

Introduction to STAC

Spatio Temporal Asset Catalog

Odatis
Atelier accès aux données

11 octobre 2024

01.

What's STAC ?

STAC → Spatio-Temporal Asset Catalogs

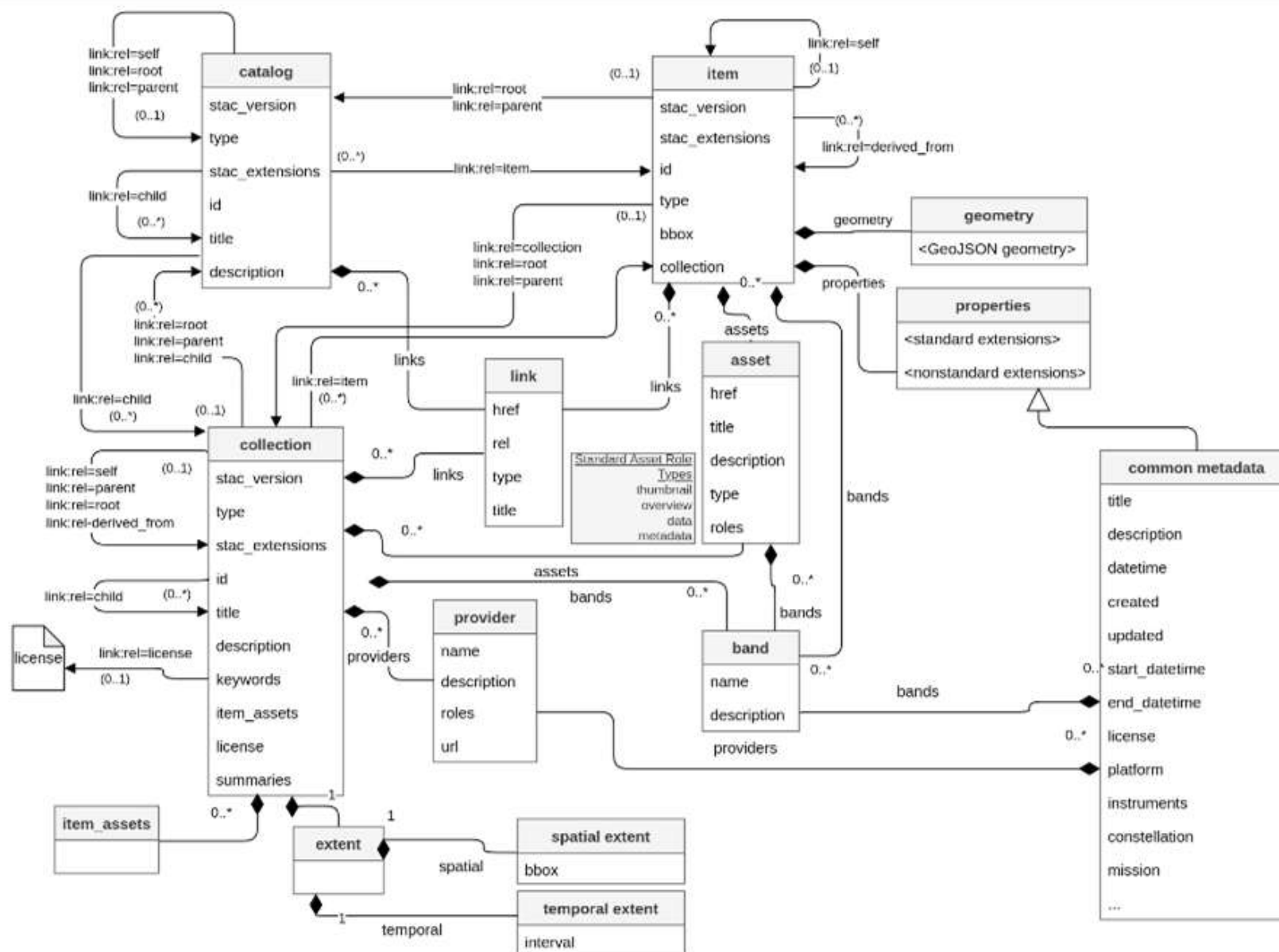
A standardized way to describe, catalogue and share spatio-temporal assets

- **Open standard** supported by a large community of developers and organizations, allowing wide adoption and interoperability
- **Simplicity** : JSON-based standard : easy to to read, write, and understand for both humans and machines
- **Interoperability**: STAC is designed to work with other geospatial formats and systems, making it easy to integrate with other standards (like GeoTIFF, NetCDF, etc.).
- **Simplify search** : By structuring metadata uniformly, it becomes easy to search, filter, and discover geospatial assets.



