



EO4EU Platform

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Challenges for exploiting EO data



Diverse sources of information



Data fragmentation



Difficulty to find and retrieve relevant data

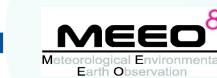


Lack of tools to download and process EO data

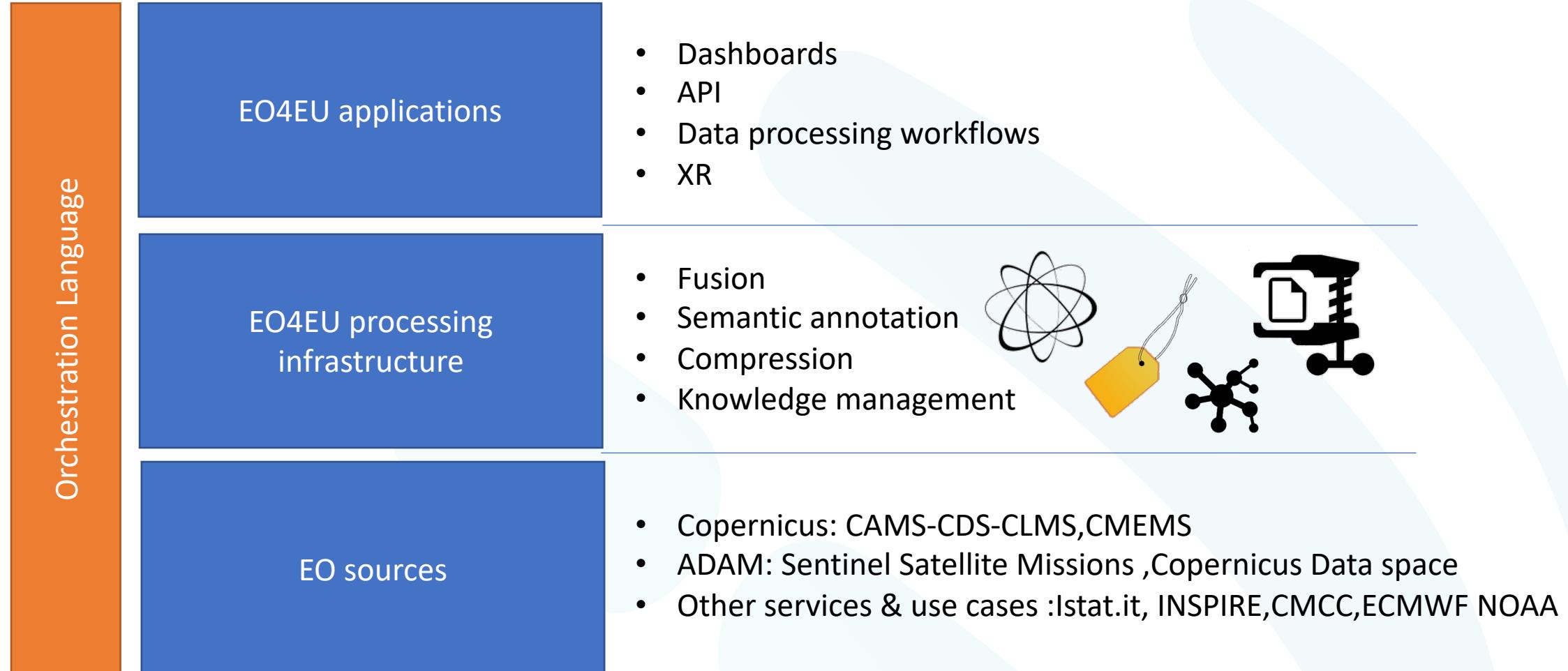
EO4EU - brief intro

- EO4EU provides improved access to the EU EO data offered by a variety of platforms and data repositories.
- Data sources include Copernicus services and associate platforms like the DIAS, but also upcoming initiatives like Destination Earth (DestinE)
- Users interact through :
 - A multi-layered user interface (GUI) for visual analytics coupled with a Workflow Editor,
 - A Command Line Interface (CLI), and a respective Application Programming Interface (API),
 - An extended reality (XR) interface

