COPSI

SOFTWARE USER MANUAL

Role/Title	Name	Signature	Date
Author	COPSI Team		14/07/2023
Verified/Approved	COPSI Team		14/07/2023

Change Register

Version/Rev.	Date	Change	Reason
1.0.0	22/12/2022	All	First Release
1.0.1	31/01/2023	5.3	Updated description related to product download
1.1.0	24/02/2023	4.2, 5.1, 5.2, 5.3	Added advanced search
2.0.0	14/04/2023	4.2, 5.3, 5.4, 5.5	Added products detail panel, geographic search, footprints customization and user edit buttons
3.0.0	14/07/2023	4.2, 5.2, 5.5, 5.6	Added multiple products details panels, customized layer switcher and OData filter builder, with multiple filter selection

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1. Introduction

The Copernicus Space Component Interface (*COPSI*) copes with the needs of having a GUI for discovering and visualizing Sentinels products disseminated by CSC services. Examples of CSC are the LTA, the PRIP or the DAS.

1.1. Purpose and Scope

This document is a comprehensive guide of the Copernicus Space Interface (*COPSI*) and provides help for interpreting the information presented. This document has been prepared in the frame of the Collaborative Data Hub Software Maintenance and Evolution Services for Digital Twin Earth (*hereinafter referred to as the "Service"*). This document applies to COPSI version 1.0.0.

The overall structure of the document is described below:

- Chapter 1 is an introduction with reference and applicable documents.
- Chapter 2 contains an application overview.
- Chapter 3 explains the concepts behind COPSI.
- Chapter 4 contains the getting started section.
- Chapter 5 describes in detail the application usage.

1.2. Applicable and Reference Documents

ID	Document Title	Reference	Issue
AD-1.	Statement of Work: Collaborative Data Hub Software - Maintenance and Evolution Services - Ready for Digital Twin Earth	ESA-EOPG-EOPGC-SOW-12	1.0
AD-2.	Collaborative Data Hub Software - Maintenance and Evolution Services - Ready for Digital Twin Earth - System Requirements Specification (SRS)	COPE-SERCO-RD-21-1177	3.0

Table 1 Applicable documents

ID	Document Title	Reference	Issue
RD-1.	DHS Operational Concept Document	COPE-SERCO-TN-21-1174	
RD-2.	COPSI System Design Document	ALIA-COPSI-SDD-22-0001 COSPI System Design Document	1.0

RD-3.	COPSI Installation and Configuration Manual	ALIA-COPSI-ICM-2022-0001_Installation_and_Configuration_Manual	3.0.0
RD-4.	Collaborative Data Hub Software - Maintenance and Evolution Services - Ready for Digital Twin Earth - System Requirements Specification (SRS)	COPE-SERCO-TN-21-1171	1.0
RD-5.	CSC Data Access Interface Control Document	ESA-EOPG-EOPGC-IF-4	1.3

Table 2 Reference documents

1.3. Acronyms

Acronym	Description
API	Application Programming Interface
CPU	Central Processing Unit
COPSI	Copernicus Space Component Interface
DHS	Data Hub Software
DHR	Data Hub Relay
DHuS	Data Hub Service
EO	Earth Observation
ESA	European Space Agency
HTTP	Hyper Text Transfer Protocol
IDP	Identity Provider
JSON	JavaScript Object Notation
RAM	Random Access Memory
TCP	Transmission Control Protocol
URL	Uniform Resource Locator
VM	Virtual Machine

2. Application Overview

The Copernicus Space Component Interface (COPSI) meets the needs of having a brand-new web-based Front-End for the Copernicus Space Component services (i.e., LTA, PRIP, DAS), that, thanks to the ESA's effort to standardize the Copernicus Space Components ICDs, expose analogous APIs for Sentinel products discovery and download.
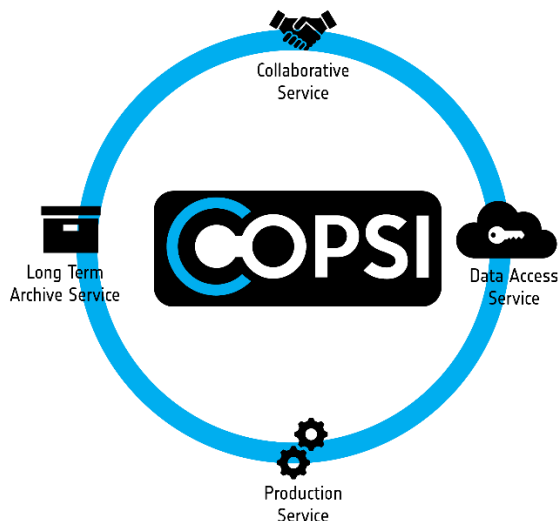

Figure 1 - COPSI Concept

COPSI is based on Angular, a platform and framework for building single-page client applications using HTML and TypeScript.
The basic building blocks of an Angular application are the components, organized into *modules*. Components define *views*, graphical elements that the application can choose and modify according to program logic and data.
Components use *services*, which provide specific functionality not directly related to views. Service providers can be injected into components, making the code modular, reusable, and efficient.
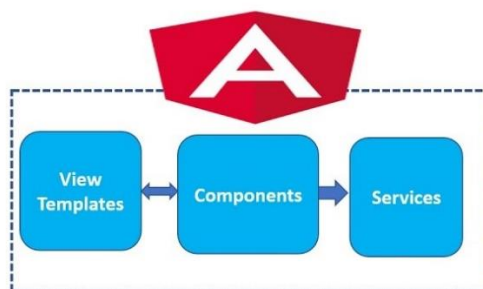
Figure 2 - Basic Angular architecture

The main goal of COPSI is to provide an instrument to the user to search, visualize and download the Copernicus Sentinels products. For this reason, its design is based on the following principles:

- Modern: this is achieved taking inspiration from the most popular, used and trendy applications.
- Clean: this implies avoiding the usage of graphical elements not associated with functionalities needed by the application.
- Intuitive: users should be able to use COPSI without reading any manual.

COPSI is free and open source, in line with the Collaborative DHS recommendation to offer a service to the community and take advantage of feedback and contribution coming from the users.

3. Concepts

COPSI main concepts are:

- **Identity**: COPSI is the Graphical User Interface for Copernicus Space Component sharing analogous ICDs. It was born to provide users an easy and intuitive way to access Copernicus data.
- **Centralized User Management**: COPSI access is regulated by the Collaborative DHS IAM. There is no need to add a specific client for COPSI, since it uses the client configured for the relevant CSC OData Server.
- **Product Discovery, Visualization and Download**: COPSI main feature is the possibility of performing an OData search of the products collected in the associated CSC service. The products that are found are listed as human readable items as well as graphically, in the map, as geometric footprints. User can download the requested products, simply by clicking on the dedicated button.

4. Getting Started

This section describes the first steps in the COPSI application: how to access and navigate between panels and a general description of the graphical user interface.

4.1. Accessing COPSI

COPSI is a web application and is accessible from the web browser. It can be installed on a local VM, or it can be hosted on a web server (Please refer to RD-3 for installation details). First time the user reaches the application URL, or, in general, if there is no authenticated session stored in the browser, a modal covers the app, suggesting the user to sign in to use COPSI.
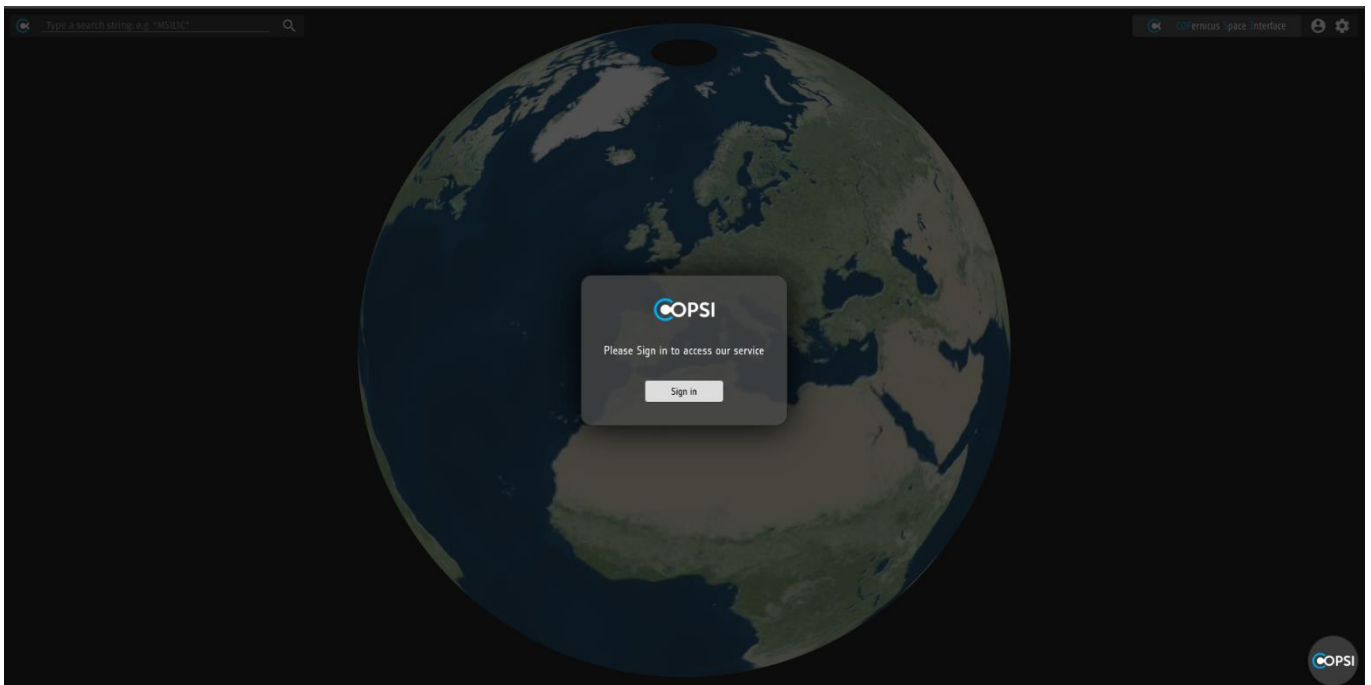

Figure 3 - Login dialog

The user will be redirected to the Sign In page of an external authentication service to supply the needed credentials.

