Scalable Sustainability

with the Microsoft Planetary Computer

Tom Augspurger / PyData Global / October 2021

Microsoft & Sustainability

Sustainability Commitments

- Carbon negative by 2030
- Water positive by 2030
- Zero waste by 2030
- Protecting Ecosystems
  - Setting aside more land than we use
  - Build a Planetary Computer

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A Planetary Computer for a Sustainable Future

Building a Planetary Computer

- Many sustainability problems look like geospatial data analysis problems
- Solving these requires data, lots of it
- We think it also requires APIs and environments

Building a Planetary Computer

Data Catalog

The Planetary Computer includes petabytes of environmental monitoring data, in consistent, analysis-ready formats, accessible through our APIs as well as directly available via Azure Storage.

API

The Planetary Computer API makes it easy for users to find exactly the data they need, simplifying search and discovery across our Data Catalog.

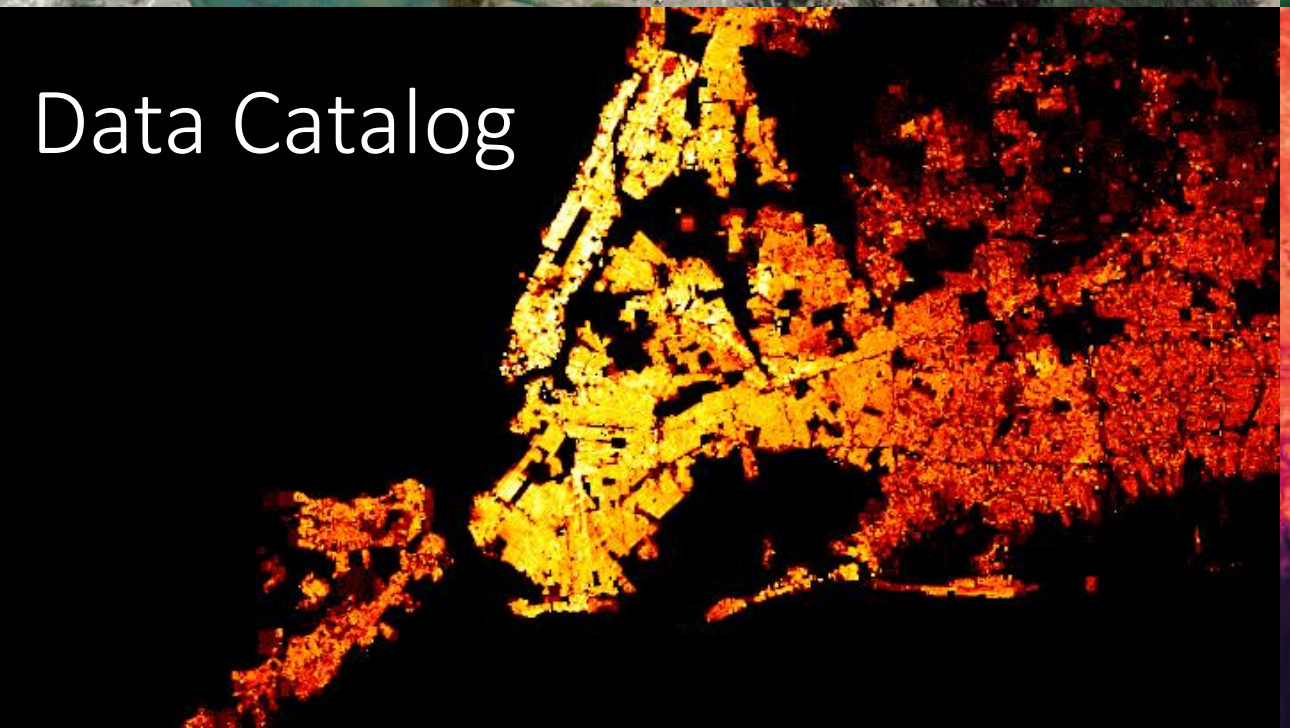
Hub

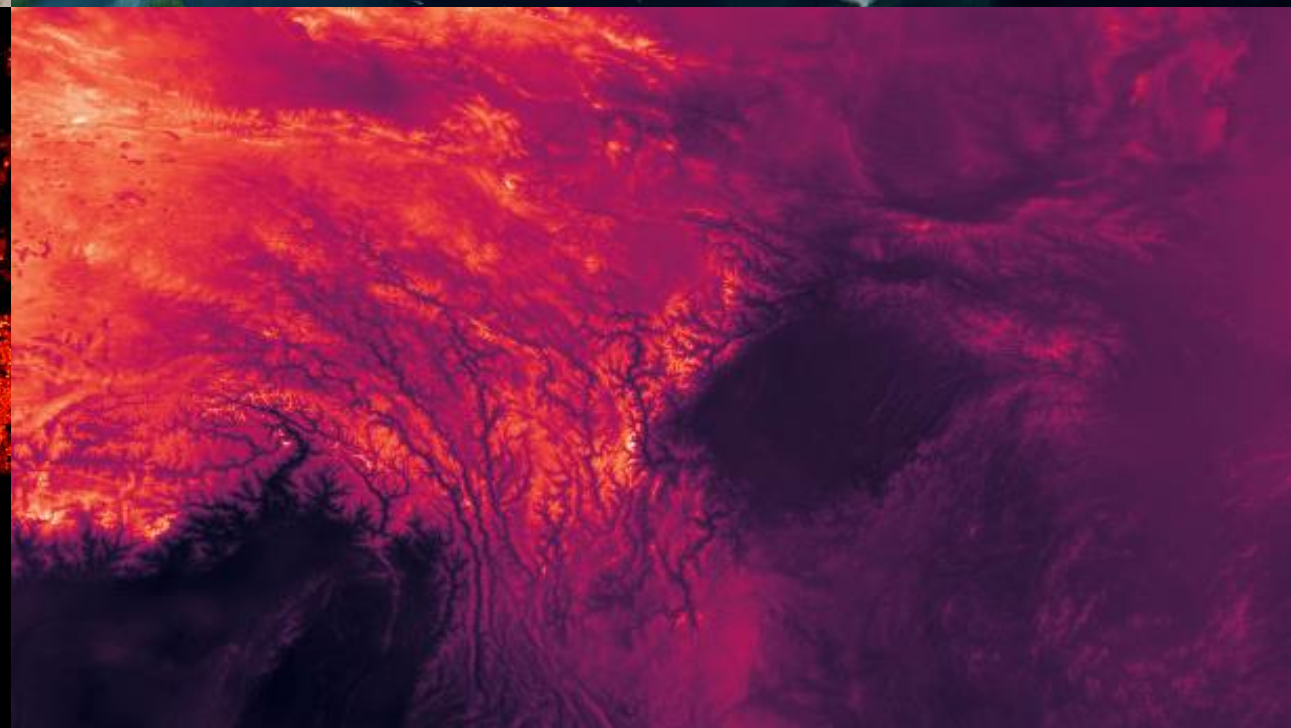
The Planetary Computer Hub is a development environment that makes our data and APIs accessible through familiar, open-source tools, and allows users to easily scale their analyses.

Applications

Partners all over the world are building on top of the Planetary Computer platform, providing the actionable information that is critical to sustainability practitioners.

Data Catalog





Data Catalog

- Lots of data in Blob Storage in analysis-ready, cloud-optimized formats
- Raster data (remote sensing, elevation data, etc.) in COG
- Earth Systems Science data (climate / weather models) in Zarr
- Tabular data in Parquet
- Focused on “cloud-native” workflows