EO4EU Partners



EO4EU architectural bird's-eye view



EO4EU Platform

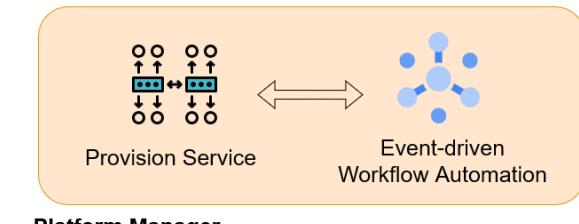
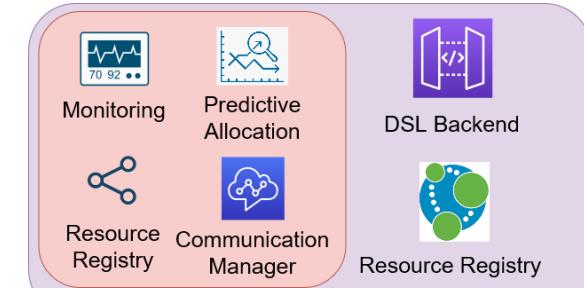
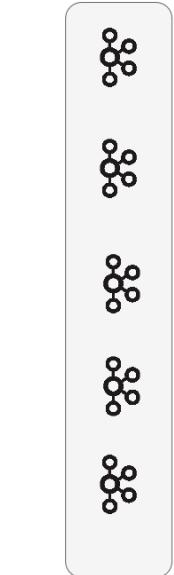
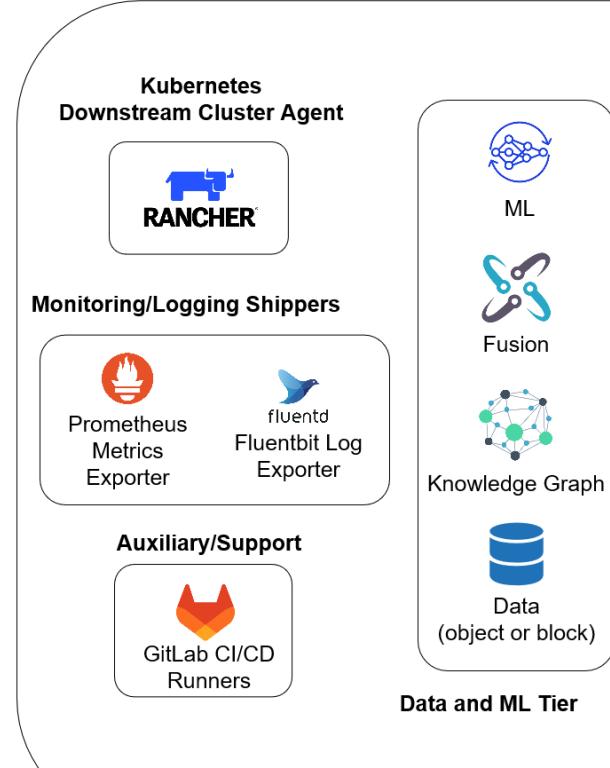
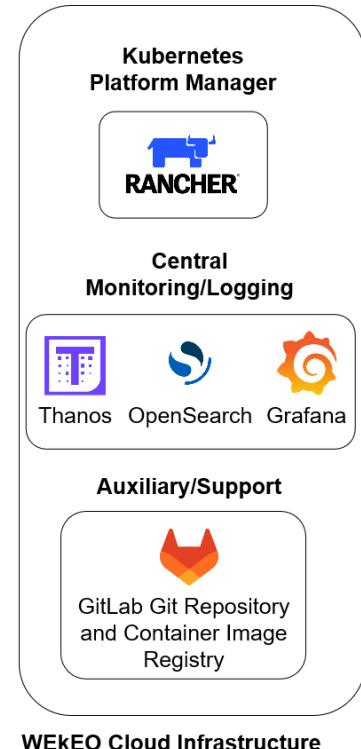
The EO4EU Platform* allows for searching, discovering processing and analyzing EO data and is based on a series of innovative technologies which allow to:

- Access** EO data from different sources (e.g., Copernicus, Galileo, ECMWF)
- Support a sophisticated representation of data through a semantic-enhanced **Knowledge Graph**
- Use **Machine Learning** from marketplace to EO data processing
- Visualize EO data through easy-to-use graphical interfaces and **Extended Reality** applications



* <https://www.eo4eu.eu/platform>

** Public user access: May 2024



EO4EU Multi-cloud infrastructure

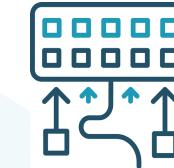
Key results



EO Data
Ecosystem



Semantic
Enhanced
Knowledge
Graphs



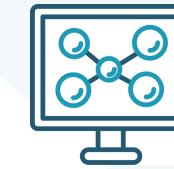
Data Fusion
Techniques



Dynamic
Semantic
Annotation
and Learned
Compression



Augmented/
Extended
Reality



Data Analytics
Visualisations

Who benefits?



Researchers and Academia:
Supports research institutions
with more accessible EO data



EO data providers:
Promotes further usage of EO
data through value added tools



Citizens and scientists:
Enables new actions to reduce
and monitor the impact of
climate change



Policy-Makers:
Supports evidence-based policy-
making and climate action



Private sector:
Encourages innovation through more
accessible EO data for non-technical users



Standards Development Organisations:
Contributes to the revision of standards
related to EO data

EO4EU Use Cases



EO for Personalised Health care Services: expand mobile allergy and airborne hazards forecasting



Food Security: improve adaptability of food production using EO4EU for live climate data tracking and analysis



Soil Erosion: Integrate rainfall datasets through EO4EU to assess soil susceptibility to water erosion



Civil Protection: Improve disaster and calamity prevention and response using EO datasets



