



# TECHNICAL NOTE

## EO Exploitation Platforms - Use Cases

|                       |                             |
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# 1 INTRODUCTION

## 1.1 Purpose

The scope of this document is to provide a set of use cases for the exploitation of EO Satellite data in Exploitation Platforms. It is relevant for the definition of an Exploitation Platform Architecture.

With EO platform, we describe an on-line system for exploitation of EO satellite data and derived information, including discovery, browse, visualization, processing, analysis of data, development of applications and tools, generation of value-added products and information, sharing, collaboration and training.

Use cases are described in a narrative way, highlighting the expected functionalities of the system. For each use case, a list of steps is provided in Appendix A to further illustrate the use cases.

The process of translation of the use-cases into an architecture is outside the scope of this document.

## 1.2 Document structure

This document is divided into the following sections:

- Section 1, this section, contains is a brief introduction, the definition of terminology and lists common references and acronyms.
- Section 2 describes the use cases object of this document;
- Appendix A provides a list of steps for each use case.

## 1.3 Terminology

The following terms will be used toward this document

| Term        | Meaning  |
|-------------|--|
| Platform    | A collection of on-line services, products and tools for development, support and collaboration offered within a distributed or central approach within a unique portal or project framework |
| Consumer    | User accessing existing services/products within the platform. Consumers may be scientific or commercial, experts of the domain or not   |
| Expert user | User developing and integrating services/products within the platform. It can be divided in two sub categories, scientific developer and value-added provider. The first has as primary      |

|                          |   |
|--------------------------|---|
|                          | objective to perform scientific research, has minimal IT knowledge (and should not spend effort to acquire it), thus requires the effort for the translation of his algorithm into a service/product to be minimised by the platform. The second has as primary objective to provide a performing, stable and reliable service/product, has deeper IT knowledge (or can spend effort to acquire it), thus requires lower-level access to the platform IT functionalities for optimization of his algorithm. |
| Processing service       | An automatic, on-line, non-interactive data processing, which is executed by the user with a pre-defined set of user-specified inputs and produces a pre-defined class of output. Processing service output is usually named processing result  |
| Interactive applications | A stand-alone application which is provided within the platform for on-line hosted processing. It implies a manual (or semi-automatic) analysis of the data. The output exported from an interactive application is usually named analysis result. An interactive application may, in some cases, include an entire Operating System containing a set of accessible sub-applications  |
| On-line analysis tool    | A set of functionalities to analyse interactively satellite data, in-situ data and/or value-added-products. Can provide GIS-like functionalities (e.g. WebGIS), multi-dimensional analysis functionalities (e.g. DataCube), etc...  |
| Value-added products     | Products generated using the platform services or via external processing services which are available on the platform to be discovered and downloaded by platform consumers  |
| Algorithm                | A self-contained step-by-step set of operations to be performed. An algorithm need to be codified in order to be able to be executed within the platform  |
| Software                 | The codification of an algorithm within a binary computer program which can be executed within the platform on-line computing environment   |
| Code                     | The codification of an algorithm performed with a given programming language. It can be compiled to generate a software or directly executed within the platform  |
| Discovery                | The act to look for a service/product within the platform   |
| Execution                | The act to start a processing service or an interactive application   |

|               |   |
|---------------|---|
| Visualization | The act to visualize, in a simple customizable manner the processing results, the products, in-situ data and/or other data within the platform  |
| Processing    | A set of pre-defined activities that interact to achieve a result. Processing considered here is always an on-line processing performed via a processing service execution  |
| Analytics     | A set of activities aimed to discover, interpret and communicate meaningful patterns within the data. Analytics considered here are performed manually (or in a semi-automatic way) on-line with the aid of Interactive applications  |
| Development   | A set of activities aimed at building new products or services to be exposed within the platform. Development may be performed outside the platform or inside. If performed outside, it will require an integration activity (for exposing the developed service within the platform) |

## 1.4 Acronyms and Abbreviations

| Acronym | Meaning                       |
|---------|-------------------------------|
| EO      | Earth Observation             |
| DOI     | Digital Object Identifier     |
| GUI     | Graphical User Interface      |
| HMI     | Human Machine Interface       |
| IAS     | Infrastructure as (a) Service |
| M2M     | Machine to Machine            |
| PAS     | Platform as (a) Service       |
| VNC     | Virtual Network Computing     |

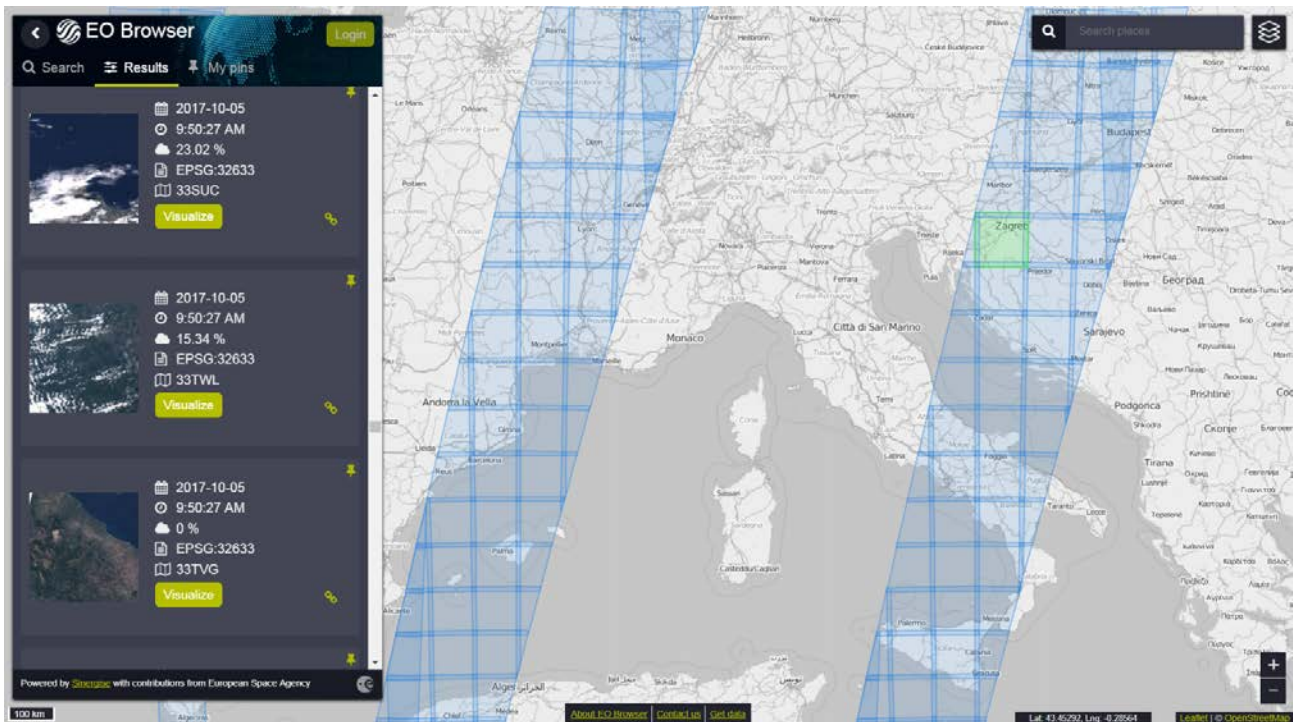
Table 1-1 Acronyms

## 2 USE CASES

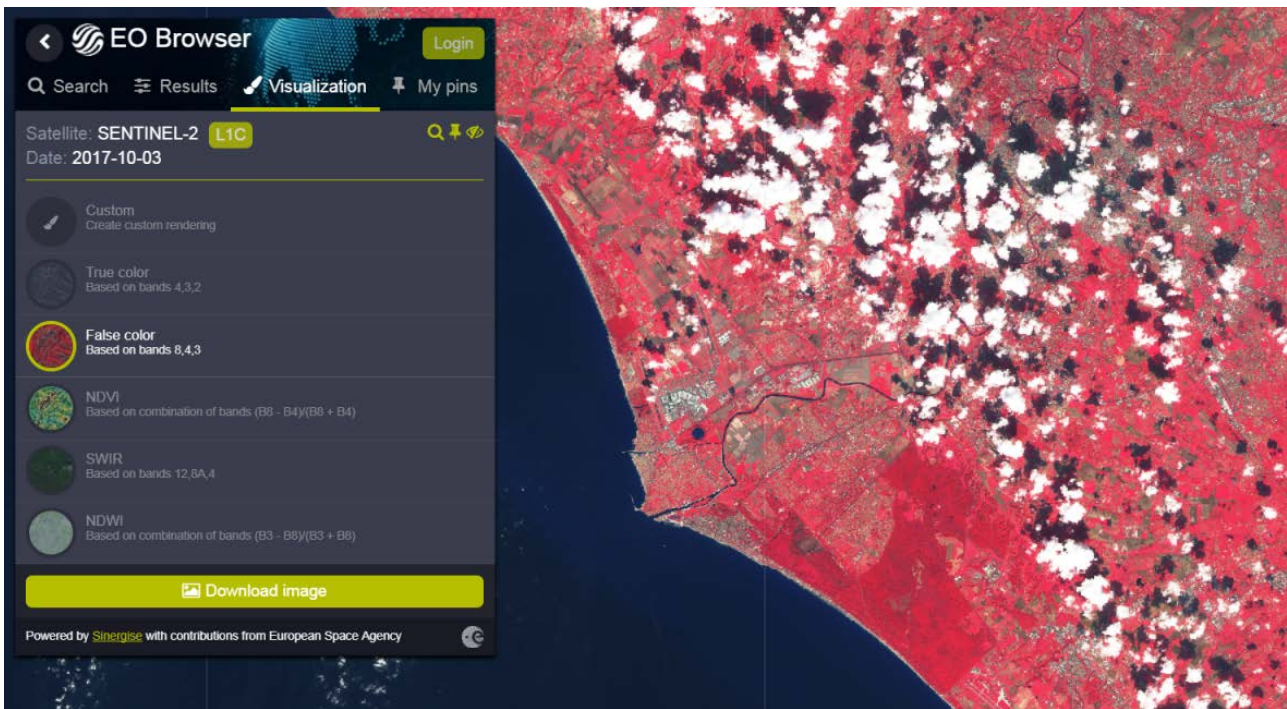
### 2.1 Consumer discovers and visualises value-added products

As a Consumer, I want to list and search for commercial or non-commercial data and/or value-added products satisfying my search criteria, get information about the products access costs, visualize them using custom visualization parameters and, potentially, download them.

