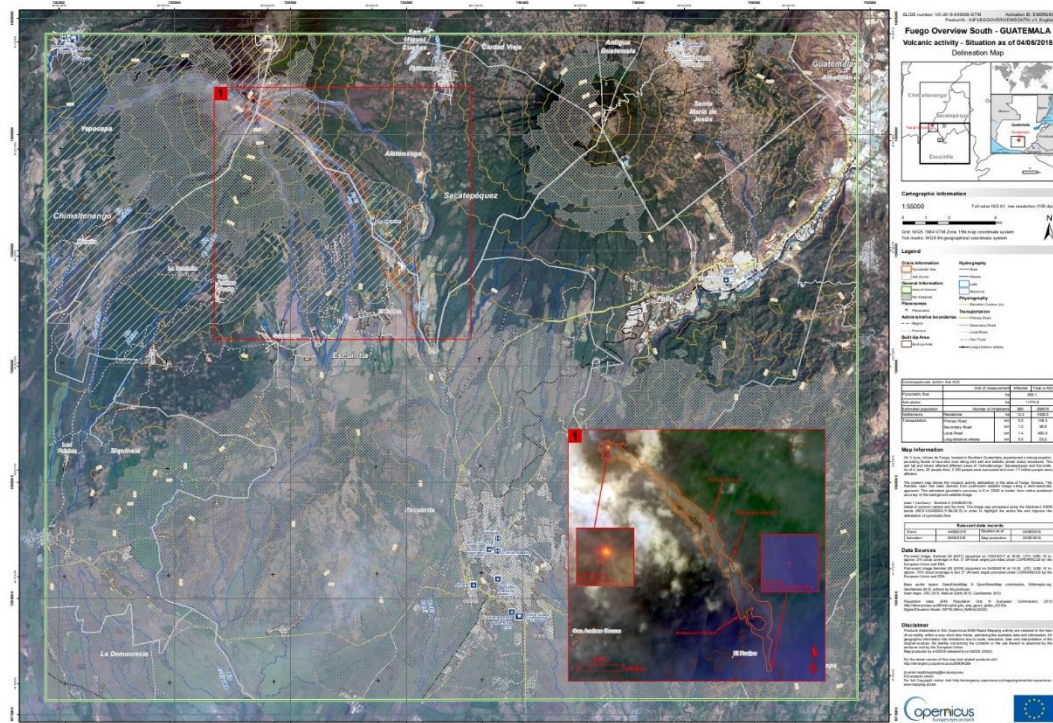


Figure 8. Illustration of a delineation map generated by the Copernicus EMS (Activation ID: EMSR289); the insert shows the pyroclastic flow and the active caldera of the volcano using specific spectral bands of Sentinel-2. Credits: Copernicus EMS.

Using the COMBI service the platform is able to create a full resolution image combining the most pertinent spectral bands of the sensor, e.g. bands 13, 12 and 2; this provide additional information from the basic full resolution visualization service supporting scenario B for which the EO data is transformed into a basic RGB image not tuned to extract information about the volcano and the pyroclastic flow.