COPSI supports the OIDC protocol (OpenID Connect with OAuth2) and it is well proven to work with the open source service Keycloak.

If the Keycloak authentication realm is configured to do so, the user can create a new account and recover a forgotten password directly from the authentication page.
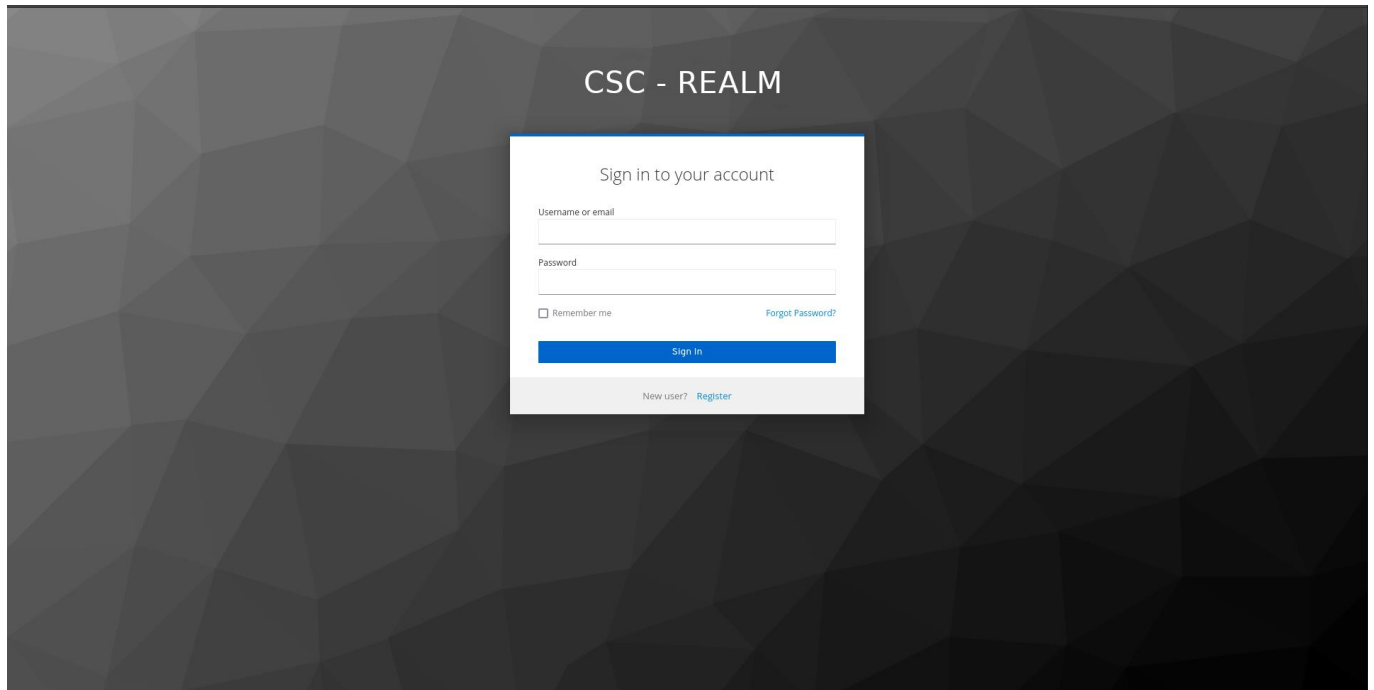

Figure 4 - Keycloak Sign-In dialog

If the login credentials are correct, the user will be redirected to the fully functional COPSI home page.

Figure 5 - COPSI home page

4.2.   Structure of COSPI

COPSI consist of one main page containing the following elements:

- Search Bar
- Menu Bar
  - o Centre Information
  - o User Information
  - o Map Settings
- Map Area
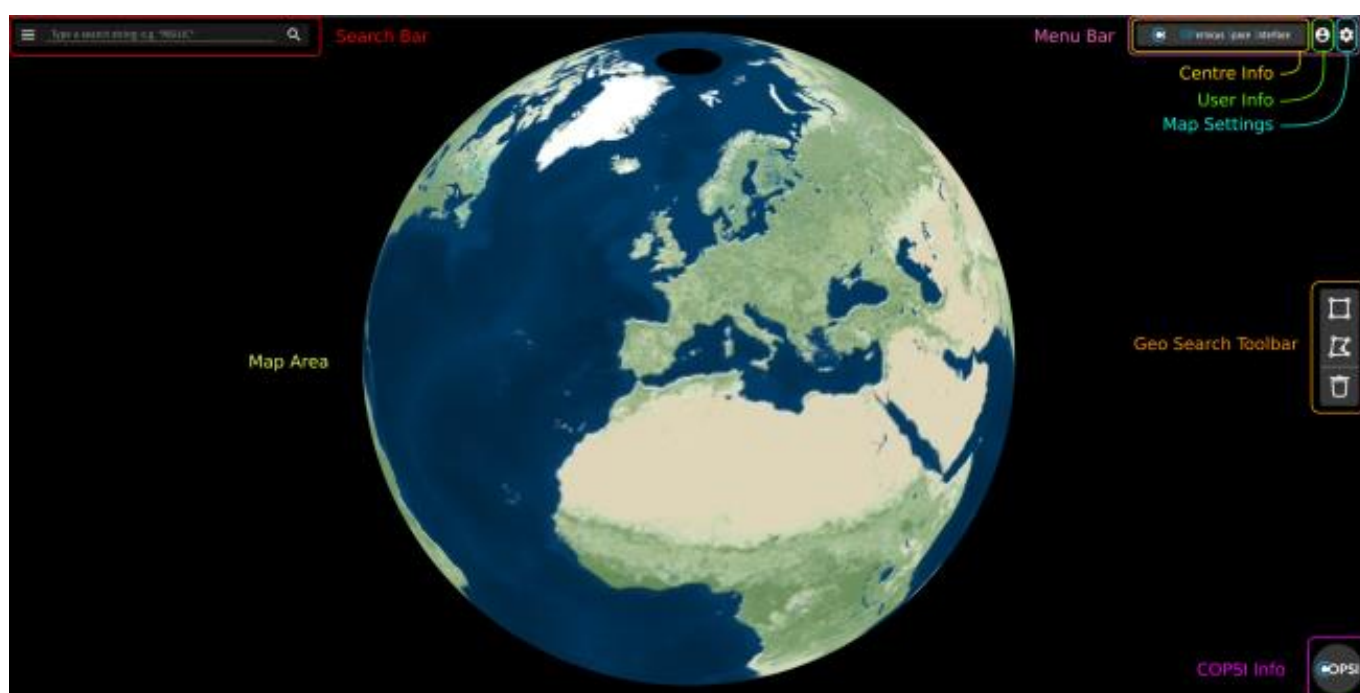- Geo Search Toolbar
- COPSI Information

Figure 6 - COPSI structure

The **Search Bar,** placed on the top left of the page, can be used as a simple text input where the user types OData searches, but gives also the possibility to perform advances searches, based on different filters which are available in the dedicated section.

The OData search filter output will be translated in real time while the user types in the search bar or choose any of the advanced filters and it will be shown directly under the search bar, in an overlaid dedicated section, which will automatically disappear after a few seconds and if no mouse events are happening inside it.

If needed, this filter output section can be pinned clicking on the relative push-pin icon so that it will not disappear. In this case the advanced filter section will be moved below the filter output section. Unpinning the filter output section will make it disappear again.

Figure 7 - Filter output pin button

The advanced search section can be shown by clicking on the icon on the left side of the search bar and it is divided in sections which will be explained later in this document.

As soon as the list of products is retrieved, it appears under the search bar (and under the filter output section, if it is pinned) to let the user scroll it and look up for the desired products.
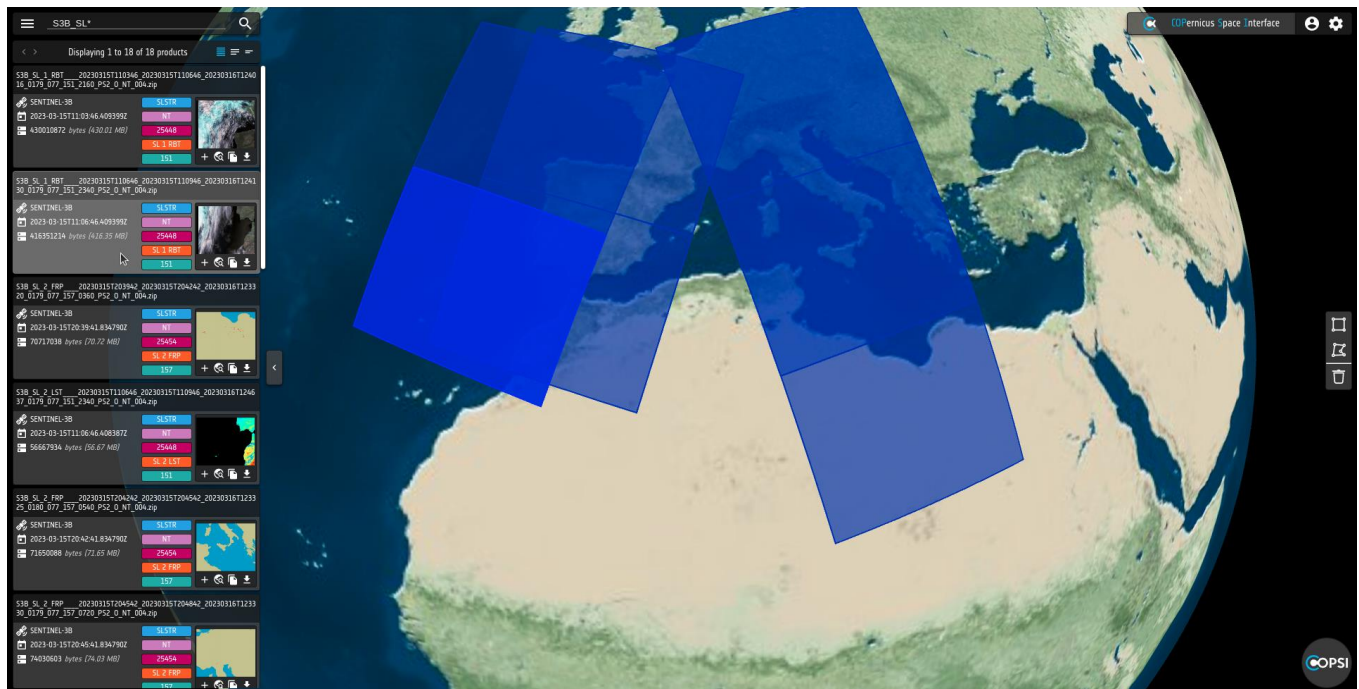