An example of implementation of such use case is shown in the following images (from the EOBrowser system, available at <http://apps.eocloud.sentinel-hub.com/eo-browser/>)



**Figure 1** Sample implementation of the “Consumer discovers and visualize value-added products” use-case, showing the discovery of EO data products [sample image taken from <http://apps.eocloud.sentinel-hub.com/eo-browser/>]



**Figure 2** Sample implementation of the “Consumer discovers and visualise value-added products” use case, showing the custom visualization of a Sentinel-2 EO data product [sample image taken from <http://apps.eocloud.sentinel-hub.com/eo-browser/>]

## 2.2 Consumer uploads data into its own workspace.

As a consumer, I want to upload data unavailable in the platform into my workspace, defining target repository and path. Additionally I want to visualize them with the data available in the platform using custom visualization parameters. Optionally I want to publish the added data in the catalogue.

An example of implementation of this case is shown in the following image (from Hydrology TEP system)



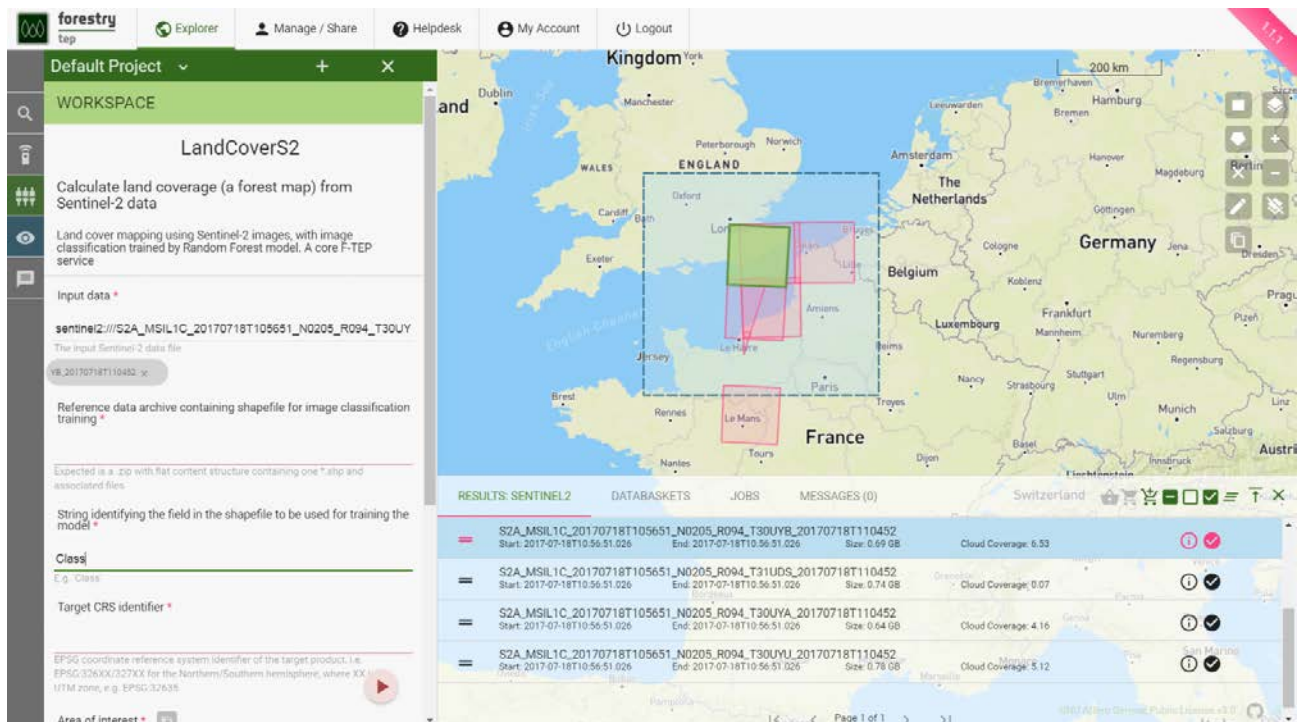
**Figure 3** Sample implementation of the “Consumer uploads data into own workspace” use case, showing the data upload [sample image taken from <http://hydrology-tep.github.io/documentation/quick-start-manual/>]



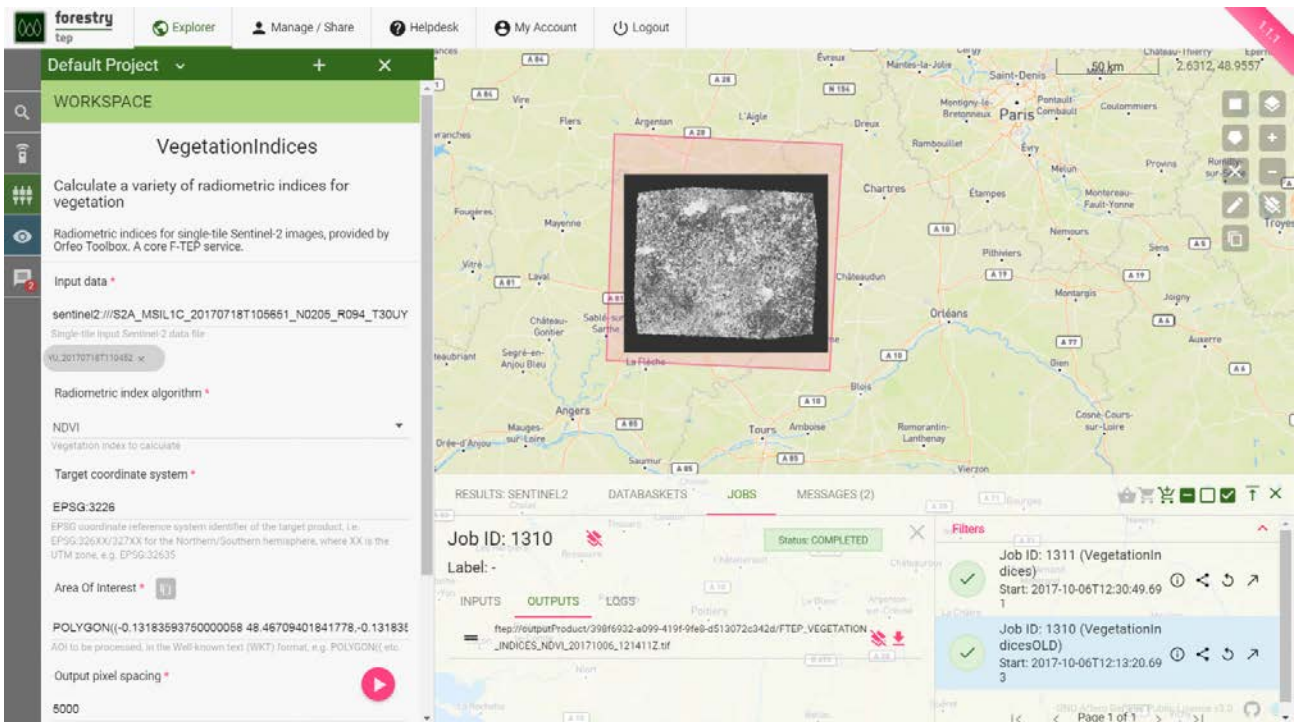
### 2.3 Consumer discovers and executes processing services

As a Consumer, I want to list and search the platform for commercial and non-commercial processing services satisfying my search criteria, read their description and execution manual, specify input data from within and outside the platform, define the processing parameters, get estimation of the execution costs and time and, potentially, execute the processing service and monitor its execution. At the end of the execution, I want to access the processing service results, visualize them using custom visualization parameters and, potentially, download them.

