

# CubeWerx Insights – An Open Framework for EO Data Processing and Analytics at Scale

## Introduction

In the last decade, the exponential growth in the volume of Earth Observation (EO) data, fueled by rapid advancements in sensor and satellite technologies, affordable access to space, and the urgent need to enhance our planetary monitoring capabilities, has been remarkable. This era has ushered in an abundance of high-quality data, encompassing high-resolution imagery, multi-spectral data, thermal imaging, and synthetic aperture radar (SAR).

However, as the development of platforms designed to interpret this vast amount of data accelerates, aiming to provide the critical "insights from orbit" necessary to address contemporary challenges, there is a looming risk. The pursuit of these advancements may inadvertently lead to the creation of new data silos, hampering cross-collaboration, data sharing, and interoperability.

## A better way forward with Open Standards and the new OGC API

Recognizing the need for a unified approach to handle EO data, the Open Geospatial Consortium (OGC), the European Space Agency (ESA) and others have developed a common framework for earth observation platforms, and a new suite of developer-friendly API specifications, known collectively as the OGC API (<https://ogcapi.ogc.org/>) and the ESA Common Architecture (<https://eo4society.esa.int/common-architecture/>). This framework, essentially a collection of interrelated APIs, serves as modular building blocks for crafting geospatial applications. Emphasizing simplicity and ease of use, these JSON/REST-based APIs enable developers to incorporate "just enough geo" functionality into their projects without being overwhelmed by extensive specifications. These standards span the full spectrum of technical requirements for EO applications, including cataloging, search, data streaming, processing, and analytics.

CubeWerx was well positioned to take a leadership role in shaping this new framework, serving both on the ESA architecture committee and as the editors of many of the OGC API specifications on which the framework is based.

## CubeWerx Insights

In this context, we introduce CubeWerx Insights, a pioneering open framework for EO data processing and analytics designed to overcome the challenges of data silos and enhance interoperability. Using the new OGC APIs, CubeWerx Insights creates a processing framework for EO data, built from the ground up to prioritize interoperability. It leverages these APIs to offer a comprehensive platform for cataloging, searching, and executing containerized applications across large-scale geodata collections housed in cloud or network-attached storage solutions. By providing open interfaces at every point of integration and linking components through a set of web dashboards, CubeWerx Insights orchestrates a cohesive and accessible application.

This framework represents a significant stride towards a more interconnected and accessible understanding of our planet, leveraging the collective power of EO data through open standards and innovative technologies. The platform is composed of the following components:

## Data Products Catalog

The Insights catalog harvests metadata from data products described using the popular STAC (Spatial Temporal Asset Catalog) specification, as well as other popular metadata standards. The catalog offers a queryable interface, implemented through the OGC API – Records specification.

By incorporating a straightforward REST API, the Insights catalog empowers users and external applications to directly query its database for their specific needs. This feature significantly enhances the accessibility and usability of the data, fostering an environment where information is readily available for processing, analysis, or download. (UI/UX is functional but not fully skinned/themed in this version).

Find Data Products | Selected Data Products (30) | Find Apps | Deploy App | Workspace | Workflows | Web Services | Jobs | Administration

Showing results 1-10 of 279.

< previous page | next page >

Find data products to process  
shift-drag to select an area of interest

search terms:   recently processed only

data product types:  RCM  RADARSAT-2  SENTINEL-1

Island, Norge, Sverige, Suomi, Finland, Benaruse, Deutschland, Россия, United Kingdom

© OpenStreetMap contributors.

