

Smart handoffs: Preserving user context between tools and services related to NASA's EOSDIS data archive

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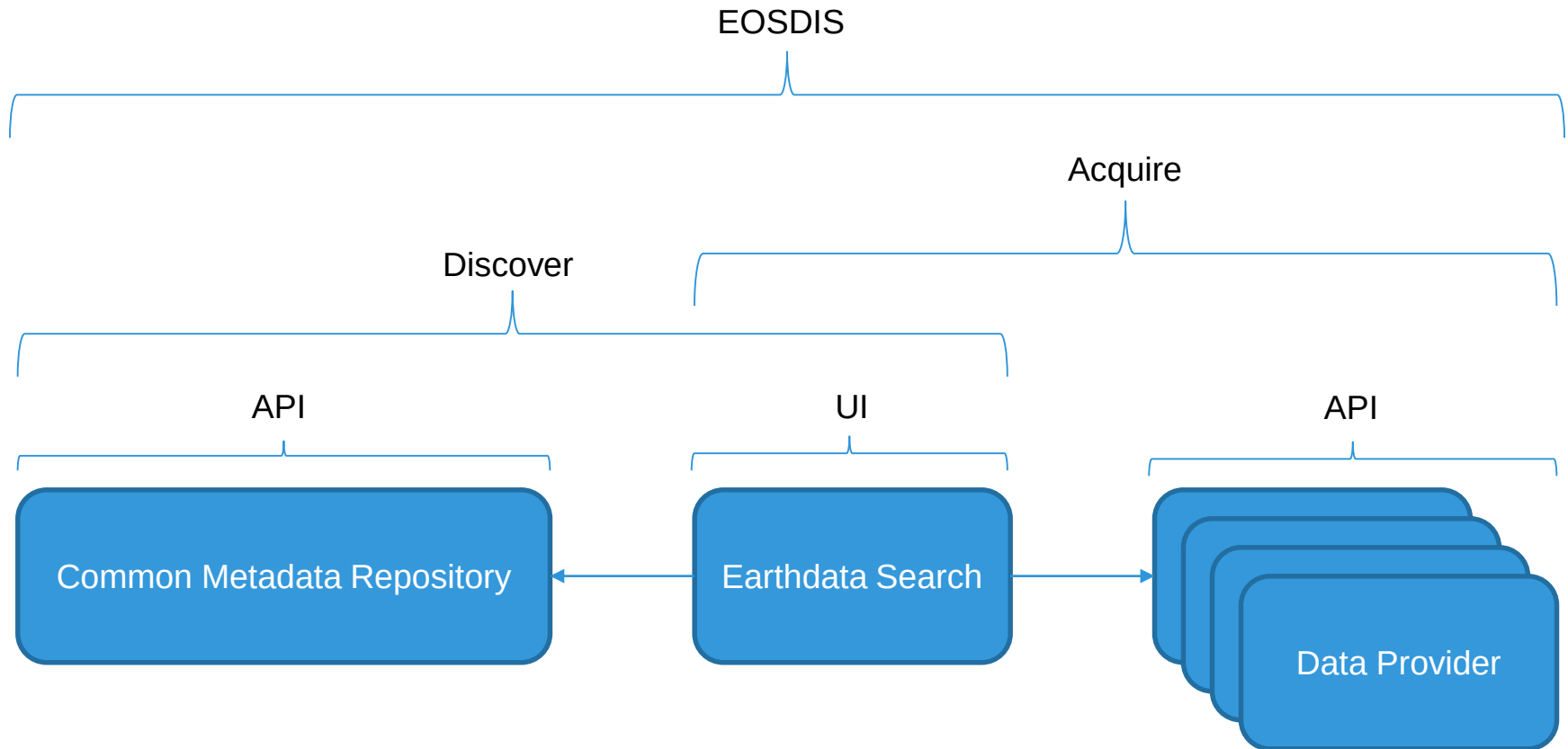
INTRODUCTION

NASA EOSDIS

NASA's Earth Observing System Data and Information System (EOSDIS) is tasked with archiving and distributing Earth Observation data across a range of disciplines, including atmospheric science, oceanography, land processes, natural hazards, solar radiance and even socioeconomic aspects relating to the environment. Given the breadth of disciplines and depth of data that EOSDIS provides, the efficient and intuitive discovery and usage of data by a scientist is of paramount importance. An effective data gathering workflow may involve switching from general use discovery tools to a more bespoke services designed specifically for the scientist's discipline. Providing concrete interoperability between such tools could vastly improve the efficiency of a scientist's workflow.