Ocean Monitoring: optimise shipping industry travel time across different oceans considering live weather data



Forest Ecosystems: Improve forest productivity using EO4EU to simulate water, energy and carbon fluxes

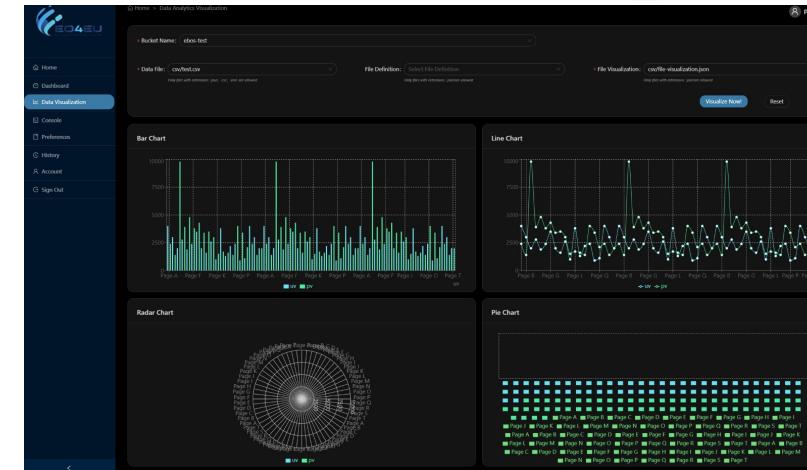
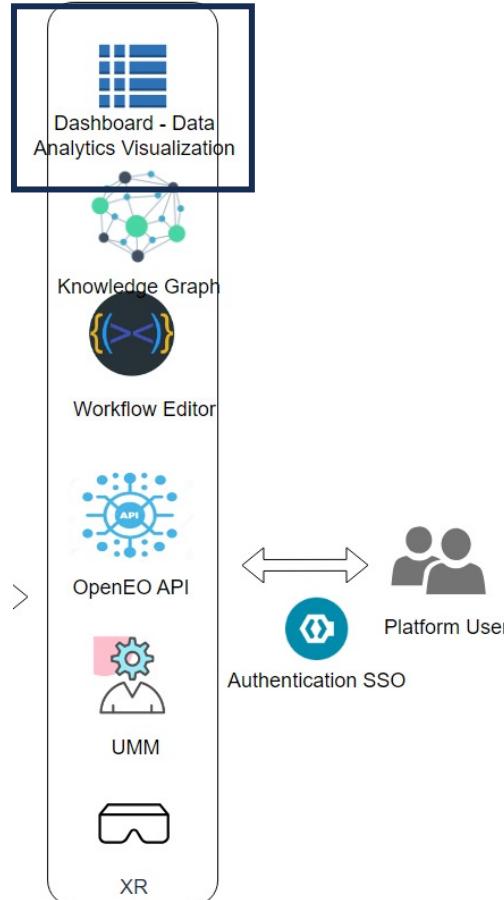