An example of implementation of such case is shown in the following images (from the Forestry TEP system)



**Figure 4** Sample implementation of the “Consumer discovers and executes processing services” use case, showing the discovery of a Sentinel-2 Land Cover processor, the selection of input data and parameters [sample image taken from <http://forestry-tep.eo.esa.int/>]



**Figure 5** Sample implementation of the “Consumer discovers and executes processing services” use case, showing the visualization of the processing results [sample image taken from <http://forestry-tep.eo.esa.int/>]

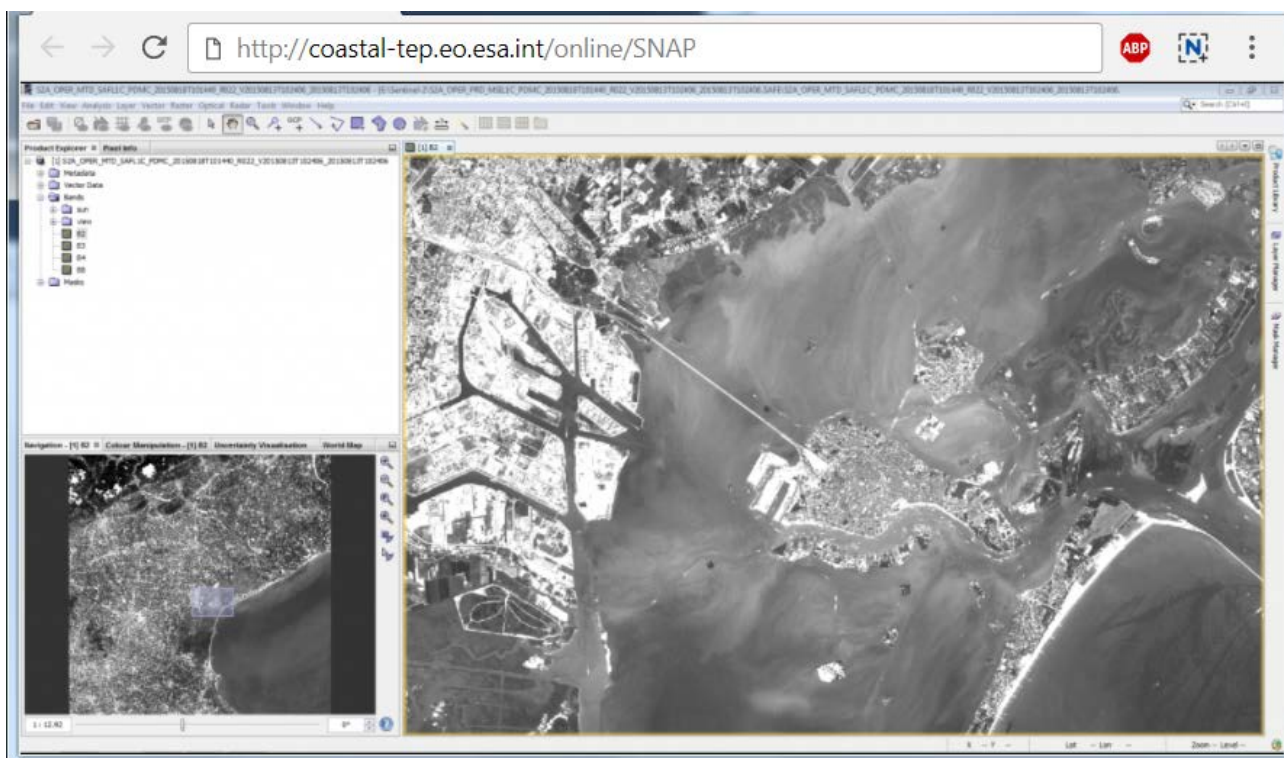
## 2.4 Consumer discovers and executes interactive applications

As a Consumer, I want to list and search the platform for commercial and non-commercial interactive applications satisfying my search criteria, read their description and execution manual, start the application, access the application graphical user interface via my web browser, perform analytics accessing EO data, value-added products and other resources available in or outside the platform, export the results (in the form of text, products, screenshots), visualise and download these results, stop the application.

An example of implementation of such case is shown in the following images (from the Coastal TEP system)



**Figure 6** Sample implementation of the “Consumer executes interactive application” use case, showing the discovery of interactive applications and the start of the SNAP application [sample image taken from <http://coastal-tep.eo.esa.int/>]

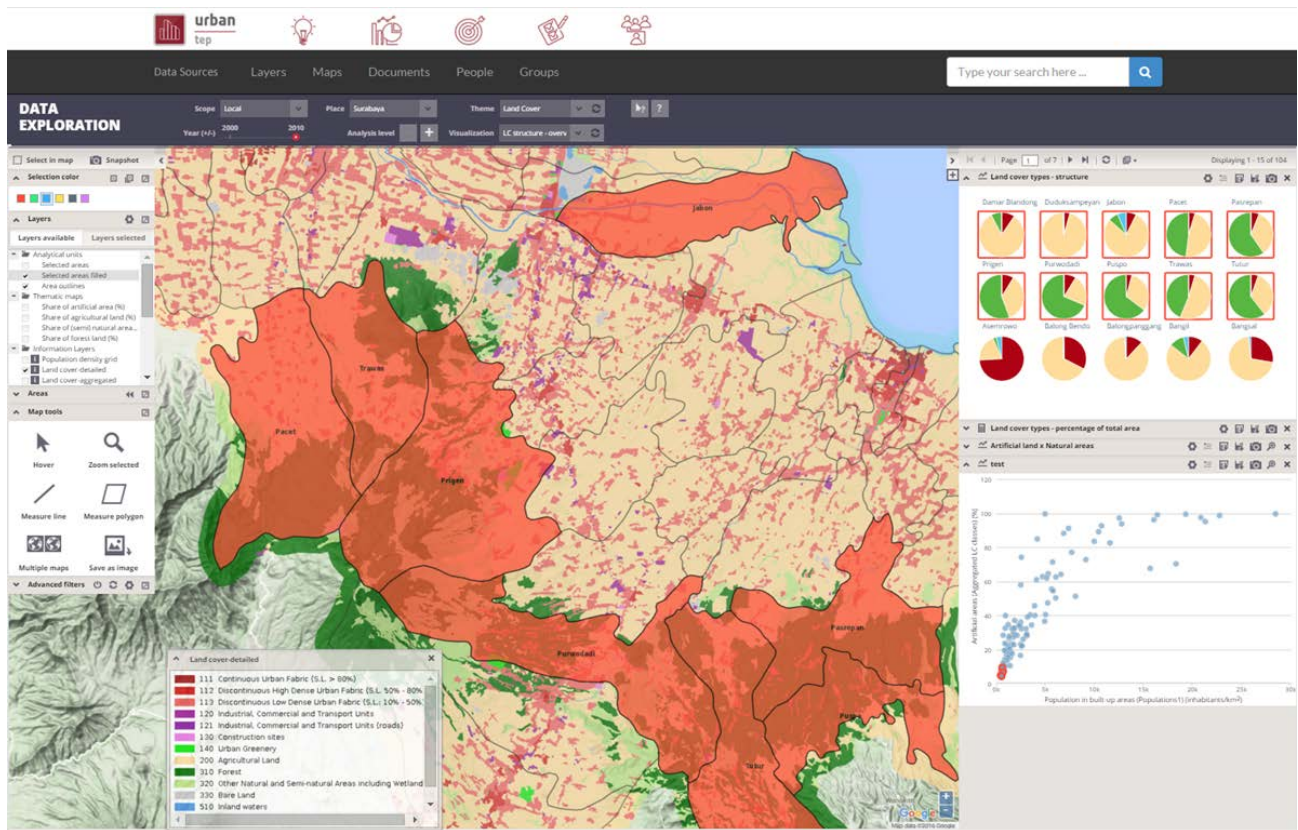


**Figure 7** Sample implementation of the “Consumer executes interactive application” use case, showing the SNAP graphical user interface accessible via the web browser [sample image taken from <http://coastal-tep.eo.esa.int>]

## 2.5 Consumer analyses value-added products

As a Consumer, I want to analyse a product, which can be EO data, results of a processing or value-added products at different, adding ancillary information such as in-situ data, at different scales, available in or outside the platform, using an interactive on-line analysis tool targeted to my specific analysis requirements (e.g. WebGIS, DataCube, etc...).

An example of implementation of such case is shown in the following images (from the Urban TEP system)

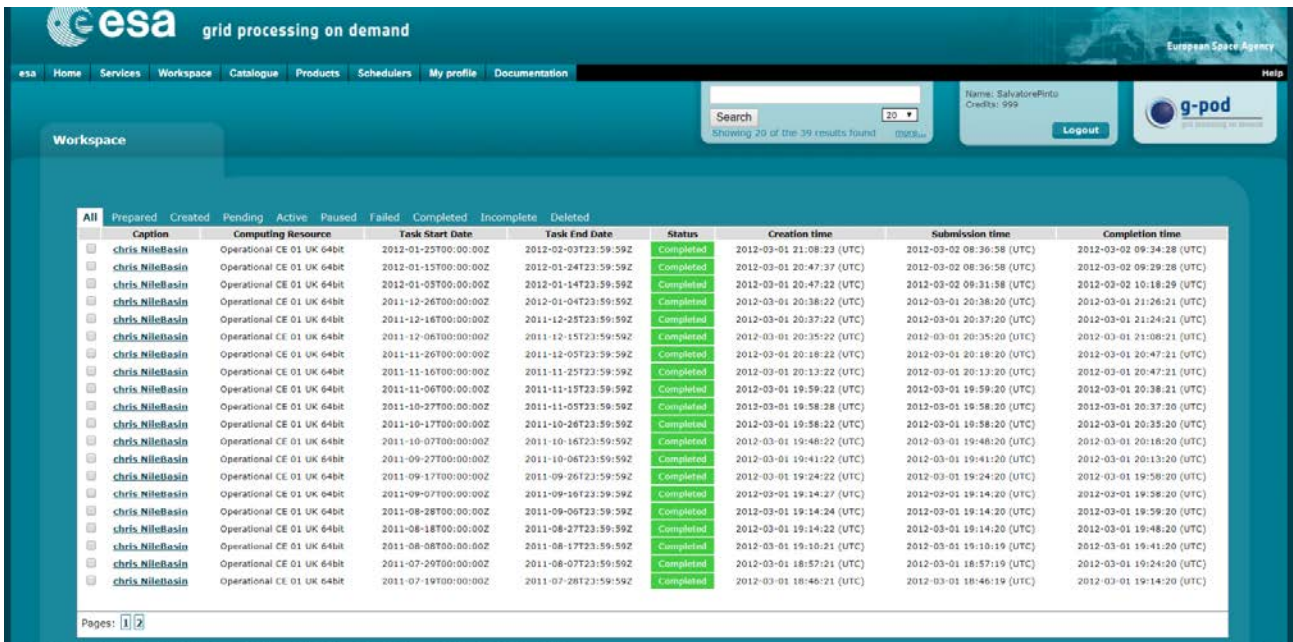


**Figure 8** Sample implementation of the “Consumer analyses value-added products” use case, showing the PUMA WebGIS online analysis tool used to combine value-added products generated by the platform with in-situ data and other ancillary information [sample image taken from <http://urban-tep.eo.esa.int>]

## 2.6 Consumer executes bulk processing

As a Consumer, I want to execute a processing service over a large amount of data, defining groups of data to be processed together (e.g. daily acquisitions, all acquisitions over a given AOI), being able to monitor the status of the processing, being alerted if there is an error in the processing.

