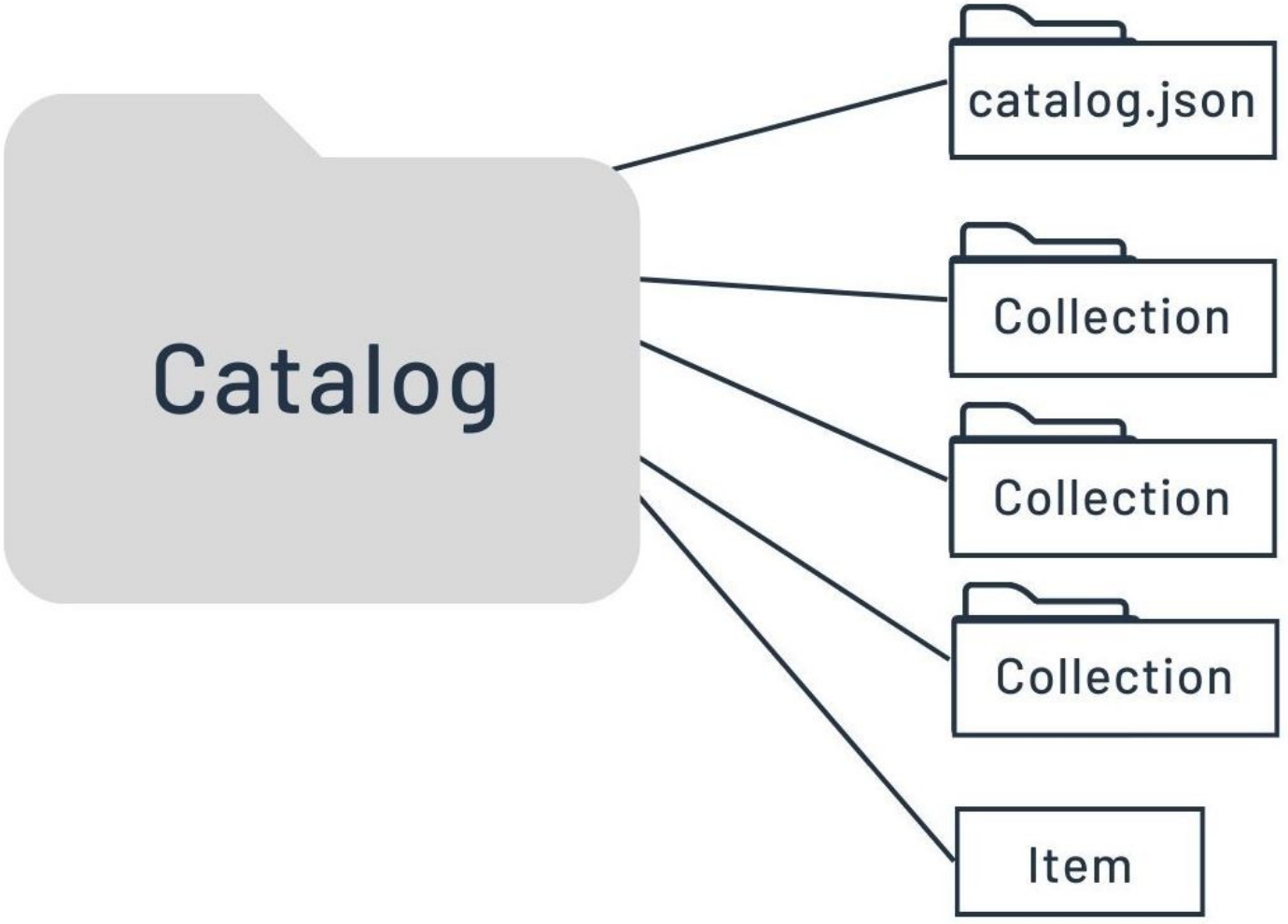

django


STAC

# What is STAC?

# STAC SpatioTemporal Asset Catalog

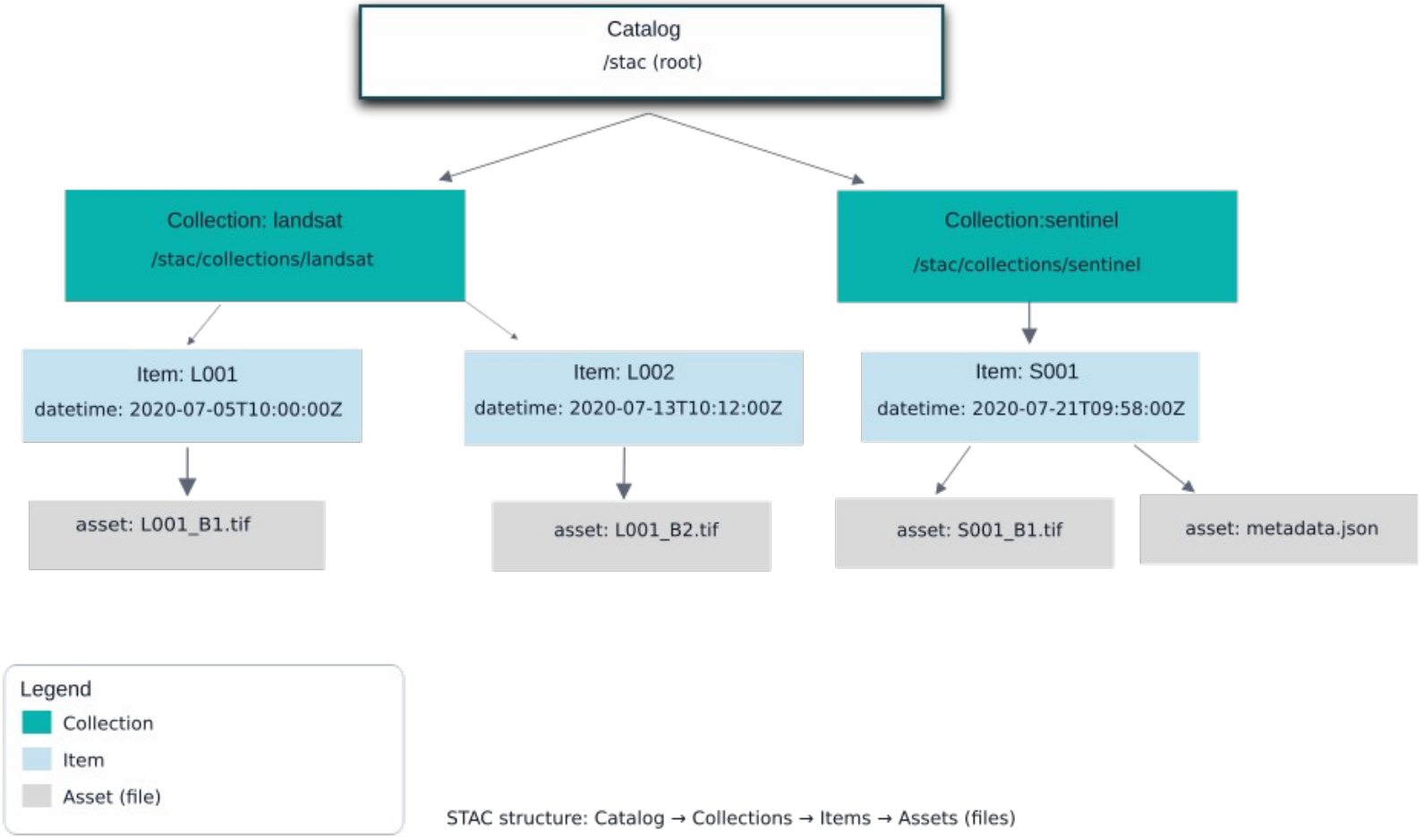
# STAC Components


Catalog
catalog.json
Collection
Collection
Collection
Item

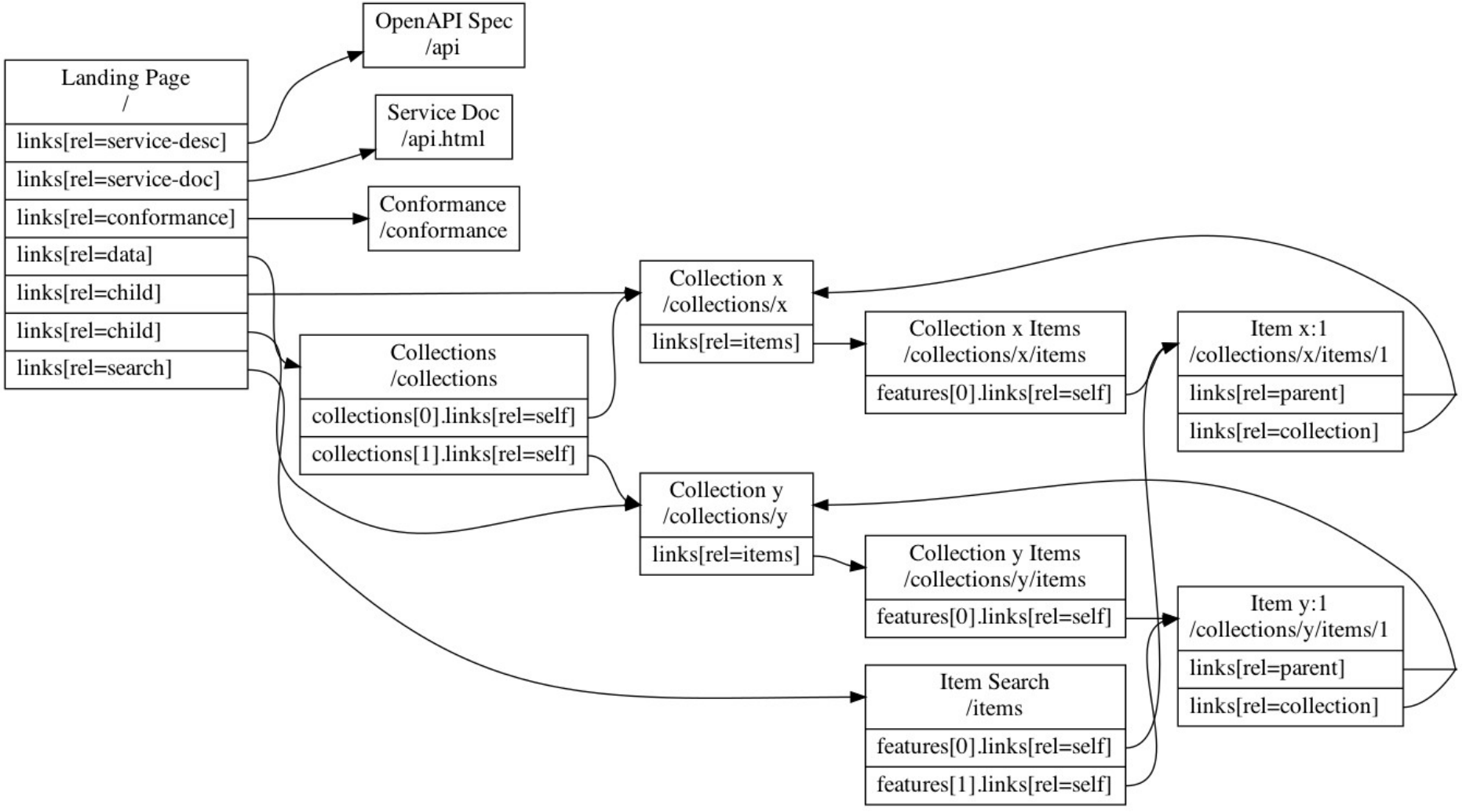
# STAC Catalogs

# Static Catalog

```
{
  "type": "Catalog",
  "id": "example-catalog",
  "stac_version": "1.1.0",
  "description": "STAC basic demonstration",
  "links": [
    {
      "rel": "root",
      "href": "./catalog.json",
      "type": "application/json"
    },
    {
      "rel": "child",
      "href": "./collection/collection.json",
      "type": "application/json",
      "title": "Collection with items (standalone)"
    },
    {
      "rel": "item",
      "href": "./item/item.json",
      "type": "application/json"
    }
  ]
}
```


Catalog
/stac (root)
Collection: landsat
/stac/collections/landsat
Collection:sentinel
/stac/collections/sentinel
Item: L001
datetime: 2020-07-05T10:00:00Z
Item: L002
datetime: 2020-07-13T10:12:00Z
Item: S001
datetime: 2020-07-21T09:58:00Z
asset: L001_B1.tif
asset: L001_B2.tif
asset: S001_B1.tif
asset: metadata.json
Legend
Collection
Item
Asset (file)
STAC structure: Catalog → Collections → Items → Assets (files)

