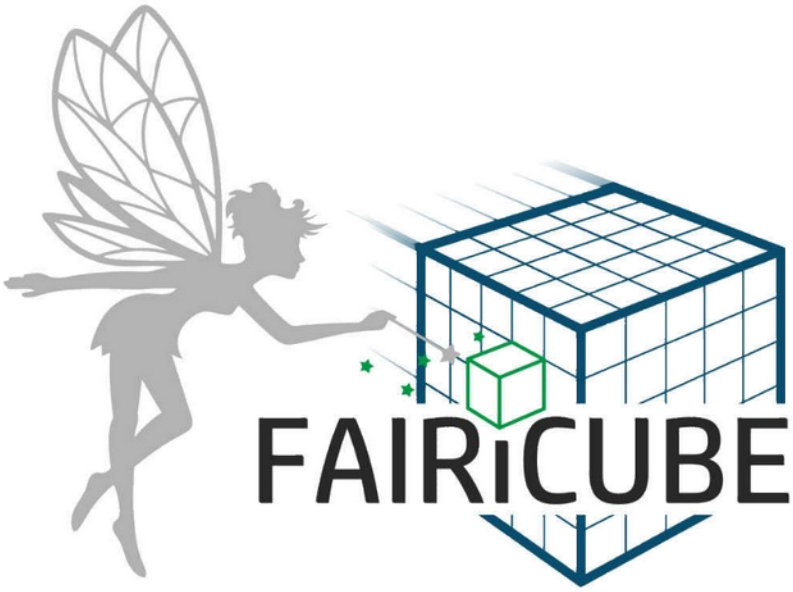

FAIRICUBE – F.A.I.R. INFORMATION CUBES

WP4 Share

D4.2 Public Listing (Catalog) of FAIRiCUBE data resources

Deliverable Lead: EOX
Deliverable due date: 31/03/2025

Version: 2.8
24/08/2025

Document Control Page

Document Control Page	
Title	D4.2 Public Listing (Catalog) of FAIRiCUBE data resources
Creator	EOX
Description	The Public Listing (Catalog) of FAIRiCUBE data resources details the processes and procedures as well as the software and services used for managing metadata of data resources within FAIRiCUBE
Publisher	"FAIRICUBE – F.A.I.R. information cubes" Consortium
Contributors	EOX, all partners
Date of delivery	
Type	Text
Language	EN-GB
Rights	Copyright "FAIRICUBE – F.A.I.R. information cubes"
Audience	☒ Public ☐ Confidential ☐ Classified
Status	☐ In Progress ☐ For Review ☐ For Approval ☐ Approved

Revision History			
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1.4	14-06-2023	Christian Schiller, EOX	reworking of Tabel 1
1.5	17-11-2023	Christian Schiller, Mussab Abdalla, Stephan Meißl, EOX	reworking of chapter due to the big changes in the metadata requirements reworking of Tabel 1, according to new Inventory.xlsx updating/adding Figures 2-4

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			showing Data Ingestion Request WebGUI
1.6	29-11-2023	Christian Schiller	Updating Chapter 2 and 4
2.0	19-12-2023	Mussab Abdalla	Final Check
2.1	20-12-2023	Jaume Targa/Lorena Banyuls (4sfera)	Final Review
2.2	2024-05-31	Mussab Abdalla, Christian Schiller	Update STAC item description Update Table 1
2.3	2024-06-21	Jaume Targa	Final Review and forma checking
2.4	2024-06-27	Mussab Abdalla, Christian Schiller	Reworking of Table 2 extended List of available resources
2.5	2025-03-11	Mussab Abdalla, Christian Schiller	Updated: links to catalog; description of the ingestion procedure and the catalog editor interface; Figures 1, 3, & 4; Reworking of Table 1; list of available resources
2.6	2025-03-26	Jaume Targa	Review
2.7	2025-03-31	Christian Schiller	Finalization
2.8	2025-08-24	Mussab Abdalla, Christian Schiller	Update Table 1 in accordance with STAC-Project Steering Committee, Update Screenshots of Catalog-Editor (Figure 2-7), update of json-Example

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Disclaimer

This document is issued within the frame and for the purpose of the FAIRICUBE project. This project has received funding from the European Union's Horizon research and innovation programme under grant agreement No. 101059238. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the European Commission.

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1 Introduction

The FAIRiCUBE Catalog, integrated into the FAIRiCUBE Hub, provides human access to the resource metadata, enabling potential users to identify and access available resources. Metadata required for the description of data resources are described within this deliverable D4.2 whereas metadata for processing/analysis resource are described in the deliverable D4.3. In addition, the information from the FAIRiCUBE Catalog on data resources is also exposed via STAC (SpatioTemporal Asset Catalog) API (Application Programming Interface). To ensure that the diverse processing-analysis resources created within the FAIRiCUBE Hub are truly FAIR, these principles must be fully applied. Pertaining to these resources, the application of the FAIR principles is:

1 **Findable**: the necessary metadata must be provided for these resources, to enable potential users to easily find them as well as assess their suitability for the task at hand.

2 **Accessible**: the resources must be available to potential users under clear conditions. If licensing conditions apply, these must be provided in a transparent manner

3 **Interoperable**: it must be possible to apply the available processing-analysis resources to different spatiotemporal settings and source data

4 **Reusable**: it must be possible to execute the available processing-analysis resources in different settings, whereby tailoring of these resources to specific requirements should be possible.

Of primary concern to this document is the findability aspect, what metadata is required to enable potential users to identify suitable data resources. The accessibility, interoperability, and reusability aspects are of secondary concern, as these are enabled by the FAIRiCUBE Hub. However, the requirements stemming from FAIRiCUBE Hub functionality must also be covered by the metadata foreseen for data resources.

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2 Metadata Requirements for Data Resources

The requirements for the Metadata, describing the datasets to be used within FAIRiCUBE, have been collected within the consortium. To collect all desired field names, discuss, harmonize, streamline and explain them was a very time-consuming task. A spreadsheet formed the basis for the collection of the desired field names needed. This spreadsheet was then translated to the Table 1 in this document. However, due to incompleteness of STAC the mapping of all the desired metadata fields to available STAC definitions was turned out to be more difficult than initially foreseen.

A need for additional metadata has been identified in use case discussions that should be covered by FAIRiCUBE Catalog. The need is to convey information about how to portray a data resource. This includes information like legends mapping values from the dataset to colours to be displayed. As this is tightly coupled with the datasets, such information should be provided on the dataset metadata level. The initial idea to manage all the information using GitHub issues had to dropped during course of the metadata definition phase, due to limitations of in the number of fields (max 55 fields supported) supported by GitHub.

Therefore, EOX developed a Web-GUI (see Figure 2) as an Input Frontend allowing to collect and edit the metadata for the data resources. The input from this Weg-GUI is collected, checked for consistency and errors and then directly stored as static STAC json items in GitHub. This ensures that all items stored in the GitHub repository act as the single "*Source of Truth*". The same interface is also available to edit already ingested metadata items.

2.1 Dataset metadata ingestion

The process of providing and submitting metadata to the FAIRiCUBE catalog is shown as a flowchart in Figure 1.

Before new metadata sets are provided one should thoroughly check the already existing FAIRiCUBE catalog at http://catalog.fairicube.eu if the desired dataset already exists. If not found in the catalog, a user may continue and search in the FAIRiCUBE Catalog Editor, provided at https://catalog-editor.eoxhub.fairicube.eu/ and check if such a dataset is already submitted as "work-in-progress". If yes, then the user may start editing the already existing entries, by pressing the respective "Edit Button" at the WebGUI (as shown in Figure 2) and provide the necessary information which is missing to continue and maybe finalize the ingestion process.
If also the Catalog Editor doesn't provide the desired dataset metadata then the user can start to add a new dataset metadata entry by selecting and pressing the "New Button" (Figure 2).

In either case, when the "Save Button" is pressed in the Catalog Editor the information will be made available as a GitHub Pull Request and the responsible information owner will be notified. Once the owner reviews the metadata dataset and all is complete and correct, the dataset will be merged and made available to the catalog (http://catalog.fairicube.eu/).