An example of implementation of such case is shown in the following images (from the G-POD system)



The screenshot shows the 'Workspace' page of the g-pod system. At the top, there is a navigation menu with 'Home', 'Services', 'Workspace', 'Catalogue', 'Products', 'Schedulers', 'My profile', and 'Documentation'. A search bar is present with the text 'Showing 20 of the 39 results found'. The user's name 'SalvatorePinto' and credit 'Credits: 999' are displayed. A 'Logout' button is also visible.

The main content is a table with the following columns: All, Prepared, Created, Pending, Active, Paused, Failed, Completed, Incomplete, Deleted. The table lists 20 tasks, each with a checkbox, a caption (all 'chris NileBasin'), a computing resource (all 'Operational CE 01 UK 64bit'), task start and end dates, a status (all 'Completed'), creation time, submission time, and completion time.

| All                      | Prepared | Created | Pending | Active | Paused | Failed | Completed | Incomplete | Deleted | Caption         | Computing Resource         | Task Start Date      | Task End Date        | Status    | Creation time             | Submission time           | Completion time           |
|--------------------------|----------|---------|---------|--------|--------|--------|-----------|------------|---------|-----------------|----------------------------|----------------------|----------------------|-----------|---------------------------|---------------------------|---------------------------|
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2012-01-25T00:00:00Z | 2012-02-03T23:59:59Z | Completed | 2012-03-01 21:08:23 (UTC) | 2012-03-02 08:36:58 (UTC) | 2012-03-02 09:34:28 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2012-01-15T00:00:00Z | 2012-01-24T23:59:59Z | Completed | 2012-03-01 20:47:37 (UTC) | 2012-03-02 08:36:58 (UTC) | 2012-03-02 09:29:28 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2012-01-05T00:00:00Z | 2012-01-14T23:59:59Z | Completed | 2012-03-01 20:47:22 (UTC) | 2012-03-02 09:31:58 (UTC) | 2012-03-02 10:18:29 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-12-26T00:00:00Z | 2012-01-04T23:59:59Z | Completed | 2012-03-01 20:38:22 (UTC) | 2012-03-01 20:38:20 (UTC) | 2012-03-01 21:26:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-12-16T00:00:00Z | 2011-12-25T23:59:59Z | Completed | 2012-03-01 20:37:22 (UTC) | 2012-03-01 20:37:20 (UTC) | 2012-03-01 21:24:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-12-06T00:00:00Z | 2011-12-15T23:59:59Z | Completed | 2012-03-01 20:35:22 (UTC) | 2012-03-01 20:35:20 (UTC) | 2012-03-01 21:08:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-11-26T00:00:00Z | 2011-12-05T23:59:59Z | Completed | 2012-03-01 20:18:22 (UTC) | 2012-03-01 20:18:20 (UTC) | 2012-03-01 20:47:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-11-16T00:00:00Z | 2011-11-25T23:59:59Z | Completed | 2012-03-01 20:13:22 (UTC) | 2012-03-01 20:13:20 (UTC) | 2012-03-01 20:47:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-11-06T00:00:00Z | 2011-11-15T23:59:59Z | Completed | 2012-03-01 19:59:22 (UTC) | 2012-03-01 19:59:20 (UTC) | 2012-03-01 20:38:21 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-10-27T00:00:00Z | 2011-11-05T23:59:59Z | Completed | 2012-03-01 19:58:28 (UTC) | 2012-03-01 19:58:20 (UTC) | 2012-03-01 20:37:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-10-17T00:00:00Z | 2011-10-26T23:59:59Z | Completed | 2012-03-01 19:58:22 (UTC) | 2012-03-01 19:58:20 (UTC) | 2012-03-01 20:35:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-10-07T00:00:00Z | 2011-10-16T23:59:59Z | Completed | 2012-03-01 19:48:22 (UTC) | 2012-03-01 19:48:20 (UTC) | 2012-03-01 20:13:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-09-27T00:00:00Z | 2011-10-06T23:59:59Z | Completed | 2012-03-01 19:41:22 (UTC) | 2012-03-01 19:41:20 (UTC) | 2012-03-01 19:58:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-09-17T00:00:00Z | 2011-09-26T23:59:59Z | Completed | 2012-03-01 19:24:22 (UTC) | 2012-03-01 19:24:20 (UTC) | 2012-03-01 19:58:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-09-07T00:00:00Z | 2011-09-16T23:59:59Z | Completed | 2012-03-01 19:14:27 (UTC) | 2012-03-01 19:14:20 (UTC) | 2012-03-01 19:58:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-08-28T00:00:00Z | 2011-09-06T23:59:59Z | Completed | 2012-03-01 19:14:24 (UTC) | 2012-03-01 19:14:20 (UTC) | 2012-03-01 19:58:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-08-18T00:00:00Z | 2011-08-27T23:59:59Z | Completed | 2012-03-01 19:14:22 (UTC) | 2012-03-01 19:14:20 (UTC) | 2012-03-01 19:48:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-08-08T00:00:00Z | 2011-08-17T23:59:59Z | Completed | 2012-03-01 19:10:21 (UTC) | 2012-03-01 19:10:19 (UTC) | 2012-03-01 19:41:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-07-29T00:00:00Z | 2011-08-07T23:59:59Z | Completed | 2012-03-01 18:57:21 (UTC) | 2012-03-01 18:57:19 (UTC) | 2012-03-01 19:24:20 (UTC) |
| <input type="checkbox"/> |          |         |         |        |        |        | Completed |            |         | chris NileBasin | Operational CE 01 UK 64bit | 2011-07-19T00:00:00Z | 2011-07-28T23:59:59Z | Completed | 2012-03-01 18:46:21 (UTC) | 2012-03-01 18:46:19 (UTC) | 2012-03-01 19:14:20 (UTC) |

Figure 9 Sample implementation of the “Consumer executes bulk processing” use case, showing the results of a bulk processing of EO data [sample image taken from <http://gpod.eo.esa.int>]

## 2.7 Consumer executes systematic processing

As a Consumer, I want to setup a processing which will be automatically executed systematically by the platform at a given time (e.g. every day, every first day of the week) for new input data (e.g. new acquisition in the past week) or at triggering of an external event (e.g. earthquake alert triggers).

An example of implementation of such case is shown in the following images (from the G-POD system)

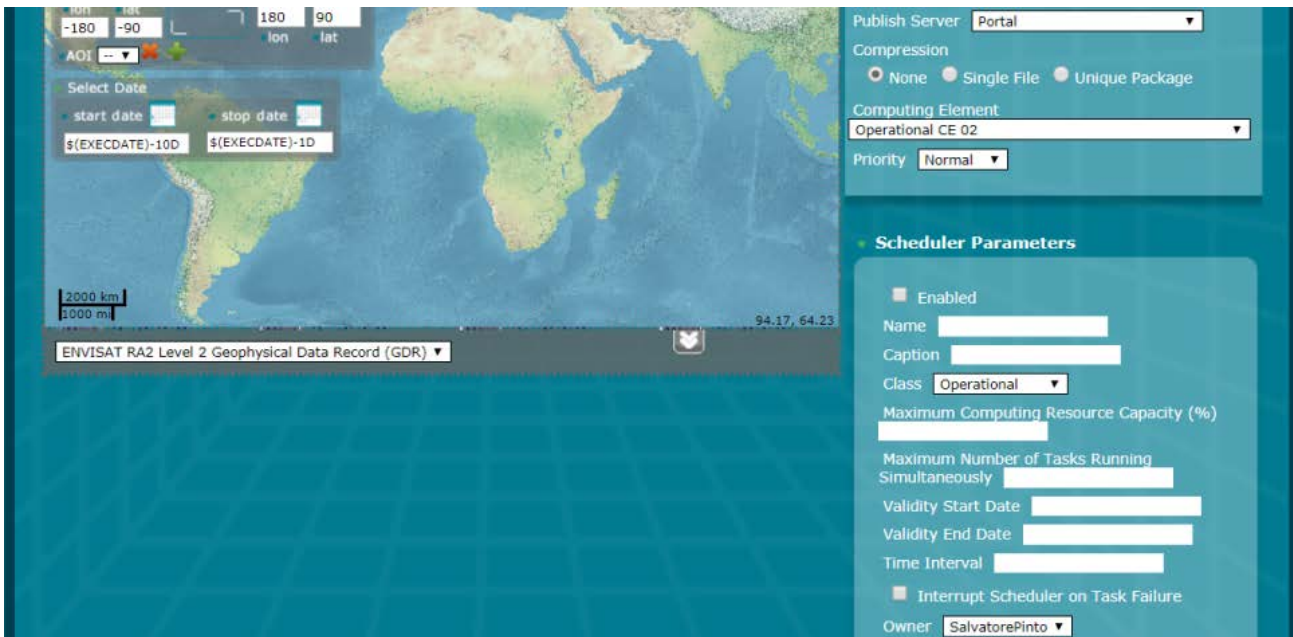


Figure 10 Sample implementation of the “Consumer executes bulk processing” use case, showing the setup of a systematic of EO data [sample image taken from <http://gpod.eo.esa.int>]

## 2.8 Consumer performs open science

As a Consumer, I want to be able to share the results of my processing, link it to a scientific publication, create a reproducible representation of a processing, assign a DOI to it to reference it into my scientific paper.