Figure 8 - Product list

When needed, the product list can be hidden to the left with a simple show/hide button, placed at the center right of the list.
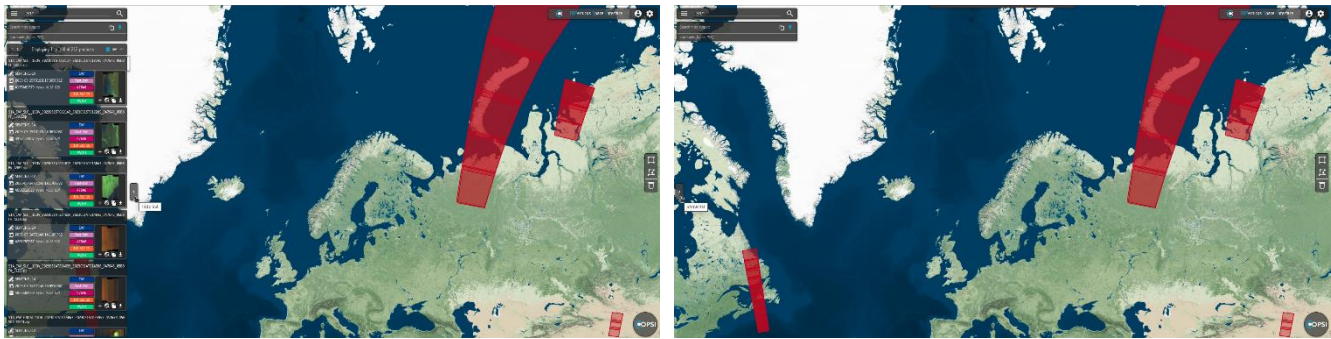
Figure 9 - Hide/Show product list

Each product in the list has a button [+] to add itself to the products details panel. The same button is used to unselect [-] the product and remove it from the panel. In the products details panel the user can compare the selected products belonging to the same search and download them.

In case the user performs a search with different filters, the products selection, together with the product details panel, are emptied.
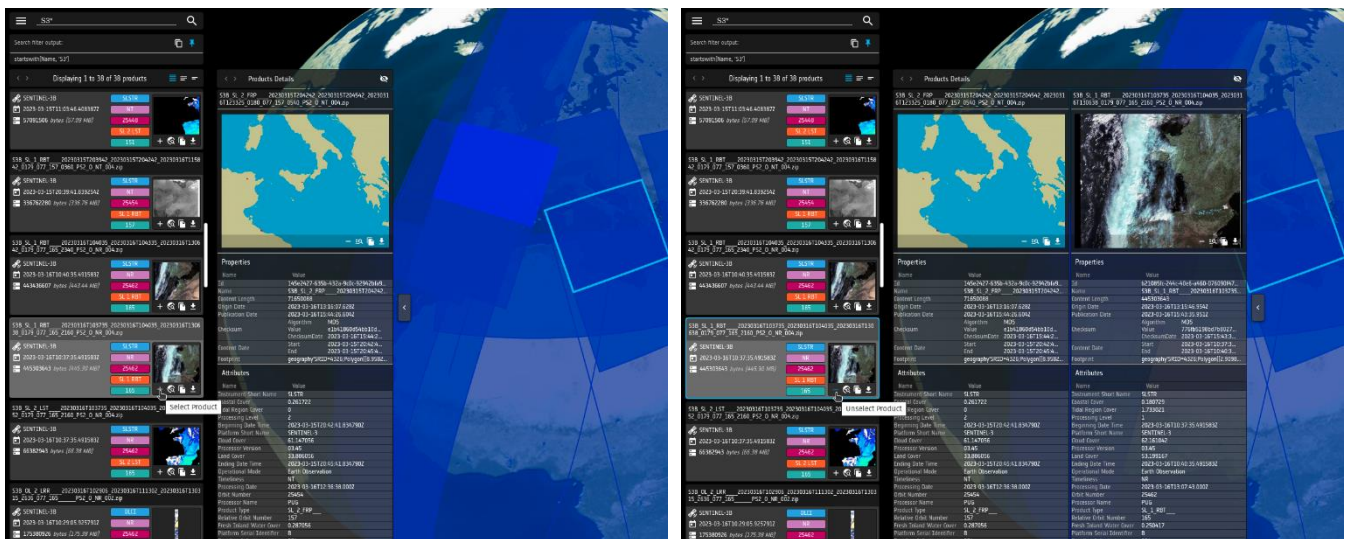

Figure 10 - Hide/Show details panel

The **Menu Bar** is a minimal and intuitive menu area, placed on the top right of the page. It contains the associated **Centre Info** as a minimal header, with its logo and name (if configured by the centre administrator) and two button icons that bring up respectively the **User Info** panel, which contains the username and the authenticated session action buttons, and the **Map Settings** panel, which contains the map projection, layers and overlay settings. There are two possible projections to choose from, a Globe view, which renders a spherical view of world, and a Mercator Plane view. The list of selectable layers instead is editable by the centre administrator and comes preconfigured with 6 different map styles.

Both menus will automatically hide if not in use after a preconfigured timeout, which defaults to 2 seconds.

Figure 11 - User info

Figure 12 - Map settings

The **Map Area** is the main element of COPSI, it spreads across the whole screen and its appearance can be configured on the fly from the Map Settings menu. Product footprints are shown on the map, based on the user search and they are highlighted when the user hover with the mouse pointer on the relative product in the list.
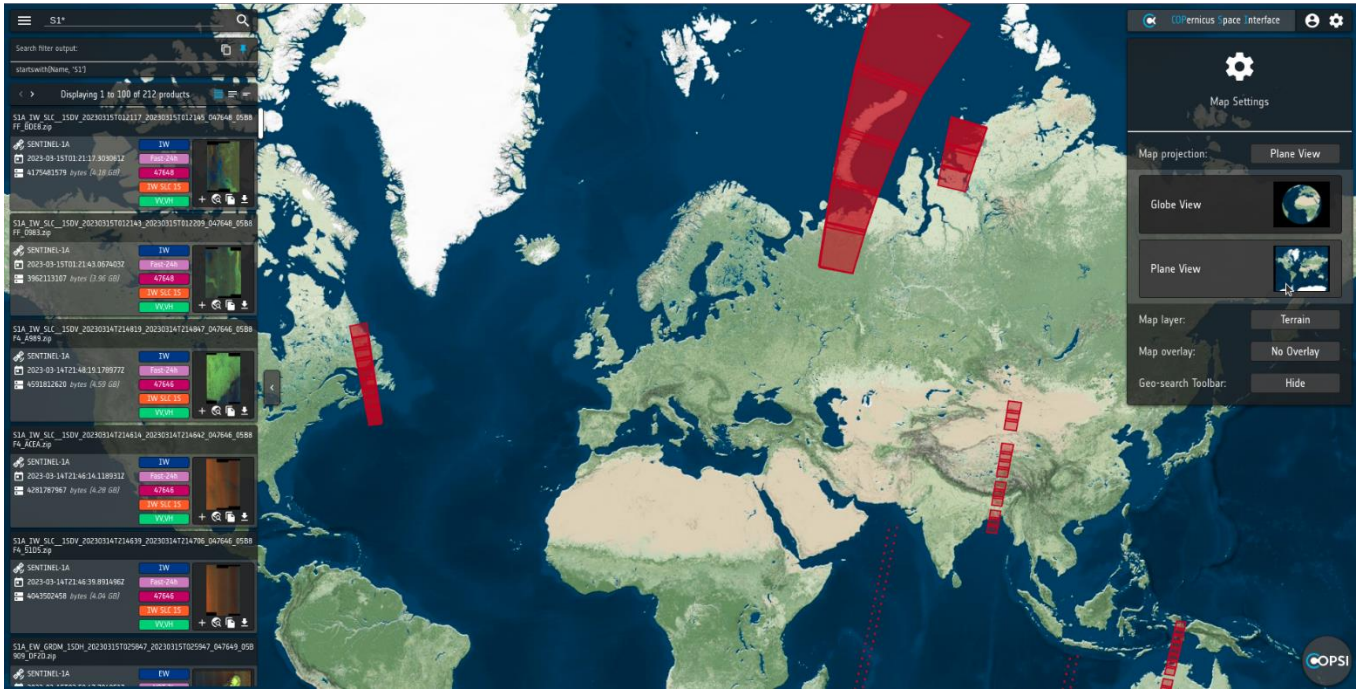
Figure 13 - COPSI plane view with products footprint

The **Geo Search Toolbar** is a minimal and intuitive panel placed on the right of the screen.

The user can perform geographic search based on polygonal areas drawn directly on the map, either in the plane view or in the globe view.

The same functionalities of this toolbar are present in a context menu that can be opened clicking with the right button everywhere on the map.

Figure 14 - Geo search toolbar and context menu

The **COPSI Info** area appears as a button with the COPSI logo on the bottom right of the screen. Clicking on it the complete Info area is revealed, containing, from left to right:

- The logos of the participants to the Collaborative DHS Consortium. Clicking on a logo, the web site of the participant is opened on a new tab of the browser.
- The logos of COPSI partners. Clicking on a logo, the web site of the partner is opened on a new tab of the browser.
- The COPSI version number.