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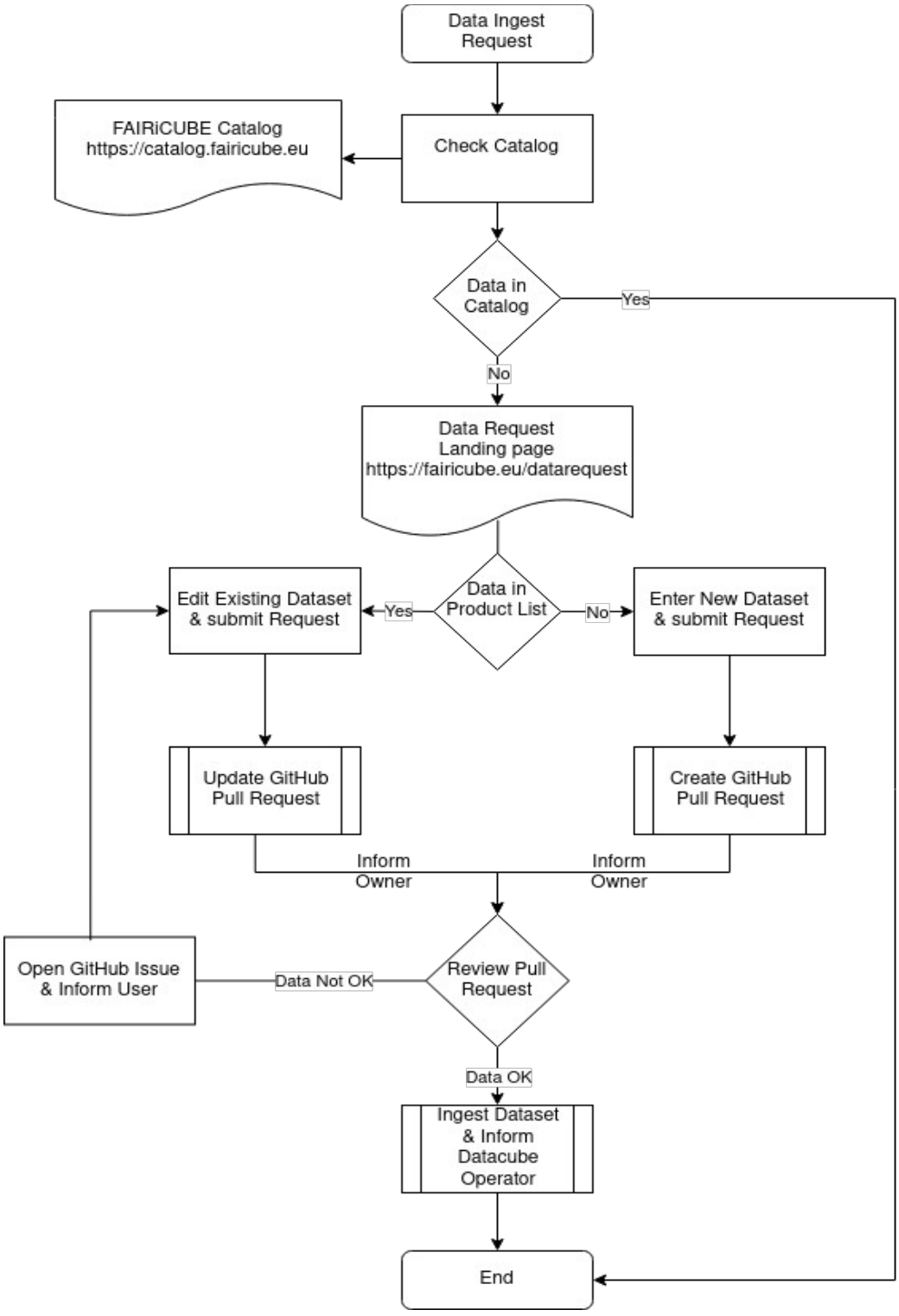

Figure 1 Data Ingestion Request Procedure

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2.1.1 Catalog Editor - Web Interface

Figure 2 shows the landing page of the WebGUI which can be used to create new or update existing datasets. In Figure 2 also a sample list of available datasets is shown, each with an "Edit Button" associated. Additionally, a "Link Button" is provided which directly links to the Pull Request in the respective GitHub repository and also provides access to the *json files and allows reviewing any changes and comments provided.

When a user enters a name in the "Search field" to Filter products the searching of available metadata datasets will be performed instantaneously. The search is not case sensitive and is full-text (i.e. also substrings inside a name will be found). This comes in handy if the name is not exactly known.
If a user presses the "New Button" on the Landing page, a new empty version of the data entry form will be displayed (Figure 3-7), allowing the user to create a new record. If a user chooses an already existing dataset and uses the "Edit Button", the same entry form will be shown but with the already available values filled in.

Thereafter the Catalog Editor will show the editing page, as shown in Figure 3-7, which provides a series of entry-fields to be filled with the respective metadata information. Some helpful text is provided together with each field, and required fields are indicated with a "*" together with the field label (e.g. Title*).

The provided "Back Button" at the top of the editing page allows to step out of the editing process without saving any of the recent changes. An additional warning will be presented to the user to make sure that performed work is not accidentality lost. The "Save Button" at the bottom of the editing page allow to save any intermediate results, so that editing can later be continued. Some plausibility checks are performed during saving and missing fields are indicated. However, while it's not possible to submit incomplete entries to the catalog, the current status of the edited fields is nevertheless stored for later editing (despite the warnings given for missing fields). Even with the possibility of saving your intermediate work effort, some fields are strictly necessary, and a saving of your work will not be possible without providing the respective information (e.g. Title, ID, Assignee)

Concurrently with the submission, when pressing the "Save Button", a GitHub Pull Request will be initiated and the Assignee will be informed about the submission. The responsibility of the Assignee is to manually verify, together with the requester, the completeness and the correctness of the submitted metadata. Any progress, problems, discussions, etc. shall be documented in a GitHub issue associated to the respective Pull Request, so that everybody interested can follow the progress and provide additional feedback and/or information as necessary.

The procedure for this verification loop is also shown in the flowchart in Figure 1. Once the verification process is successfully finished, the requester will initiate the merge process at GitHub, which will then initiate the deployment procedure, implemented using GitHub pages. The metadata content is directly harvested (STAC-fastapi/pgSTAC to provide a STAC API) and made available via the Catalog Client, based on STAC Browser. After the successful merge the Pull Request will be closed, and the respective branch will be closed and deleted. However, any issues and discussions associated with the Pull Request will stay available, even after the branch has been merged and deleted. The dataset metadata will then be available via the FAIRiCUBE catalog, which is deployed at https://catalog.fairicube.eu.

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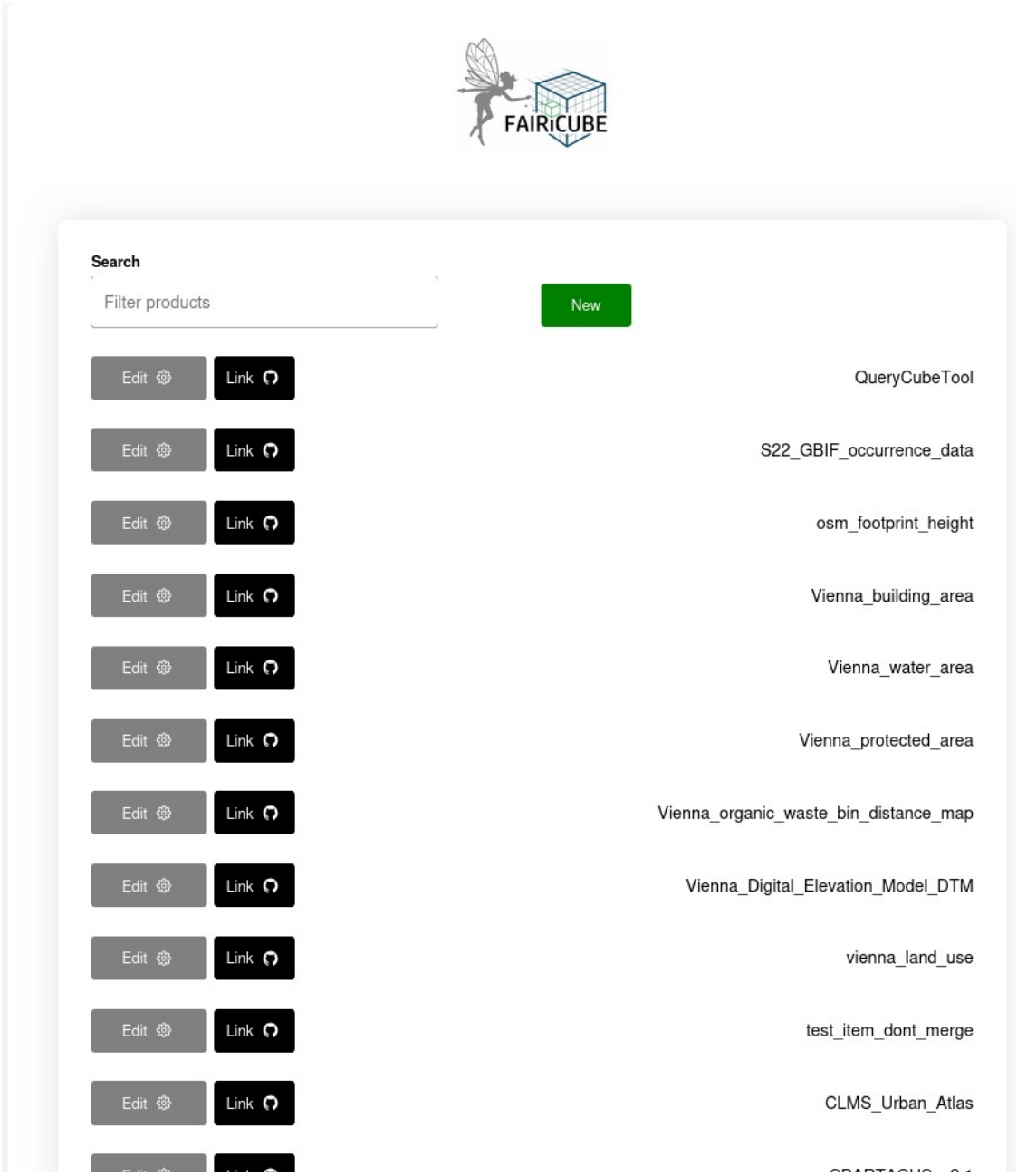

Figure 2: Data Ingestion Request Web GUI – Landing page (partly)