An example of implementation of such case is shown in the following images (from the GeoHazards TEP system)

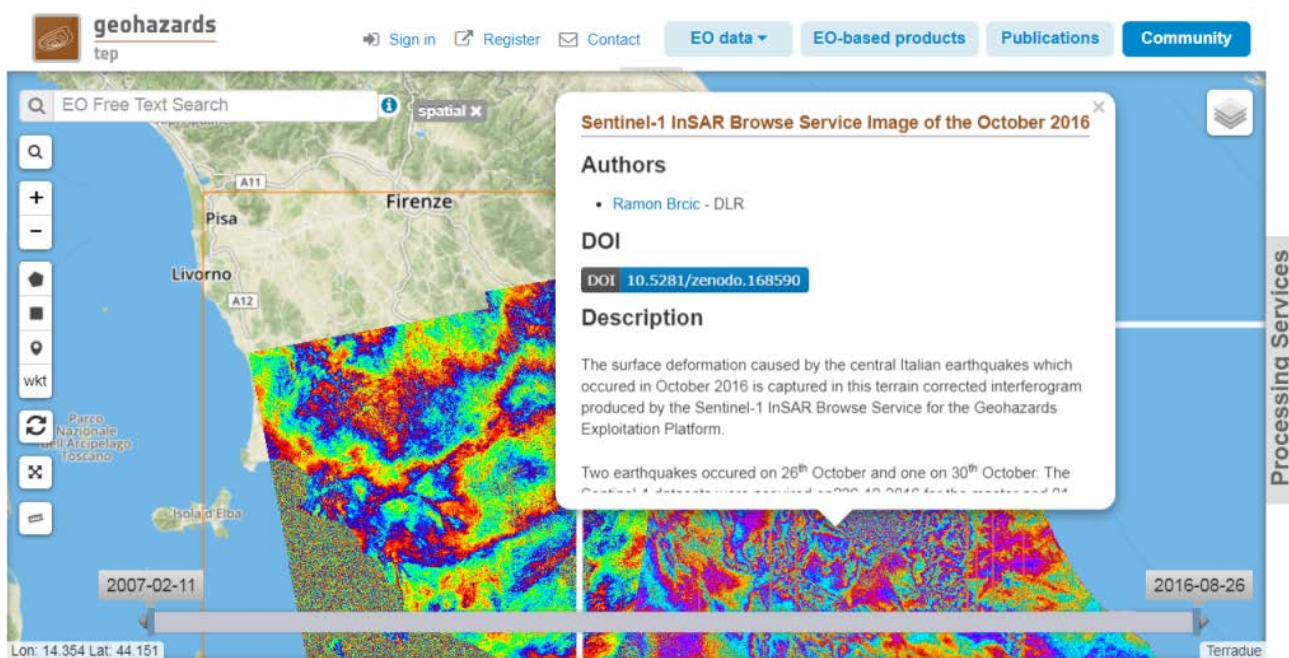


Figure 4 Sample implementation of the “Consumer performs collaboration” use case, showing a published and shared result with its reference to the scientific publication [sample image taken from <http://geohazards-tep.eo.esa.int>]

## 2.9 Consumer accesses the EP with an external application

As a Consumer, I want to be able to use or develop external (e.g. mobile) applications to access programmatically the EP services.

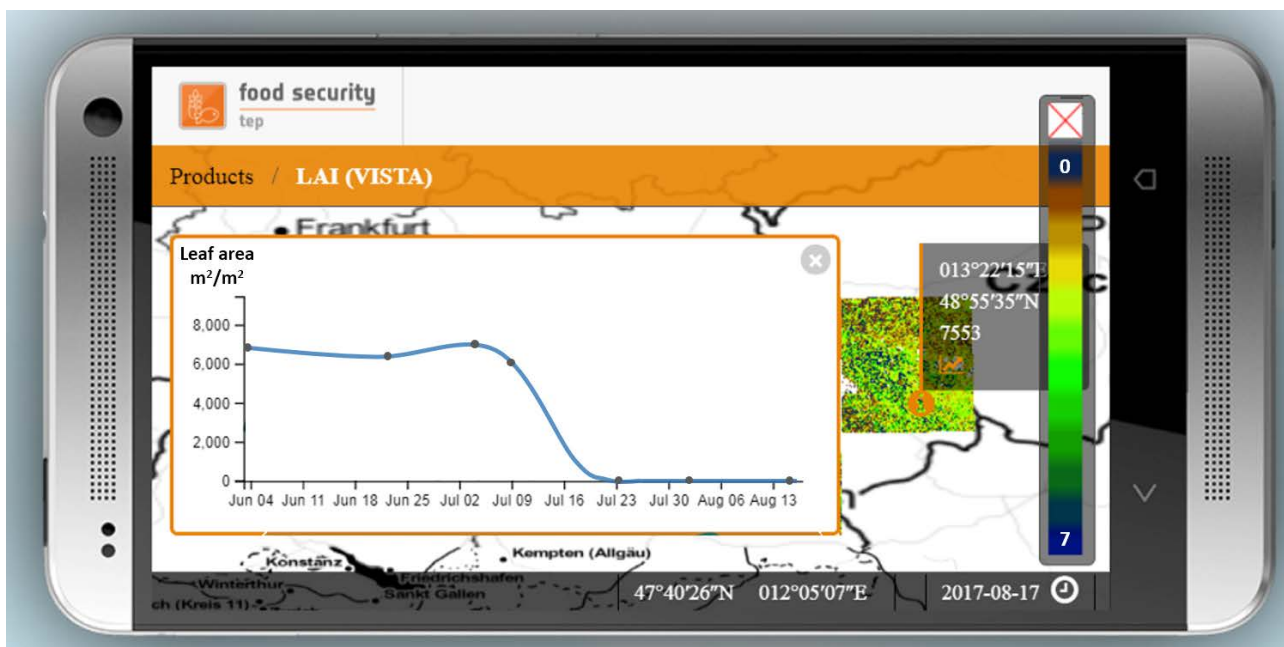
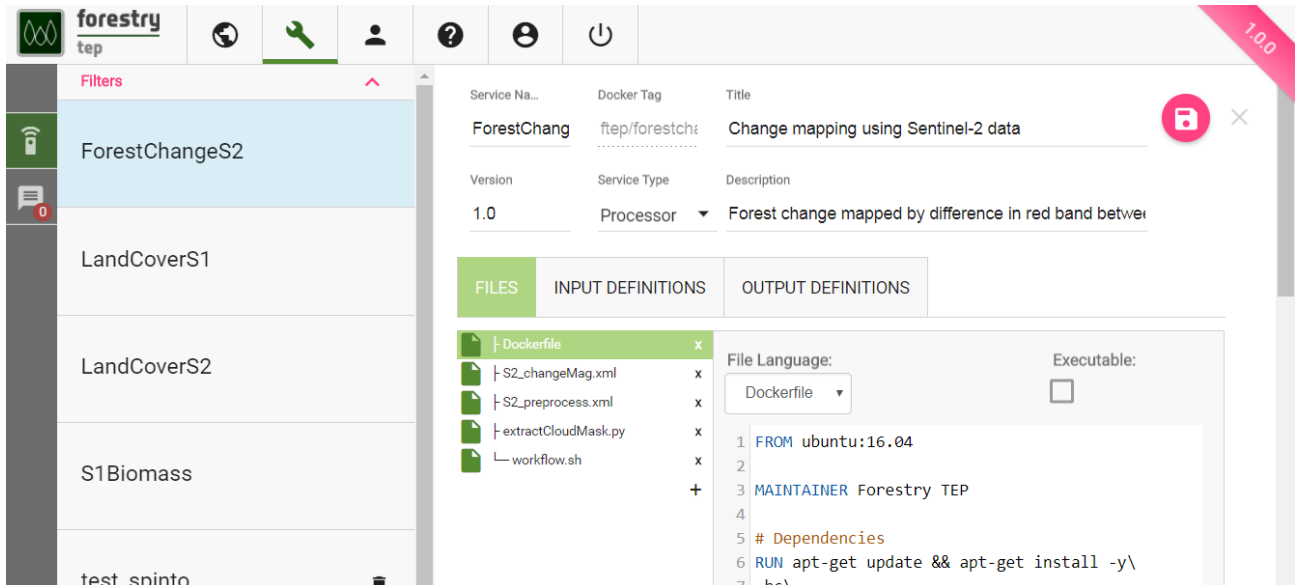


Figure 5 Sample implementation of the "Consumer accesses the EP with an external application" use case, showing a mobile application interfacing with the EP discovery, browse and visualization services [sample image taken from <http://forestry-tep.eo.esa.int>]

## 2.10 Expert user builds new processing services

As an Expert user, I want to integrate my own software into the platform to be exposed as a new processing service. I want to be able to package and deploy the software on the platform, test it in an on-line hosted processing environment, accessing all the required data for the test itself, debug errors, inspect processing logs and then publish the software as a new processing service for me or the Consumers to use.