Environmental Pests: Locust plague impact assessment and prediction



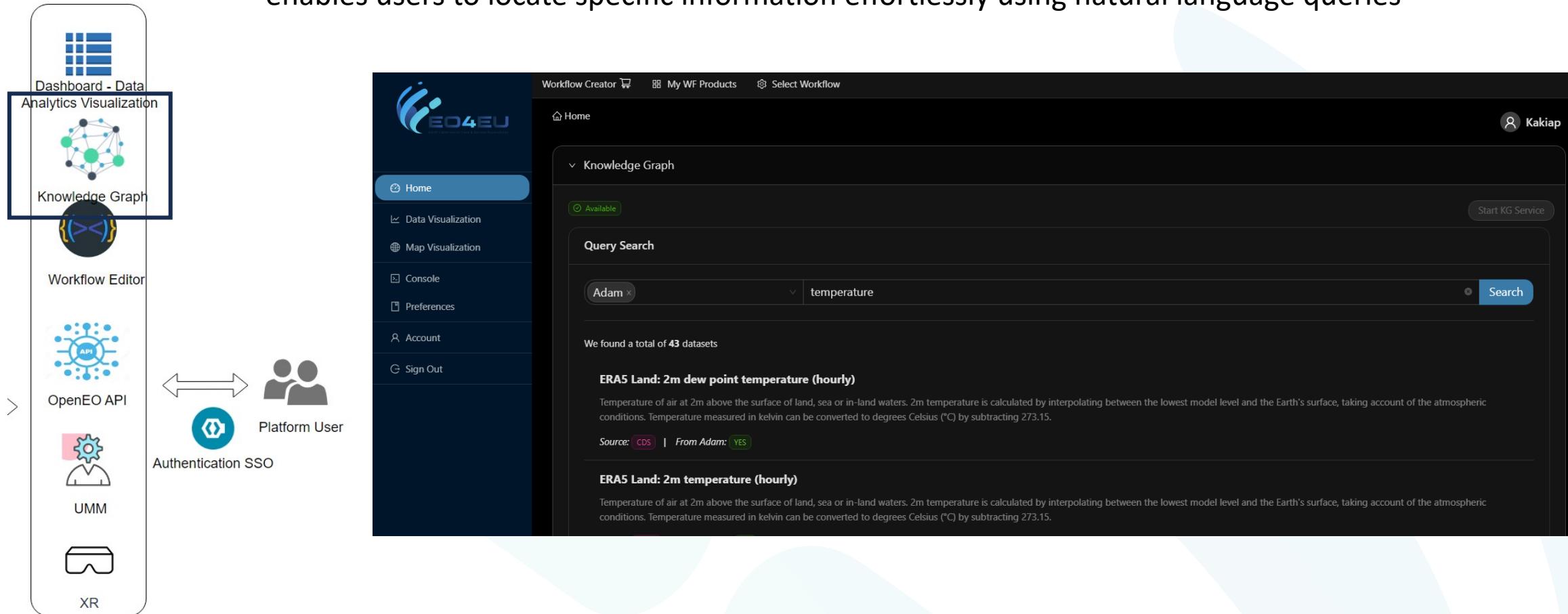
Visit <https://eo4eu.eu/use-cases>

EO4EU Components – Data visualization

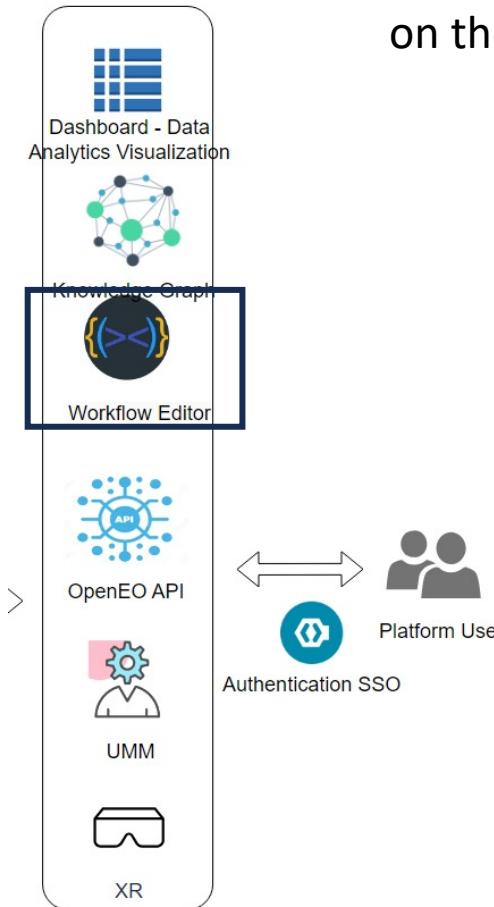


EO4EU knowledge graph enables users to access and explore EO data and derive valuable insights.

- integrates disparate datasets so that users can explore interconnected data points
- enables users to locate specific information effortlessly using natural language queries



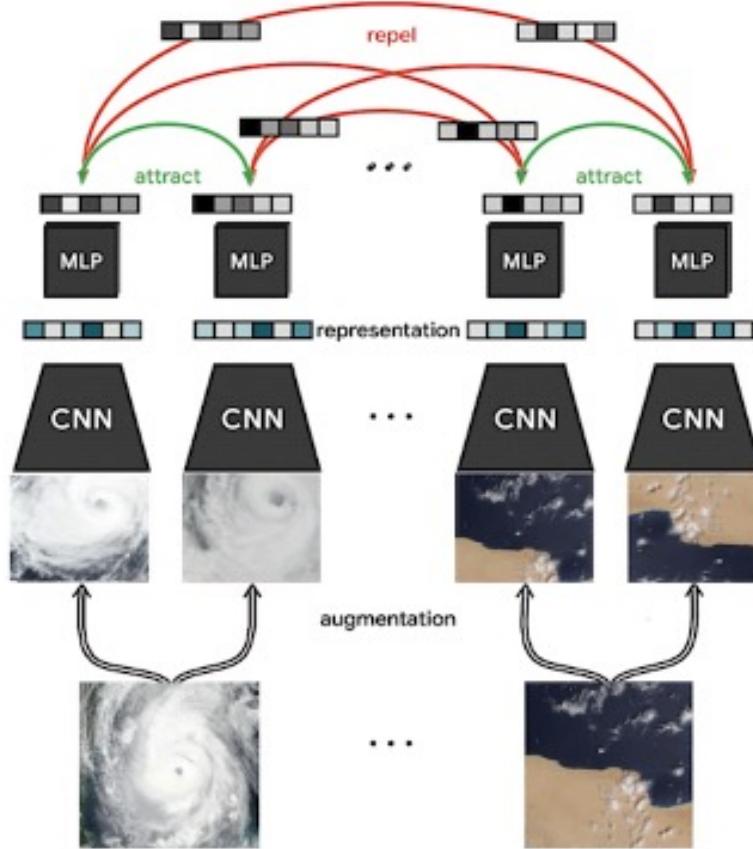
- Canvas with all the available tasks represented as blocks in the left column.
- User can drag & drop the block on the central canvas and connect the block using the links
- Blocks can also be configured by opening the configuration form available by clicking on the menu on the top right of the block