**S1A EW GRDM 1SDH 20240201T003754**  
**20240201T003859 052358 0654C4 86EE**  
SENTINEL-1 SAR Standard (S1A) product with unique product identifier 86EE, of type Ground Range Detected (GRD), acquired between 2024-02-01T00:37:54Z and 2024-02-01T00:38:59Z on orbit 52358 with Medium resolution using beam mode Extra-Wide swath and processing level 1, with Dual Horizontal transmit, Horizontal receive / Horizontal transmit, Vertical receive SAR polarization  
has bands: HV, HH  
Show Details | selected:

**S1A EW GRDM 1SDH 20240201T003859**  
**20240201T003959 052358 0654C4 A670**  
SENTINEL-1 SAR Standard (S1A) product with unique product identifier A670, of type Ground Range Detected (GRD), acquired between 2024-02-01T00:38:59Z and 2024-02-01T00:39:59Z on orbit 52358 with Medium resolution using beam mode Extra-Wide swath and processing level 1, with Dual Horizontal transmit, Horizontal receive / Horizontal

Select Page | Select All | Process Selected

Fig 1: Insights web client catalog search

The central functionality of the Insights platform is to allow in situ processing of data products. The web client here is used to select a number of data products for further processing:

Find Data Products   Selected Data Products (30)   Find Apps   Deploy App   Workspace   Workflows   Web Services   Jobs   Administration

The screenshot displays the Insights web client interface. At the top, there is a navigation bar with the following items: Find Data Products, Selected Data Products (30), Find Apps, Deploy App, Workspace, Workflows, Web Services, Jobs, and Administration. The main content area is divided into three product cards and a sidebar on the right.

**Product Card 1 (RCM):**  
Thumbnail:   
ID: **RCM1 OK1942466 PK2106650 2 SC50MB 20220530 094823 HH HV GRD**  
Description: RCM "Ground Range Georeferenced Detected Product" acquired from satellite no. 1 on 2022-05-30T09:48:23Z with unique product identifier 2106650 using beam mode SC50MB, version 2 with polarizations [(Horizontal on transmit, Horizontal on receive),(Horizontal on transmit, Vertical on receive)].  
has bands: HV, HH  
Buttons: Show Details, Deselect

**Product Card 2 (RADARSAT-2):**  
Thumbnail:   
ID: **RS2 OK75610 IK475527 PEK002723555 OSVN 20160505 092737 HH HV SCF**  
Description: RADARSAT-2 Product, Acquired 2016-05-05T09:27:37Z, Ocean Surveillance Very-Wide Near (OSVN), ScanSAR fine (SCF)  
has bands: HV, HH  
Buttons: Show Details, Deselect

**Product Card 3 (RADARSAT-2):**  
Thumbnail:   
ID: **PDS 05492260**  
Description: RADARSAT-2 Product, Processing and Delivery Subsystem #05492260  
has bands: HV, HH  
Buttons: Show Details, Deselect

**Map:** A map of the North Atlantic region showing the search area with several rectangular overlays. © OpenStreetMap contributors.

**Common Bands:**  
(none)

**Data Product Types:**  
RCM  
RADARSAT-2  
SENTINEL-1

**Action Buttons:**  
Deselect All   Select More Data Products  
Find Compatible Apps

Fig 2: Insights web client selecting search results for image processing/analytcs

## Analytics – The Application Deployment and Execution Service

The Application Deployment and Execution Service (ADES) is the cornerstone of the Stratos platform. It is based on the OGC API – Processes specification. Specifically, the ADES supports the following major functions:

- Deploy/Remove new containerized workloads to/from the platform.
- Query a list of applications (processes) available through the platform (including filtering by those applicable to a given set of data product types).
- Execute a process on a set of data products.
- Query the progress of running processes.
- Download or visualize the results of a process execution.

The screenshot displays the ADES interface with a navigation bar at the top containing links: Find Data Products, Selected Data Products (1), Find Apps, Deploy App, Workspace, Workflows, Web Services, Jobs, and Administration. The 'Find Apps' tab is active. Below the navigation bar, the text 'Find an app to execute' is followed by a search filter: 'for selected data product: RS2 OK75610 IK475527 PEK002723555 OSVN 20160505 092737 HH HV SCF'. A search terms input field and a checkbox for 'recently executed only' are present. Below this, it says 'Showing all 4 results.' and provides navigation for 'previous page' and 'next page'. Four application cards are listed, each with a title, description, accepts, and needs bands, and buttons for 'Show Details' and 'Execute With Selected Data Product':