<https://earthdata.nasa.gov>

EOSDIS discovery & acquisition



Common Metadata Repository

The Common Metadata Repository (CMR) is a high-performance, high-quality, continuously evolving metadata system that catalogs Earth Science data and associated service metadata records. These metadata records are registered, modified, discovered, and accessed through programmatic interfaces leveraging standard protocols and APIs.

<https://cmr.earthdata.nasa.gov/search/>

Earthdata Search

Earthdata Search provides easy-to-use access to EOSDIS services for Earth science data discovery, filtering, visualization, and access. It also serves as a platform to feature planned EOSDIS services as they become available. Through these services, Earthdata Search allows users to:

- Search for Earth observation data
- Preview Earth observation data
- Acquire Earth observation data

<https://search.earthdata.nasa.gov>

EOSDIS Data Providers

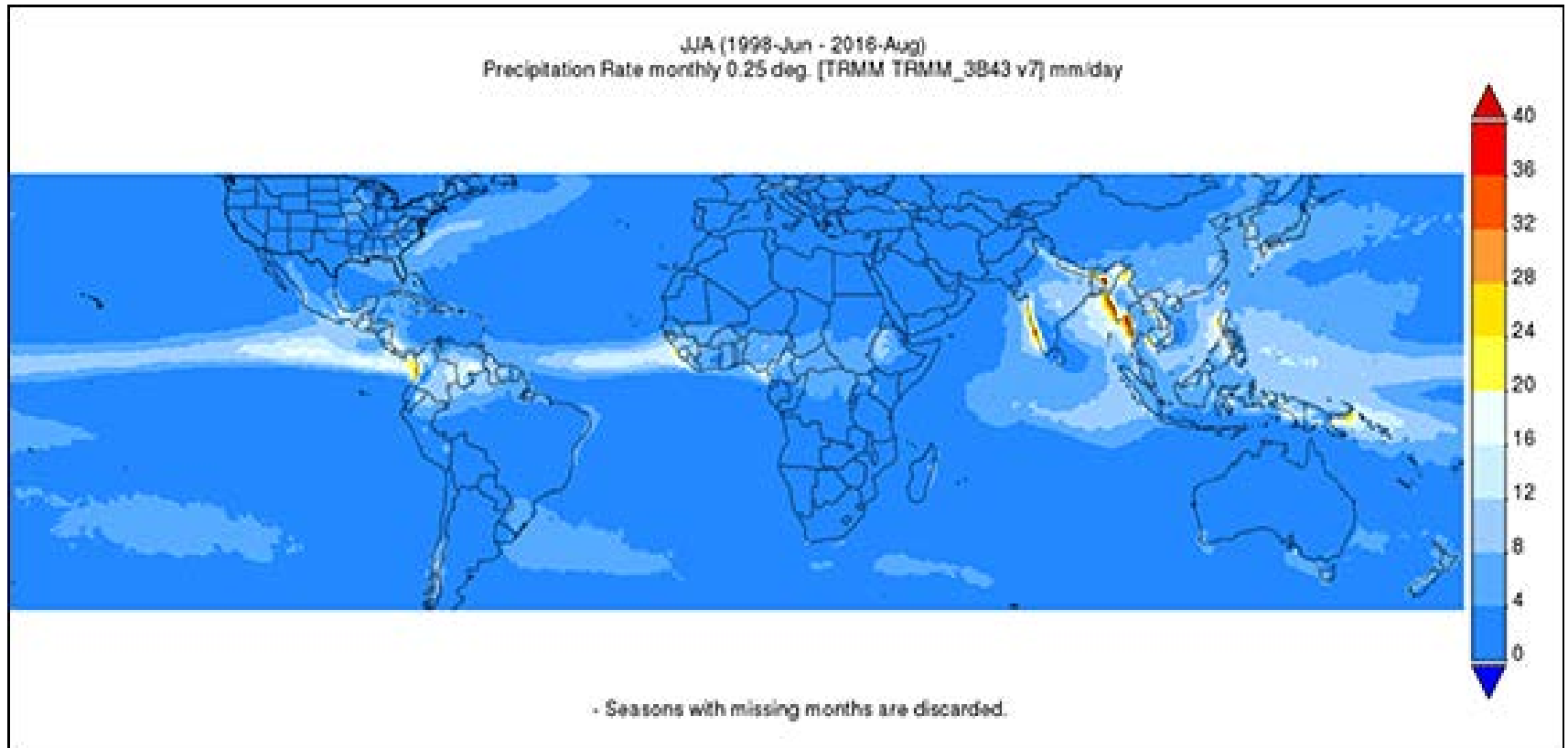


Image sources: NASA / JPL (<https://podaac-tools.jpl.nasa.gov/soto>)