# STAC API Links

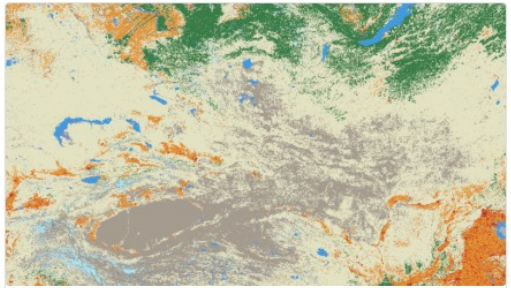


# STAC Assets


```
[{
      "href": "/assets/LC08_L2SP_047027_20200729_02_T1_SR_B4.tif",
      "title": "Asset data",
      "type": "image/tiff; application=geotiff",
      "roles": [
        "data"
      ]
},


{
      "href":
"/assets/LC08_L2SP_047027_20200729_02_T1_SR_B4/thumbnail.png",
      "title": "Asset thumbnail",
      "type": "image/png",
      "roles": [
        "thumbnail"
      ]
}]
```

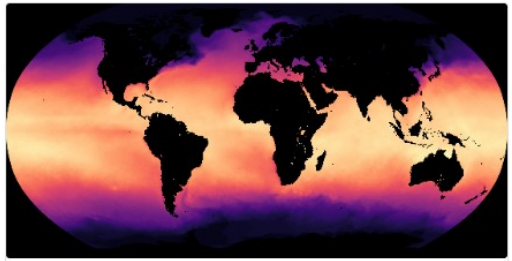
# MICROSOFT PLANETARY COMPUTER STAC API



## 10m Annual Land Use Land Cover (9-class) V1

COG Note: A new version of this item is available for your use. This mature version of the map remains available for use in existing applications. This item wil…

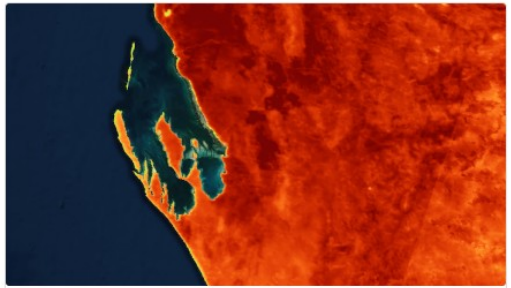
2017-01-01 00:00:00 UTC – 2023-01-01 00:00:00 UTC



## ERA5 - PDS

Zarr ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate covering the period from January 1950 to present. ERA5 is produced by…

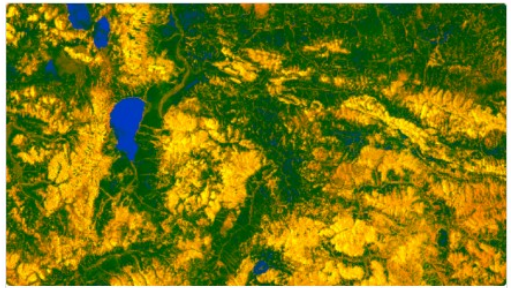
1979-01-01 0:00:00 UTC until present



## MODIS Land Surface Temperature/Emissivity 8-Day

HDF COG The Moderate Resolution Imaging Spectroradiometer (MODIS) Land Surface Temperature/Emissivity 8-Day Version 6.1 product…

2000-02-18 0:00:00 UTC until present



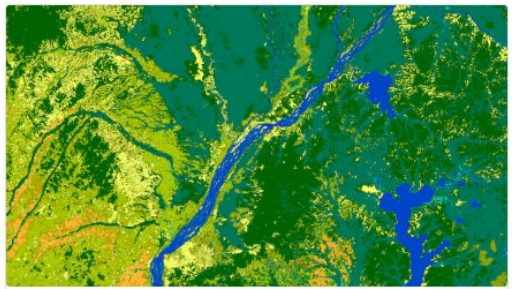
## Sentinel 1 Radiometrically Terrain Corrected (RTC)

COG The Sentinel-1 mission is a constellation of two polar-orbiting satellites, operating day and night performing C-band synthetic aperture radar imaging.…