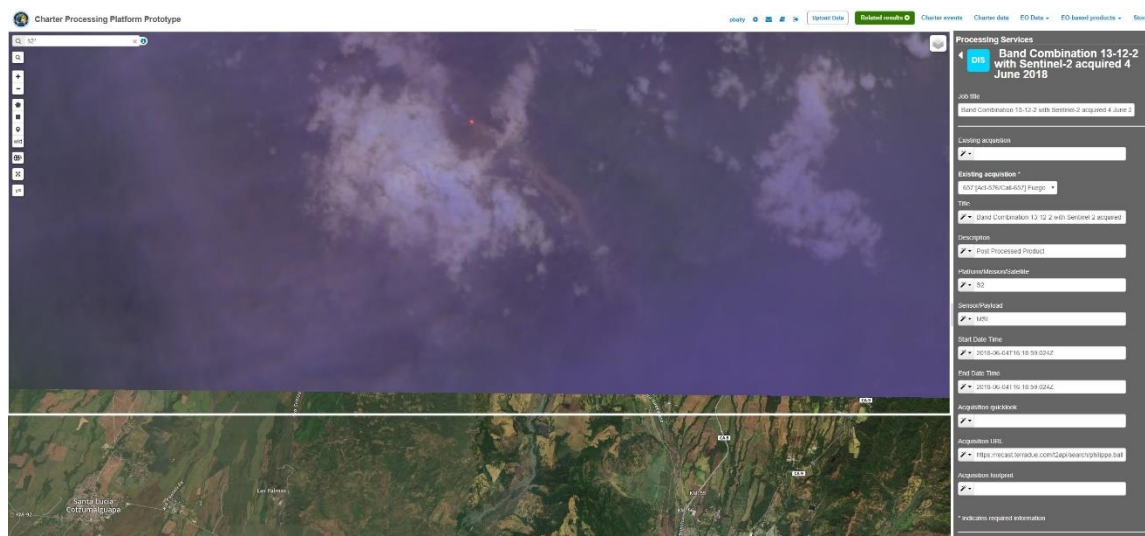


Figure 9. Illustration of the image created using the COMBI service that is displaying bands 13, 12 and 2 of the Sentinel-2 acquisition of 4 June 2018. Credits: Copernicus programme 2018, Terradue.

4. Additional services

The platform provides EO processing tools to exploit EO data. Section 4.1 and 4.2 show two examples using open & free data. Other examples are available concerning Landsat data. In addition, EO processing services are in preparation and are not exposed in the current prototype and are able to process EO data from a broad range of EO missions, SAR & Optical and including commercial data.

4.1. Additional post processing service: SNAC - SNAP Sentinel-1 GRD Amplitude Change.

Additional services that support basic analysis (e.g. change detection) are available on the platform. SNAC is dedicated to open and free Sentinel-1 data. An RGB composite of backscattering can be obtained from a pair of S-1 GRD IW or EW (pre and post event) using the SNAC SAR based processing service.

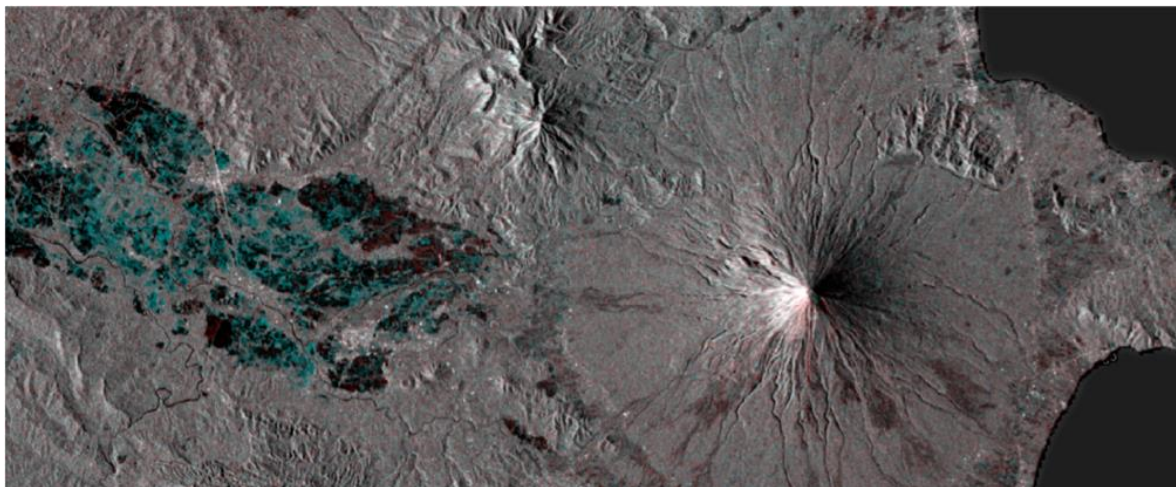


Figure 10. Image composite showing amplitude changes (red: radar signal increase; blue: radar signal decrease) using a pair of Sentinel-1 GRD acquisitions and the SNAC service, over the Mayon volcano in the Philippines. Credits Terradue.