  - Put compute and data in the same Azure region
  - Scalable, parallel access directly from blob storage into memory

STAC-powered APIs

The SpatioTemporal Asset Catalog

Why is STAC helpful?

- Given Landsat-8 C2-L2 COGs in blob storage: **find all the scenes covering Wyoming in 2016**


```
[
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2016/026/032/LC08_L2SP_026032_20160325_20200907_02_T1/LC08_L2SP_026032_20160325_20200907_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2016/026/032/LC08_L2SP_026032_20160512_20200907_02_T1/LC08_L2SP_026032_20160512_20200907_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2016/026/032/LC08_L2SP_026032_20160613_20200906_02_T1/LC08_L2SP_026032_20160613_20200906_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2016/026/032/LC08_L2SP_026032_20160816_20200906_02_T1/LC08_L2SP_026032_20160816_20200906_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2020/025/032/LC08_L2SP_025032_20200329_20200822_02_T1/LC08_L2SP_025032_20200329_20200822_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2018/026/031/LC08_L2SP_026031_20180126_20200902_02_T1/LC08_L2SP_026031_20180126_20200902_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2018/026/032/LC08_L2SP_026032_20180721_20200831_02_T1/LC08_L2SP_026032_20180721_20200831_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2016/025/032/LC08_L2SP_025032_20160910_20200906_02_T1/LC08_L2SP_025032_20160910_20200906_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2020/026/031/LC08_L2SP_026031_20200421_20200822_02_T1/LC08_L2SP_026031_20200421_20200822_02_T1_SR_B2.TIF",
    "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2020/026/031/LC08_L2SP_026031_20200827_20200906_02_T1/LC08_L2SP_026031_20200827_20200906_02_T1_SR_B2.TIF",
]
```