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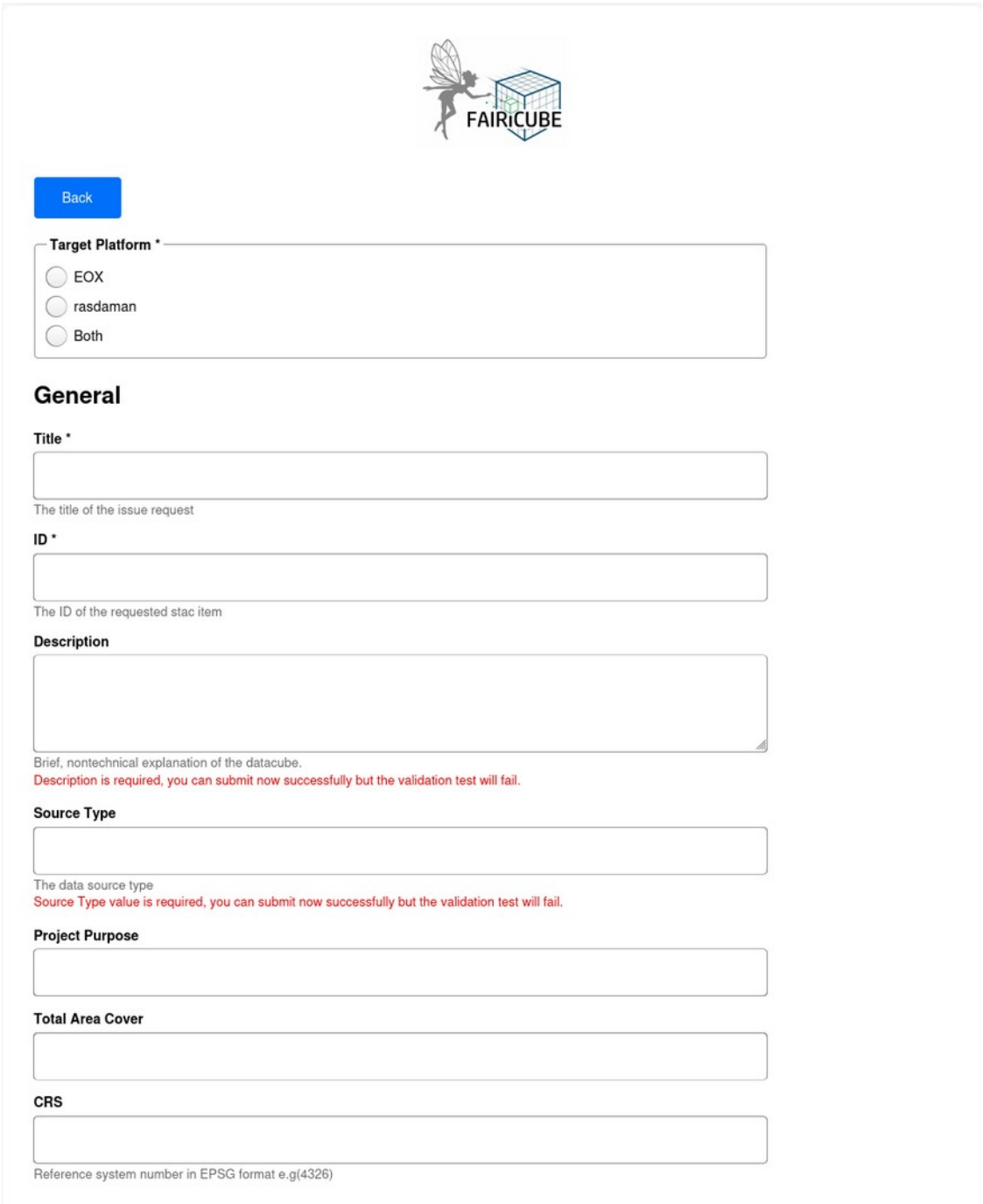

Figure 3: Data Ingestion Request Web GUI - Data entry page Part-1

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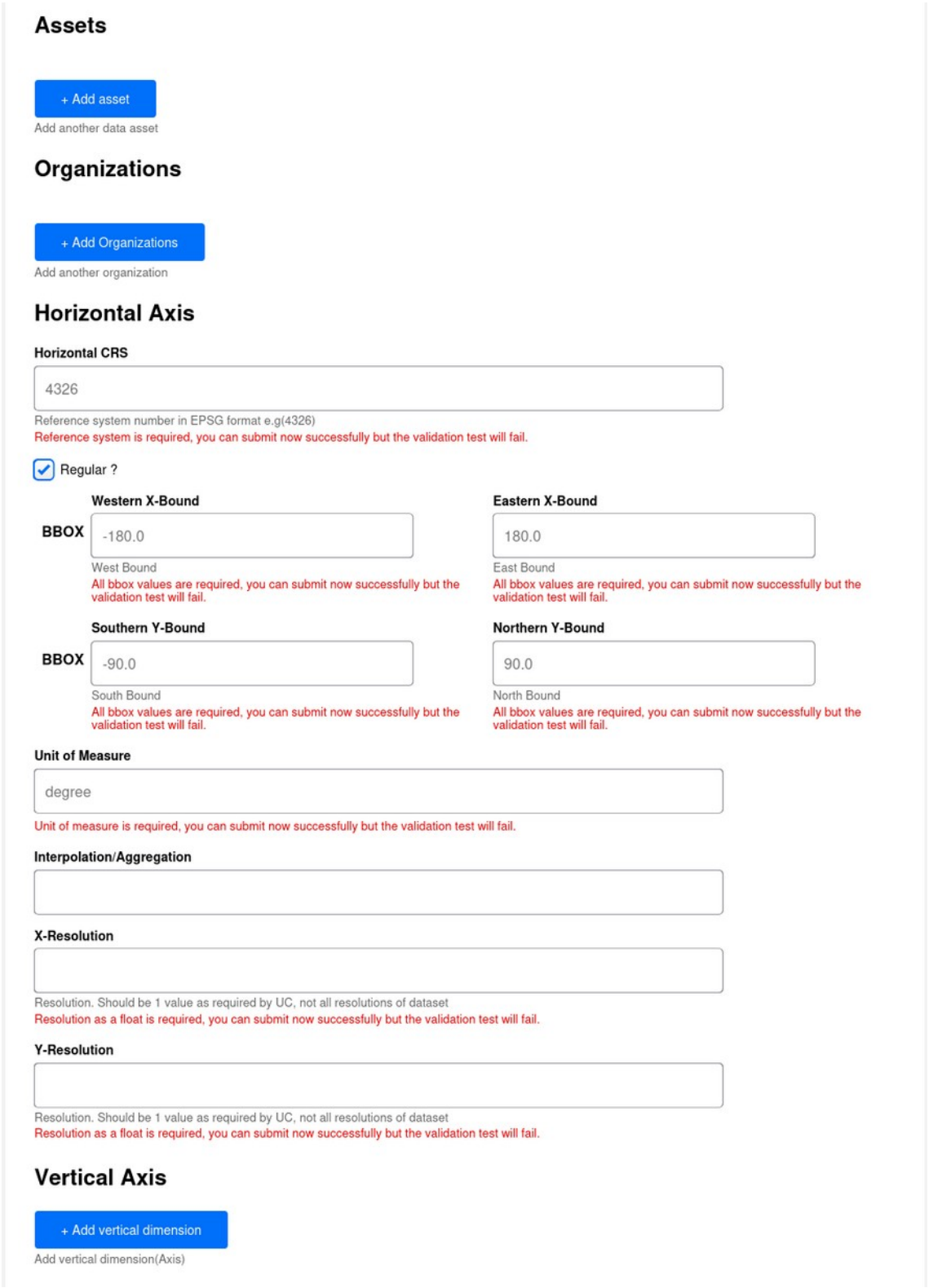