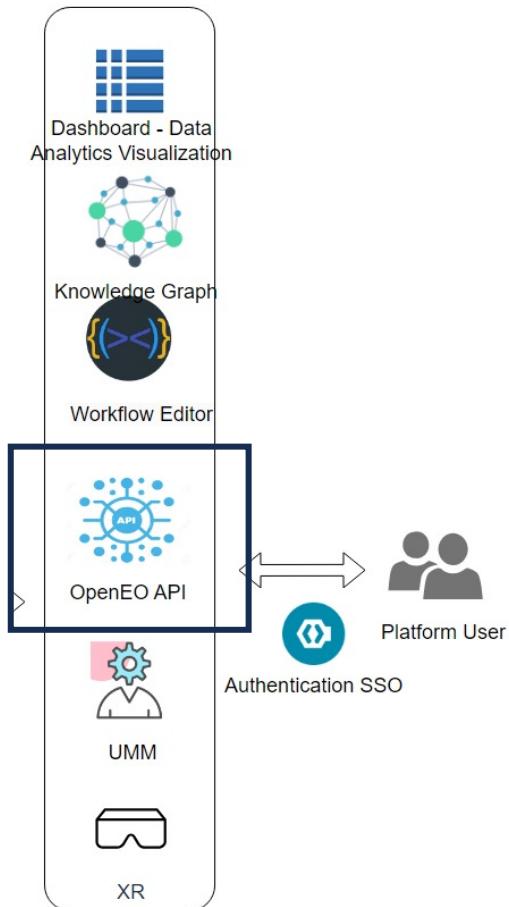
- Creates pipelines for
 - Spatiotemporal processing
 - Cleaning and preparation of data



Self Supervised Learning for EO Data



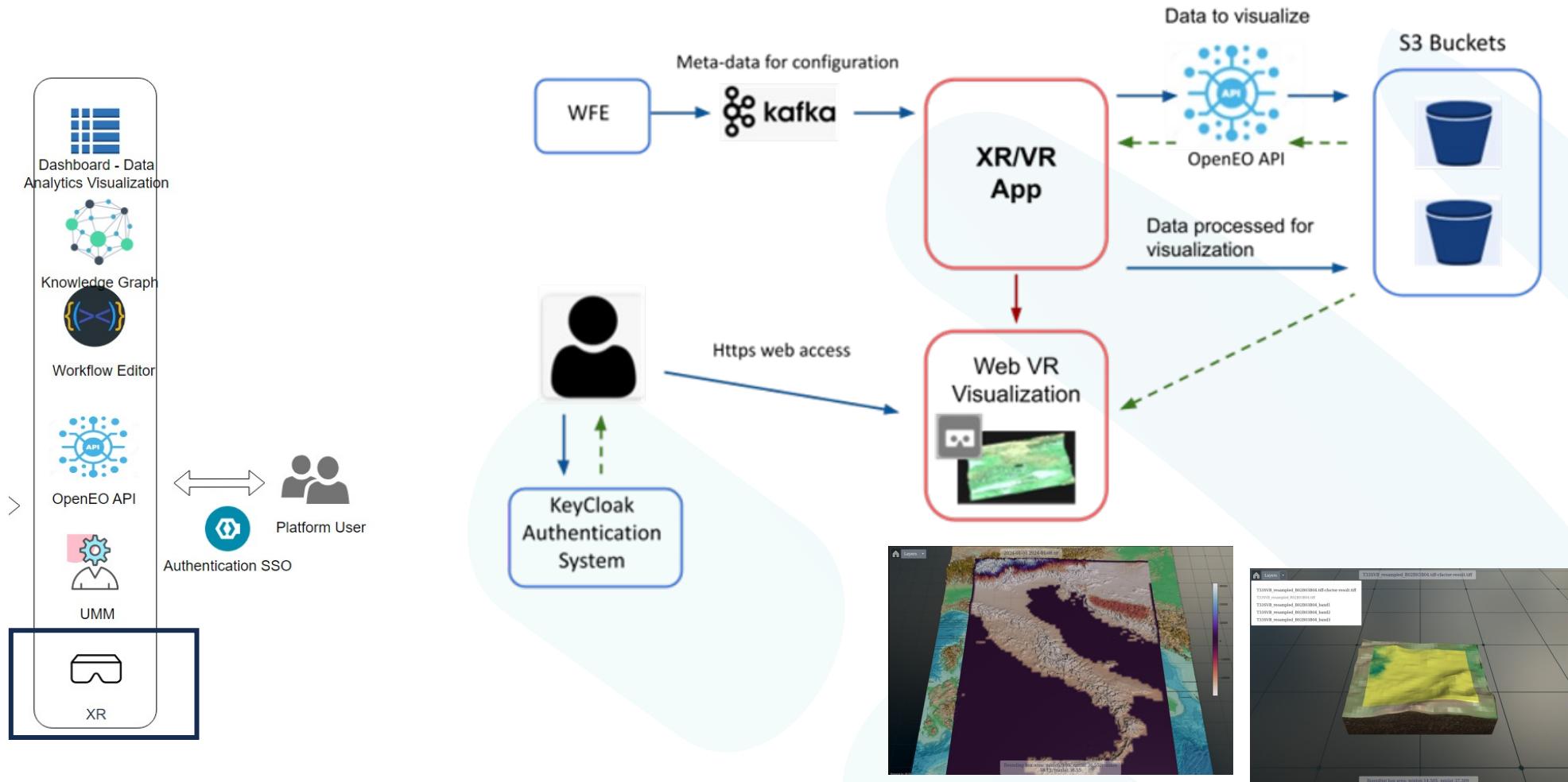
- We used contrastive learning
 - ⌚ to learn representations that bring close instances that should be similar
 - ⌚ using ConvNets and MLPs
 - ⌚ With EO specific augmentations,
- ⌚ We evaluate the learnt representations in downstream supervised tasks, land coverage.