2014-10-10 0:28:21 UTC until present

## 10m Annual Land Use Land Cover (9-class) V2

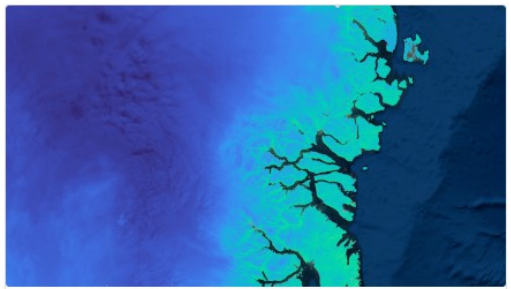
COG Time series of annual global maps of land use and land cover (LULC). It currently has data from 2017-



## ESA Climate Change Initiative Land Cover Maps (Cloud Optimized GeoTIFF)

COG The ESA Climate Change Initiative (CCI) Land Cover dataset provides consistent global annual land cover maps at 300m spatial resolution from 1992 to…

1992-01-01 00:00:00 UTC – 2020-12-31 23:59:59 UTC



## MODIS Land Surface Temperature/Emissivity Daily

HDF COG The Moderate Resolution Imaging Spectroradiometer (MODIS) Land Surface Temperature/Emissivity Daily Version 6.1 product…

## Sentinel-2 Level-2A

COG The Sentinel-2 program provides global imagery in thirteen spectral bands at 10m-60m resolution and a revisit time of approximately five days. This dataset…

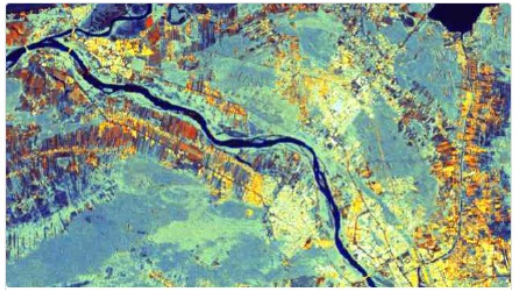
2015-06-27 10:25:31 UTC until present

# COPERNICUS DATA SPACE ECOSYSTEM STAC CATALOG

## Cubes and Clouds - Snow Cover

COG Snow Cover Community Mapping Project of the MOOC Cubes and Clouds - Cloud Native Open Data Science for Earth Observation. Every item comes fro…

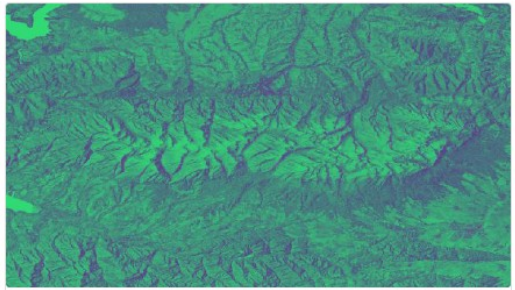
2017-12-01 00:00:00 UTC – 2025-03-20 00:00:00 UTC



## Sentinel-1 Global Mosaics

COG ZIP Sentinel-1 monthly mosaics are generated from monthly stacks of Sentinel-1 GRD data by calculating the weighted sum of the terrain corrected…

2020-01-01 0:00:00 UTC until present



## Sentinel-1 Ground Range Detected (GRD)

## Sentinel-3 SRAL Land Radar Altimetry - Sea Ice (NRT)

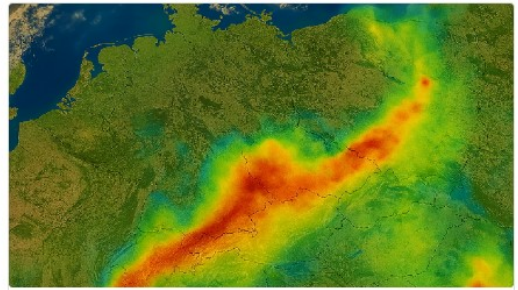
ZIP NetCDF This Collection provides Sentinel-3 SRAL Level-2 Land Altimetry Sea Ice products, which contains estimations of the radar freeboard over the…

2023-09-20 5:44:46 UTC until present

## Sentinel-3 SRAL Land Radar Altimetry - Sea Ice (NTC)

ZIP NetCDF This Collection provides Sentinel-3 SRAL Level-2 Land Altimetry Sea Ice products, which contains estimations of the radar freeboard over the…