Figure 4: Data Ingestion Request Web GUI - Data entry page Part-2

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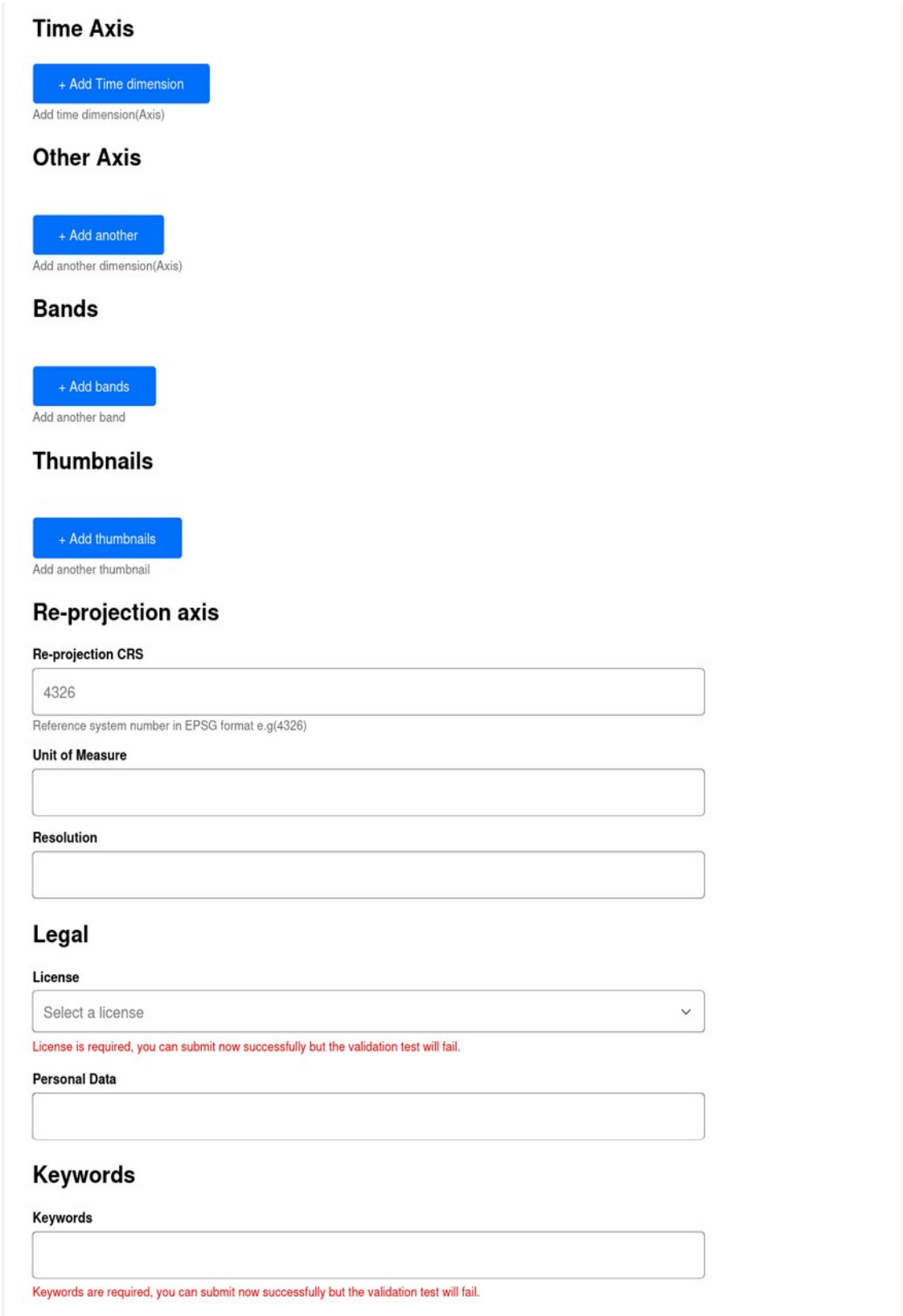

Figure 5: Data Ingestion Request Web GUI - Data entry page Part-3

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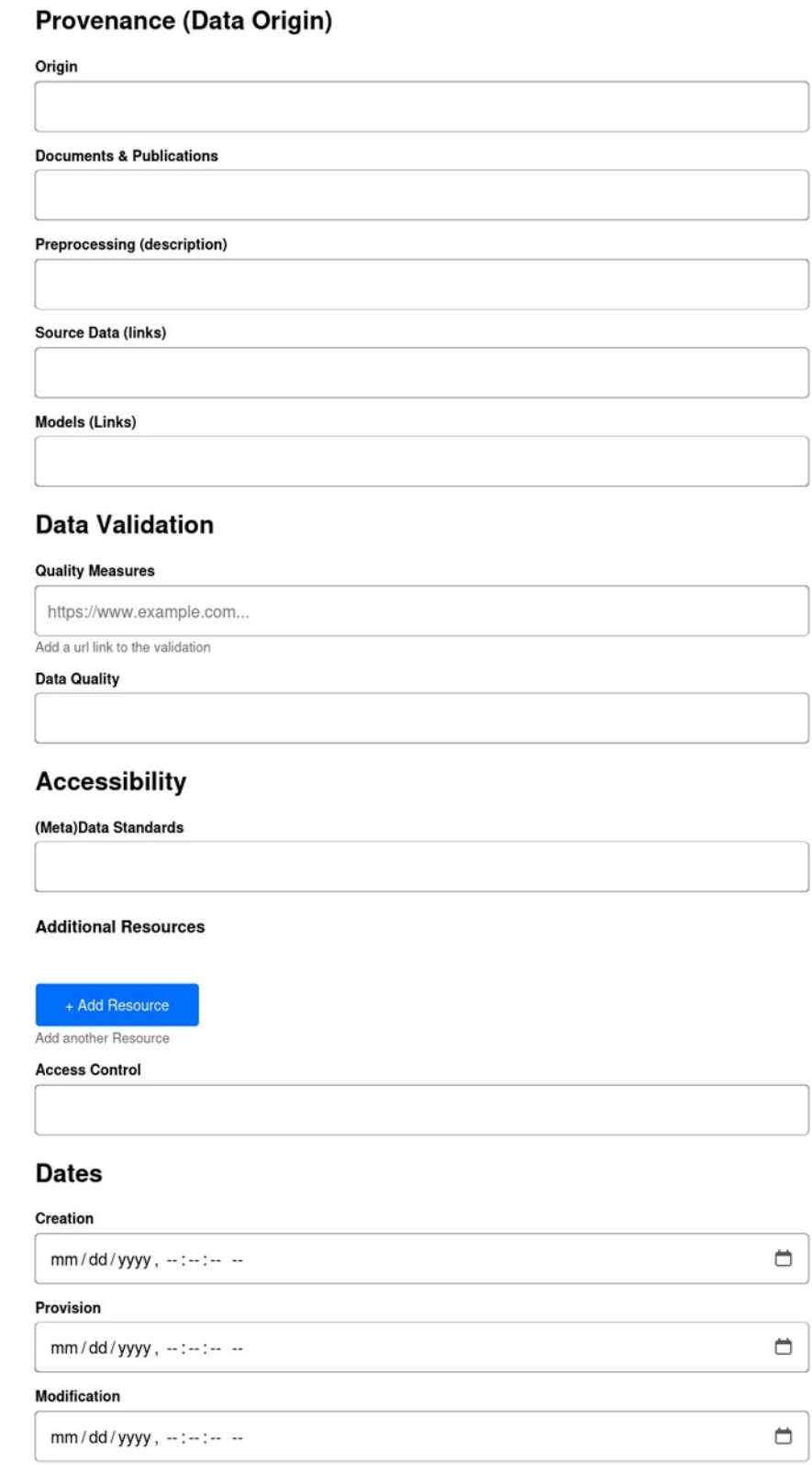

Figure 6: Data Ingestion Request Web GUI - Data entry page Part-4

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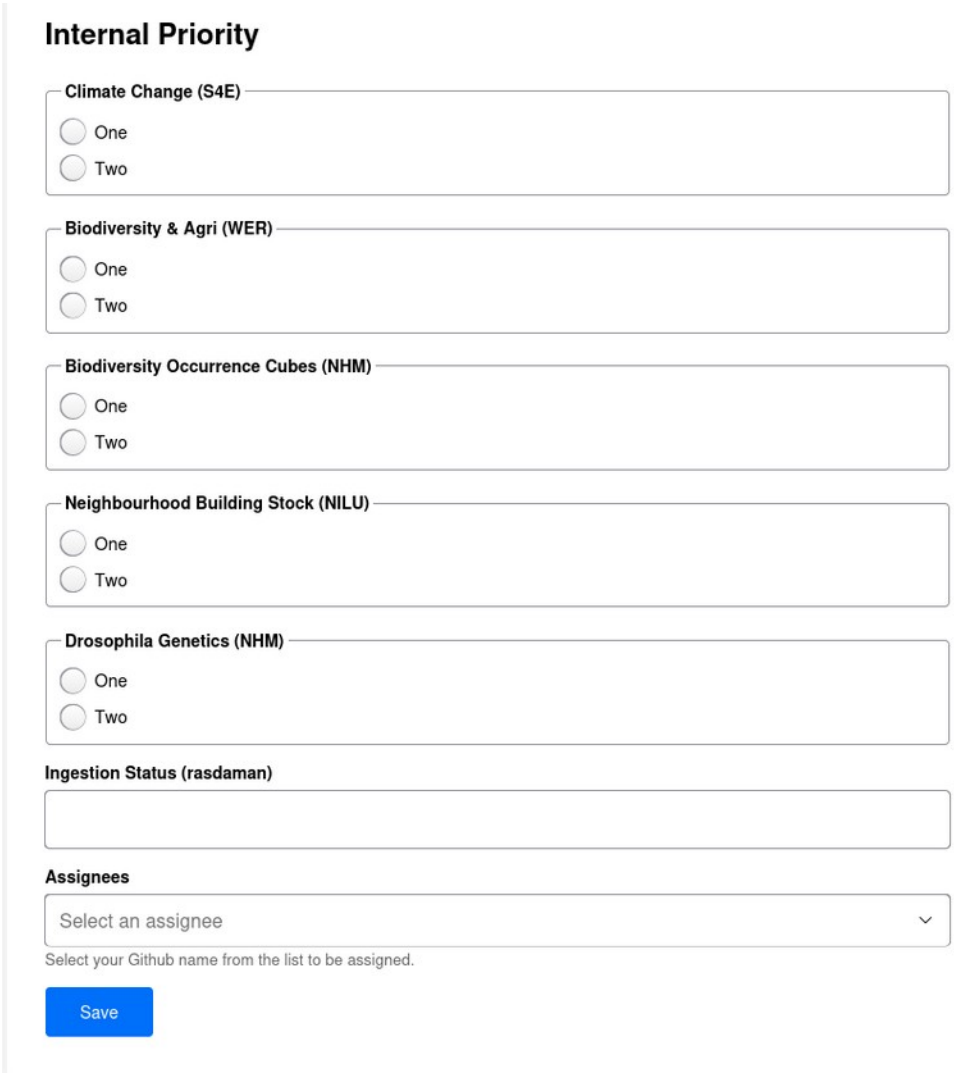

Figure 7: Data Ingestion Request Web GUI - Data entry page Part-5

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3 FAIRiCUBE Metadata for Data Resources

In this section, the metadata identified for the description of data resources and their mapping to the STAC standard are described. In addition, new STAC fields are proposed which are desired by the FAIRiCUBE team members but are currently not covered by the STAC standard or by a STAC extension.