NASA / GSFC (<https://giovanni.gsfc.nasa.gov>)

Smart Handoffs - Origin

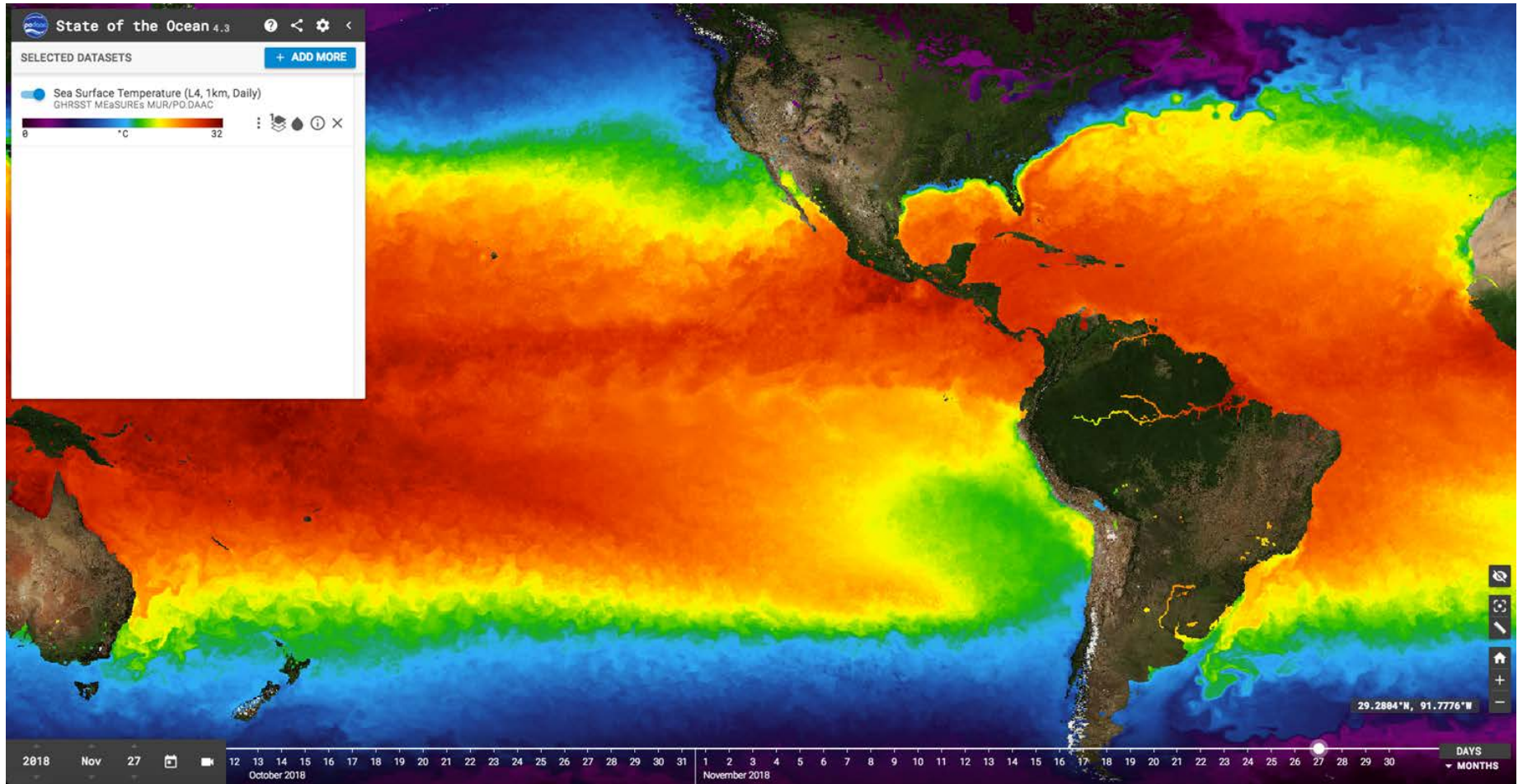


Image sources: NASA (<https://search.earthdata.nasa.gov>)
NASA / JPL (<https://podaac-tools.jpl.nasa.gov/soto>)