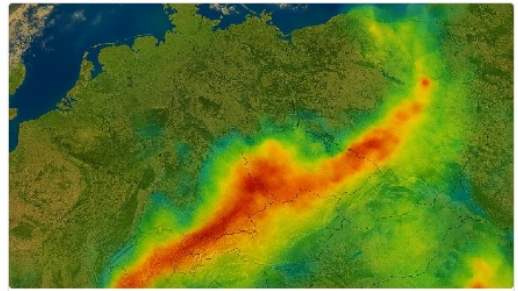
2016-03-01 14:07:51 UTC until present



## Sentinel-5P Level 1 Radiance Band 3 (OFFL)

NetCDF This Collection provides Sentinel-5P Level-1 RA BD3 products, which contains Earth radiance spectra for spectral band 3.

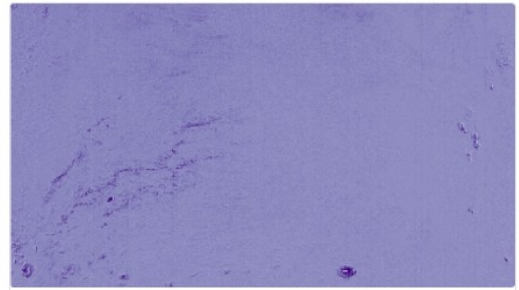
2018-04-30 0:19:50 UTC until present



## Sentinel-5P Level 1 Radiance Band 3 (RPRO)

NetCDF This Collection provides Sentinel-5P Level-1 RA BD3 products, which contains Earth radiance spectra for spectral band 3.

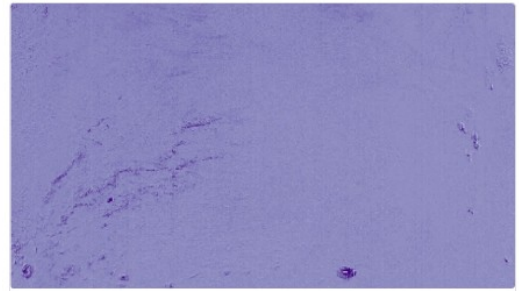
2018-04-30 0:19:50 UTC until present



## Sentinel-5P Level 2 Formaldehyde (OFFL)

NetCDF This Collection provides Sentinel-5P Level-2 HCHO products, which contains high-resolution imagery of atmospheric formaldehyde concentrations.

2018-04-30 0:18:51 UTC until present



## Sentinel-5P Level 2 Formaldehyde (RPRO)

NetCDF This Collection provides Sentinel-5P Level-2 HCHO products, which contains high-resolution imagery of atmospheric formaldehyde concentrations.