The FAIRiCUBE consortium decided to rely on the STAC (SpatioTemporal Asset Catalog) specification[1]. The four key components of STAC include items, catalogs, collections, and the STAC API[2]:

- **STAC Item**: A STAC item is the foundational building block of STAC. It is GeoJSON supplemented with additional metadata that enables clients to traverse through catalogs.
- **STAC Catalog**: A Catalog is usually the starting point for navigating a STAC. A catalog.json file will contain contains links to some combination of other catalogs, collections, and/or items. This combination is quite variable and flexible depending on how the data is being organized.
- **STAC Collection**: A STAC Collection builds upon the STAC Catalog specification to include additional metadata about a set of items that exist as part of the collection.
- **STAC API**: STAC Catalogs can be static, by creating the json files and storing them. This makes static STAC Catalogs highly portable, reliable, providing a solid foundation for building dynamic versions through the use of APIs. A STAC API is a RESTful API specification for querying STAC Catalogs in a dynamic way. It is designed with a standard set of endpoints for searching Catalogs, collections, and items.

The entry point to the FAIRiCUBE Catalog is a STAC Catalog[3]. It lists all the available STAC collections, where each STAC Collection includes data as individual STAC Items linking to the describing json files. An example snippet from the entry STAC Catalog representing the FAIRiCUBE Catalog for the CORINE Land Cover looks like this:

```
{
    "rel": "item",
    "type": "application/json",
    "href": "
https://fairicube.github.io/data-requests/CORINE_LAND_COVER/CORINE_LAND_COV
ER.json",

}
```

The full item description for the CORINE Land Cover utilizing the STAC Datacube extension[4] looks like below. This item describes the CORINE Land Cover which is a typical land cover dataset consisting of 44 land cover and land use classes derived from a series of satellite missions since it was first established in 1990 currently up to 2018.

1 https://stacspec.org

2 https://stacspec.org/en/tutorials/intro-to-stac/

3 https://catalog.fairicube.eu/stac/index.json

4 https://github.com/stac-extensions/datacube

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```
{
    "id": "corine_land_cover",
    "bbox": [
        -56.5051419017044,
        24.2841770079211,
        72.90613675900907,
        58.95275109308057
    ],
    "type": "Feature",
    "links": [
        {
            "rel": "collection",
            "type": "application/json",
            "href": "https://stacapi.eoxhub.fairicube.eu/collections/index"
        },
        {
            "rel": "parent",
            "type": "application/json",
            "href": "https://stacapi.eoxhub.fairicube.eu/collections/index"
        },
        {
            "rel": "root",
            "type": "application/json",
            "href": "https://stacapi.eoxhub.fairicube.eu/"
        },
        {
            "rel": "self",
            "type": "application/geo+json",
            "href":
"https://stacapi.eoxhub.fairicube.eu/collections/index/items/corine_land_co
ver"
        },
        {
            "rel": "about",
            "href":
"https://catalog:JdpsUHpPoqXtbM3@fairicube.rasdaman.com/rasdaman/ows?
&SERVICE=WCS&VERSION=2.1.0&REQUEST=DescribeCoverage&COVERAGEID=corine_land_
cover&outputType=GeneralGridCoverage",
            "type": "text/xml",
            "title": "Link to the rasdaman coverage description in XML"
        },
        {
            "rel": "service",
            "href":
"https://catalog:JdpsUHpPoqXtbM3@fairicube.rasdaman.com/rasdaman-
dashboard/?layers=corine_land_cover",
            "type": "text/html",
            "title": "Link to the rasdaman web application to Access,
process gridded data"
        },
        {
            "rel": "cite-as",
            "href": "https://land.copernicus.eu/pan-european/corine-land-
cover",
            "title": "EEA"
        },
        {
            "rel": "processing",
```


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```
            "href":
"https://sdi.eea.europa.eu/catalogue/copernicus/api/records/c89324ef-7729-
4477-9f1b-623f5f88eaa1?language=all",
            "title": "Documents & Publications"
        },
        {
            "rel": "measurement-method",
            "href": "https://www.mdpi.com/2072-4292/14/21/5455",
            "type": "text/html",
            "title": "Measurement Method"
        },
        {
            "rel": "processing-validation",
            "href": "https://land.copernicus.eu/terms-of-use",
            "type": "text/html",
            "title": "Validation"
        }
    ],
    "assets": {
        "thumbnail_rasdaman": {
            "href":
"https://catalog:JdpsUHpPoqXtbM3@fairicube.rasdaman.com/rasdaman/ows?
service=WMS&version=1.3.0&request=GetMap&layers=corine_land_cover&bbox=24.2
841770079211,-
56.5051419017044,58.95275109308057,72.90613675900907&time=\"1990-01-
01T00:00Z\"&width=800&height=600&crs=EPSG:4326&format=image/
png&transparent=true&styles=",
            "roles": [
                "thumbnail"
            ]
        }
    },
    "geometry": {
        "type": "Polygon",
        "coordinates": [
            [
                [
                    -56.5051419017044,
                    24.2841770079211
                ],
                [
                    -56.5051419017044,
                    58.95275109308057
                ],
                [
                    72.90613675900907,
                    58.95275109308057
                ],
                [
                    72.90613675900907,
                    24.2841770079211
                ],
                [
                    -56.5051419017044,
                    24.2841770079211
                ]
            ]
        ]
```


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```
    },
    "properties": {
        "API": "OGC WCS, WCPS, WMS, WMTS",
        "bands": [
            {
                "unit": "1",
                "nodata": -32768,
                "band_name": "landcover",
                "data_type": "int16",
                "fairicube:definition":
"https://land.copernicus.eu/en/products/corine-land-cover",
                "fairicube:comment": "CLC code representing a landform
feature (urban area, forests, etc). For more details about the classes see
the CORINE Land Cover nomenclature guidelines:
https://land.copernicus.eu/user-corner/technical-library/corine-land-cover-
nomenclature-guidelines/html/index.html",
                "fairicube:interpolation": "nearest",
                "classification:classes": [
                    {
                        "name": "land cover",
                        "value": "0"
                    },
                    {
                        "name": "forest",
                        "value": "1"
                    }
                ]
            }
        ],
        "title": "Corine Land Cover",
        "region:name": "EEA-38+UK",
        "license": "other",
        "contacts": [
            {
                "name": "EEA",
                "comments": "The present 100m raster dataset is the 2018
CLC status layer modified for the purpose of consistent statistical
analysis in the land cover change accounting system at EEA.\n\nCORINE Land
Cover (CLC) data are produced from 1986 for European (EEA member or
cooperating) countries. Altogether five mapping inventories were
implemented in this period, producing five status layers (CLC1990, CLC2000,
CLC2006, CLC2012, CLC2018) and four CLC-Change (CLCC) layers for the
corresponding periods (1990-2000, 2000-2006, 2006-2012, 2012-2018). Pan-
European CLC and CLCC data are available as vector and raster products.",
                "organization": "EEA"
            }
        ],
        "datetime": "2000-01-01T00:00:00Z",
        "keywords": "land cover, landscape, landscape alteration, land,
land use",
        "proj:code": "EPSG:3035",
        "description": "The CORINE Land Cover (CLC) inventory consists of
44 land cover and land use classes derived from a series of satellite
missions since it was first established.",
        "end_datetime": "2018-01-01T00:00:00Z",
        "start_datetime": "1990-01-01T00:00:00Z",
        "updated": "2020-05-20T12:13:02Z",
        "published": "2018-10-03T06:45:55Z",
```


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```
        "wasDerivedFrom": "https://land.copernicus.eu/en/products/corine-
land-cover",
        "fairicube:purpose": "data collection and standardization",
        "fairicube:quality_measures": "standardized calibration",
        "cube:dimensions": {
            "x": {
                "axis": "x",
                "step": 100,
                "type": "spatial",
                "unit": "metre",
                "extent": [
                    900000,
                    7400000
                ],
                "reference_system": "3035"
            },
            "y": {
                "axis": "y",
                "step": "-100",
                "type": "spatial",
                "unit": "metre",
                "extent": [
                    900000,
                    5500000
                ],
                "reference_system": "3035"
            },
            "time": {
                "type": "temporal",
                "unit": "day",
                "values": [
                    "1990-01-01T00:00Z",
                    "2000-01-01T00:00Z",
                    "2006-01-01T00:00Z",
                    "2012-01-01T00:00Z",
                    "2018-01-01T00:00Z"
                ]
            }
        },
        "fairicube:source_type": "grid",
        "provenance_name": "European Union's Copernicus Land Monitoring
Service",
        "processing:facility": "Rasdaman",
        "processing:lineage": "NDVI Deep Learning Fusion Network"
    },
    "stac_extensions": [
        "https://stac-extensions.github.io/timestamps/v1.1.0/schema.json"
        "https://stac-extensions.github.io/datacube/v2.3.0/schema.json",

"https://ogcincubator.github.io/bblock-prov-schema/build/annotated/ogc-
utils/prov/schema.json",
        "https://stac-extensions.github.io/projection/v2.0.0/schema.json",
        "https://stac-extensions.github.io/contacts/v0.1.1/schema.json",
        "https://stac-extensions.github.io/processing/v1.2.0/schema.json",
        "https://stac-extensions.github.io/region/v0.1.0/schema.json",


    ],
```