Figure 15 - COPSI info

5. COPSI Functionalities

5.1.   Product Search

Collaborative DHS users perform requests towards the DHS Catalogue by clicking on the lens icon of the search bar, by pressing the Enter key from inside the search bar or by clicking on the submit icon inside the advanced search section.
If the input text of the search is left blank, and no advanced filters or geographical filters are set, a request with no filters is sent.
Since the DHS Catalogue is based on OData protocol, and in particular on the odata/v1/Products API detailed in RD-5, a full text search is not supported, but users must specify a filter using the proper OData $filter syntax[1].

However, users can add the wildcard '*' to a text string as a simplified form of the query by product Name, as explained below:

<Text>* will be replaced by **startswith(Name,'<Text>')** in the request forwarded to the DHS Catalogue
<Text> will be replaced by **contains(Name,'<Text>')** in the request forwarded to the DHS Catalogue
***<Text>** will be replaced by **endswith(Name,'<Text>')** in the request forwarded to the DHS Catalogue

For instance, adding the text ***S3B_OL*** in the search bar, will imply to perform the request **odata/v1/Products?$filter=contains(Name, 'S3B_OL').**
Similarly, adding the text **S2*** in the search bar, will imply to perform the request **odata/v1/Products?$filter=startswith(Name, 'S2')**

A combination of simplified filters can be used, joined by the logical operators 'and' or 'or' (in lowercase), e.g.:

S3B_OL* or S3B_SL*
Will be parsed to:
startswith(Name, 'S3B_OL') or startswith(Name, 'S3B_SL')

When using round brackets those must be surrounded by blank characters,
e.g.:

S3* and (*OL* or *SL*)
Will be parsed to:
startswith(Name, 'S3') and (contains(Name, 'OL') or contains(Name, 'SL'))

The filter parser gives also a helper function, which add an 'and' before any string containing a '*' if there is no other logical operator.
e.g.:

S2B* *L1C*
Will be parsed to:
startswith(Name, 'S2B') and contains(Name, 'L1C')

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[1] Please refer to OData official documentation at http://docs.oasis-open.org/odata/odata/v4.01/odata-v4.01-part2-url-conventions.html for more details.

Please note that, if it is necessary to search for a specific product by name, the following syntaxes are correct:

Name eq 'S2B_OPER_MSI_L1C_DS_2BPS_20220523T002058_S20220523T000611_N04.04.tar'

Or

S2B_OPER_MSI_L1C_DS_2BPS_20220523T002058_S20220523T000611_N04.04.tar

Or

*S2B_OPER_MSI_L1C_DS_2BPS_20220523T002058_S20220523T000611_N04.04.tar

Or

S2B_OPER_MSI_L1C_DS_2BPS_20220523T002058_S20220523T000611_N04.04.tar*

Other filter examples which can be typed and accepted in the search text input are:

Query by Sensing Date:

ContentDate/Start gt 2022-05-15T00:00:00.000Z and ContentDate/End lt 2022-05-16T00:00:00.000Z

Query by Publication Date:

PublicationDate gt 2023-01-01T00:00:00.000Z

Query by geographic criteria
OData.CSC.Intersects(area=geography'SRID=4326;POLYGON((-127.89734578345   45.234534534,-127.89734578345   45.234534534,-127.89734578345   45.234534534,-127.89734578345 45.234534534))')

Query by Attributes

Attributes/OData.CSC.StringAttribute/any(att:att/Name   eq   'productType'   and   att/OData.CSC. StringAttribute/Value eq 'MSI_L1C_DS')
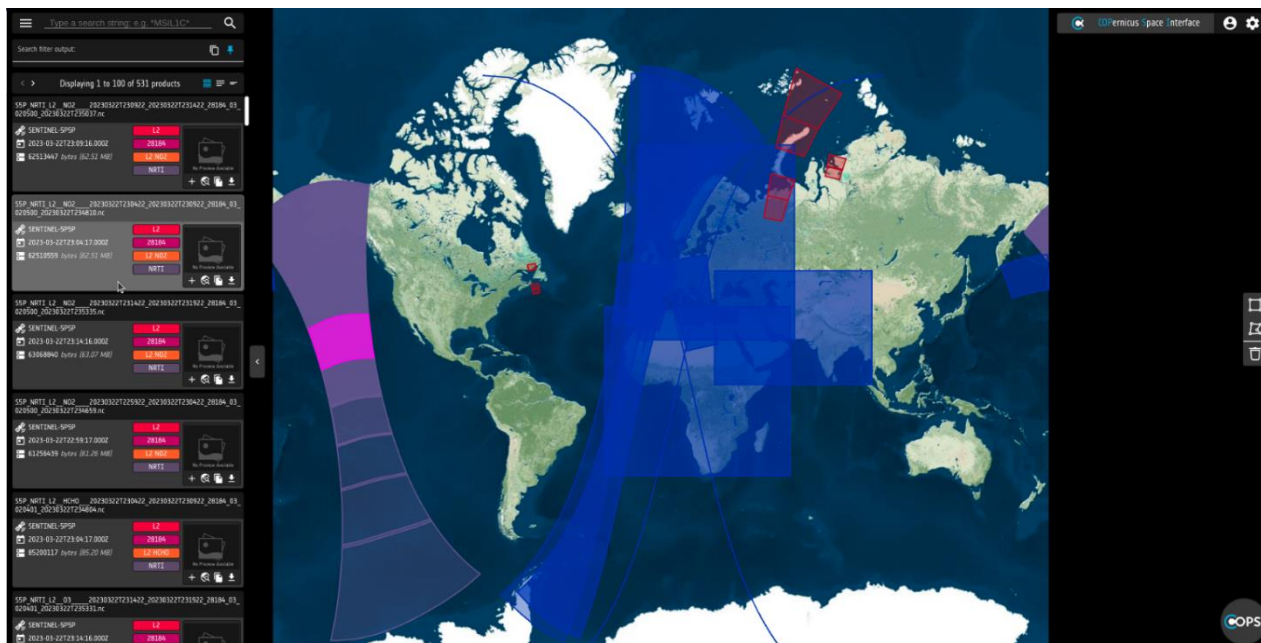
Figure 16 - Search results visualization

Please note that, in case of error returned by the requests due to bad filters or service unavailability, an error message is displayed at the centre of the screen, reporting the error root cause.
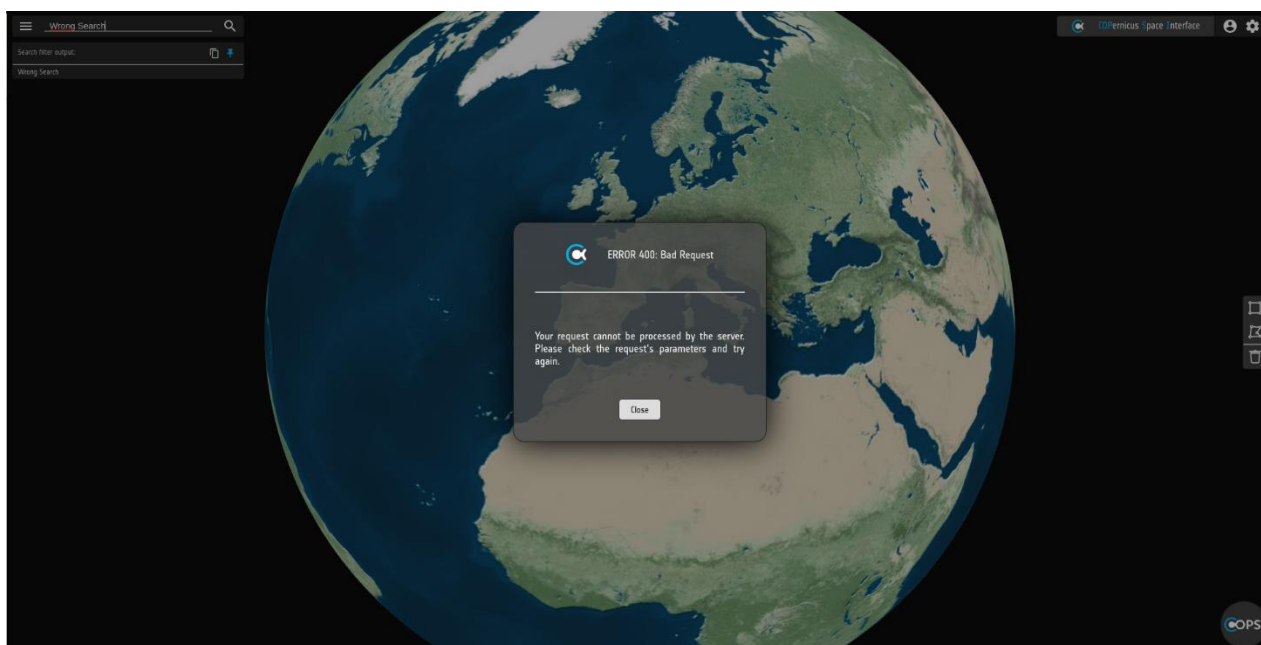

Figure 17 - Error notification

5.2. Advanced Search

The user can set many preconfigured filters directly in the advanced search section and those will be automatically parsed in the correct OData protocol.
The advanced search section is shown when its icon in the search bar is clicked, and it is divided into sections:

- In the header section there are two buttons: a bin icon button which resets all the advanced filters (except geographical filters) and a submit icon button which, as well as the magnifier icon button in the search bar, starts the product search.

- The first section shows the order and sorting of the retrieved products. Note that those don't change the current product list order and sorting, instead those filters, as the others, will take effect only on the next search.

- The second section gives the possibility to filter the products by sensing date (content date) or publication date. It is possible to type just a start date, a stop date or both to filter an interval. If a start date is more recent than its relative stop date it will be shown as an error and the search buttons will turn red and will be disabled.