Applications	
GET	/Applications
POST	/Applications
GET	/Applications/{id}
PUR	/Applications/{id}
DELETE	/Applications/{id}
GET	/Applications/{id}/client-secret
GET	/Applications/{id}/roles
Auth	
POST	/Auth/Token
GET	/Auth/UserInfo
POST	/Auth/Token/Refresh
Groups	
GET	/Groups/count
GET	/Groups
POST	/Groups
GET	/Groups/{id}
PUR	/Groups/{id}
DELETE	/Groups/{id}
GET	/Groups/{id}/members
Resources	
GET	/Resources/count
S3	
POST	/S3/bucket/create
GET	/S3/buckets
GET	/S3/bucket/{bucketName}
DELETE	/S3/bucket/delete
POST	/S3/bucket/{bucketName}/files/upload
GET	/S3/bucket/{bucketName}/files
Store	
POST	/Store
GET	/Store/all
DELETE	/Store/clear
Users	
GET	/Users/count
GET	/Users
POST	/Users
GET	/Users/{id}
PUR	/Users/{id}
DELETE	/Users/{id}
GET	/Users/{id}/history
GET	/Users/{id}/credentials

- External user access to the EO4EU platform using their own dashboard, using compatible OpenEO API can:
 - Connect with KG
 - Create/start/select aWF workflow
 - Communicate with CFS components
 - Access S3 bucket
 - Visualize Data

EO4EU Components – XR/VR



Data Tier

A set of data sources is the input of the platform. Heterogeneous data that need pre-processing with the help of a Knowledge Graph.

•Data Sources

- Interlink heterogeneous data sources (different type formats) with the EO4EU ecosystem through Open APIs (e.g. Climate Data Store API for historical occurrence of extreme weather events).
- Access to historical and daily EO datasets.
- Access to real time data collections streamlines (for live connections with devices and applications).
- Access to open access cohorts of the EC through cloud-based platforms established to provide centralized access to Copernicus data, as well as to GEOSS, INSPIRE, DestinE, Galileo/ EGNOS programmes.
- Access to open datasets and services provided by ECMWF.