- Ship Detection Process**  
A Process that detects ships in SAR Images and outputs the detections into various output file formats including GeoJSON. RADARSAT2 SAR images are supported.  
accepts: RADARSAT-2
- Radar Forest Degradation Index (RFDI)**  
From the Awesome Spectral Index database. Formula:  $(HH - HV)/(HH + HV)$   
accepts: image/tiff, RCM, RADARSAT-2, SENTINEL-1  
needs bands: HH, HV
- Dual-Polarized Radar Vegetation Index HH (DpRVIHH)**  
From the Awesome Spectral Index database. Formula:  $(4.0 * HV)/(HH + HV)$   
accepts: image/tiff, RCM, RADARSAT-2, SENTINEL-1  
needs bands: HV, HH
- EO Product Zipper**  
Given a Web-accessible EO product directory reference, this function will generate a ZIP file of the product.  
accepts: RADARSAT-2, RCM, SENTINEL-1

Fig 3: Querying the ADES for processes applicable to my selected data products

Once the required application has been selected the user can submit the job for processing:

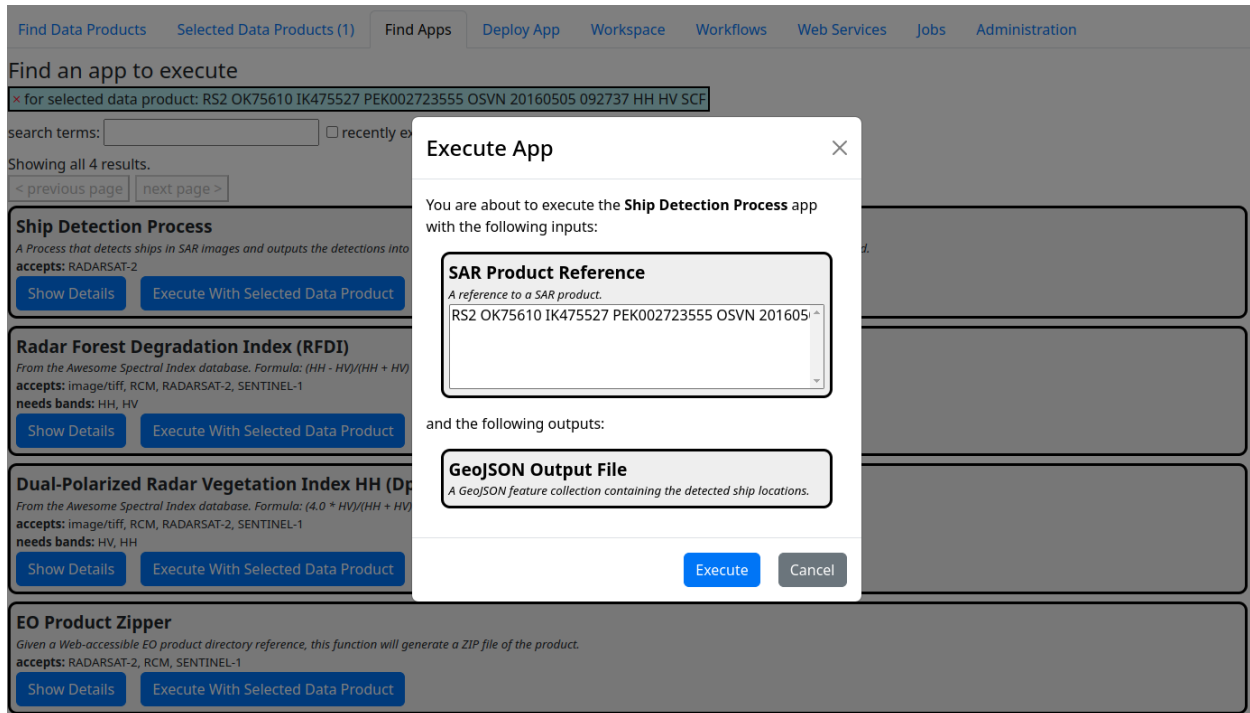


Fig 4: Process execution

The ADES keeps a catalog of all completed and running processes, and the web client allows the user to check the status of running jobs, fetch results, and a number of other useful features.

