Enhancing Geospatial Data Interoperability with pyarc2stac

Slesa Adhikari[1], Abdelhak Marouane[1], Saadiq Mohiuddin[2], Brian Freitag[3]

[1] UAH, [2] DevSeed, [3] NASA

The Challenge

Increasing use of geospatial data in Earth science demands interoperability.

Proprietary services like ESRI (e.g., ImageServer, MapServer) provide valuable data but are often siloed.

Challenge: How to integrate these services seamlessly into modern, open, and discoverable data ecosystems.

What is pyarc2stac?

A Python tool developed to extract metadata from ArcGIS services and convert it into the SpatioTemporal Asset Catalog (STAC) format.

Enables seamless discovery and integration of ArcGIS data services with other STAC-enabled resources.

Links OGC-compliant visualization services offered by ArcGIS to make data more accessible.

Key Benefits:

Interoperability: ESRI services become part of open ecosystems.

Enhanced visualization options: View data using standard OGC tools, bypassing proprietary limitations.

How pyarc2stac Works

Steps:

1. Extract metadata from ESRI services.
2. Convert metadata into STAC-compliant format.
3. Integrate OGC visualization links.

Technical Highlights:

Supports various ESRI services: ImageServer, MapServer, FeatureServer.

Outputs standardized STAC JSON metadata for indexing and discovery.