- Then there are several sections, one for every mission preconfigured by the centre Administrators, related to the OData attribute filters, each one individually activable through a sliding button, which will display its relative filters subsection. Each one of those filters can be a dropdown option selector in which multiple options can be selected, a text input or a range input (in which is possible to input both min and max values or also just one of the two). Also in the range input, if the min value is greater than the max value, it will be highlighted as an error and the search action will be inhibited.
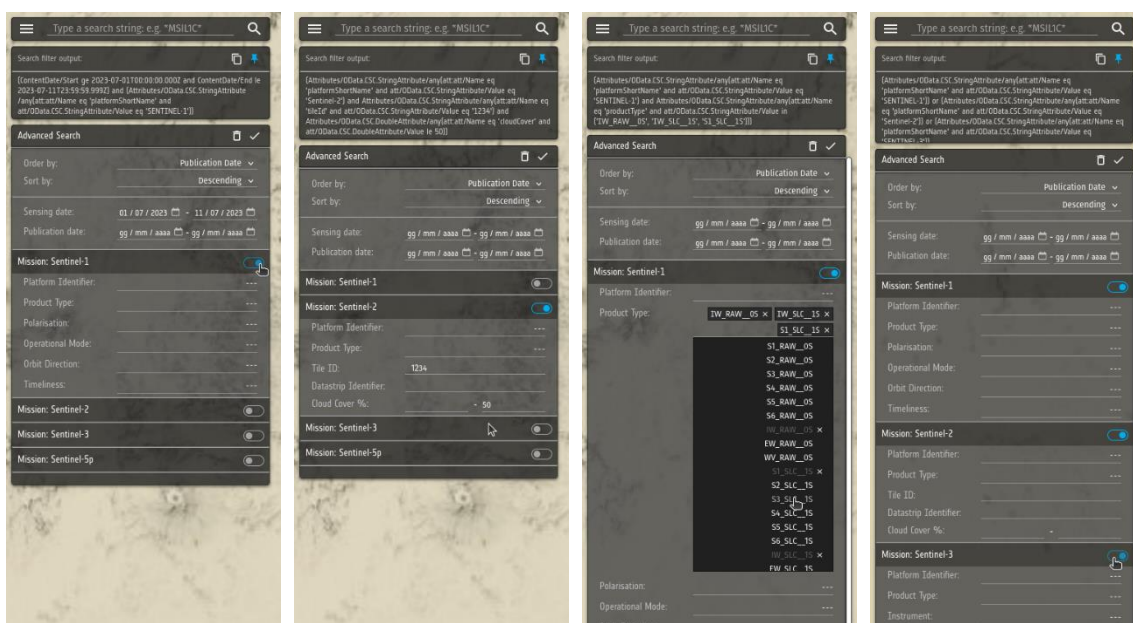

Figure 18 - Advanced search filter examples

By default, when selecting multiple choices for the same attribute, a special OData filter parsing will be used to shorten the filter output (figure 18c):

Attributes/OData.CSC.StringAttribute/any(att:att/Name eq '<AttributeName>' and att/OData.CSC.StringAttribute/Value in ('AttributeValue1', 'AttributeValue2', …'AttributeValueN'))

If the catalog doesn't support this special filter, the COPSI administrator can change the default configuration and a simple **OR** logical operator between the multiple attribute values will be used instead.

When the search is submitted and there is at least one filter selected, the advanced filter icon will change color and shape to show that the current retrieved product list is filtered. In this situation, if all the filters are cleared, manually or by clicking the bin icon, the advanced search icon stay in the 'filtered' state until the new search is performed, again to help the user understand that the product list is still the filtered one until an unfiltered search is performed.
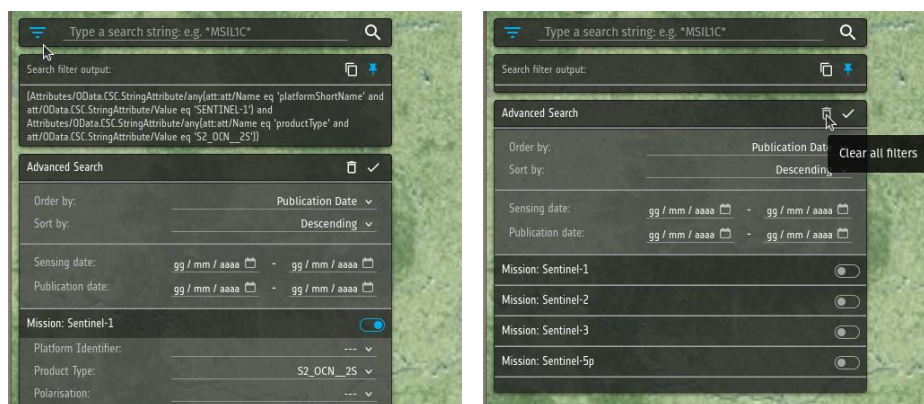

Figure 19 - Advanced search icon with products filtered and clear filters button

5.3.   Geo Search

A geographic search can be performed drawing a polygon directly on the map. The geo search toolbar offers three buttons to draw on the map:

- Draw rectangle
- Draw polygon
- Delete polygon

Figure 20 - Geo search context menu and toolbar

The same buttons can be reached using the context menu, which appears clicking with the right mouse button everywhere on the map. For this reason, the visibility of the toolbar can be configured by the COPSI admin.

When clicking on the 'Draw Rectangle' button the user can start drawing the first point of the rectangle clicking with the left button on the map. A rectangle will appear as a preview to correctly position the closing point. After clicking a second time the rectangle will be set and the relative geographic OData search will be shown in the filter output panel.

Figure 21 - Draw rectangle

In a similar way, clicking on the 'Draw Polygon' button, the user can start drawing the first point of a polygon clicking with the left mouse button on the map. Every new click adds a vertex, while a preview of the resulting polygon is shown automatically. When the user clicks on the first drawn point the polygon becomes closed and the relative geographic OData search appears in the filter output panel.
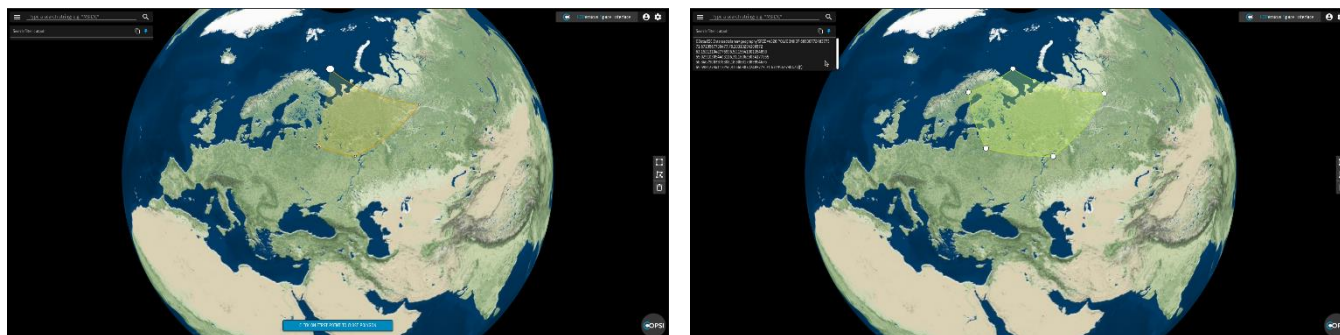

Figure 22 - Draw polygon

While drawing and after a polygon is ready, the user can delete the polygon clicking on the 'Delete Polygon' button or simply pressing the ESC key on the keyboard as a shortcut.
After the polygon is drawn, the user can modify it by:

- dragging the whole polygon on the map pressing the left mouse button inside the polygon, moving the mouse to the desired position and leaving the mouse button.
- Dragging each single point of the polygon using the same method but pointing on a vertex.
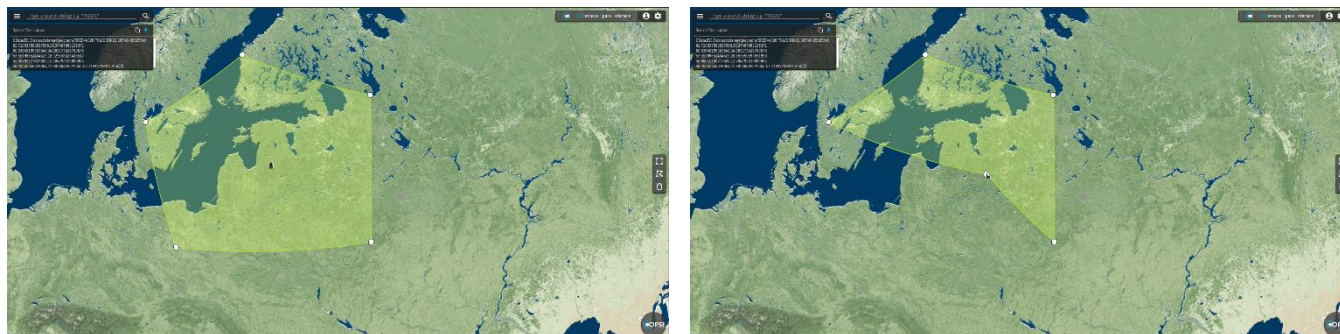