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```
    "stac_version": "1.0.0"
}
```

The STAC Datacube extension is currently already in *Candidate* stage which represents the highest maturity stage before a stable released version. The aim of the STAC Datacube Extension is to provide a way to specify datacube related metadata, especially their dimensions and potentially more in the future as needed in FAIRiCUBE. Non-cubed data can also be described by STAC metadata and included in the FAIRiCUBE Catalog.

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3.1 Metadata mapping

The table below provides a mapping from the metadata fields collected by the FAIRiCUBE consortium to the STAC naming schema. FAIRiCUBE tries to use existing STAC names whenever possible. However, a set of items used in FAIRiCUBE are currently neither available in the STAC basic standard nor in any of the extensions. The FAIRiCUBE project will therefore propose the expansion of the basic standard or of extensions, where appropriate, to the respective responsible STAC teams.

The mapping applied in FAIRiCUBE is based on STAC v1.0.0.

Notes - Explanations to Table 1:

R / O	*Required/ Optional*
stac:common	*referrs to: https://github.com/radiantearth/stac-spec/blob/master/item-spec/common-metadata.md#provider-object*
Existing (implemented) STAC Field Name	*these STAC names are either already defined by the standard or defined by an extension*

Table 1: Mapping from metadata requirements to STAC

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
Data cube – Not Applicable				
Data item				
Title	stac:common:title	string	A human readable title describing the Item. The title of the collection which will be displayed in the catalog	R
ID	stac:item:id	string	Dataset identifier, must be unique within the catalog (no spaces or slashes or back-slashes are allowed)	R
Description	stac:common:description	string	A brief, verbal, non-technical description of the dataset. A Detailed multi-line description to fully explain the STAC entity.	R
Total Area Cover	stac:region:name	string	A brief verbal description, as comma separated list, of the area covered (e.g. EEA+38, Netherlands, World), etc.	O
CRS	stac:proj:code	string	The spatial reference system for the data cube, specified EPSG	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
			number of the described data (e.g. EPSG:4326, EPSG:3035)Authority and specific code of the data source (e.g., `EPSG:3857`)	
Assets				
Name	stac:common:assets:<name>	string	Provide Name of the dataset (no spaces or slashes or back-slashes are allowed)	R
Location	stac:common:assets:<name>:href	string	URI to the asset object. Relative and absolute URI are both allowed. Trailing slashes are significant.	R
Role	stac:common:assets:<name>:roles	string	The semantic roles of the asset. The `roles` field can be given any value. However, there are a few standardized role names that can be found in the best practices. Commonly used are `thumbnail`, `overview`, `data` and `metadata`.	R
Keywords	stac:common:keywords	string	List of keywords describing the STAC entity.	R
Horizontal Axis				
Horizontal CRS	stac:cube:dimensions:[x, y]:reference_system	string| number| object	The spatial reference system for the data, specified as numerical EPSG code, WKT2 (ISO 19162) string or PROJJSON object. Defaults to EPSG code 4326.	R
Western X-Bound	stac:cube:dimensions:x:extent[0]	[number]	Extent (lower bounds) of the dimension as two-element array. Open intervals with `null` are not allowed.	R
Eastern X-Bound	stac:cube:dimensions:x:extent[1]	[number]	Extent (lupper bounds) of the dimension as two-element array. Open intervals with `null` are not allowed.	R
Southern Y-Bound	stac:cube:dimensions:y:extent[0]	[number]	Extent (lower bounds) of the dimension as two-element array. Open intervals with `null` are not allowed.	R
Northern Y-Bound	stac:cube:dimensions:y:extent[1]	[number]	Extent (lupper bounds) of the dimension as two-element array. Open intervals with `null` are not allowed.	R
X-values	stac:cube:dimensions:x:values	[number]	Optionally, an ordered list of all values. (along X-axis)	O
Y-values	stac:cube:dimensions:y:values	[number]	Optionally, an ordered list of all values. (along Y-axis)	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
Unit of Measure	stac:cube:[x, y]:unit	string	The unit of measurement for the data, preferably compliant to UDUNITS-2 units (singular).	R
Interpolation/ Aggregation	stac:cube:[x, y]:fairicube:interpolation	string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).	O
X-Resolution	stac:cube:dimensions:x:step	number| null	The space between the values. Use `null` for irregularly spaced steps.	R
Y-Resolution	stac:cube:dimensions:y:step	number| null	The space between the values. Use `null` for irregularly spaced steps.	R
Vertical Axis				
Vertical CRS	stac:cube:dimensions:z:reference_system	string| number| object	The spatial reference system for the data, specified as numerical EPSG code, WKT2 (ISO 19162) string or PROJJSON object. Defaults to EPSG code 4326.	O
Bottom Bound	stac:cube:dimensions:z:extent[0]	[number| null]	If the dimension consists of ordinal values, the extent (lower and upper bounds) of the values as two-element array. Use `null` for open intervals.	O
Top Bound	stac:cube:dimensions:z:extent[1]	[number| null]	If the dimension consists of ordinal values, the extent (lower and upper bounds) of the values as two-element array. Use `null` for open intervals.	O
Vertical Axis Values	stac:cube:dimensions:z:values	[number| string]	An ordered list of all values, especially useful for nominal values.	O
Unit of Measure	stac:cube:z:unitstac:cube:dimensions:z:unit	string	The unit of measurement for the data, preferably compliant to UDUNITS-2 units (singular).	O
Interpolation/ Aggregation	stac:cube:z:fairicube:interpolation	string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).	O
Resolution	stac:cube:dimensions:z:step	number| null	If the dimension consists of interval values, the space between the values. Use `null` for irregularly spaced steps.	O
Time Axis				
Begin Time	stac:cube:dimensions:time:extent[0]	[string|	Extent (lower bounds) of the dimension as two-element array. The	R

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
		null]	dates and/or times must be strings compliant to ISO 8601. `null` is allowed for open date ranges.	
End Time	stac:cube:dimensions:time:extent[1]	[string| null]	Extent (upper bounds) of the dimension as two-element array. The dates and/or times must be strings compliant to ISO 8601. `null` is allowed for open date ranges.	R
Unit of Measure	stac:cube:dimensions:time:unit	string	The temporal reference system for the data is expected to be ISO 8601 compliant (Gregorian calendar / UTC).	R
Interpolation/ Aggregation	stac:cube:dimensions:time:fairicube:interpolation	string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).	R