STAC concepts

- STAC Catalog
- STAC Collection
- STAC Item
- STAC Asset



<https://github.com/radianteearth/stac-spec/blob/master/STAC-UML.pdf>



STAC Catalog

<https://github.com/radiantearth/stac-spec/blob/v1.0.0/catalog-spec/catalog-spec.md>

- Collection of STAC sub-catalogs, STAC Collections or STAC Items
- Allowing data to be structured hierarchically
- No spatio-temporal metadata
- Mandatory attributes
 - Identifier
 - Description



STAC Collection

<https://github.com/radiantearth/stac-spec/blob/v1.0.0/collection-spec/collection-spec.md>

- Similar to Catalog
 - Collection of STAC Catalogs, STAC sub-Collections or STAC Items
 - But with more metadata
- Group all items with common properties and in same spatio-temporal range
- Possible link to STAC Asset
- Mandatory attributes
 - Identifier
 - Description
 - Spatio-temporal range for all its items
 - License



STAC Item

<https://github.com/radiantearth/stac-spec/blob/v1.0.0/item-spec/item-spec.md>

- Main atomic unit of the STAC Catalog
- Represents a unique spatio-temporal resource (GeoJSON representation only)
- Links to STAC assets
- Mandatory attributes
 - Identifier
 - Footprint
 - Bounding Box
 - Date and time



STAC Asset

- File linked to an Item or Collection
- Mandatory attribute
 - Link to the asset object (URL or path)
- Optional important attributes
 - Media type: png, tiff, xml, x-netcdf, ...
 - Role: data, metadata, overview, thumbnail, ...

STAC Common Metadata

- A list of STAC Common Metadata are defined for the properties of STAC Item or Asset
- <https://github.com/radiantearth/stac-spec/blob/master/commons/common-metadata.md#data-values>

- [Basics](#)
- [Date and Time](#)
 - [Date and Time Range](#)
- [Licensing](#)
 - [License relation](#)
- [Provider](#)
 - [Provider Object](#)
 - [roles](#)
- [Instrument](#)
 - [platform](#)
 - [instruments](#)
 - [constellation](#)
 - [mission](#)
 - [gsd](#)
- [Bands](#)
 - [Band Object](#)
- [Data Values](#)
 - [No-data](#)
 - [Units](#)
 - [Statistics Object](#)
 - [Data Types](#)



STAC Extensions

<https://stac-extensions.github.io/>

- Extend the STAC Catalog
- Allow to add specific metadata for Collection, Item or Asset
- Standardize these metadata
- Main STAC Extensions
 - SAR (Synthetic Aperture Radar) : for radar data
 - EO (Electro-Optical) : for optical satellite imagery data
 - Sat : to add satellite information
 - File : to add file-specific information like size or checksum
 - Scientific : to add DOI or citation
 - ...

Best Practices

<https://github.com/radiantearth/stac-spec/blob/v1.0.0/best-practices.md>

- Catalogs shall be subdivided into collections based on themes, time range or geographic regions
- Items should represent specific data units (satellite images, observations, ...)
- Avoid overloading a catalog with too many resources. Sub-catalog shall be created
 - Try to keep the size of each sub-catalog under a Megabyte (metadata)
- Limit the number of metadata for STAC Catalog, Collection or Item
 - Put only the fields to be searched in these STAC Object
 - Linked lots of metadata to the STAC Asset



02.

Static vs dynamic catalog

Static Catalog

- **Set of pre-generated and fixed JSON STAC Files**
 - just a JSON document linking to other JSON documents (defined a tree structure)
 - Each STAC Object (Catalog, Collection, Item) is associated with a JSON file
- Not respond dynamically to requests
- Can only really be crawled by search engines and active catalogs
- Reliable (no clusters or databases to maintain)



Dynamic Catalog

- **Generate metadata on-the-fly through a web API (using a backend)**
 - Handle large and frequently updated datasets
 - More flexibility for querying and retrieving data
- More scalable and adaptable
 - Generate various views of the catalog (expose the same Items in different sub-catalog organization structures)
- May be populated by a static catalog



03.

Rich ecosystem

Tools

<https://stacindex.org/ecosystem>

- **pystac:**
 - <https://github.com/stac-utils/pystac>
 - <https://pystac.readthedocs.io/en/stable/>
- **pystac-client:** <https://github.com/stac-utils/pystac-client>
- **stac-fastapi:** <https://github.com/stac-utils/stac-fastapi>
- **stac-pydantic:** <https://github.com/stac-utils/stac-pydantic>
- **sat-stac:** <https://github.com/sat-utils/sat-stac>
- **eo-dag:** <https://eodag.readthedocs.io/en/stable/>
- **pygeoapi:** <https://docs.pygeoapi.io/en/latest/data-publishing/stac.html>



STAC Browser

STAC Browser

Partager Langue: Français ▼

Parcourir

Veuillez spécifier un catalogue STAC ou un API...

https://...