Figure 23 - Drag polygon or vertex

Finally, the geographic search can be performed, after a polygon is ready, clicking on the magnifier icon, in the search bar. All the products in the catalogue, which cross the drawn polygon, will be shown in the list.
The geographic search can be used together with a text search and advanced filters and those will be linked with an AND logic operator.
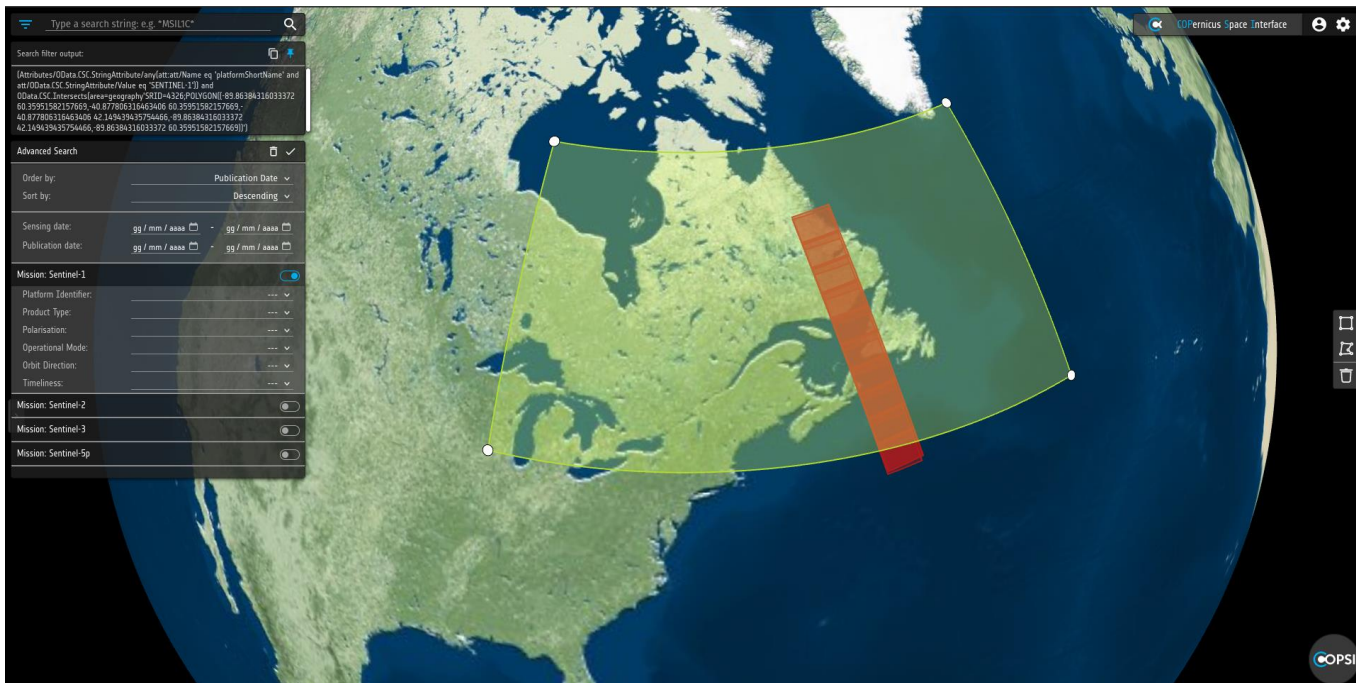
Figure 24 - Performing a geo search with advanced filters

5.4.   Product visualization

As soon as the product request is fulfilled a list of product appears under the search bar. The list is scrollable and contains the number of elements that has been set in the configuration file by the COPSI admin. In the header section of the list a text displays which part of the product list the user is watching and the total number of products found.
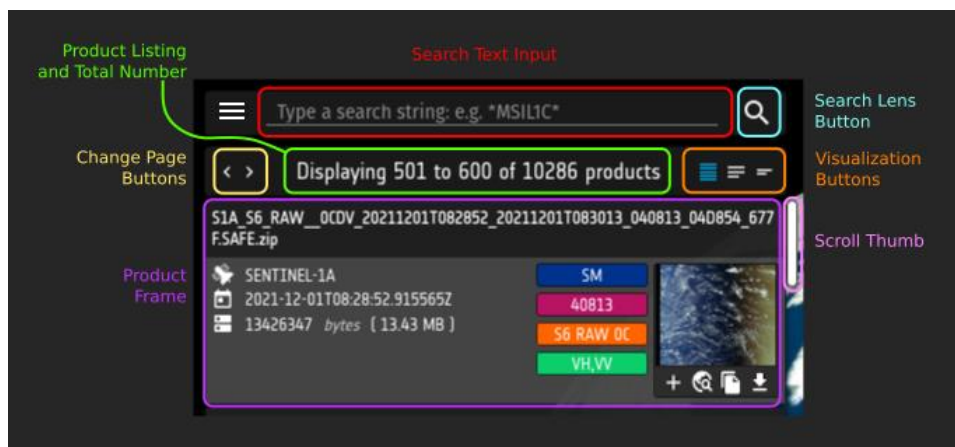

Figure 25 - Product list elements

To visualize the next page of products the user can click on the top left arrow buttons, or simply insist to scroll the list past its bottom or top end. In the latter case the scroll thumb will change color to underline that a page change is going to happen on mouse scrolling.
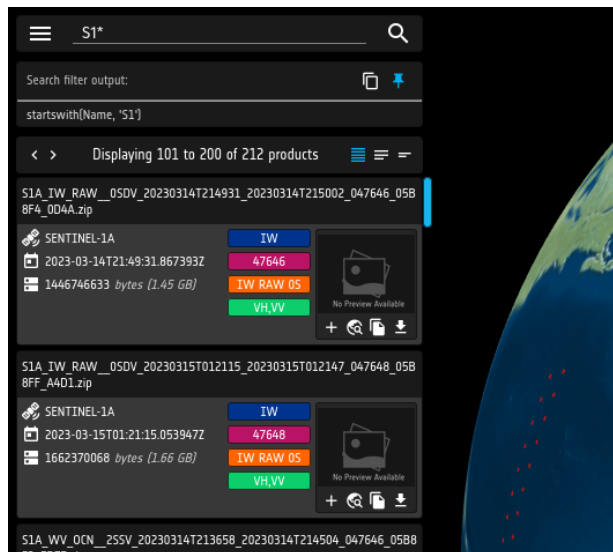

Figure 26 - Scrollbar color change when a new page is going to be loaded

On the top right of the Product List there are three buttons which change the list visualization details.
Those are from left to right the Detailed, Simple and Minimal view buttons.
In the Detailed view, which is selected by default, more data are visible in the product frame, taking more vertical space.
Selecting the Simple view the product name is omitted taking less space per product.
Clicking on the Minimal view button only the product name is shown, taking even less space, so that more products are visible on the screen at once.
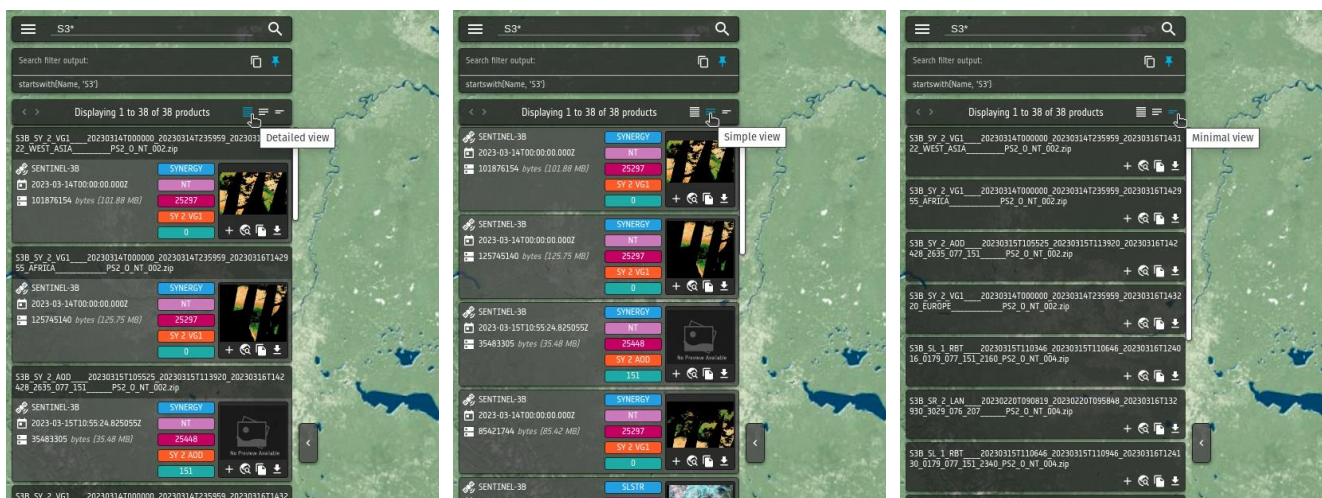

Figure 27 - Different list view: Detailed, Simple and Minimal

Every product in the list is contained in a frame and the Product Name is on the top as a header (except for the simple view, in which the header is omitted).

On the left of the frame there are the main Product Info, such as the Platform Name with Serial Id, the Sensing Date and the File Size (expressed both in plain bytes and in a simplified unit).

In the middle there are up to five coloured product tags, which are configured by the admin.

On the right part of the frame there is a Quick Look of the product imagery, if it is present, otherwise a placeholder is shown and below that there is the action buttons area. In COPSI version 1.x those are the Copy URL and the Download Product buttons.
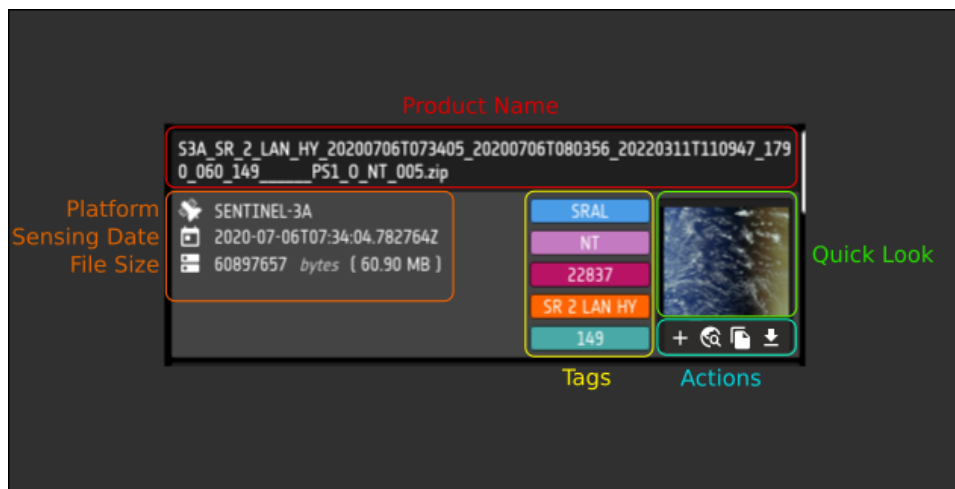