The screenshot shows the 'Jobs' tab in the application interface. The table below lists the job results:

App	Data Product(s)	Status	Created	Finished	Progress
Ship Detection Process	RS2 OK75610 IK475527 PEK00272...	running	2024-03-13 13:23:28	-	0%
Redness Index (RI)	/notOptimized.tif	running	2024-03-12 17:43:30	-	0%
Ship Detection Process	RS2 OK75610 IK475527 PEK00272...	successful	2024-03-11 16:46:16	2024-03-11 17:20:23	100%
Dual-Polarized Radar Vegetati...	RCM1 OK1942466 PK2106657 1 SC...	successful	2024-03-07 16:01:16	2024-03-07 16:02:59	100%
Radar Forest Degradation Inde...	RCM1 OK1942466 PK2106657 1 SC...	running	2024-03-01 10:13:30	-	0%
EO Product Zipper	RCM1 OK1942466 PK2106657 1 SC...	successful	2024-03-01 10:09:59	2024-03-01 10:10:21	100%
Radar Forest Degradation Inde...	PDS 05608020	successful	2024-02-27 15:01:07	2024-02-27 15:02:51	100%
Radar Forest Degradation Inde...		successful	2024-02-27 14:35:10	2024-02-27 14:37:00	100%
EO Product Zipper		successful	2024-02-27 11:58:01	2024-02-27 11:58:20	100%
Vertical Dual De-Polarization...		successful	2024-02-26 12:34:28	2024-02-26 12:37:14	100%
EO Product Zipper		successful	2024-02-26 12:32:37	2024-02-26 12:32:51	100%
EO Product Zipper		successful	2024-02-26 12:28:53	2024-02-26 12:29:07	100%
EO Product Zipper		successful	2024-02-16 12:23:51	2024-02-16 12:24:31	100%
VW-VH Ratio (VWVHR)		failed	2024-02-16 12:09:05	2024-02-16 12:09:05	0%
Vertical Dual De-Polarization...		failed	2024-02-16 12:01:18	2024-02-16 12:01:18	0%
VW-VH Sum (VWVHS)		failed	2024-02-16 11:59:47	2024-02-16 11:59:47	0%
VW-VH Ratio (VWVHR)		failed	2024-02-16 11:58:36	2024-02-16 11:58:36	0%
Green Leaf Index (GLI)		successful	2024-02-07 16:18:24	2024-02-07 16:18:28	100%
Radar Forest Degradation Inde...		successful	2024-01-29 22:01:41	2024-01-29 22:03:30	100%
Dual-Polarized Radar Vegetati...		successful	2024-01-29 12:11:15	2024-01-29 12:13:34	100%

Fig 5: Monitoring job results

When a job is completed, the user has the ability to download the results or if applicable, display them directly in the web client:

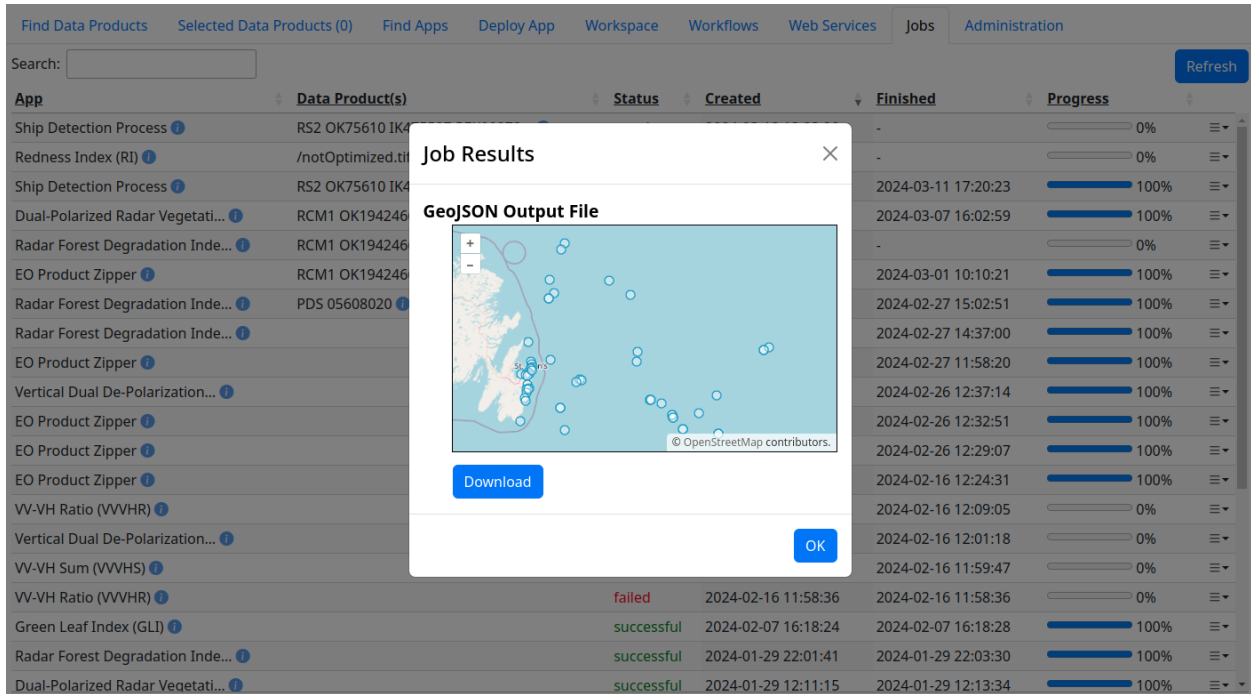


Fig 6: Visualizing a job result with GeoJSON outputs

## User Workspace

Each user of the platform has a workspace where they can upload their own data for processing, push their containerized applications for deployment, copy data from the catalog, deploy ad-hoc web mapping services and many other useful functions.

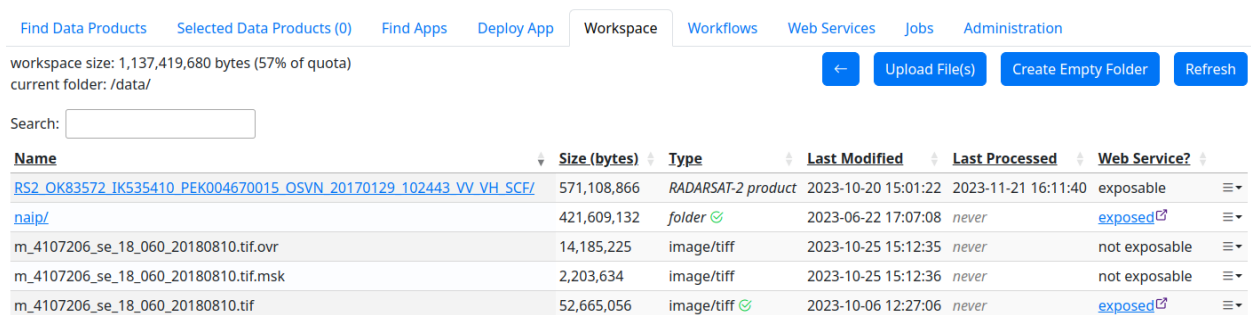


Fig 7: User Workspace

Here we see several web services that the user has chosen to deploy based on data in their web space. If the data product is of a type that the platform supports, such as GeoTIFF, GeoJSON, etc, the user can request a set of OGC API web mapping and legacy (WMS, WMTS, etc) endpoints.