Resolution	stac:cube:dimensions:time:step	string	The space between the temporal instances as ISO 8601 duration, e.g. `P1D`. Use `null` for irregularly spaced steps.	R
Other Axis				
Name	stac:cube:dimensions:<name>	string	The name of the additional deimension	O
CRS	stac:cube:dimensions:<name>:reference_system	string| number| object	The spatial reference system for the data, specified as numerical EPSG code, WKT2 (ISO 19162) string or PROJJSON object. Defaults to EPSG code 4326.	O
Lower Boundary	stac:cube:dimensions:<name>:extent[0]	[number]	If the dimension consists of ordinal values, the extent (lower and upper bounds) of the values as two-element array. Use `null` for open intervals.	O
Upper Boundary	stac:cube:dimensions:<name>:extent[1]	[number]	If the dimension consists of ordinal values, the extent (lower and upper bounds) of the values as two-element array. Use `null` for open intervals.	O
Unit of Measure	stac:cube:dimensions:<name>:unit	string	The unit of measurement for the data, preferably compliant to UDUNITS-2 units (singular).	O
Interpolation/ Aggregation	stac:cube:dimensions:<name>:fairicube:interpolation	string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).	O
Values	stac:cube:dimensions:<name>:values	[number| string]	An ordered list of all values, especially useful for nominal values.	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
Interpolation/ Aggregation		string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).	O
Resolution	stac:cube:dimensions:<name>:step	number| null	If the dimension consists of interval values, the space between the values. Use `null` for irregularly spaced steps.	O
Bands				
Range Type	stac:common:bands:[{ }, { }, ...]:name	string	The name of the band (e.g., "B01", "B8", "band2", "red", "windspeed"), which should be unique across all bands defined in the list of bands. This is typically the name the data provider uses for the band.	R
Unit of Measure	stac:common:bands:[{ }, { }, ...]:unit	string	The unit of measurement for the data, preferably compliant to UDUNITS-2 units (singular).	R
Data Type	stac:common:bands:[{ }, { }, ...]:data_type	string	The data type gives information about the values. This can be used to indicate the (maximum) range of numerical values expected. For example `uint8` indicates that the numbers are in a range between 0 and 255, they can never be smaller or larger.	R
Null Values	stac:common:bands:[{ }, { }, ...]:nodata	number| string	Value used to identify no-data, The no-data value must be provided either as: a number (e.g. 255) or as a string: e.g. NaN (not a number)	R
Definition	stac:common:bands:fairicube:definitions	string	Provide a semantic definition (or link) for the supplied dataset (what measurements are represented eg. velocity)	R
Description	stac:common:bands:[{ }, { }, ...]:description	string	Description to fully explain the band. Free textual description of the dataset content	R
Category -List	- stac:common:bands:[{ }, { }, ...]:classification:classes:[name] - stac:common:bands:[{ }, { }, ...]:classification:classes:[value]	[number, string]	list (e.g. Legend) describing the relationship between the values and their meaning, as a set of comma separated tuples [value, name].	O
Comment	stac:common:bands:[{ }, { }, ...]:fairicube:comment	string	Any helpful comments about the dataset (e.g. processing details for processors and producers)	O
Measurement method	stac:common:links:[{ }, { }, ...]:href	string	A link to a workflow, protocol, plan, algorithm, or computational	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
			method specifying how create a value.A link to a workflow, protocol, plan, algorithm, or computational method specifying how create a value.	
Interpolation/ Aggregation	stac:common:bands:[{ }, { }, ...]:fairicube:interpolation	string	The method which has been applied for Interpolation / Aggregation (NA, nearest, spline, etc.).The method which has been applied for Interpolation / aggregation (NA, nearest, spline, etc.)	O
Thumbnails				
Source	stac:common:assets:<name>:href	string	A link where the Thumbnail is stored	O
Name	stac:common:assets:<name>	string	The name applied fort the asset.	O
Accessibility				
(Meta)data Standards	stac:common:links:[{ }, { }, ...]:href	tring	Link to an external catalog representing the same dataset but with another standard	O
Link	stac:common:links:[{ }, { }, ...]:href	string	Link to any additional resources related to the data (e.g script to subset the original data)	O
Title	stac:common:links:[{ }, { }, ...]:title	string	The title of the link which will appear in the catalog browser	O
Language	stac:common:links:[{ }, { }, ...]:example:language	string	The language in which the additional resource - in case the linked resource is a script -	O
Description	stac:common:links:[{ }, { }, ...]:description	string	A brief description of the additional resource.	O
Dates				
Creation	stac:common:datetime	string| null	The searchable date and time of the assets, which must be in UTC. It is formatted according to RFC 3339, section 5.6.(Example: 1985-04-12T23:20:50.52Z)	O
Provision	stac:timestamp:published	string	Date and time the corresponding data was published the first time, which must be in UTC. It is formatted according to RFC 3339, section 5.6.(Example: 1985-04-12T23:20:50.52Z)	O
Modification	stac:common:updated	string	Date and time the corresponding STAC entity or Asset was updated last, which must be in UTC. It is formatted according to RFC 3339, section 5.6.(Example: 1985-04-12T23:20:50.52Z)	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
Validation				
Quality Measures	stac:fairicube:quality_measures	string	Describe any quality measures (standardised calibration, repeated samples or measurements, data capture, data entry validation, peer review of data, or representation with controlled vocabularies)	O
Validation Link	stac:common:links:[{ }, { }, ...]:href	string	URL to any kind of validation that has been applied after processing, e.g. a validation report or a script used for validation. The link relation must be *processing-validation.*	O
Provenance / Data Provider				
Name	stac:contacts:name	string	The name of the responsible person of the Data Provider	R
Organization	stac:contacts:organization	string	Organization/affiliation of the contact.	R
Email	stac:contacts:emails	string	Email address at which contact can be made.	O
ORCID ID	stac:contacts:identifier	string	The ORCID ID, uniquely identifying a contact.	O
Project Purpose	stac:fairicube:purpose	string	The purpose/aim/description of the project	O
Role	stac:contacts:roles	string	The set of named duties, job functions and/or permissions associated with this contact. See the Provider Object for examples.	O
Documentation Link	stac:common:links:[{ }, { }, ...]:href	string	Using the relation cite-as	O
Comments	stac:contact:description	string	Description to add further provider information such as processing details for processors and producers, hosting details for hosts or basic contact information	O