An example of implementation of such case is shown in the following images (from the Forestry TEP system)



The screenshot displays the 'forestry tep' web interface. On the left, a sidebar lists services: ForestChangeS2 (selected), LandCoverS1, LandCoverS2, S1Biomass, and test\_spinto. The main area shows the configuration for 'ForestChangeS2'. A table lists service details:

| Service Na... | Docker Tag    | Title                                |
|---------------|---------------|--------------------------------------|
| ForestChang   | ftep/forestch | Change mapping using Sentinel-2 data |

Below the table, the 'INPUT DEFINITIONS' tab is active, showing a file explorer with the following files:

- Dockerfile
- S2\_changeMag.xml
- S2\_preprocess.xml
- extractCloudMask.py
- workflow.sh

The 'OUTPUT DEFINITIONS' tab is also visible. The 'File Language' is set to 'Dockerfile'. The code editor shows the following content:

```

1 FROM ubuntu:16.04
2
3 MAINTAINER Forestry TEP
4
5 # Dependencies
6 RUN apt-get update && apt-get install -y\
7 hr\

```

**Figure 6** Sample implementation of the “Expert user builds new processing services” use case, showing the web interface to upload processors, define metadata, create and deploy packages for a new processing service [sample image taken from <http://forestry-tep.eo.esa.int>]

## 2.11 Expert user builds new processing services chains

As an Expert user, I want to chain several processing services, potentially offered by different platforms, in parallel or sequentially, defining the relations, input, output and parameters of each step, and publishing the processing services chain as a new processing service for me or the Consumer to use.

An example of implementation of such case is shown in the following images (from the GeoHazards TEP system)



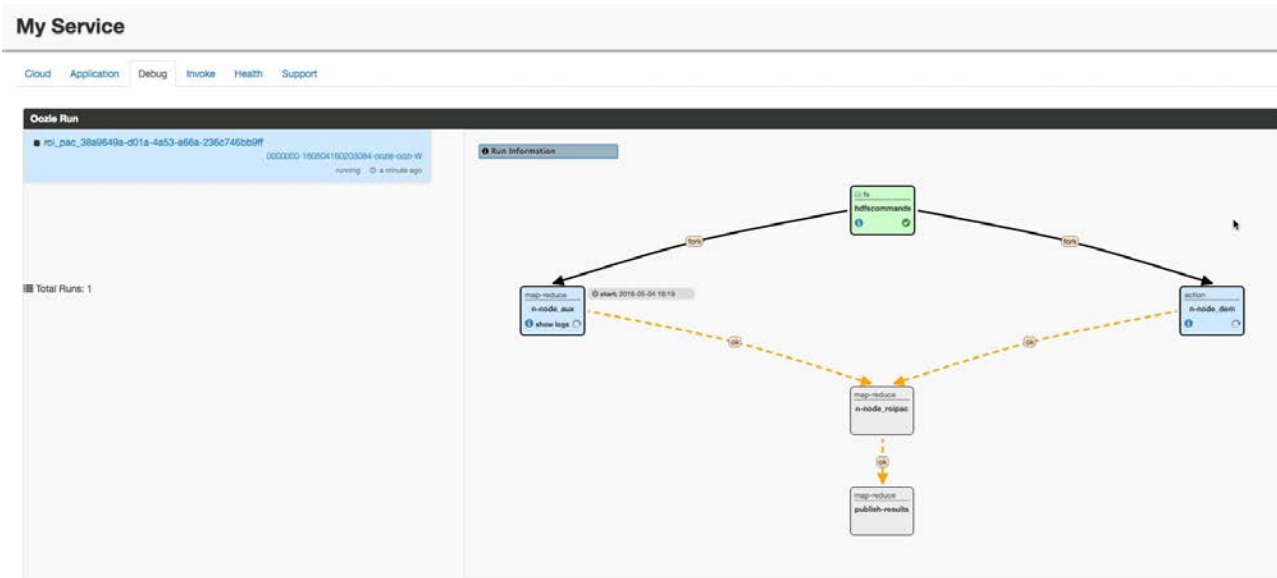


Figure 14 Sample implementation of the “Expert user builds new processing chains” use case, showing the web interface to chain different processors and publish them as a new processing service [sample image taken from <http://geohazards-tep.eo.esa.int>]

## 2.12 Expert user builds new interactive applications

As an Expert user, I want to integrate my own standalone application software into the platform to be exposed as a new interactive application. I want to be able to package, upload and deploy a stand-alone application into the platform, being able to execute it on-line, with access to all the data registered in the platform, test it and then publish it as a new interactive application for the Consumer to use.

An example of implementation of such case is shown in the following images (from the Forestry TEP system)

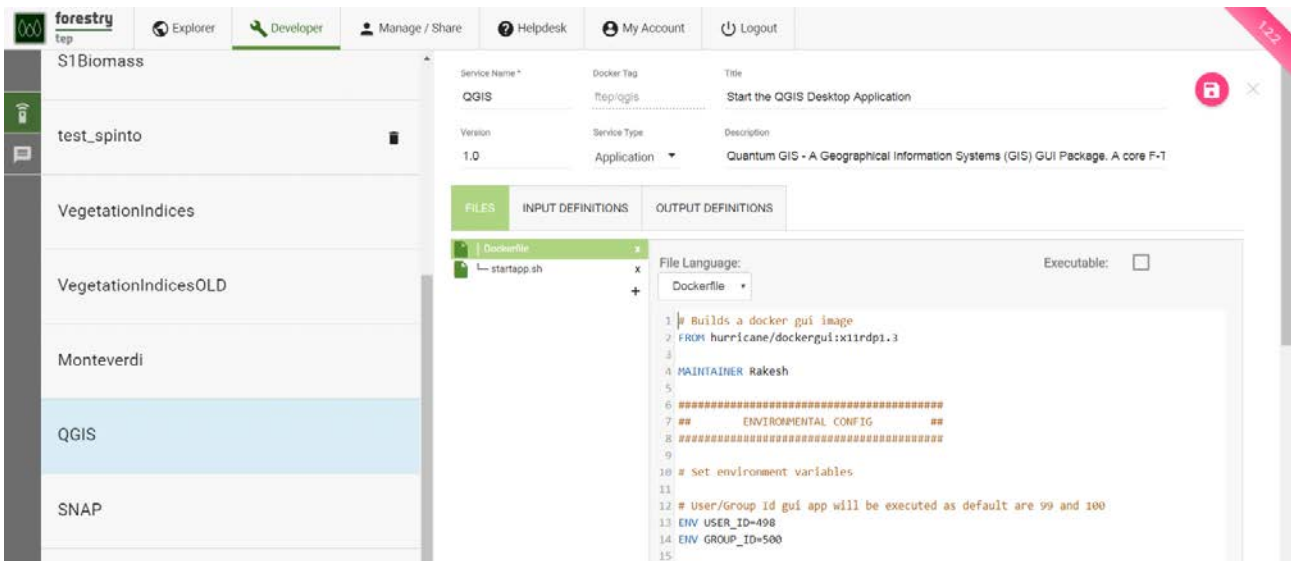


Figure 15 Sample implementation of the “Expert user builds new interactive applications” use case, showing the web interface to upload applications, define metadata, create and deploy packages for a new interactive application [sample image taken from <http://forestry-tep.eo.int>]

### 2.13 Expert user builds new value-added products

As an Expert user, I want to be able to configure and execute a bulk (use case 2.5) or systematic processing (use case 2.6) and publish its results automatically as a new value-added product collection into the platform, for the Consumer to discover and visualise (use case 2.1).

An example of implementation of such case is shown in the following images (from the GeoHazards TEP)