Charger

... ou en sélectionner un dans STAC Index:

Copernicus Data Space Ecosystem An open ecosystem that provides free instant access to a wide range of data and services from the Copernicus Sentinel missions and more on our planet's land, oceans and atmosphere.	API
Copernicus Data Space Ecosystem (openEO) This openEO service runs on the Copernicus Data Space Ecosystem and offers data access and processing on full archives of Copernicus data, such as the Sentinels.	Catalogue
CREODIAS Release post: [https://creodias.eu/forum/-/message_boards/message/291442]	Catalogue
Cubes and Clouds - Snow Cover Snow Cover Community Mapping Project of the MOOC Cubes and Clouds - Cloud Native Open Data Science for Earth Observation. Every item comes from a successful participant of the online course!	Catalogue
data.geo.admin.ch Data Catalog of the Swiss Federal Spatial Data Infrastructure	API
DestinE Data Lake The DestinE Data Lake (DEDL) provides discovery, access, and big data processing services.	API

→ Dynamic Catalog

→ Static Catalog

<https://github.com/radianteearth/stac-browser>

<https://radianteearth.github.io/stac-browser/>

SMOS

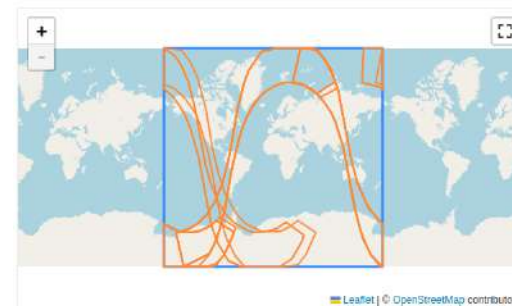
API Source Partager Langue: Français ▼

dans Catalogue En haut Parcourir Rechercher

Description

The Soil Moisture and Ocean Salinity (SMOS) mission was launched on 2 November 2009. It is one of the European Space Agency's Earth Explorer missions, which form the science and research element of the Living Planet Programme. The payload of SMOS consists of the Microwave Imaging Radiometer using Aperture Synthesis (MIRAS) instrument, a passive microwave 2-D interferometric radiometer, operating in L-band (1.413 GHz, 21 cm) within a protected wavelength/frequency band (<https://creodias.eu/eodata/smos/>).

Licence proprietary
Étendue temporelle 13/01/2010 00:00:00 UTC jusqu'à présent



Éléments

Premier Précédent Suivant Afficher les filtres

SM_OPER_MIR_BWLF1C_20240720T211719_20240720T221039_724_001_1 20/07/2024, 21:17:18 UTC – 22:10:39 UTC
SM_OPER_MIR_BWLF1C_20240720T220730_20240720T230041_724_001_1 20/07/2024, 22:07:29 UTC – 23:00:41 UTC
SM_OPER_MIR_BWSF1C_20240720T211719_20240720T221039_724_001_1 20/07/2024, 21:17:18 UTC – 22:10:39 UTC
SM_OPER_MIR_BWSF1C_20240720T220730_20240720T230041_724_001_1 20/07/2024, 22:07:29 UTC – 23:00:41 UTC



03.