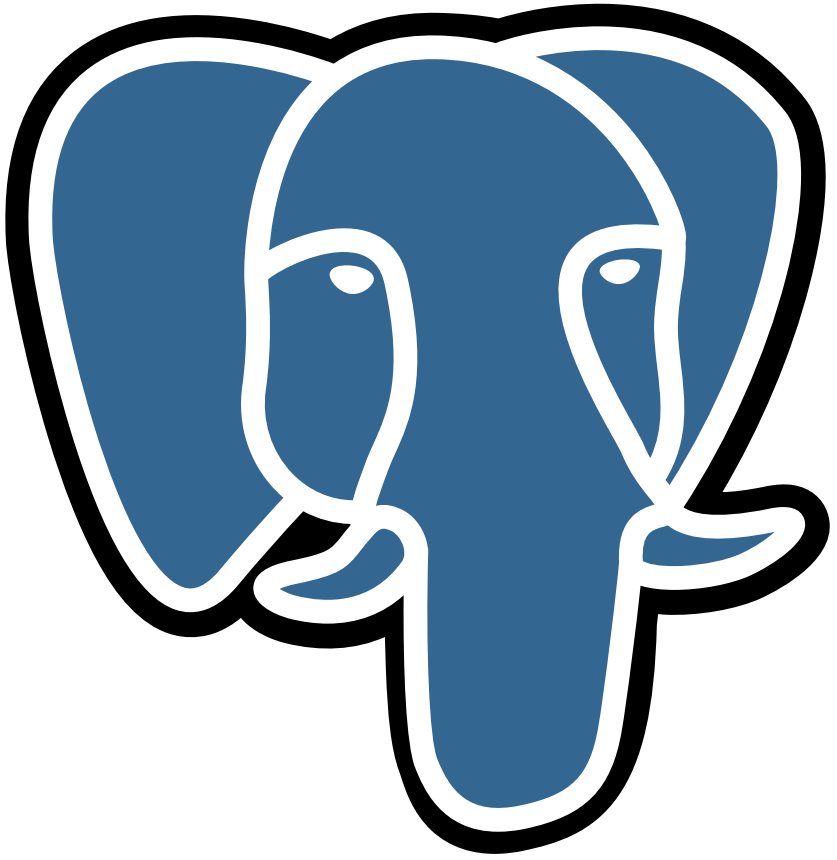
2018-04-30 0:18:51 UTC until present

# See more STAC catalogs

https://stacindex.org/catalogs

# Building STAC APIs

- PostGIS
- GeoDjango
- Django Rest Framework
- Validators(stac and stac-api)



# PostGIS

# PostGIS

- Rich in geospatial functions (1000 functions!)
- Spatial Indexing and Filtering
- Django Integration

# Spatial Indexing

```
from django.contrib.gis.geos import Polygon

bbox = Polygon.from_bbox((-10, -10, 10, 10))
items = STACItem.objects.filter(geometry__intersects=bbox)
```

```
Index Scan using stac_items_geom_idx on stac_items
(cost=0.14..12.43 rows=50 width=...)
  Index Cond: (geometry && '0103000020E6100000...'::geometry)
  Filter: _st_intersects(geometry,
'0103000020E6100000...'::geometry)

Planning Time: 0.089 ms
Execution Time: 1.21 ms
```

# GeoDjango

- Modeling
- Spatial queries
- GeoJSON serialization

# GeoDjango

```
from django.contrib.gis.db import models

class STACCollection(models.Model):
    spatial_extent = models.PolygonField(srid=4326)
    ...other fields


class STACItem(models.Model):
    geometry = models.GeometryField(srid=4326)
    ...other fields
```

# GeoDjango

```
from django.contrib.gis.geos import Polygon
from rest_framework.response import Response
from rest_framework import viewsets
from .models import STACItem
from .serializers import STACItemSerializer

class STACItemViewSet(viewsets.ReadOnlyModelViewSet):
    queryset = STACItem.objects.all()
    serializer_class = STACItemSerializer

    def list(self, request, *args, **kwargs):
        bbox = request.query_params.get('bbox')
        if bbox:
            minx, miny, maxx, maxy = map(float, bbox.split(','))
            bbox_poly = Polygon.from_bbox((minx, miny, maxx, maxy))
            self.queryset =
self.queryset.filter(geometry__intersects=bbox_poly)

        return super().list(request, *args, **kwargs)
/stac/api/search?bbox=36.5,-3.6,37.0,-3.2
```


django
REST
framework

# DRF

- Structure(API endpoints)
- CRUD Endpoints
- Browsable

# Django Rest Framework

```
/stac/
/stac/collections
/stac/collections/{collection_id}
/stac/collections/{collection_id}/items
```

```
class STACCollectionViewSet(viewsets.ReadOnlyModelViewSet):
    queryset = STACCollection.objects.all()
    serializer_class = STACCollectionSerializer
    lookup_field = 'collection_id'
```

```
 from rest_framework_gis.serializers import GeoFeatureModelSerializer

 class STACAssetSerializer(GeoFeatureModelSerializer):
    class Meta:
        model = STACAsset
        fields = [
            'href', 'title', 'type', 'roles', 'asset_file', 'thumbnail'
        ]
```

# STAC Validation

- stac-validator
- stac-api-validator

# Large Datasets & Performance

- Cloud Storage( S3, minio, Google Cloud Storage)

- Indexing

```
from django.contrib.gis.db import models


class STACItem(models.Model):
    geometry = models.GeometryField(srid=4326, spatial_index=True)
    datetime = models.DateTimeField(db_index=True)
```

# Django built STAC API inside STAC Browser.

# Don’ts

- Skip STAC Documentation!
- Store geometry using other types
- Unpaginate large items and collections

# Benefits

- Common web standards
- Easy to extend
- Ecosystem

# Lets have a django-stac package?

Asanteni!