'General purpose' discovery

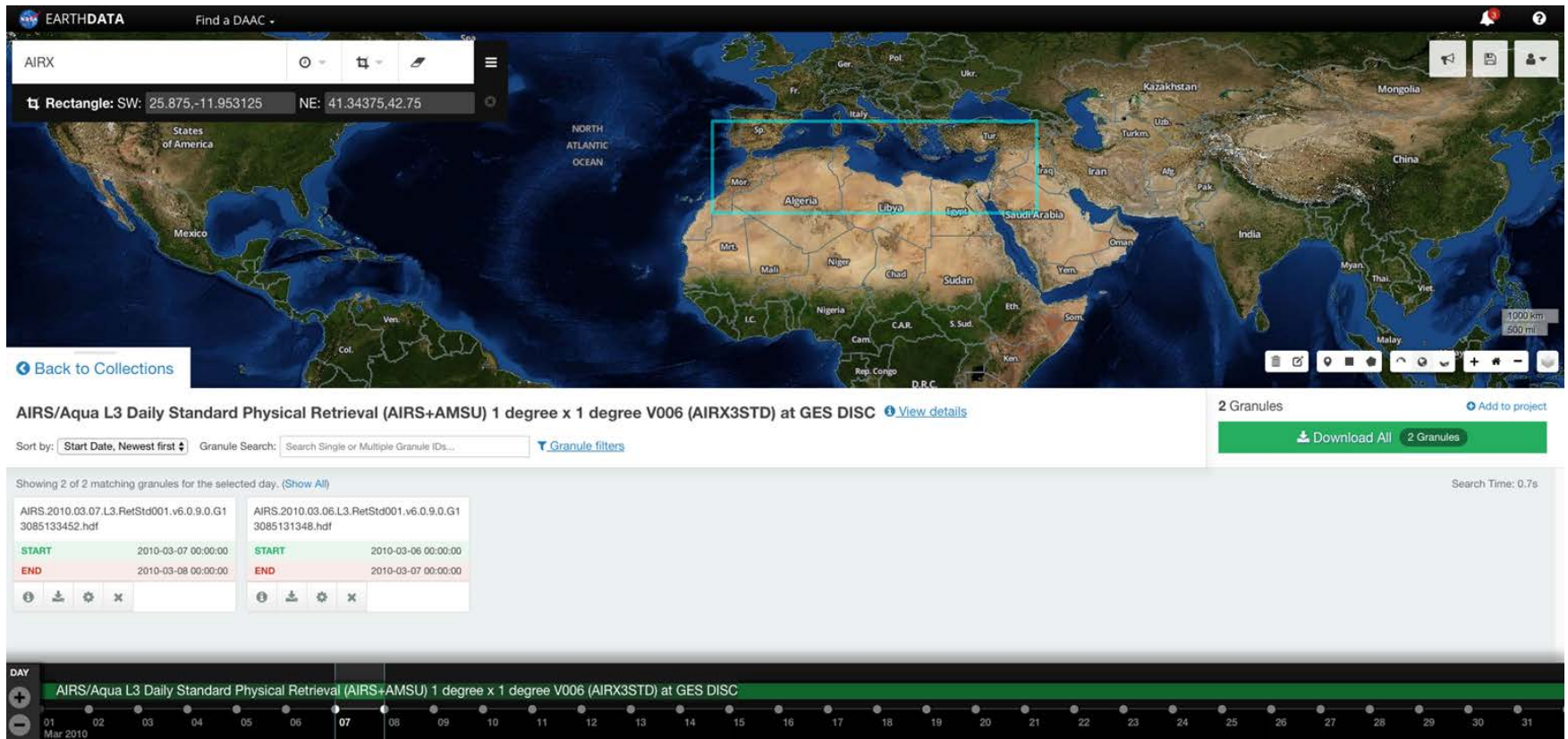


Image sources: NASA (<https://search.earthdata.nasa.gov>)

That would also look great in ...

- Giovanni
- State of the Ocean
- <Your application here>

But how do I get there?