Example

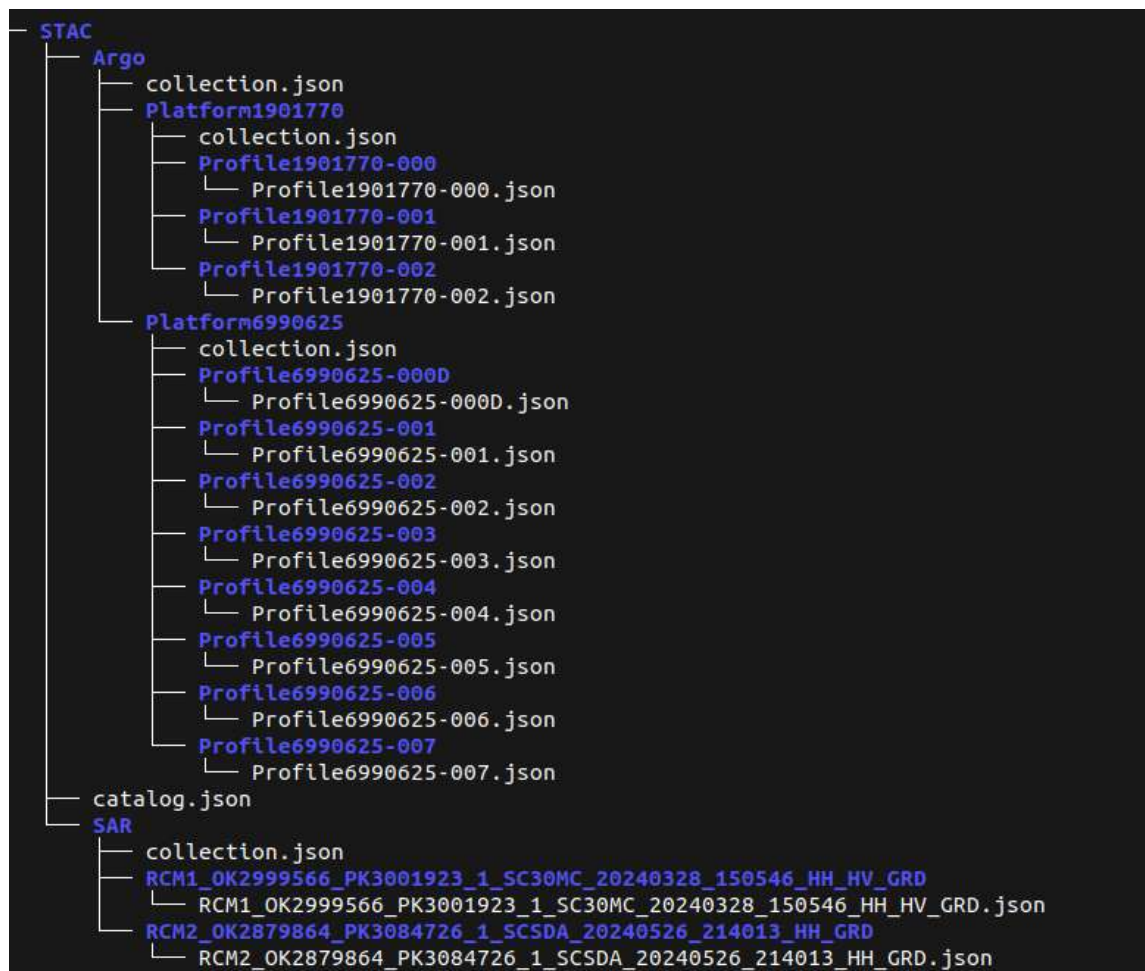
Ifremer STAC Catalog

Start with a static catalog

- Discover and learn STAC architecture, components and best practices
- Evaluate STAC for different data collections and data types
 - Start with few data in order to prototype (metadata, extensions, ...)
- Iterate with data managers
- Collections
 - ARGO - in-situ data
 - RADSAT - SAR data
 - DAS - Optic fiber data



STAC Ifremer Catalog tree



- One Catalog : Ifremer
- Two child Collections of the Catalog Ifremer : Argo and SAR
- For the **Argo Collection**, a sub-Collection for each Platform
- For each Platform sub-Collection, as many Items as Profiles for the Argo Platform
- For the **SAR Collection**, as many Items as satellite images

File catalog.json

<https://isi-sbx.ifremer.fr/stac/STAC/catalog.json>

```
1 {
2   "type": "Catalog",
3   "id": "Catalog-Ifremer",
4   "stac_version": "1.0.0",
5   "description": "A catalog with several platforms",
6   "links": [
7     {
8       "rel": "root",
9       "href": "./catalog.json",
10      "type": "application/json"
11    },
12    {
13      "rel": "child",
14      "href": "./Argo/collection.json",
15      "type": "application/json"
16    },
17    {
18      "rel": "child",
19      "href": "./SAR/collection.json",
20      "type": "application/json",
21      "title": "RADARSAT Constellation - SAR"
22    }
23  ]
24 }
```



File catalog.json

<https://radianteearth.github.io/stac-browser/#/external/isi-sbx.ifremer.fr/stac/STAC/catalog.json?.language=fr>

Catalog-Ifremer

[Source](#) [Partager](#) [Langue: Français ▼](#)

[Parcourir](#)

Description

A catalog with several platforms

Catalogues 2

[Tuiles](#) [Liste](#) [↓ ↑ Ordre croissant](#) [↑ ↓ Ordre décroissant](#)

[Filter](#) Filtrer les catalogues par titre, description ou mots-clés

Argo Collection



RADARSAT Constellation - SAR

RADARSAT Constellation Collection



File collection.json (for Argo STAC Collection)

```
1 {
2   "type": "Collection",
3   "id": "Argo",
4   "stac_version": "1.0.0",
5   "description": "Argo Collection",
6   "links": [
7     {
8       "rel": "root",
9       "href": "../catalog.json",
10      "type": "application/json"
11    },
12    {
13      "rel": "cite-as",
14      "href": "https://doi.org/10.17882/42182"
15    },
16    {
17      "rel": "icon",
18      "href": "https://argo.ucsd.edu/wp-content/uploads/sites/361/2020/07/Argo_Icon.png",
19      "type": "image/png",
20      "title": "Argo Icon"
21    },
22    {
23      "rel": "child",
24      "href": "./Platform1901770/collection.json",
25      "type": "application/json",
26      "title": "Platform1901770"
27    },
28    {
29      "rel": "child",
30      "href": "./Platform6990625/collection.json",
31      "type": "application/json",
32      "title": "Platform6990625"
33    },
34    {
35      "rel": "parent",
36      "href": "../catalog.json",
37      "type": "application/json"
38    }
39  ],
```