Data Tier

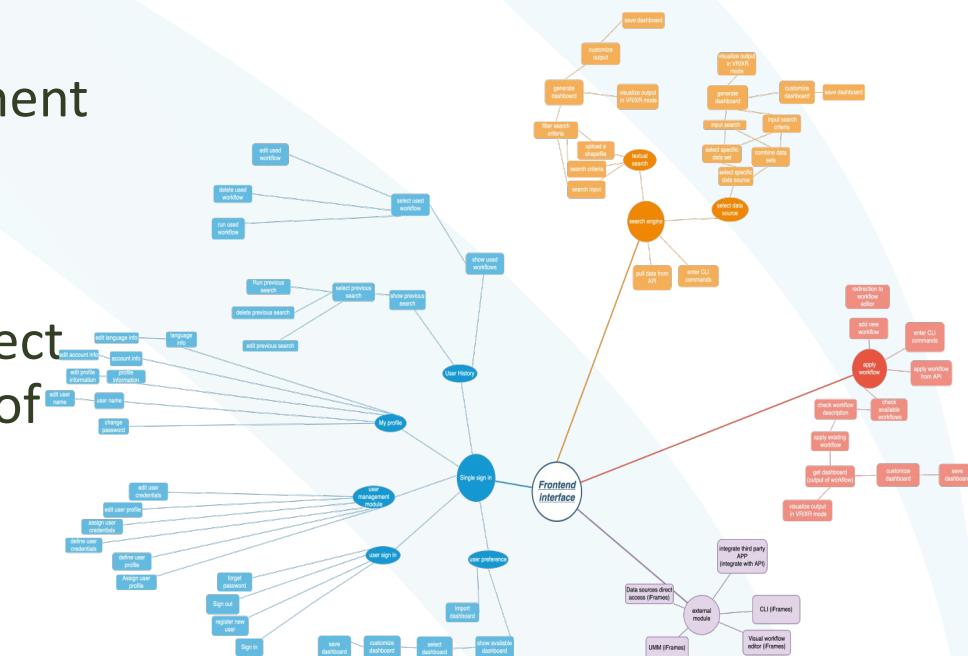
Knowledge Graph-based Decision Making

- A Graph-Based Text Representation is introduced.
- This approach enables the extraction of informative features, structural or textual, for each entity related to the whole knowledge graph.
- For structure-related features, graph measures or indices such as common neighbors, preferential attachment and Adamic Adar indexing will be used.
- For text-related features, graph similarity techniques including graph neural networks and graph kernels will be used.
- By establishing a link prediction pipeline, EO4EU focuses on predicting possible relationship types between nodes of a knowledge graph.

Front-end Tier - Dashboard - Data Analytics Visualization

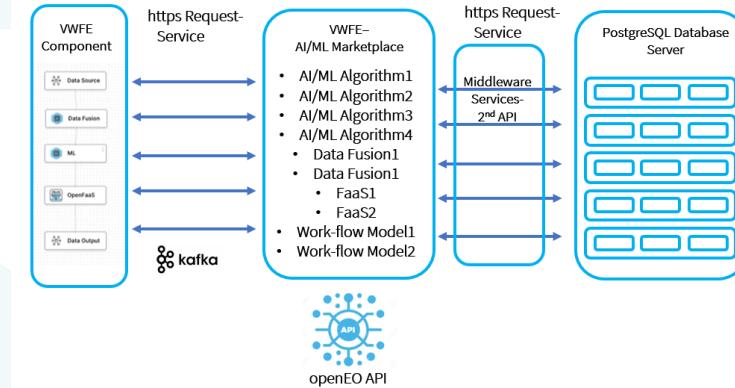
Provides multi-dimensional User Interface-UI (Web, XR, CLI, API) that enables the user to interact and control the platform.

- Decision-making and policy-maker
 - Real-time data analytics and interpretation of environment observations
 - Real-time mapping and interactions
 - Smart Search Engine based on Text or Annotation – Select Data - Smart Category-Type-Parameters Search Engine of the searched item
 - Dashboard creation
 - Web XR/VR Visualization methods
 - Data Analytics based on statistical metrics



Front-end Tier - AI/ML Marketplace

- AI/ML Models-Algorithms-Techniques
- Metadata
- Data Models for Processing and Communication from Block to Block
- Programming Code
- Configuration Files
- Documentation



Building processing workflows

Available Tasks

You can drag these to the pane on the right.