- Open up a new browser window
- Navigate to the application
- Add my constraints
- Is this the same collection?

APPROACH

Smart handoffs - Vision

1. Transfer a user from Earth Science Web Tool A to Earth Science Web Tool B, *without* losing their “place” with respect to,
 - Space
 - Time
 - Dataset
2. Transfer a user from a commercial search tool to the Earth Science Web Tool, without losing their place
3. Integration via simple database updates to unified metadata model concepts (minimal code changes)

NASA EOSDIS UMM concepts

The unified metadata model,

- UMM-C - datasets
- UMM-G - files
- UMM-S - services
- UMM-VAR - variables

And associations between them

Why so difficult?

EARTHDATA Data Discovery - DAACs - Community - Science Disciplines -

GIOVANNI The Bridge Between Data and Science v 4.30 Feedback Help

Select Plot
 Maps: Time Averaged Map * Comparisons: Select... Vertical: Select... Time Series: Select... Miscellaneous: Select...

Select Date Range (UTC)
 YYYY-MM-DD HH:mm to 2016 - 09 - 02 00 : 00 to 2016 - 10 - 01 23 : 59
 Valid Range: 1948-01-01 to 2019-05-07

Select Region (Bounding Box or Shape)
 Format: West, South, East, North
 -13.1309,25.8349,37.9352,44.1672

Select Variables
 Number of matching Variables: 42 of 1989 Total Variable(s) included in Plot: 0
 Please select at least 1 variable
 Keyword: AIRX3STM Search Clear

Variable	Units	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Vert. Slice
☐ Ozone Total Column (Daytime/Ascending) (AIRX3STM v006)	DU	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Ozone Total Column (Nighttime/Descending) (AIRX3STM v006)	DU	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Cloud Fraction (Daytime/Ascending) (AIRX3STM v006)	-	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Cloud Fraction (Nighttime/Descending) (AIRX3STM v006)	-	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Geopotential Height (Daytime/Ascending) (AIRX3STM v006)	m	AIRS	Monthly	1°	2002-09-01	2016-09-30	1000 hPa
☐ Geopotential Height (Nighttime/Descending) (AIRX3STM v006)	m	AIRS	Monthly	1°	2002-09-01	2016-09-30	1000 hPa
☐ Relative Humidity at Surface (Daytime/Ascending) (AIRX3STM v006)	percent	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Relative Humidity at Surface (Nighttime/Descending) (AIRX3STM v006)	percent	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Air temperature at surface (Daytime/Ascending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Air temperature at surface (Nighttime/Descending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Surface Temperature (Daytime/Ascending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Surface Temperature (Nighttime/Descending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Height (Daytime/Ascending) (AIRX3STM v006)	m	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Height (Nighttime/Descending) (AIRX3STM v006)	m	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Pressure (Daytime/Ascending) (AIRX3STM v006)	hPa	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Pressure (Nighttime/Descending) (AIRX3STM v006)	hPa	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Temperature (Daytime/Ascending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Tropopause Temperature (Nighttime/Descending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Ozone_Mole Fraction in Air (Daytime/Ascending) (AIRX3STM v006)	ppbv	AIRS	Monthly	1°	2002-09-01	2016-09-30	1000 hPa
☐ Ozone_Mole Fraction in Air (Nighttime/Descending) (AIRX3STM v006)	ppbv	AIRS	Monthly	1°	2002-09-01	2016-09-30	1000 hPa
☐ Cloud Top Pressure (Daytime/Ascending) (AIRX3STM v006)	hPa	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Cloud Top Pressure (Nighttime/Descending) (AIRX3STM v006)	hPa	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Cloud Top Temperature (Daytime/Ascending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Cloud Top Temperature (Nighttime/Descending) (AIRX3STM v006)	K	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Outgoing Longwave Radiation Clear Sky (Daytime/Ascending) (AIRX3STM v006)	W/m2	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Outgoing Longwave Radiation Clear Sky (Nighttime/Descending) (AIRX3STM v006)	W/m2	AIRS	Monthly	1°	2002-09-01	2016-09-30	-
☐ Outgoing Longwave Radiation (Daytime/Ascending) (AIRX3STM v006)	W/m2	AIRS	Monthly	1°	2002-09-01	2016-09-30	-

Reset Plot Data

NASA Official: Angela Li Web Curator: M. Hagde Privacy Powered By Contact GES DISC

Image sources: NASA (<https://search.earthdata.nasa.gov>)
 NASA / GSFC (<https://giovanni.gsfc.nasa.gov>)

KEY CHALLENGES

Context A to context B

I have the following constraints,

- Collection
- Spatial
- Temporal

How do I get that context to another tool?