Figure 28 - Product item elements

Hovering with the mouse over a product in the list will highlight its frame and accordingly its related footprint on the map will be highlighted too.
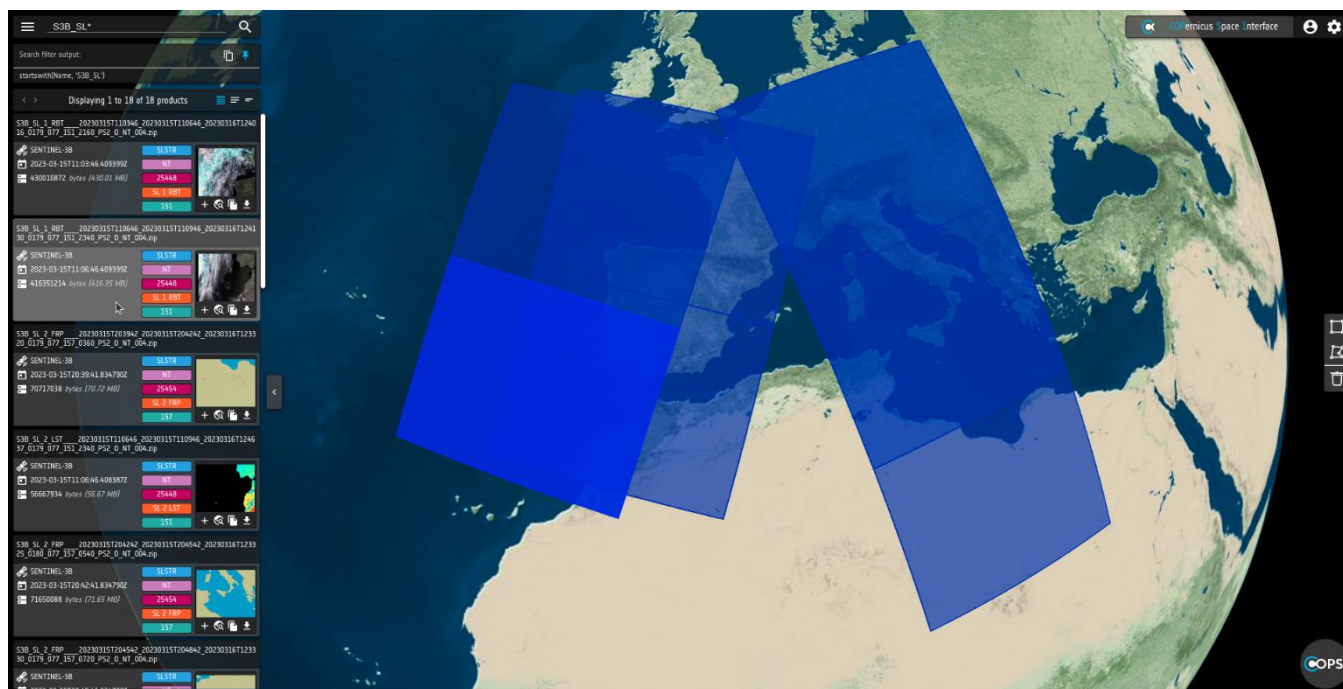

Figure 29 - Footprint highlight on product list item mouse hovering

Hovering with the mouse on the footprints in the map will highlight all the footprints which the mouse pointer is inside and the products in the list, relative to those footprints, are highlighted too.
When there is at least one footprint highlighted under the pointer, if clicking with the left mouse button, a footprint list appears next to the pointer, showing a brief description of all the highlighted footprints.

Figure 30 - Footprints highlight on mouse hovering

This highlighted product list will disappear automatically after a few seconds if the mouse pointer is left outside the list. Otherwise, when hovering each product frame in this footprint products list, its frame will be highlighted together with the relative frame in the main product list and the relative footprint on the map.
If the user clicks with the left mouse button on a product frame in this footprint product list, the main list will scroll to show the relative product frame.
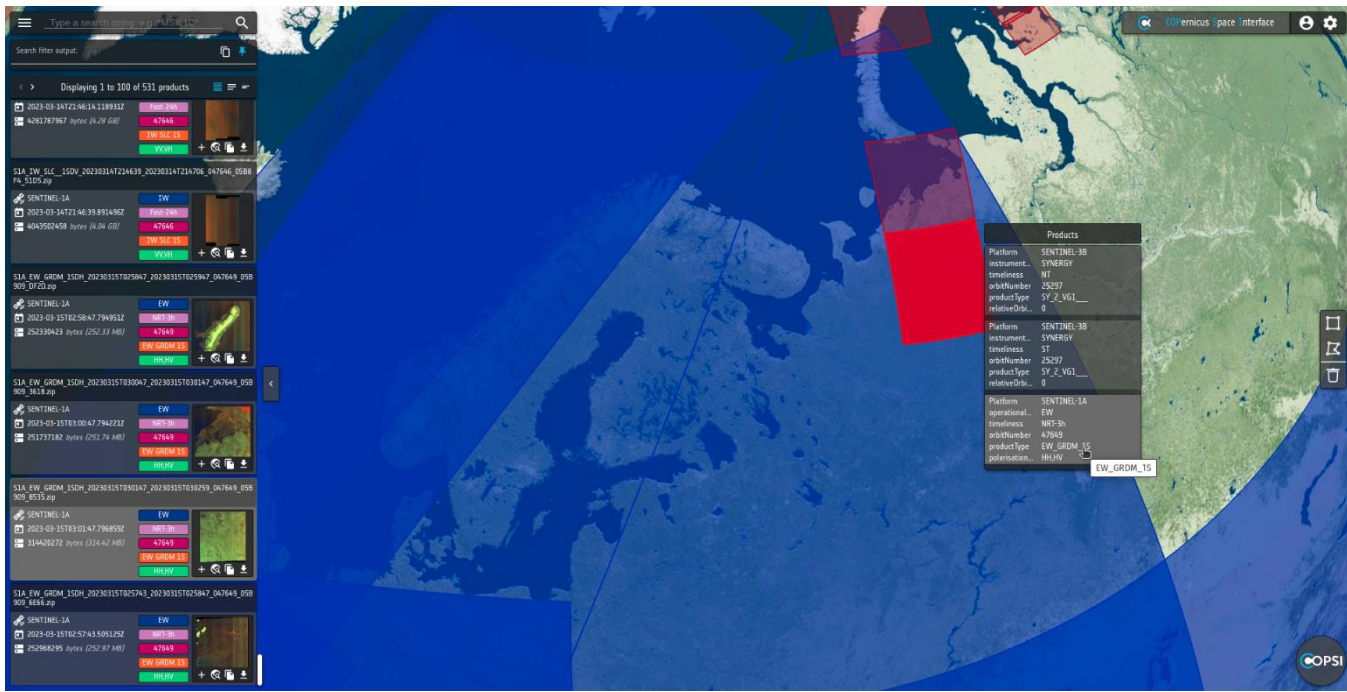
Figure 31 – Showing relative product in the main product list

5.5.   Product actions

There are four possible actions on the products:

- **Select Product:** Add the product to the details panel on the right of the product list.
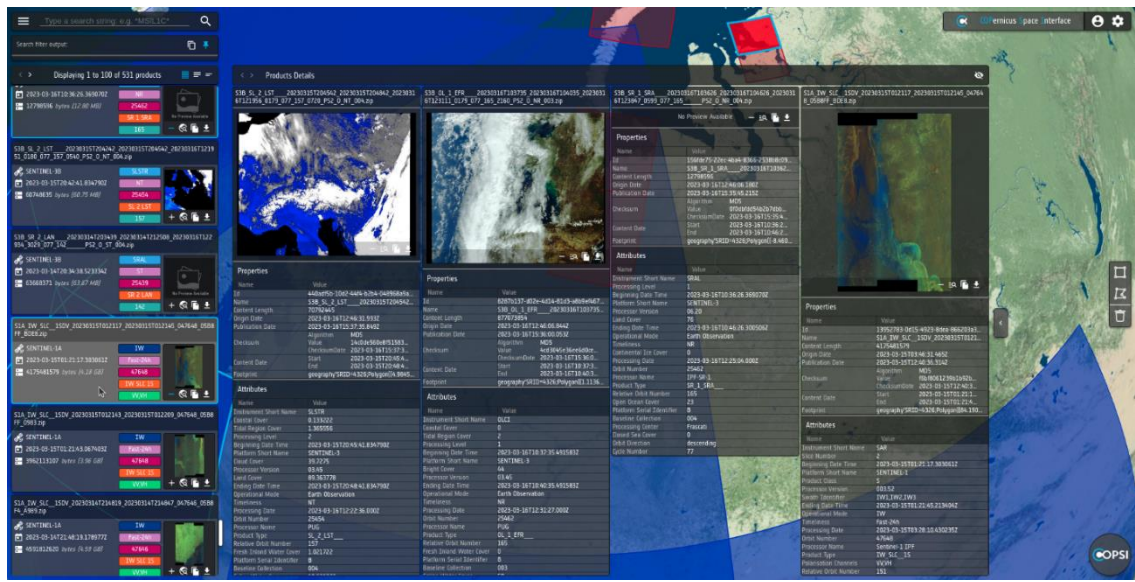