Search

Data Source Data Output

OpenFaaS ML

Data Fusion AR/XR

Customer Face

OpenFaaS Configuration

You can use the editor to create your own script.

```

1 def handle(req):
2     import boto3
3     import os
4     import json
5     """Handle a request to the function
6     Args:
7         req (str): request body test test test
8     """
9     s3_bucket_name = get_configMap("s3", "bucket")
10
11     resource = boto3.resource(
12         "s3",
13         region_name=get_configMap("s3-access", "region_name"),
14         endpoint_url=get_configMap("s3-access", "endpoint_url"),
15         aws_access_key_id=get_configMap("s3-access", "aws_access_key_id"),
16         aws_secret_access_key=get_configMap("s3-access", "aws_secret_access_key"),
17     )
18
19     file_url = req["file_url"].split("/")
20     local_file=req["file_url"].rsplit("/",1)[1]
21     resource.Bucket(s3_bucket_name).download_file(file_url, "./"+local_file)
22     # Python code-----
23     print(local_file)
24
25
26     output_file = local_file
27
28     resource.Bucket(s3_bucket_name).upload_file(

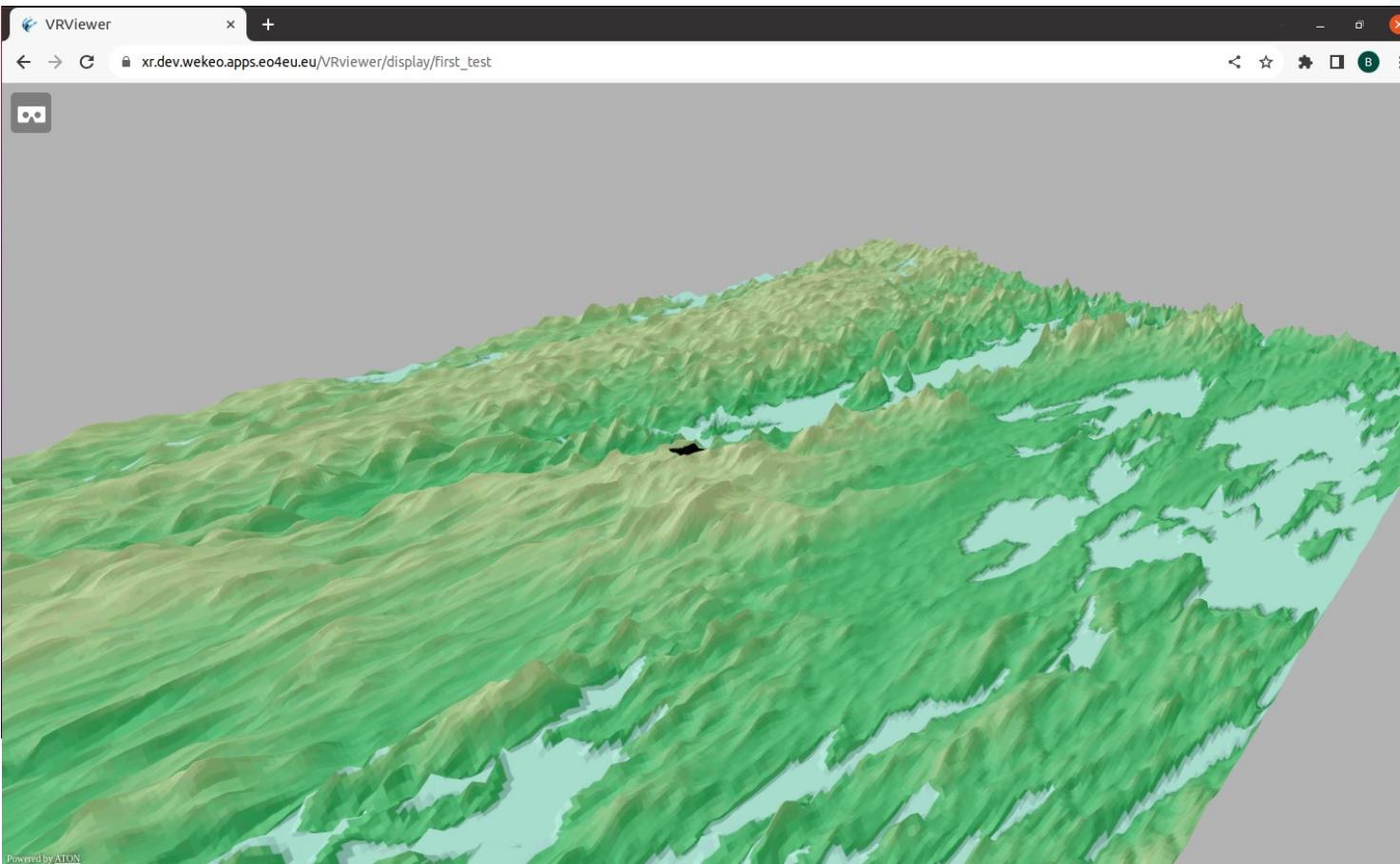
```

Building processing workflows

The screenshot shows the EO4EU platform interface. On the left, there's a sidebar with a search bar and a list of available tasks: Data Source, Data Output, OpenFaaS, ML, Data Fusion, AR/XR, and Customer Face. A central workspace displays a workflow diagram with three main components: 'Data Source', 'OpenFaaS', and 'Data Output'. Arrows indicate a flow from 'Data Source' to 'OpenFaaS', and from 'OpenFaaS' to 'Data Output'. On the right, there's a 'Script (Python3)' editor titled 'OpenFaaS Configuration' containing the following Python code:

```
1 def handle(req):
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4     import json
5     """Handle a request to the function
6     Args:
7         req (str): request body test test test
8     """
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14        endpoint_url=get_configMap("s3-access", "endpoint_url"),
15        aws_access_key_id=get_configMap("s3-access", "aws_access_key_id"),
16        aws_secret_access_key=get_configMap("s3-access", "aws_secret_access_key"),
17    )
18
19    file_url = req["file_url"].split("/",3)[3]
20    local_file=req["file_url"].rsplit("/",1)[1]
21    resource.Bucket(s3_bucket_name).download_file(file_url, "./"+local_file)
22    # Python code-----
23    print(local_file)
24
25
26    output_file = local_file
27
28    resource.Bucket(s3_bucket_name).upload_file(
```

At the bottom left, there's a copyright notice: ©2023 All rights reserved | EO4EU.



<https://xr.dev.wekeo.apps.eo4eu.eu/VRviewer>

Prepare the EO data

- Download the data from S3 bucket
- Reproject the data to EPSG:4326

Prepare the 3D model

- Get the Digital Elevation Model
- Get the texture for the context
- Create a 3D model integrating the EO data, the context data and the DEM

Export and Display

- Export the 3D model to GLTF
- Create 3D tiles from the exported model
- Display on a Webpage



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