I need to be able to describe the API

Standards for API description

Schema.org search actions

- <https://schema.org/docs/actions.html>
- 'The act of searching for an object'

```
{
  "@context": "http://schema.org",
  "@type": "ServiceChannel",
  "url": "https://giovanni.gsfc.nasa.gov/giovanni",
  "providesService": {
    "@type": "Service",
    "name": "Giovanni",
    "url": "https://giovanni.gsfc.nasa.gov/giovanni",
    "potentialAction": {
      "@type": "SearchAction",
      "target": "https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime={start}&endtime={end}&bbox={box}&dataKeyword={collection}&data={variables}",
      ...
    }
  }
}
```


Standards for constraints

```
{
  "@context": "http://schema.org",
  "@type": "ServiceChannel",
  "url": "https://giovanni.gsfc.nasa.gov/giovanni",
  "providesService": {
    "@type": "Service",
    "name": "Giovanni",
    "url": "https://giovanni.gsfc.nasa.gov/giovanni",
    "potentialAction": {
      "@type": "SearchAction",
      "target": "https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime={start}&endtime={end}&bbox={box}&dataKeyword={collection}&data={variables}",
      "query-input": [
        {
          "@type": "PropertyValueSpecification",
          "valueRequired": false,
          "valueName": "start",
          "defaultValue": {
            "@id": "schema:startDate",
            "@type": "Property"
          }
        },
        {
          "@type": "PropertyValueSpecification",
          "valueRequired": false,
          "valueName": "end",
          "defaultValue": {
            "@id": "schema:endDate",
            "@type": "Property"
          }
        },
        {
          "@type": "PropertyValueSpecification",
          "valueRequired": false,
          "valueName": "box",
          "defaultValue": {
            "@type": "Place",
            "geo": {
              "@type": "GeoShape",
              "box": "-90.0000 180.0000 90.0000 -180.0000"
            }
          }
        }
      ]
    }
  }
}
```

Collection aliasing

Most of our tools follow the same standards, except...

We all have our own names for collections.

How do we handle that?

We can alias a collection name as follows,

```
{"app-name": "Giovanni", "alias": "dataKeyword=AIRX3STD"}
```

By association between a UMM-S and UMM-C

Integration expectations

This approach assumes the following,

- We can interact with your application in a RESTful way, via GET or POST with Keyword-Value pairs.
- Your application responds with a HTML user interface.

There are applications out there that we would like to hand off to that don't conform to this.

CONCLUSION

To Giovanni - Demo



Image sources: NASA (<https://search.earthdata.nasa.gov>)
NASA / GSFC (<https://giovanni.gsfc.nasa.gov>)