<https://isi-sbx.ifremer.fr/stac/STAC/Argo/collection.json>

```
40   "stac_extensions": [
41     "https://stac-extensions.github.io/scientific/v1.0.0/schema.json"
42   ],
43   "sci:doi": "10.17882/42182",
44   "sci:citation": "Argo (2024). Argo float data and metadata from Global Data Assembly Center",
45   "extent": {
46     "spatial": {
47       "bbox": [
48         -180,
49         -90,
50         180,
51         90
52       ]
53     },
54     "temporal": {
55       "interval": [
56         null,
57         null
58       ]
59     }
60   },
61   "license": "CC-BY-4.0"
62 }
```



File collection.json (for Argo STAC Collection)

<https://radianteearth.github.io/stac-browser/#/external/isi-shv-ifremer.fr/stac/STAC/Argo/collection.json>



dans Catalog-Ifremer

↑ En haut

🗺 Parcourir

🔗 Source

🔗 Partager

🌐 Langue: Français

Description

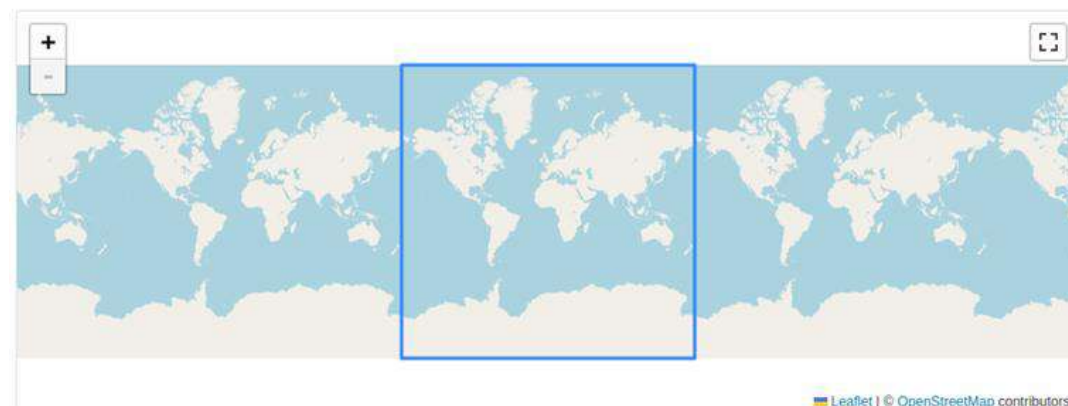
Argo Collection

Licence

CC-BY-4.0

Étendue temporelle

S.O.



Métadonnées

Scientifique

DOI 10.17882/42182

Citation Argo (2024). Argo float data and metadata from Global Data Assembly Centre (Argo GDAC). SEANOE. <https://doi.org/10.17882/42182>

Ressources supplémentaires

- Information de citation: DOI 10.17882/42182

Catalogues 2

🗺 Tuiles

📋 Liste

⬇ Ordre croissant

⬆ Ordre décroissant

🔍 Filtrer les catalogues par titre, description ou mots-clés



Platform1901770

Argo Australia

11/08/2024 00:41:20 UTC – 30/08/2024 14:31:20 UTC



Platform6990625

Argo Spain

12/12/2023 14:29:00 UTC – 04/09/2024 14:51:20 UTC



File Profilexxx.json (for Argo STAC Item)

```
1 {
2   "type": "Feature",
3   "stac_version": "1.0.0",
4   "id": "Profile1901770-000",
5   "properties": {
6     "title": "Profile001",
7     "sci:doi": "10.17882/42182",
8     "sci:citation": "Argo (2024). Argo float data and metadata from Global Data
9     "datetime": "2024-08-11T00:41:20Z"
10  },
11  "geometry": {
12    "type": "Point",
13    "coordinates": [
14      64.39939,
15      -40.03426
16    ]
17  },
18  "links": [
19    {
20      "rel": "root",
21      "href": "../.../catalog.json",
22      "type": "application/json"
23    },
24    {
25      "rel": "collection",
26      "href": "../collection.json",
27      "type": "application/json",
28      "title": "Platform1901770"
29    },
30    {
31      "rel": "cite-as",
32      "href": "https://doi.org/10.17882/42182"
33    },
34    {
35      "rel": "next",
36      "href": "../Profile1901770-001/Profile1901770-001.json",
37      "type": "application/json",
38      "title": "Next Profile"
39    }
40  ]
41 }
```