Figure 32 - Products details panel example

- **Zoom To Map Position:** When clicked the map moves and zoom to the relative product footprint.
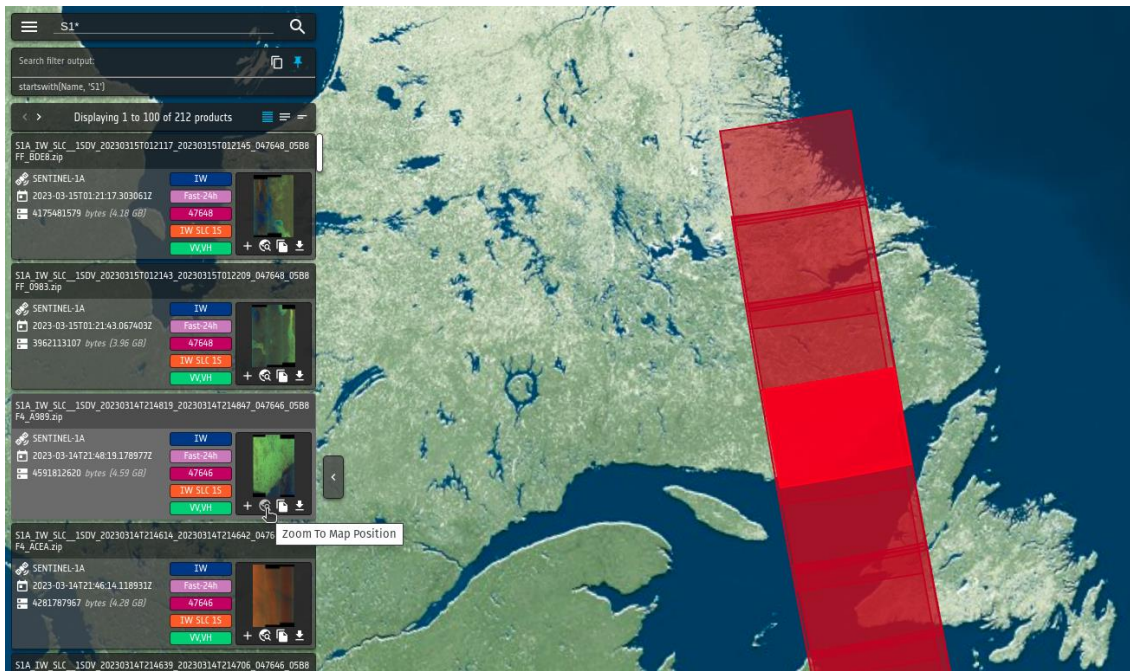

Figure 33 - Zoom to map position

- **Copy Url:** Clicking with the left mouse button on the Copy Url button, the whole link address is copied in the clipboard, so that the user can paste it elsewhere if needed.
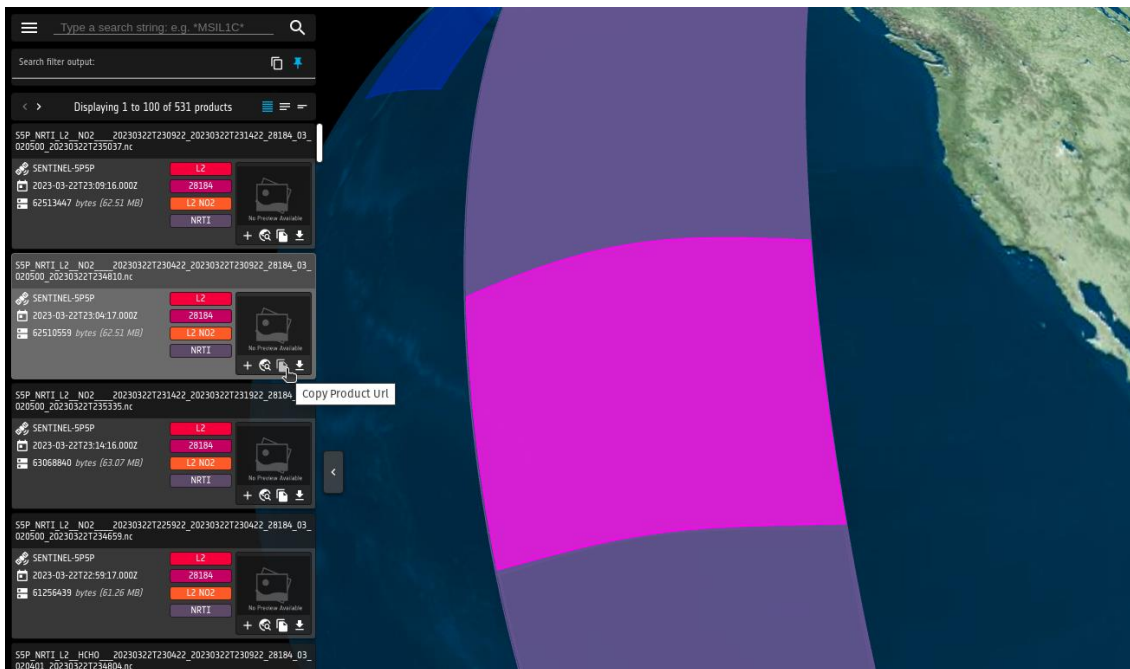

Figure 34 - Copy URL

- **Download Product:** The Download Product action starts as soon as the relative button is pressed, and a progress bar appears both in the lower part of the product frame and in the product details panel (if that product is selected), to let the user know which product download is going on at the moment and show its progress. User should pay attention that the download will be aborted if the web page is going to be closed or reloaded. While downloading a product, its relative download button changes its shape to a cancel button, so that the user can stop the action. The user can restart that product download if needed. After a successful download, the relative button changes its color to blue to let the user know which product has been downloaded in the current page. Note that if the page is changed or updated, or if the user cancel a further download on the same product, the download button will no longer be blue, but white, as default.
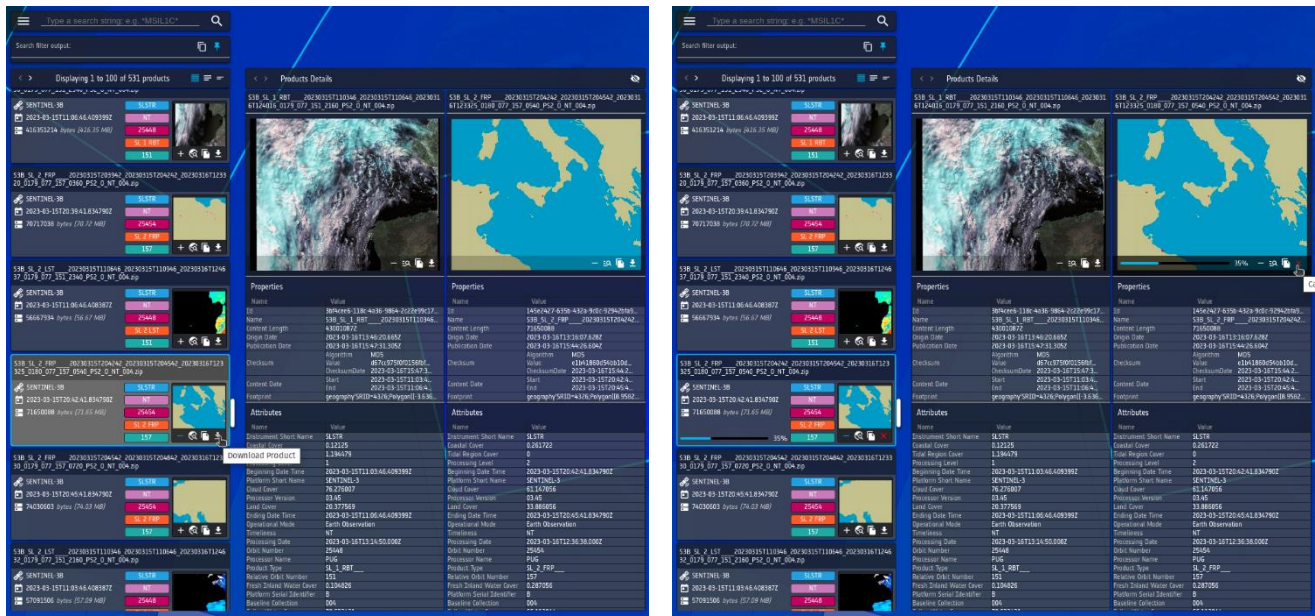

Figure 35 – Download and Cancel Download buttons

5.6   Products details panel

The details panel contains all the selected products and each one is displayed in its own frame showing the Product name, a Preview of the product image (if present), a Properties section and an Attributes section. Only the most relevant attributes are shown, filtered by a list preconfigured by the COPSI administrator. Each product details frame contains the same four action buttons present in the product list, repeated in its header. In case the number of selected products will overflow the screen, it is possible to scroll the panel either with the mouse wheel on the header of the details panel or (holding the SHIFT key) on the selected products frames.
The products details panel can be hidden clicking on the eye icon on the right of its header and can be shown again clicking on the same icon, that is now present beside the product list hide button.
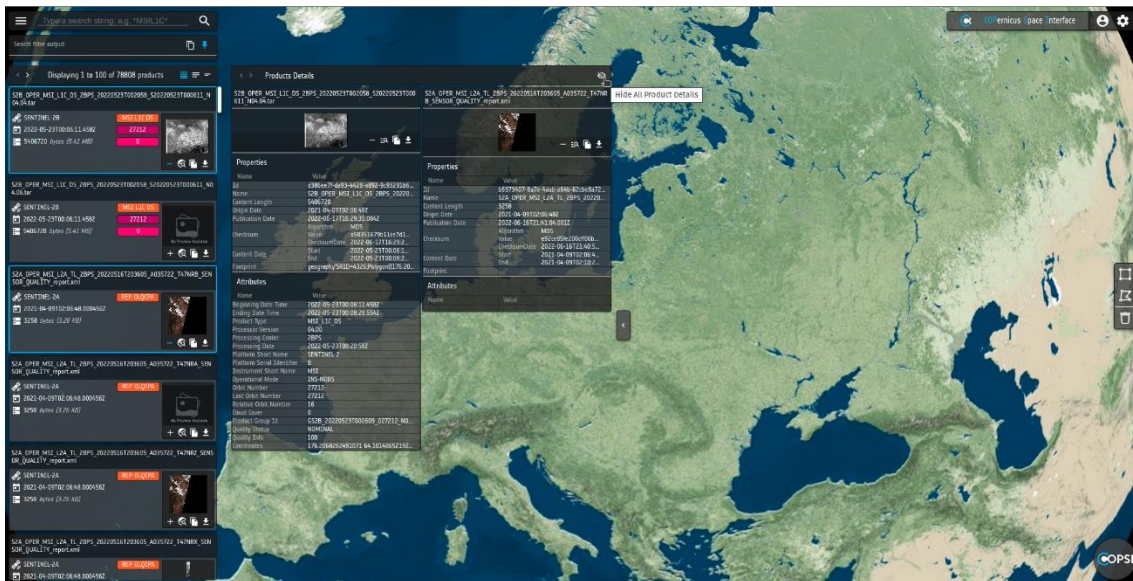

Figure 36 – Hide Products Details Panel

Figure 37 – Show Products Details Panel

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