Band combination analysis can be performed using SNAC as follows:

1. Select a S-1 GRD pair of a Charter activation
2. Open the processing services panel and select SNAC service
3. Drag and drop each acquisition in the Master and Slave fields
4. Process and display the resulting amplitude change product
5. The product can be downloaded as GeoTIFF file

A more detailed description of the steps listed above can be found at the following url:

https://terradue.github.io/doc-tep-geohazards-v2/tutorials/rss_snap_s1_snac.html

4.2. Additional post processing service: COIN – Coherence and Intensity chain for Sentinel-1

Additional services that support basic analysis (e.g. change detection) are available on the platform. COIN service is dedicated to open and free Sentinel-1 data. It is another SAR processing service based on SNAP and it is meant for creating geocoded composites of coherence and amplitude images from a pair of Sentinel 1 SLC data (i.e. TOPSAR IW data in complex format). Combining multiple pairs allows the user to perform a SAR based change detection analysis.

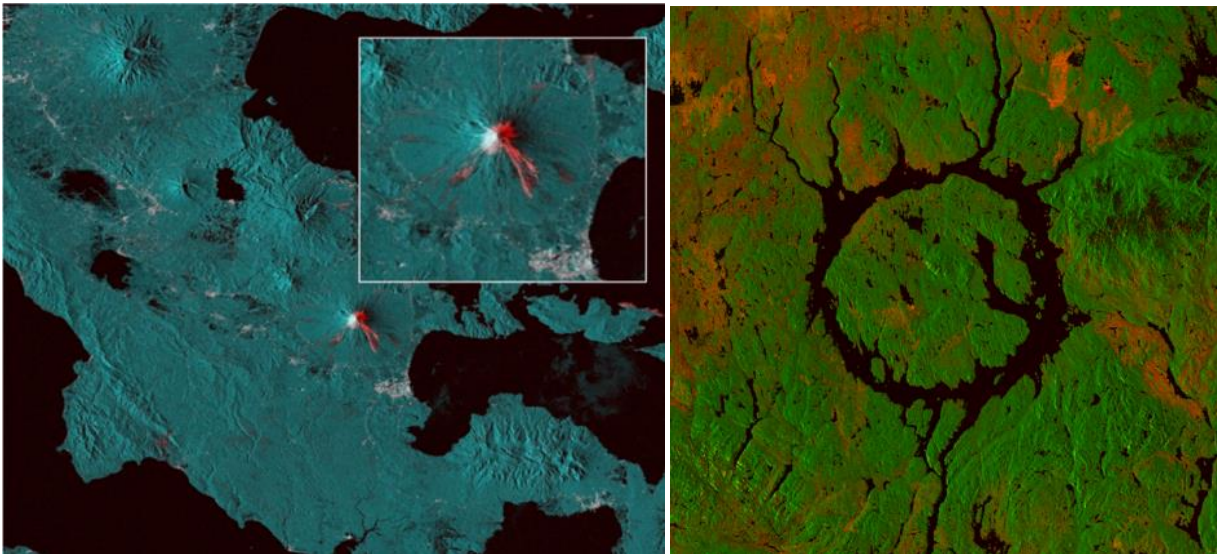


Figure 411. On the left, coherence (red) and amplitude (cyan) image composite using a consecutive pair of Sentinel-1 SLC acquisitions and the COIN service over the Mayon volcano in the Philippines. On the right, same over Lake Manicouagan in Québec, Canada, with a coherence (red) and amplitude (green) image composite generated using COIN. Credits, Terradue.

Band combination analysis can be performed using COIN as follows:

1. Select a S-1 SLC pair of a Charter activation or over a selected AOI
2. Open the processing services panel and select COIN service
3. Drag and drop each acquisition in the Master and Slave fields
4. Process and display the resulting coherence intensity change product
5. The product can be downloaded as GeoTIFF file

A more detailed description of the steps listed above can be found at the following url:

https://terradue.github.io/doc-tep-geohazards-v2/tutorials/rss_snap_s1_coin.html