<https://isi-sbx.ifremer.fr/stac/STAC/Argo/Platform1901770/Profile1901770-000/Profile1901770-000.json>

```
42 {
43   "rel": "parent",
44   "href": "../collection.json",
45   "type": "application/json",
46   "title": "Platform1901770"
47 },
48 "assets": {
49   "Profile_File": {
50     "href": "https://data-argo.ifremer.fr/dac/csiro/1901770/profiles/R1901770-000/Profile1901770-000.json",
51     "type": "application/x-netcdf",
52     "title": "Profile file",
53     "file:size": 60124,
54     "roles": [
55       "metadata"
56     ]
57   },
58   "bbox": [
59     64.39939,
60     -40.03426,
61     64.39939,
62     -40.03426
63   ],
64   "stac_extensions": [
65     "https://stac-extensions.github.io/file/v2.1.0/schema.json",
66     "https://stac-extensions.github.io/scientific/v1.0.0/schema.json"
67   ],
68   "collection": "Platform1901770"
69 }
```



File Profilexxx.json (for Argo STAC Item)

<https://radianteearth.github.io/stac-browser/#/external/isi-sbx.ifremer.fr/stac/STAC/Argo/Platform1901770/Profile1901770-000/Profile1901770-000.json>

Profile001

dans Catalog-Ifremer

[En haut](#) [Collection](#) [Parcourir](#)

[Source](#) [Partager](#) [Langue: Français](#)



Ressource

▼ Profile file

[MÉTADONNÉES](#) [NETCDF](#)

NetCDF

[Télécharger](#) [Copier le lien](#)

Métadonnées

Fichier

Taille 58.71 kB

Collection

Platform1901770

Argo Australia

11/08/2024 00:41:20 UTC – 30/08/2024 14:31:20 UTC

Métadonnées

Général

Heure des données 11/08/2024 00:41:20 UTC

Scientifique

DOI 10.17882/42182

Citation Argo (2024). Argo float data and metadata from Global Data Assembly Centre (Argo GDAC). SEANOE. <https://doi.org/10.17882/42182>

Ressources supplémentaires

- Information de citation: DOI 10.17882/42182



File collection.json (for SAR STAC Collection)

<https://isi-sbx.ifremer.fr/stac/STAC/SAR/collection.json>

```
{
  "type": "Collection",
  "id": "SAR",
  "stac_version": "1.0.0",
  "description": "RADARSAT Constellation Collection",
  "links": [
    {
      "rel": "root",
      "href": "../catalog.json",
      "type": "application/json"
    },
    {
      "rel": "related",
      "href": "https://www.asc-csa.gc.ca/eng/satellites/radarsat/",
      "type": "text/html",
      "title": "Radarsat website"
    },
    {
      "rel": "item",
      "href": "./RCM2_OK2879864_PK3084726_1_SCSA_20240526_214013_HH_GRD/RCM2_OK2879864_PK3084726_1_SCSA_20240526_214013_HH_GRD.json",
      "type": "application/json"
    },
    {
      "rel": "item",
      "href": "./RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json",
      "type": "application/json"
    },
    {
      "rel": "parent",
      "href": "../catalog.json",
      "type": "application/json"
    }
  ]
}
```

```
{
  "title": "RADARSAT Constellation - SAR",
  "extent": {
    "spatial": {
      "bbox": [
        -180,
        -90,
        180,
        90
      ]
    },
    "temporal": {
      "interval": [
        null,
        null
      ]
    }
  },
  "license": "OGL-Canada-2.0"
}
```

File collection.json (for SAR STAC Collection))

https://radianteearth.github.io/stac-browser/#/external/isi-sbx.ifremer.fr/stac/STAC/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json