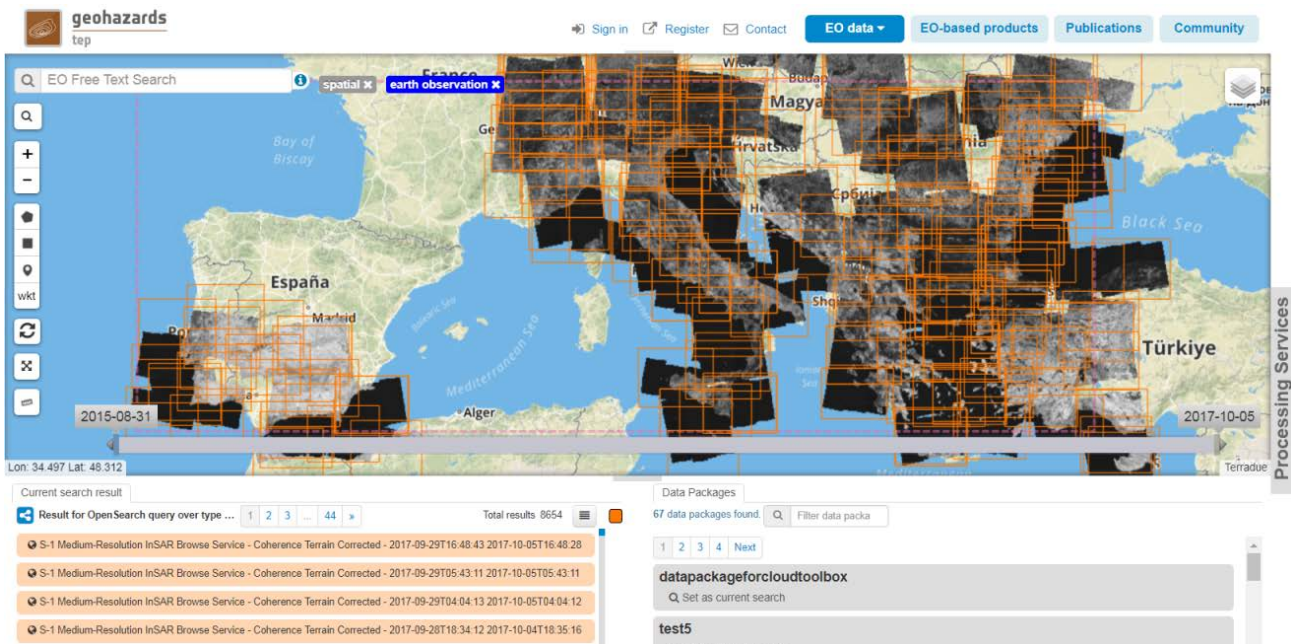


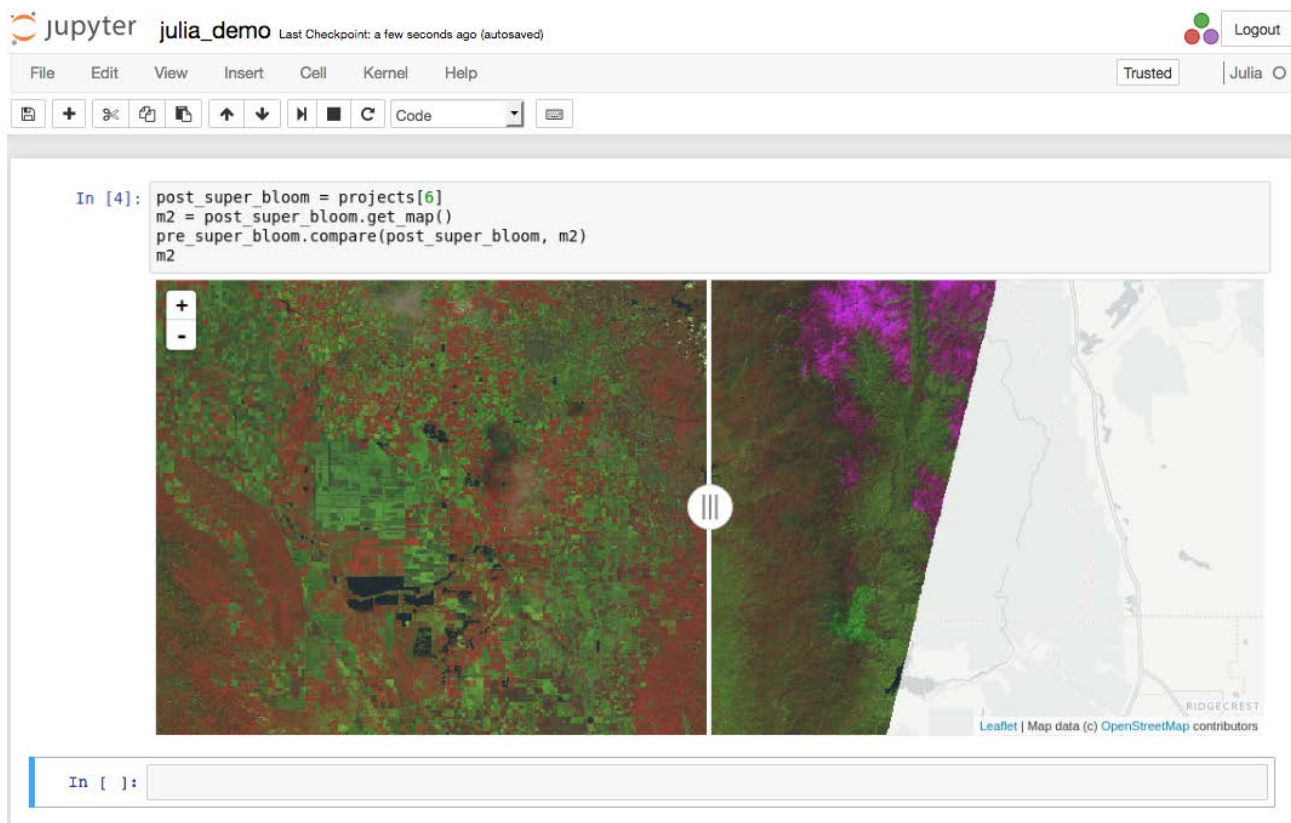
Figure 16 Sample implementation of the “Expert user builds new value-added products” use case, showing the Sentinel-1 InSAR browse products published into the platform and systematically produced

by the platform after each Sentinel-1 acquisition [sample image taken from <http://geohazards-tep.eo.esa.int>]

## 2.14 Expert user develops and executes code via a web development environment

As an Expert user, I want to access an on-line interactive development environment where I can upload my code (written according to my preferred programming language) and execute it in total or step-by-step, to analyse input data, value-added products and other ancillary data. When I upload my code, I want to use a general set of libraries to process and visualise EO data (e.g. SNAP python library) together with specific libraries required by my application (e.g. Tensorflow machine learning library) and libraries to access the other services provided by the platform.

An example of implementation of such case is shown in the following images (as mock-up)

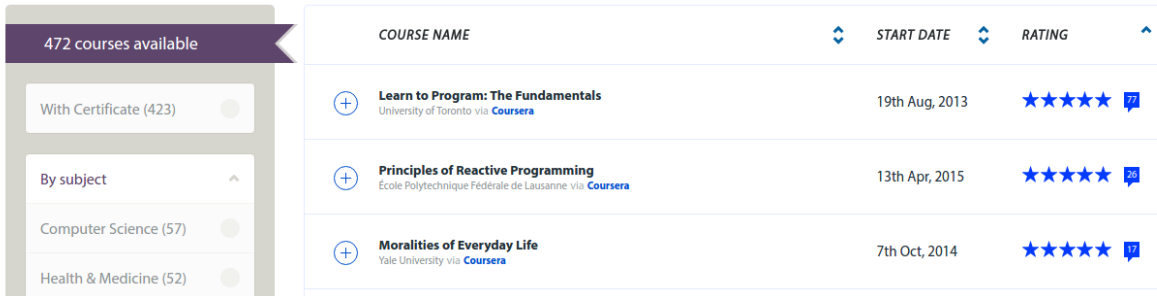


**Figure 17** Sample implementation of the “Expert user develops and executes code via a web development environment” use case, showing processing of sentinel images [mock-up generated with images from <http://rasterfoundry.com>]

## 2.15 Expert user performs training

As an Expert user, I want to be able to share my processing services or interactive applications with a set of Consumers, including tutorials and documentation, to perform live demonstrations, create and stream lessons, webinars, exercise and tests, merge these into on-line courses for the Consumers to attend. As a Consumer, I want to be able to list, discover and attend the on-line courses.

An example of implementation of such case is shown in the following image (as mock-up)



| 472 courses available  |  | COURSE NAME  | START DATE     | RATING |
|------------------------|--|--|----------------|--------|
| With Certificate (423) |  | + Learn to Program: The Fundamentals<br><small>University of Toronto via Coursera</small>                    | 19th Aug, 2013 | ★★★★★  |
| By subject             |  | + Principles of Reactive Programming<br><small>Ecole Polytechnique Fédérale de Lausanne via Coursera</small> | 13th Apr, 2015 | ★★★★★  |
| Computer Science (57)  |  | + Moralities of Everyday Life<br><small>Yale University via Coursera</small>                                 | 7th Oct, 2014  | ★★★★★  |
| Health & Medicine (52) |  |  |                |        |

**Figure 7** Sample implementation of the “Expert user performs training” use case, showing a list of courses [mock-up generated with images from <http://coursera.org>]

## **APPENDIX A USE CASES STEPS**

### Consumer discovers and visualizes value-added products

- a. Consumer logs in on the EP.
- b. Consumer searches for collections of products (commercial and non-commercial EO data and/or value-added products) available into the EP according to some criteria (e.g. a word in collection name, sensor type, data resolution). In case no specific criterion is selected the whole list of processing services is shown.
- c. Consumer selects a specific collection among those returned by the search, which includes only collections for which the customer has the right to visualize them.
- d. Consumer searches within the collection for products matching some criteria (e.g. area of interest time of interests).
- e. Consumer selects the products of interest; the EP checks that the Consumer is authorized to access the product.
- f. Consumer requests cost to access products.
- g. Optionally, the Consumer visualizes the product (using custom visualization parameters)
- h. Optionally, the Consumer downloads the results.

### Consumer uploads data into its own workspace

- a. Consumer logs in on the EP.
- b. Consumer uploads data into its own workspace, defining where data should be saved. EP checks that consumer has the right do to that.
- c. Optionally, consumer visualizes loaded data specifying visualization parameters.
- d. Optionally, consumer publishes data in the catalogue.

### Consumer discovers and executes processing services

- a. Consumer logs in on the EP.
- b. Consumer searches for the processing services available into the EP according to some search criteria. In case no specific criterion is selected the whole list of processing services is shown.
- c. EP returns those matching the search criteria among those the customer is authorized to view.
- d. Consumer selects the processing service of interests; the EP checks that the Consumer is authorized to execute the processing service.
- e. Optionally, consumer accesses the user manual of the processing service to understand its required input data and parameters.
- f. Consumer searches the EP catalogue for data of interest for his area of interest and/or his time of interest and other parameters.
- g. Consumer selects the input data.
- h. Consumer specifies the input parameters of the processing service.
- i. Consumer requests processing execution.



- j. The EP checks that the Consumer has the authorization to launch the processing service and access the specified data.
- k. The EP estimates the cost and duration of the processing and checks that the Consumer has enough resources to execute the processing.
- l. Consumer is presented with the cost and duration estimation and confirms the processing
- m. Consumer monitors the processing for status (e.g. percentage of execution, execution logs) and completion.
- n. When execution is completed, the Consumer lists the processing results.
- o. Optionally, the Consumer visualizes the processing logs (e.g. in case of errors).
- p. Optionally, the Consumer visualizes the results (using custom visualization parameters).
- q. Optionally, the Consumer downloads the results.