To SOTO

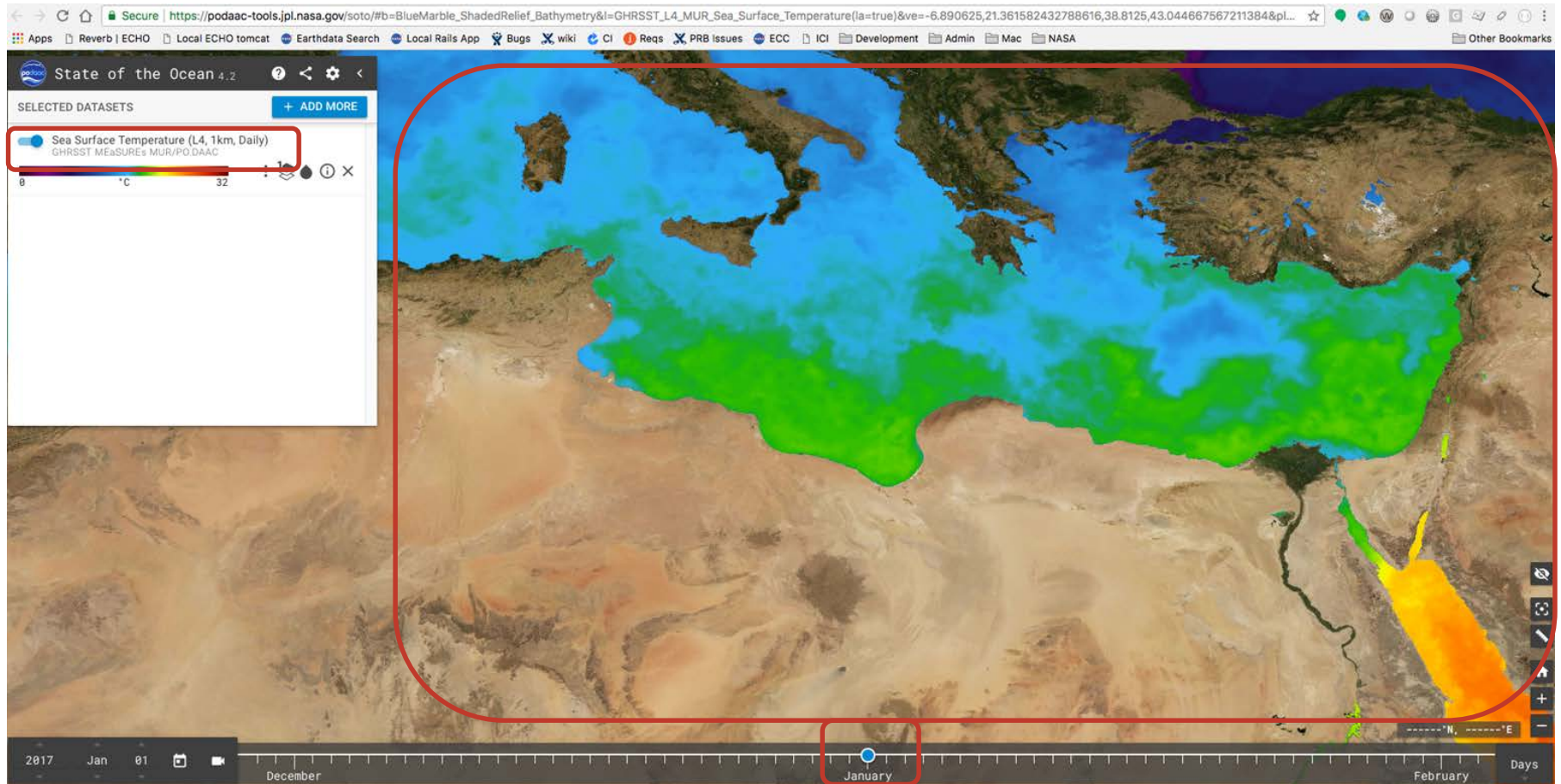


Image sources: NASA (<https://search.earthdata.nasa.gov>)
NASA / JPL (<https://podaac-tools.jpl.nasa.gov/soto>)

Current state of play

- Earthdata Search to Giovanni – now
- Earthdata Search to State of the Ocean – Q4 2019
- Earthdata Search to **your application** - ?
- **Your application** to Earthdata Search - ?

GOING FURTHER

Embed your search action

```
{
  "@context": "http://schema.org",
  "@type": "ServiceChannel",
  "url": "https://search.earthdata.nasa.gov",
  "providesService": {
    "@type": "Service",
    "name": "Earthdata Search",
    "url": "https://search.earthdata.nasa.gov",
    "potentialAction": {
      "@type": "SearchAction",
      "target": "https://search.earthdata.nasa.gov/search?q={query}&qt={temporal}&sb={box}",
      "query-input": [
        {
          "@type": "PropertyValueSpecification",
          "valueRequired": false,
          "valueName": "temporal",
          "defaultValue": {
            "@id": "schema:datasetTimeInterval",
            "@type": "Property"
          }
        },
        {
          "@type": "PropertyValueSpecification",
          "valueRequired": false,
          "valueName": "box",
          "defaultValue": {
            "@type": "Place",
            "geo": {
              "@type": "GeoShape",
              "box": "-90.0000 180.0000 90.0000 -180.0000"
            }
          }
        }
      ],
      {
        "@type": "PropertyValueSpecification",
        "valueRequired": false,
        "valueName": "query"
      }
    ]
  }
}
```

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No download...

- Traditional earth science analytics = local download
- With the cloud...
 - Put the data next to the analytics
 - Put the analytics next to the discovery
 - Use smart hand offs to navigate workflow
 - **A complete, End-to-end workflow in the cloud**

QUESTIONS

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Raytheon