RADARSAT Constellation - SAR

dans Catalog-Ifremer

↑ En haut

📄 Parcourir

🔗 Source

🔗 Partager

🌐 Langue: Français

Description

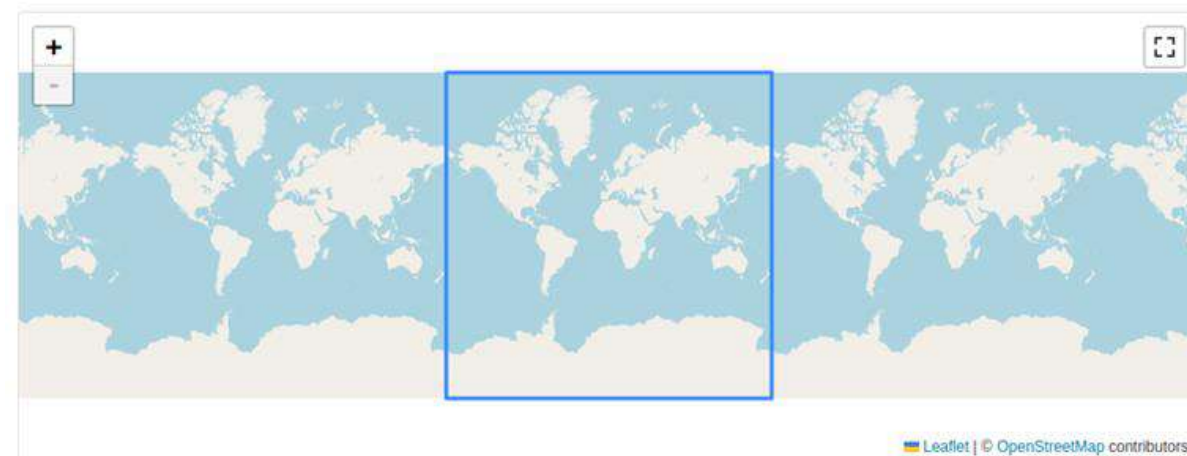
RADARSAT Constellation Collection

Licence

OGL-Canada-2.0

Étendue temporelle

S.O.



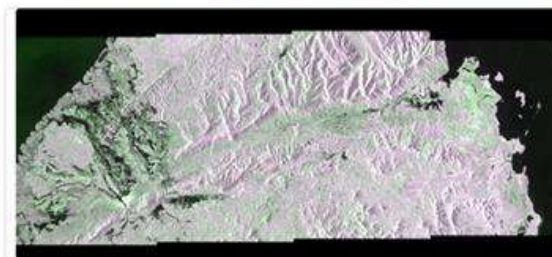
Ressources supplémentaires

- Radarsat website

Éléments 2

⬇️ Ordre croissant

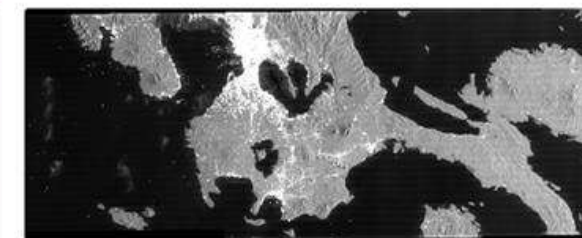
⬆️ Ordre décroissant



RCM1_OK2999566_PK3001923_1_SC30MC_2
0240328_150546_HH_HV_GRD

📍 3001923_1

28/03/2024 15:05:46 UTC



RCM2_OK2879864_PK3084726_1_SCSDA_20
240526_214013_HH_GRD

📍 3084726_1

26/05/2024 21:40:13 UTC



File RCMxxx.json (for SAR STAC Item)

[https://isi-](https://isi-sbx.ifremer.fr/stac/STAC/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json)

[sbx.ifremer.fr/stac/STAC/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json](https://isi-sbx.ifremer.fr/stac/STAC/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json)

```
{
  "type": "Feature",
  "stac_version": "1.0.0",
  "id": "RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD",
  "properties": {
    "description": "3001923_1",
    "platform": "RCM-1",
    "constellation": "Radarsat",
    "instruments": [
      "SAR"
    ],
    "mission": "Storms",
    "sar:instrument_mode": "Medium Resolution 30m",
    "sar:frequency_band": "C",
    "sar:polarizations": [
      "HH",
      "HV"
    ],
    "sar:product_type": "GRD",
    "sar:center_frequency": 5.405,
    "sar:observation_direction": "right",
    "sat:orbit_state": "ascending",
    "datetime": "2024-03-28T15:05:46.887000Z"
  },
  "geometry": {
    "type": "Polygon",
    "coordinates": [
      [
        [
          48.732344840184844,
          -13.372954281173223
        ]
      ]
    ]
  }
}
```

```
  "assets": {
    "overview": {
      "href": "https://isi-sbx.ifremer.fr/stac/data/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD_overview.png",
      "type": "image/png",
      "title": "Overview",
      "file:size": 227983,
      "roles": [
        "overview"
      ]
    },
    "3001923_1_HH.tif": {
      "href": "https://isi-sbx.ifremer.fr/stac/data/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD_3001923_1_HH.tif",
      "type": "image/tiff; application=geotiff; profile=cloud-optimized",
      "title": "HH image",
      "sar:polarizations": [
        "HH"
      ],
      "file:size": 97875988,
      "roles": [
        "data"
      ]
    },
    "3001923_1_HV.tif": {
      "href": "https://isi-sbx.ifremer.fr/stac/data/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD_3001923_1_HV.tif",
      "type": "image/tiff; application=geotiff; profile=cloud-optimized",
      "title": "HV image",
      "sar:polarizations": [
        "HV"
      ],
      "file:size": 97875988,
      "roles": [
        "data"
      ]
    }
  }
}
```