#### Consumer discovers and executes interactive applications

- a. Consumer logs in on the EP.
- b. Consumer searches for interactive applications available into the EP according to some search criteria.
- c. EP returns those matching their search criteria among those the customer is authorized to view.
- d. In case no specific criterion is selected the whole list of interactive applications is shown.
- e. Optionally, consumer reads the description and execution manual.
- f. Consumer selects the application of interest.
- g. Consumer searches the EP catalogue for data of interest for the analysis, for his area of interest and/or his time of interests and other parameters.
- h. Consumer selects the input data.
- i. EP checks that the Consumer is authorized to access the data and presents cost indication if applicable.
- j. Consumer accepts and starts the interactive application.
- k. Consumer accesses the application graphical user interface through a web browser.
- l. Customer performs analytics.
- m. Optionally, Consumer accesses additional data (EP will check rights and cost if applicable).
- n. Customer exports analysis results and save it on the EP.
- o. Optionally, the Consumer visualizes the results (using custom visualization parameters).
- p. Optionally, the Consumer downloads the results.

#### Consumer analyses value-added products

- a. Consumer logs in on the EP.
- b. Consumer searches for analytic tools.
- c. EP returns those matching their search criteria among those the customer is authorized to view.
- d. Consumer selects and accesses analytic tools of interest. EP checks that Consumer is authorized to use these tools.



- e. Consumer searches the commercial and non-commercial EO data, processing and/or value-added products available into the EP. EP returns those matching the search criteria among those the customer is authorized to view.
- f. Consumer selects products of interest for his area of interest and/or his time of interests and other parameters. EP checks that the Consumer is authorized to access the product.
- g. Optionally, Consumer adds ancillary information available in or outside the platform; EP checks that the Consumer is authorized to access the data.
- h. Consumer performs specific analysis, using the interactive on-line analysis tool functionalities.
- i. Optionally, Customer exports analysis results.
- j. Optionally, the Consumer downloads the exported analysis results.

### Consumer executes bulk processing

- a. Consumer logs in on the EP.
- b. Consumer lists the processing services available into the EP.
- c. Consumer searches for the processing service of interest.
- d. Consumer selects the processing service of interest; the EP checks that the Consumer is authorized to access the processing service.
- e. Optionally, consumer accesses the user manual of the processing service to understand its required input data and parameters.
- f. Consumer defines groups of input data to be processed (by a search to the EP catalogue to define data of interest). EP checks that the Consumer is authorized to access the data.
- g. Consumer specifies the input parameters of the processing service.
- h. Optionally, the Consumer defines a collection of data to which the results have to be included.
- i. Consumer requests estimation of cost to access and process data, and overall duration of the bulk processing. The EP checks that the Consumer has enough resources to execute the bulk processing.
- j. Consumer executes the bulk processing.
- k. EP splits the bulk-processing request into several processing services executions for the groups of input data.
- l. EP checks for errors during the processing. If they occur consumer is alerted.
- m. Consumer monitors the processing for status (e.g. percentage of execution, execution logs) and completion, for the overall bulk processing and optionally for each one of the processing services execution.
- n. When bulk execution is completed, EP notifies the completion of the bulk processing.
- o. Consumer lists the processing results.
- p. Optionally, the Consumer visualizes the processing logs (e.g. in case of errors).
- q. Optionally, the Consumer visualizes the results (using custom visualization parameters).
- r. Optionally, the Consumer downloads the results.
- s. Optionally, the results are included in the collection of the EP.

### Consumer executes systematic processing.

- a. Consumer logs in on the EP.
- b. Consumer lists the processing services available into the EP.
- c. Consumer searches for the processing service of interest.
- d. Consumer selects the processing service of interest; the EP checks that the Consumer is authorized to access the processing service.
- e. Optionally, consumer accesses the user manual of the processing service to understand its required input data and parameters.
- f. Consumer defines groups of input data to be processed (by a search to the EP catalogue to define data of interest). EP checks that the Consumer is authorized to access the data.
- g. Consumer defines the periodicity of the processing (given time, new input data or triggered by external event).
- h. Consumer specifies the input parameters of the processing service.
- i. Optionally, the Consumer defines a collection of data to which the results have to be included.
- j. Consumer requests estimation of future costs per run.
- k. Consumer sets up the systematic processing.
- l. EP checks that the Consumer has enough resources to execute the foreseen processing service. If resources are not enough, the EP alerts consumer.
- m. EP executes processing services according to the defined periodicity.
- n. EP checks for errors during the processing. If they occur consumer is alerted.
- o. Consumer monitors the processing for status (e.g. percentage of execution, execution logs) and completion, for the overall systematic processing and optionally for each one of the processing services executions.
- p. Optionally, EP notifies the completion of each processing execution.
- q. Consumer lists the processing results.
- r. Optionally, the Consumer visualizes the processing logs (e.g. in case of errors).
- s. Optionally, the Consumer visualizes the results (using custom visualization parameters).
- t. Optionally, the Consumer downloads the results.
- u. Optionally, the results are included in the collection of the EP.

### Consumer performs open science.

- a. Consumer logs in on the EP.
- b. Consumer selects items (e.g. data, processing services, processing results) to be shared with the community.
- c. EP verifies that Consumer has right to share item (e.g. is the owner).
- d. Consumer lists the collaborative options (share processing results, link to scientific publication, create reproducible representation of a processing...).
- e. Consumer selects collaborative option.
- f. Consumer specifies collaborators and their access rights (e.g. read only for a group, write for a given user, public access to everybody...).
- g. The EP generates a reference to the shared item.
- h. Optionally, collaborations are automatically notified of the sharing of the item.





- i. Optionally, Consumer publishes the reference to the shared item to an external system.
- j. Collaborators access the shared item. EP verifies authorization of access request.

#### Consumer accesses the EP services with an external application

- a. Consumer logs in on the EP via an external application, via a delegated authentication mechanism.
- b. The external application lists and executes the EP services on behalf of the user via a programmable interface (e.g. API).

#### Expert user builds new processing services.

- a. Expert user logs in on the EP.
- b. Expert user accesses local or remote development environment.
- c. Expert user packages the SW into a non-interactive application package following a given standard.
- d. Expert user deploys the package on the platform, creating a new test processing service. EP checks that Expert user is authorized to do so.
- e. Expert user tests processing services execution (as per Consumer discovery and execute processing services use case).
- f. The EP checks for errors during the processing. If they occur consumer can modify the software, package and upload it and re-test it.
- g. When processing service is stable, Expert user publishes the software as a new processing service.
- h. EP verifies the software for adherence to EP terms and conditions, checks that the Expert user is authorized to publish the processing service.
- i. EP includes the processing service in the list of processing services.
- j. Optionally, EP notifies Consumers about the new service.

#### Expert user builds new processing chains.

- a. Expert user logs in on the EP.
- b. Expert user lists processing services from the platform.
- c. Expert user chooses processing services to be chained. EP checks that Expert user is authorized to use those processing services.
- d. Expert user defines new processing chain, defining all aspects of the new chain including steps parallelization, input/output parameters of each step of the processing chain.
- e. Optionally, Expert user tests processing chain execution (as per Consumer discovery and execute processing services use case, for each processing service included in the chain).
- f. Expert user publishes the new processing chain as a new processing service; the EP checks that the Expert user is authorized to publish the processing chain.
- g. EP includes the processing service in the list of processing services.
- h. Optionally, EP notifies Consumers about the new service.

### Expert user builds new interactive application

- a. Expert user logs in on the EP.
- b. Expert user accesses local or remote development environment.
- c. Expert user packages the SW into an interactive application package following a given standard.
- d. Expert user deploys the package on the platform, creating a new test interactive application. EP checks that Expert user is authorized to do so.
- e. Expert user tests interactive application services execution (as per Consumer discovery and execute interactive application use case).
- f. The EP checks for errors during the processing. If they occur consumer can modify the software, package and upload it and re-test it.
- g. When processing service is stable, Expert user publishes the software as a new interactive application.
- h. EP verifies the software for adherence to EP terms and conditions, checks that the Expert user is authorized to publish the interactive application.
- i. EP includes the processing service in the list of interactive application.
- j. Optionally, EP notifies Consumers about the new interactive application.

### Expert user builds new value-added products

- a. Expert user logs in on the EP.
- b. Expert user defines a product collection, including description of the product, basic metadata and other information.
- c. Expert user selects a bulk or systematic processing (defined in the Consumer executes bulk processing and Consumer executes systematic processing use cases).
- d. Expert user configures the bulk or systematic processing to publish data into the defined product collection. EP checks user is authorized to access results of the bulk or systematic processing.
- e. EP publishes results automatically once processing is over, and includes the new value-added product in the list of value-added product collections.

### Expert user develops and executes code via a web development environment

- a. Expert user logs in on the EP.
- b. Expert user accesses on-line interactive development environment. EP checks that Expert user is authorized to do so.
- c. Expert user develops and/or uploads code. NOTE: EP provides access to libraries (general, specific and from other services, including libraries to select and access data), according to Expert User rights.
- d. Expert User executes code in total or step-by-step basis to perform his analysis.
- e. Optionally, Expert User saves developments (code) and/or processing results in their private environment.
- f. Optionally, Expert User downloads the saved processing results.



Expert user performs training.

- a. Expert user logs on the EP.
- b. Expert user accesses training environment.
- c. Expert user defines on-line courses. EP checks that Expert user has the authorization to define them and includes new courses on the list.
- d. Expert user defines items to share for the training: processing services, interactive applications, tutorials and documentation.
- e. Consumer lists and discovers on-line courses.
- f. Consumer asks to attend online course. Expert user and EP provide access.
- g. Consumer accesses training environment defined by Expert User (including shared training items). EP checks that Consumer is authorized to do so.
- h. Expert user performs training according to different options defined: live demonstration, online courses, webinars...

Note: all the use cases described shall be extended in a context of platforms federation in which services and data on any platform can be accessed from any other platform in the federation.