Why is STAC helpful?

```
catalog = pystac_client.Client.open(
  "https://planetarycomputer.microsoft.com/api/stac/v1"
)

search = catalog.search(
    collections=["landsat-8-c2-l2"],
    intersects=wyoming_geometry,
    datetime="2016-01-01/2016-12-31",
)
```

SpatioTemporal Asset Catalog (STAC)

- Community-driven spec developed since 2017
- Defines **JSON schemas** for encoding metadata about spatiotemporal data
- Core definitions, with core and community **extensions**

STAC sponsors & developers

planet. Radiant Earth Foundation EARTH IMAGERY FOR IMPACT Microsoft

geo Element 84 MAXAR TECHNOLOGIES ARTURO

USGS science for a changing world cosmiQ works aws Digital Earth AFRICA WORLD BANK GROUP azavea

NASA UMBRA open EO PIXEL8 astraea NEAR SPACE LABS THE CLIMATE CORPORATION VULCAN L3HARRIS Google Earth Engine

```
{
  "id": "LC08_L2SP_063016_20211020_02_T1",
  "bbox": [
    -142.19877367,
    61.69871544,
    -137.19238411,
    63.96095456
  ],
  "type": "Feature",
  "links": [
    {
      "rel": "collection",
      "type": "application/json",
      "href": "https://planetarycomputer.microsoft.com/api/stac/v1/collections/landsat-8-c2-l2"
    },
    {
      "rel": "parent",
      "type": "application/json",
      "href": "https://planetarycomputer.microsoft.com/api/stac/v1/collections/landsat-8-c2-l2"
    },
    {
      "rel": "root",
      "type": "application/json",
      "href": "https://planetarycomputer.microsoft.com/api/stac/v1/"
    },
    {
      "rel": "self",
      "type": "application/geo+json",
      "href": "https://planetarycomputer.microsoft.com/api/stac/v1/collections/landsat-8-c2-l2/items/LC08_L2SP_063016_20211020_02_T1"
    },
    {
      "rel": "alternate",
      "type": "application/json",
      "title": "tiles",
      "href": "https://planetarycomputer.microsoft.com/api/stac/v1/collections/landsat-8-c2-l2/items/LC08_L2SP_063016_20211020_02_T1/tiles"
    },
    {
      "rel": "preview",
      "href": "https://planetarycomputer.microsoft.com/api/data/v1/item/map?collection=landsat-8-c2-l2&item=LC08_L2SP_063016_20211020_02_T1",
      "title": "Map of item",
      "type": "text/html"
    }
  ],
  "assets": {
    "ANG": {
      "href": "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2021/063/016/LC08_L2SP_063016_20211020_20211026_02_T1/LC08_L2SP_063016_20211020_20211026_02_T1_ANG.txt",
      "type": "text/plain",
      "title": "Angle Coefficients File",
      "description": "Collection 2 Level-1 Angle Coefficients File (ANG)"
    },
    "SR_B1": {
      "gsd": 30,
      "href": "https://landsateuwest.blob.core.windows.net/landsat-c2/level-2/standard/oli-tirs/2021/063/016/LC08_L2SP_063016_20211020_20211026_02_T1/LC08_L2SP_063016_20211020_20211026_02_T1_SR_B1.TIF",
      "type": "image/tiff; application=geotiff; profile=cloud-optimized",
      "title": "Coastal/Aerosol Band (B1)",
      "eo:bands": [
        {
          "gsd": 30,
          "name": "SR_B1",
          "common_name": "coastal",
          "center_wavelength": 0.44,
          "full_width_half_max": 0.02
        }
      ],
      "proj:shape": [
        8251,
        8181
      ],
      "description": "Collection 2 Level-2 Coastal/Aerosol Band (B1) Surface Reflectance",
      "proj:transform": [
        30,
```

STAC API

- Defines **OpenAPI schemas** for searching and discovering STAC metadata
- Aligns with and extends the **OGC API - Features** specification
- Includes a **search** endpoint for spatiotemporal and attribute queries within or across Collections
- Current version: v1.0.0-beta.4

The Hub

- JupyterHub deployment in the same region as the data
- Building on lessons learned by pangeo
- Includes Dask Gateway for scaling out
- https://github.com/microsoft/planetary-computer-hub

Demo

Thanks!

- https://planetarycomputer.microsoft.com/
- https://github.com/microsoft/PlanetaryComputerExamples