Find Data Products Selected Data Products (0) Find Apps Deploy App Workspace Workflows **Web Services** Jobs Administration

**Test Web service**  public

collection ID: m\_4107206\_se\_18\_060\_20180810

OGC API URL: [https://dev.cubewerx.com/~pomakis/cubewerx/cubeserv/default/ogcApi/tep\\_pomakis/collections/m\\_4107206\\_se\\_18\\_060\\_20180810](https://dev.cubewerx.com/~pomakis/cubewerx/cubeserv/default/ogcApi/tep_pomakis/collections/m_4107206_se_18_060_20180810)

source: /data/m\_4107206\_se\_18\_060\_20180810.tif

nullColor: auto

[Delete](#)

**NAIP Service**  public

collection ID: naip

OGC API URL: [https://dev.cubewerx.com/~pomakis/cubewerx/cubeserv/default/ogcApi/tep\\_pomakis/collections/naip](https://dev.cubewerx.com/~pomakis/cubewerx/cubeserv/default/ogcApi/tep_pomakis/collections/naip)

source: /data/naip/

nullColor: auto


[Delete](#)

Fig 8: Workspace items deployed as web services

The URLs link to service description documents which may be shared with developers to include in their applications, or desktop users running tools like QGIS, ArcGIS etc. These APIs are supported by hundreds of web mapping frameworks and desktop applications.

**Test Web service** signed in as **Keith Pomakis** - [\[sign out\]](#)

Collection ID: m\_4107206\_se\_18\_060\_20180810



**WGS 84 Geographic Extent:**

Minimum Latitude: 41.86371521239912

Minimum Longitude: -72.32628595149598

Maximum Latitude: 41.94878631678591

Maximum Longitude: -72.23614401500258

show context layer

---

**Coordinate Reference Systems**

The native coordinate reference system of this collection is:

**NAD83 / UTM zone 18N** (<http://www.opengis.net/def/crs/EPSSG/0/26918>)

The following other coordinate reference systems are also available:

- WGS 84** (<http://www.opengis.net/def/crs/EPSSG/0/4326>)
- WGS 84 (CRS84)** (<http://www.opengis.net/def/crs/OGC/1.3/CRS84>)
- WGS 84 / Pseudo-Mercator** (<http://www.opengis.net/def/crs/EPSSG/0/3857>)
- WGS 84 / World Mercator** (<http://www.opengis.net/def/crs/EPSSG/0/3395>)
- NAD27** (<http://www.opengis.net/def/crs/EPSSG/0/4267>)
- NAD27 (CRS27)** (<http://www.opengis.net/def/crs/OGC/1.3/CRS27>)
- NAD83** (<http://www.opengis.net/def/crs/EPSSG/0/4269>)
- NAD83 (CRS83)** (<http://www.opengis.net/def/crs/OGC/1.3/CRS83>)
- NAD83(CRS) / MTM zone 4** (<http://www.opengis.net/def/crs/EPSSG/0/2946>)
- NAD83(CRS) / MTM zone 5** (<http://www.opengis.net/def/crs/EPSSG/0/2947>)

([expand to show entire list](#))

---

**Links**

The following resources are available for this collection:

- [this collection as JSON](#)
- [this collection as XML](#)
- [the coverage of this collection](#)
- [the domain set of the coverage of this collection](#)
- [the range type of the coverage of this collection](#)
- [the source images of this collection](#)
- [the available styles for this collection, with links to style-specific map layers and tiles](#)
- [a map layer of this collection in the default style \(accepts query parameters for subsetting, etc.\)](#)
- [a legend graphic depicting the map layer of this collection in the default style](#)
- [map tiles of this collection in the default style](#)
- [coverage tiles of this collection](#)

Copyright © 1997-2024 CubeWerx Inc.® Version 9.5.34.

Fig 9: A sample service description document

The platform also automatically provides a Swagger UI/OpenAPI document for each service endpoint.