Data Origin / Data Source				
Data Source	stac:prov:wasDerivedFrom	string	A link or description to the location where the supplied data originated from (prov:wasDerivedFrom (OGC))	O
Source Type	stac:fairicube:source_type	string	The type of the original data (grid or vector)	O
Documents & publications	stac:common:links:[{ }, { }, ...]:href	string	Provide information to any further helpful documents or publications available (link)	O
Preprocessing	stac:processing:lineage	string	Describe preprocessing steps performed on the original data	O

Input Term	Existing STAC Field Name	Element type	Description / Notes / Examples	R / O
(Description)				
Models (Links)	stac:prov:wasGeneratedBy	string	Link to the preprocessing script or models applied (prov:wasGeneratedBy (OGC))	O
Legal				
License	stac:common:license	string	Select from Drop-Down List. Item's license(s), either a SPDX License identifier, various if multiple licenses apply or proprietary for all other cases. Should be defined at the Collection level if possible.	R
Link	stac:common:links:[{ }, { }, ...]:href	string	If "Other" is chosen from the Drop-Down list, then a link to the License applicable shall be provided Describe what fields should be field for a href object (add Name or Title field)	O

4 FAIRiCUBE Catalog for Data Resources

Below are some screenshots showing the dynamic STAC Browser based on STAC-fastapi.

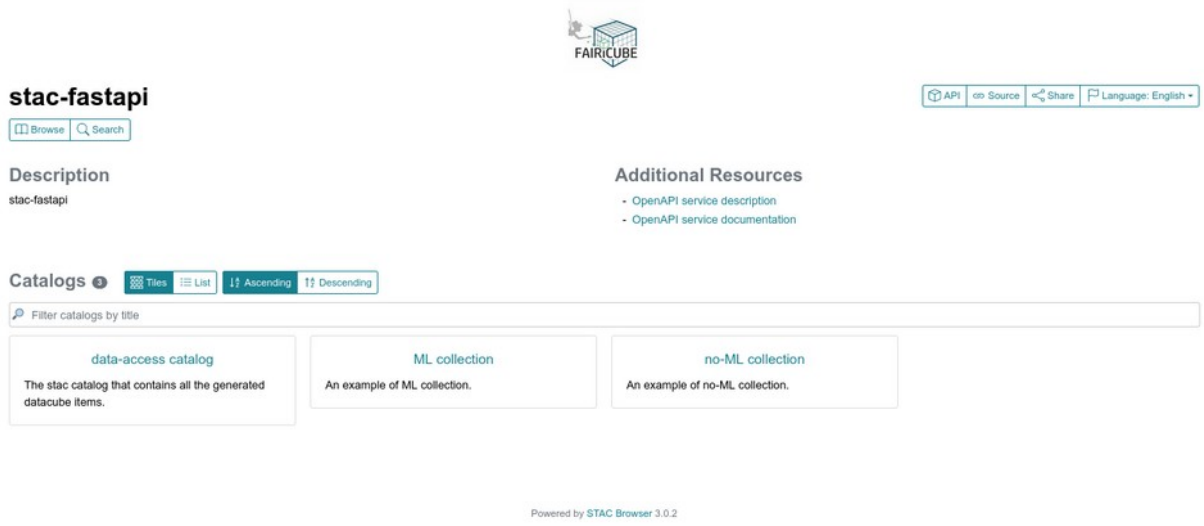

Figure 8: Dynamic Catalog based on STAC -fastapi

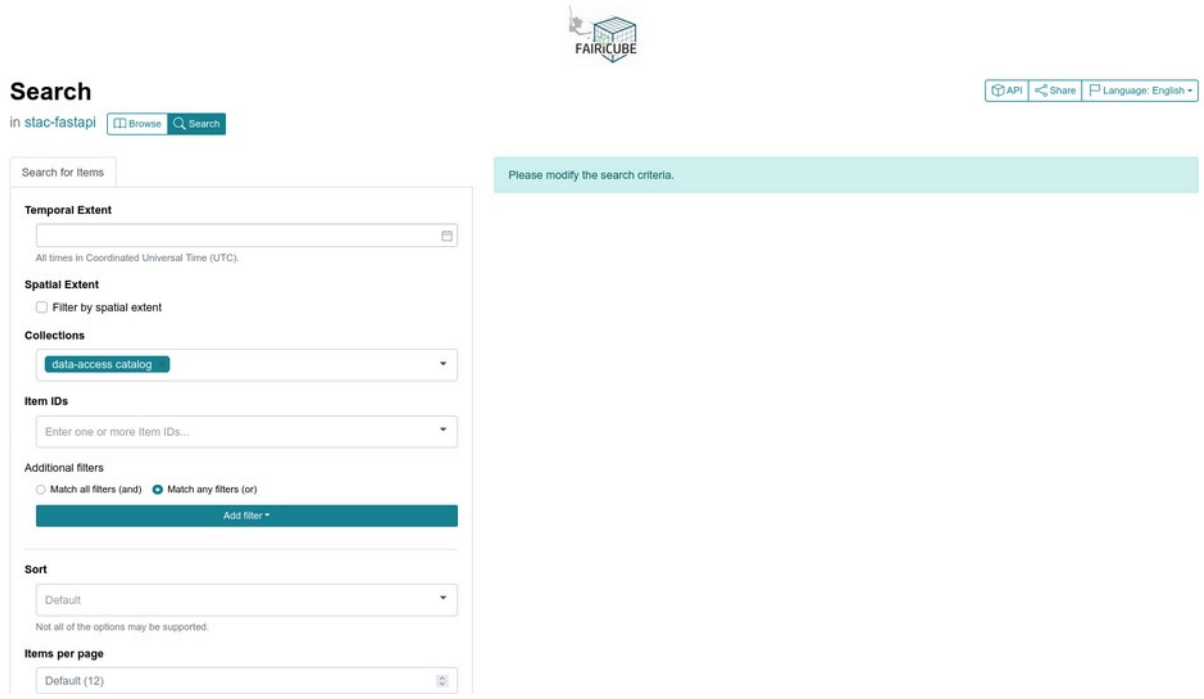

Figure 9: Dynamic Catalog - Search Interface

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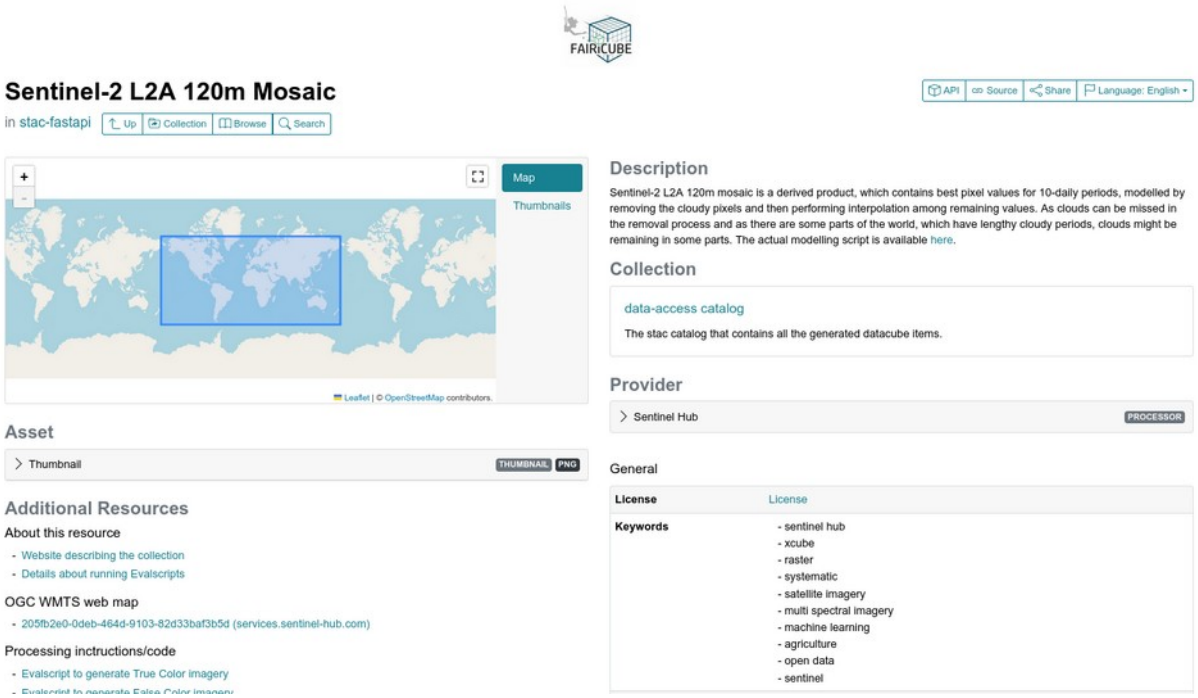

Figure 10: Dynamic Catalog – Data item description

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5 Data Resources

At the initial setup of FAIRiCUBE Hub the following existing data collections were made available via data federation to the FAIRiCUBE users:

- European Data Cube
- Sentinel Hub
- EarthServer
- CoperniCUBE

In addition, FAIRiCUBE users requested additional datasets to be integrated.

5.1 Resources made available in FAIRiCUBE

The following list presents a snapshot (at the time of writing) of the available datasets supplied to FAIRiCUBE. The actual listing of datasets available can always be investigated via the catalog, found at https://catalog.fairicube.eu.

- ADC_Arable_Land_Markers_Autumn
- ADC_Arable_Land_Markers_Spring
- ADC_Crop_Parcels_Crop_Code
- ADC_Crop_Parcels_Field_ID
- ADC_Crop_Rotation_Index
- ADC_Grassland_Markers_NDVI_Spring
- ADC_Grassland_Markers_No_Mowing
- ADC_arable_land_markers_no_ndvi
- ALOS_PALSAR2_AGRICULTURE
- ALOS_PALSAR2_L2_1_10M
- ALOS_PALSAR2_L2_1_3M
- ALOS_PALSAR2_RICE_PADDY_FIELD_MAP
- CAMS_GLC
- CDS_2M_TEMP_2020
- CNES_LAND_COVER_MAP
- CNR_CHL
- CNR_TSM
- COPERNICUS_30
- CORINE_LAND_COVER
- CORINE_LAND_COVER_ACCOUNTING_LAYERS
- E12C_MOTORWAY
- E12D_PRIMARY
- EEA_RIVER_AND_LAKE_ICE_EXTENT_SENTINEL1
- EMODNET_VESSEL_DENSITY
- EMODNET_VESSEL_DENSITY_CARGO
- EMODNET_VESSEL_DENSITY_OTHER
- EMODNET_VESSEL_DENSITY_TANKER

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- ERA5_Land_monthly
- ERA5_WIND_U
- ERA5_WIND_V
- ESA_WORLDCOVER_10M_2020_V1
- GHS_BUILT_S2
- GLOBAL_LAND_COVER
- GLOBAL_SURFACE_WATER
- ICEYE_GRD_E11
- ICEYE_GRD_E11A
- ICEYE_GRD_E13B
- ICEYE_GRD_E3
- JAXA_WQ_CHLA_ANOMALY
- JAXA_WQ_CHLA_AVERAGE
- JAXA_WQ_TSM_ANOMALY
- JAXA_WQ_TSM_AVERAGE
- LANDSAT1-5_MSS_L1
- LANDSAT4-5_TM_L1
- LANDSAT4-5_TM_L2
- LANDSAT7_ETM_L1
- LANDSAT7_ETM_L2
- LANDSAT8-9_L1
- LANDSAT8-9_L2
- LGN
- LGN_Monitoring
- LTK_NATIONAL_HIGH_RESOLUTION_LAYER
- MAPZEN_DEM
- MODIS
- NASA_HARMONIZED_LANDSAT_SENTINEL
- POPULATION_DENSITY
- Precipitation_Netherlands
- RIVER_AND_LAKE_ICE_EXTENT_SENTINEL1_SENTINEL2
- RIVER_AND_LAKE_ICE_EXTENT_SENTINEL2
- SEASONAL_TRAJECTORIES
- SEA_ICE_INDEX
- SENTINEL1_CARD4L
- SENTINEL1_GRD
- SENTINEL2_L1C_SENTINELHUB
- SENTINEL2_L2A_MOSAIC_120
- SENTINEL2_L2A_SENTINELHUB
- SENTINEL3_OLCI_L1B
- SENTINEL3_SLSTR
- SENTINEL_5P_CH4_T7D_AVERAGE
- SENTINEL_5P_CO_T3D_AVERAGE
- SENTINEL_5P_L2
- SENTINEL_5P_NO2_T14D_AVERAGE
- Temperature_Netherlands
- VEGETATION_INDICES

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- VEGETATION_PHENOLOGY_AND_PRODUCTIVITY_PARAMETERS_SEASON_1
- VEGETATION_PHENOLOGY_AND_PRODUCTIVITY_PARAMETERS_SEASON_2
- Vienna_building_volume
- Vienna_districts
- Vienna_imperviousness_density_2018
- Vienna_tree_cover_2018
- Vienna_vineyard_area
- WATER_BODIES
- air_temperature_city_of_luxembourg_2017
- city_features_collection
- corine_land_cover
- dominant_leaf_type_10m
- dominant_leaf_type_20m
- eu_demography
- european_settlement_map_2015
- european_settlement_map_2018
- forest_type_10m
- forest_type_20m
- global_pesticide_grids_apr_h
- global_pesticide_grids_apr_l
- global_pesticide_grids_crops
- global_pesticide_grids_qi
- grassland_10m
- grassland_20m
- imperviousness_10m
- imperviousness_20m
- land_cover_city_of_luxembourg
- land_use_luxembourg
- shadow_index_city_of_luxembourg
- small_woody_features_2015
- small_woody_features_2018
- soil_nitrogen_city_of_luxembourg
- soil_ph_city_of_luxembourg
- tree_cover_density_10m
- tree_cover_density_20m
- water_and_wetness_10m
- water_and_wetness_20m
- wetness_index_city_of_luxembourg

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6 References

[1] STAC website: https://stacspec.org (accessed 20-08-2025)

[2] STAC Datacube Extension: https://github.com/stac-extensions/datacube (accessed 20-08-2025)

[3] STAC Common Metadata: https://github.com/radiantearth/stac-spec/blob/master/item-spec/common-metadata.md (accessed 20-08-2025)

[4] STAC Extensions: https://github.com/stac-extensions/ (accessed 20-08-2025)

[5] STAC Best Practices: https://github.com/radiantearth/stac-spec/blob/master/best-practices.md (accessed 30-05-2024)

[6] STAC Item Specification: https://github.com/radiantearth/stac-spec/blob/master/item-spec/item-spec.md (accessed 20-08-2025)

[7] STAC Collection Specification: https://github.com/radiantearth/stac-spec/tree/master/collection-spec (accessed 20-08-2025)

[8] Processing: https://github.com/stac-extensions/processing (accessed 20-08-2025)

[9] Example links Extension https://github.com/stac-extensions/example-links (accessed 20-08-2025)

[10] Provenance Extension https://ogcincubator.github.io/bblocks-stac/bblock/ogc.contrib.stac.item-prov (accessed 20-08-2025)

[11] Projection Extension https://github.com/stac-extensions/projection (accessed 20-08-2025)

[12] Classification Extension https://github.com/stac-extensions/classification (accessed 20-08-2025)

[13] Time Stamps EXtension https://github.com/stac-extensions/timestamps (accessed 20-08-2025)

[14] FAIRiCUBE Extension https://github.com/FAIRiCUBE/fairicube (accessed 20-08-2025)

[15] D4.1 FAIRiCUBE Hub Architecture

[16] D5.2 Description of the datacube ingestion pipelines

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