File RCMxxx.json (for SAR STAC Item)

https://radianteearth.github.io/stac-browser/#/external/isi-sbx.ifremer.fr/stac/STAC/SAR/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD/RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD.json

RCM1_OK2999566_PK3001923_1_SC30MC_20240328_150546_HH_HV_GRD

Source

Partager

Langue: Français

dans Catalog-Ifremer

En haut

Collection

Parcourir

Carte

Aperçus

Leaflet | © OpenStreetMap contributors

Ressources

> Overview

AFFICHÉ

OVERVIEW

PNG

> HH image

DONNÉES

COG

> HV image

DONNÉES

COG

> Metadata file

MÉTADONNÉES

XML

Description

3001923_1

Collection

RADARSAT Constellation - SAR

RADARSAT Constellation Collection

Métadonnées

Général

Plateforme	RCM-1
Constellation	Radarsat
Instruments	SAR
Mission	Storms
Heure des données	28/03/2024 15:05:46 UTC

RSO

Mode de l'instrument	Medium Resolution 30m
Fréquence de la bande	C
Polarisations	HH, HV
Type de produit	GRD
Fréquence centrale	5,405 GHz
Observation Direction	right



Specific Metadata

- Despite all the STAC Common Metadata fields and the various extensions, there is no field available to accommodate certain metadata.
- 2 Possibilities :
 - Use the extra-fields property for each STAC Object
 - Create a new extension

Case for the Argo Platform Collection

<https://isi-sbx.ifremer.fr/stac/STAC/Argo/Platform1901770/collection.json>

```
53 "instruments": [  
54   "CTD_PRES",  
55   "CTD_TEMP",  
56   "CTD_CNDC"  
57 ],  
58 "sensors": [  
59   {  
60     "name": "CTD_PRES",  
61     "URI_sensor": "http://vocab.nerc.ac.uk/argos/CTD_PRES",  
62     "maker": "DRUCK",  
63     "model": "DRUCK",  
64     "serial_no": "12376468"  
65   },  
66   {  
67     "name": "CTD_TEMP",  
68     "URI_sensor": "http://vocab.nerc.ac.uk/argos/CTD_TEMP",  
69   }  
70 ]
```

```
81 "physical_parameters": [  
82   {  
83     "name": "PRES",  
84     "URI_parameter": "http://vocab.nerc.ac.uk/argos/PRES",  
85     "sensor": "CTD_PRES",  
86     "units": "decibar",  
87     "URI_units": "http://vocab.nerc.ac.uk/argos/decibar",  
88     "accuracy": "2.4",  
89     "resolution": "0.1",  
90     "predeployment_calib_equation": "y=PTCA0+PTCA1*t+PTCA2*t^2; n=x*PTCB0/(PTCB0+PTCA2*t+PTCA1*t+PTCA0)",  
91     "predeployment_calib_coefficient": "ptca2=-1.127612; ptcb0=321528.3; ptcb1=-1.127612",  
92     "predeployment_calib_comment": ""  
93   },  
94   {  
95     "name": "TEMP",  
96     "URI_parameter": "http://vocab.nerc.ac.uk/argos/TEMP",  
97     "sensor": "CTD_TEMP",  
98     "units": "Celsius",  
99     "URI_units": "http://vocab.nerc.ac.uk/argos/Celsius",  
100    "accuracy": "0.2",  
101    "resolution": "0.1",  
102    "predeployment_calib_equation": "y=PTCA0+PTCA1*t+PTCA2*t^2; n=x*PTCB0/(PTCB0+PTCA2*t+PTCA1*t+PTCA0)",  
103    "predeployment_calib_coefficient": "ptca2=-1.127612; ptcb0=321528.3; ptcb1=-1.127612",  
104    "predeployment_calib_comment": ""  
105  }  
106 ]
```



Open questions

- STAC Metadata
 - STAC extension for ARGO data ?
 - [STAC GeoParquet specification](#) for easily and efficiently storing and querying large amounts of homogenous STAC items ?
 - All metadata or only useful metadata for search and/or data download services
 - Duplicate metadata on each element (Collection, Item) ?
- Partition collection in smallest sub-collections : per time, per geographical area, ... ?
- Link with GeoNetwork-based ODATIS catalog for the generalization ?



Helpful STAC links

- Specification
 - <https://stacspec.org/en>
 - <https://github.com/radianteearth/stac-spec>
- Examples
 - Python Tutorial to create a STAC Catalog
 - <https://stacspec.org/en/tutorials/2-create-stac-catalog-python/>
 - STAC Index
 - <https://stacindex.org/>