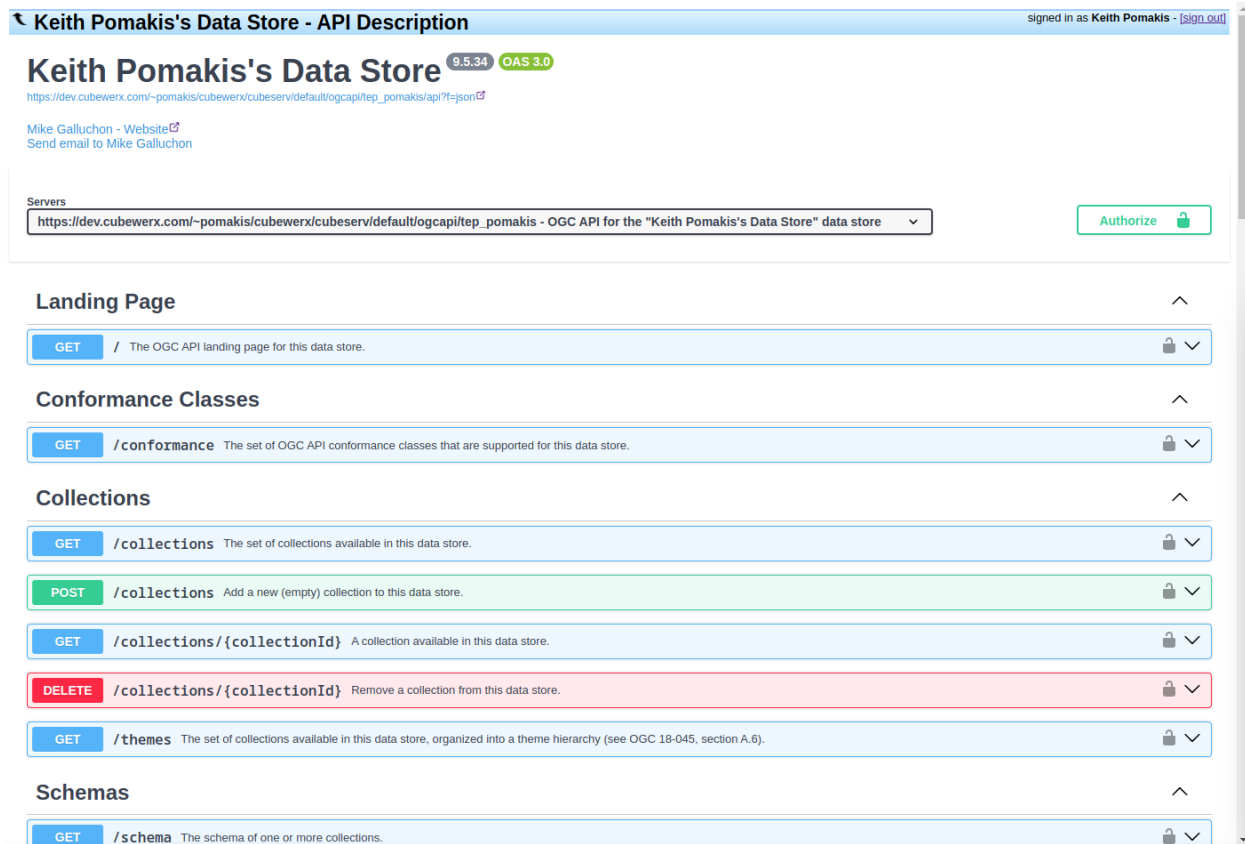


Fig 10: An OpenAPI document generated by the platform in a SwaggerUI

## Conclusion

CubeWerx Insights marks a departure from traditional EO data platforms by integrating interoperability as a core feature, not an afterthought. It enables easy integration for third parties, whether they're looking to search the catalog, develop new processes, or connect to web services. This approach addresses the challenges of the rapidly expanding EO industry without resorting to the creation of closed-off data silos.

With the OGC APIs, CubeWerx Insights offers a straightforward way for users to engage with a truly open platform. This design encourages not just the use of the platform, but active contribution to its ecosystem. CubeWerx Insights is built for those who see the value in open access to EO data and are looking for a platform that supports this vision.

CubeWerx Insights is in the late stages of product development, with a targeted release date in Q4, 2024. Please contact us at [info@cubewerx.com](mailto:info@cubewerx.com) if you have any questions, or would like to hear more about the platform.