How it supports interoperability: Example

the 

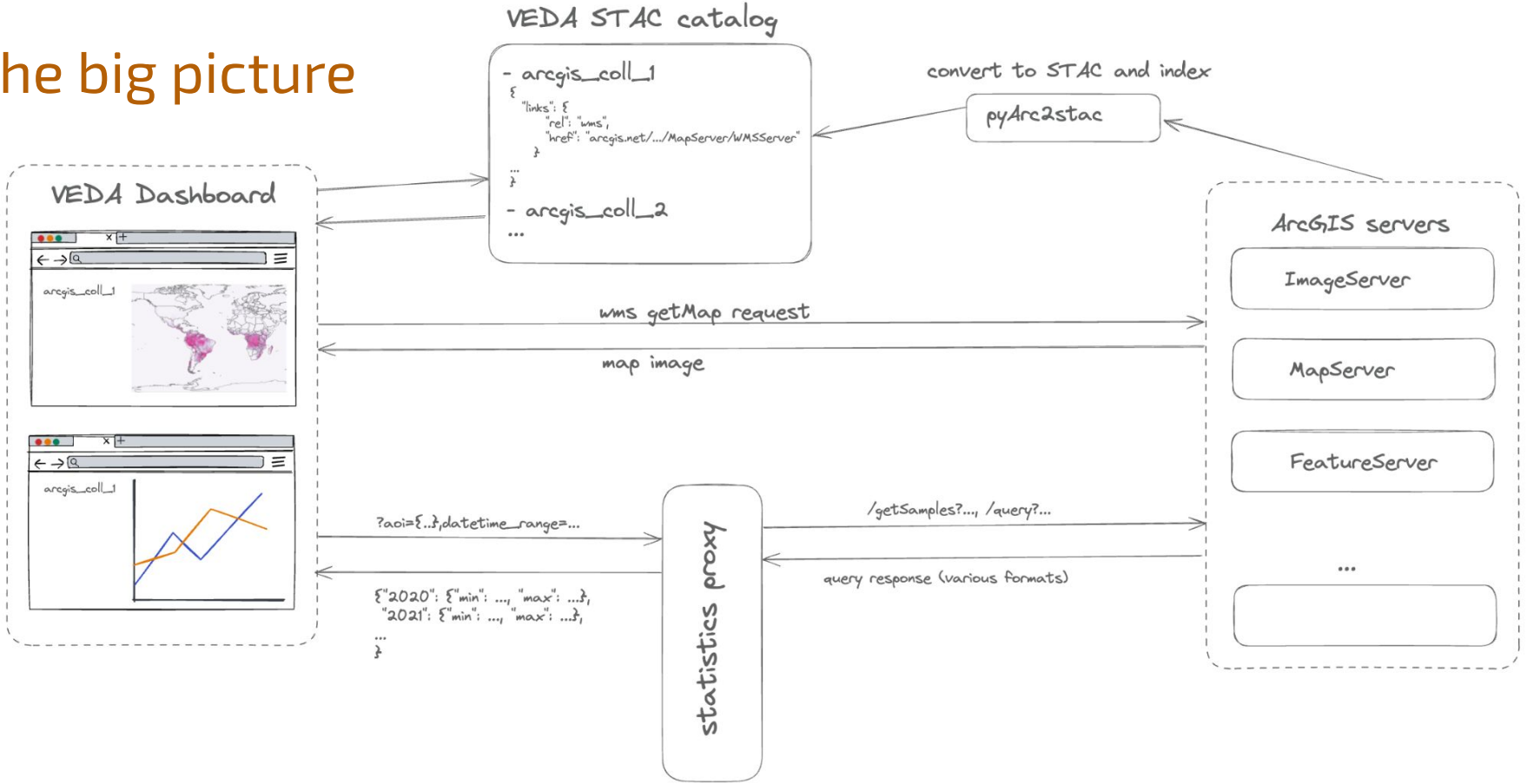
project

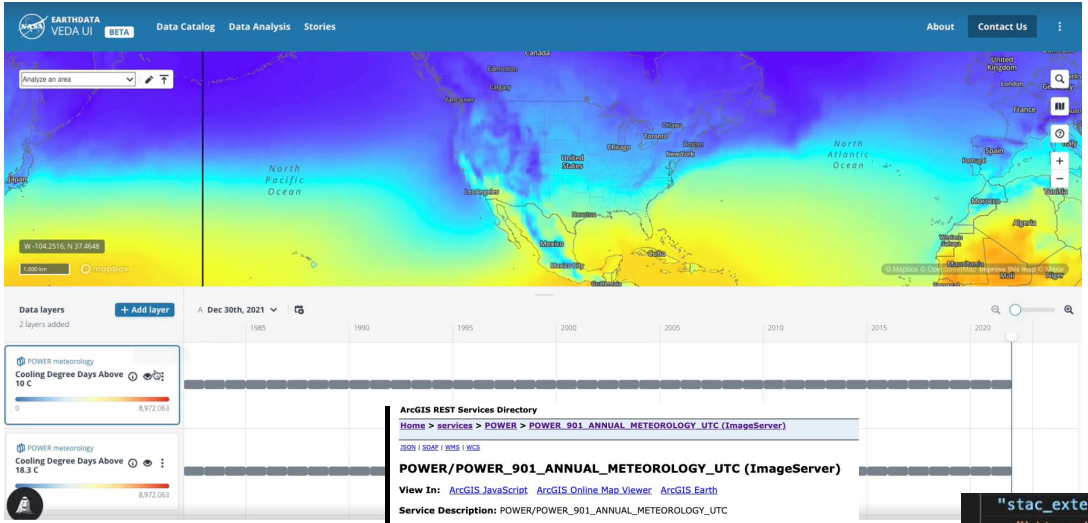
- Open Earth Science Platform
- Integrates community driven tools and technologies
  - (STAC API + TiTiler) eoAPI + JupyterHub + others
- Focuses on open and community standards, and interoperability between services

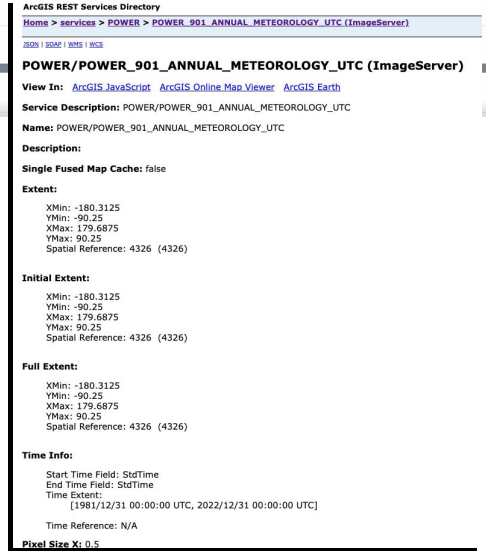
How it supports interoperability: Example

- VEDA uses a STAC catalog to index data and TiTiler to serve the data visualization via OGC compliant APIs
- A need for visualizing datasets from ESRI imageserver in the VEDA dashboard
  - Option 1:
    - Write custom code into the frontend to support the visualization
    - Every type of external visualization would need custom code added to the website
  - Option 2: ✅
    - Index ESRI imageserver dataset into the existing STAC catalog along with it's OGC-compliant offerings, and use that to seamlessly integrate to the existing code

The big picture







ArcGIS REST Services Directory

Home > services > POWER > POWER_901_ANNUAL_METEOROLOGY_UTC (ImageServer)

JSON | SOAP | WMS | WCS

POWER/POWER_901_ANNUAL_METEOROLOGY_UTC (ImageServer)

View In: ArcGIS JavaScript ArcGIS Online Map Viewer ArcGIS Earth

Service Description: POWER/POWER_901_ANNUAL_METEOROLOGY_UTC

Name: POWER/POWER_901_ANNUAL_METEOROLOGY_UTC

Description:

Single Fused Map Cache: false

Extent:

XMin: -180.3125
YMin: -90.25
XMax: 179.6875
YMax: 90.25
Spatial Reference: 4326 (4326)

Initial Extent:

XMin: -180.3125
YMin: -90.25
XMax: 179.6875
YMax: 90.25
Spatial Reference: 4326 (4326)

Full Extent:

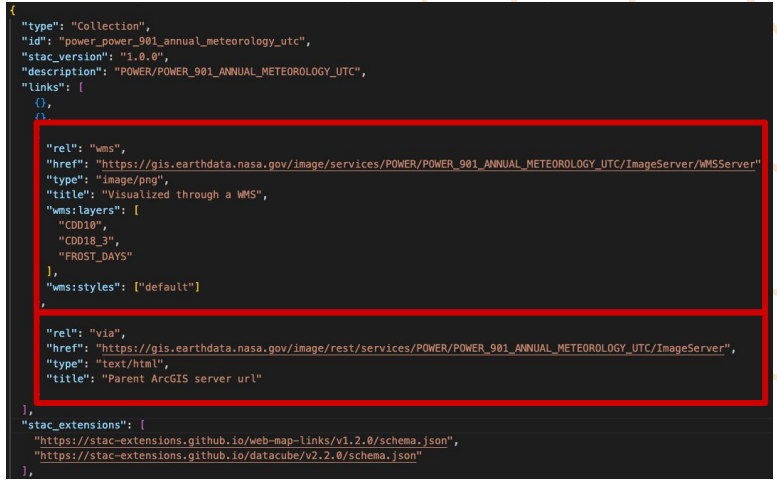
XMin: -180.3125
YMin: -90.25
XMax: 179.6875
YMax: 90.25
Spatial Reference: 4326 (4326)

Time Info:

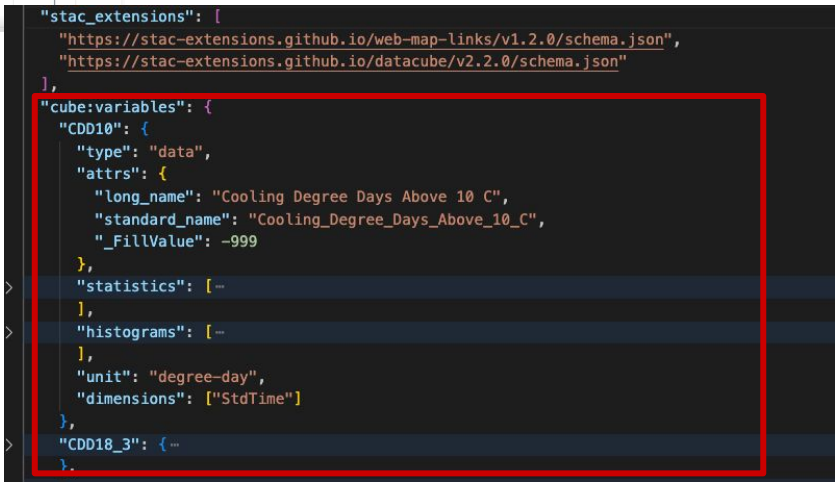
Start Time Field: StdTime
End Time Field: StdTime
Time Extent:
[1981/12/31 00:00:00 UTC, 2022/12/31 00:00:00 UTC]

Time Reference: N/A

Pixel Size X: 0.5



```
{
  "type": "Collection",
  "id": "power_power_901_annual_meteorology_utc",
  "stac_version": "1.0.0",
  "description": "POWER/POWER_901_ANNUAL_METEOROLOGY_UTC",
  "links": [
    {},
    {
      "rel": "wms",
      "href": "https://gis.earthdata.nasa.gov/image/services/POWER/POWER_901_ANNUAL_METEOROLOGY_UTC/ImageServer/WMSServer"
      "type": "image/png",
      "title": "Visualized through a WMS",
      "wms:layers": [
        "CDD10",
        "CDD18_3",
        "FROST_DAYS"
      ],
      "wms:styles": ["default"]
      ,
      "rel": "via",
      "href": "https://gis.earthdata.nasa.gov/image/rest/services/POWER/POWER_901_ANNUAL_METEOROLOGY_UTC/ImageServer",
      "type": "text/html",
      "title": "Parent ArcGIS server url"
    ],
    "stac_extensions": [
      "https://stac-extensions.github.io/web-map-links/v1.2.0/schema.json",
      "https://stac-extensions.github.io/datacube/v2.2.0/schema.json"
    ],
```



```
  "stac_extensions": [
    "https://stac-extensions.github.io/web-map-links/v1.2.0/schema.json",
    "https://stac-extensions.github.io/datacube/v2.2.0/schema.json"
  ],
  "cube:variables": {
    "CDD10": {
      "type": "data",
      "attrs": {
        "long_name": "Cooling Degree Days Above 10 C",
        "standard_name": "Cooling_Degree_Days_Above_10_C",
        "_FillValue": -999
      },
      "statistics": [...
      ],
      "histograms": [...
      ],
      "unit": "degree-day",
      "dimensions": ["StdTime"]
    },
    "CDD18_3": {...
    },
```

Future Potential

Vision:

- Broaden compatibility to other proprietary geospatial services
- Encourage adoption of open standards for geospatial data sharing

...Questions?

https://github.com/NASA-IMPACT/pyarc2stac/