



# EOSDIS

NASA'S EARTH OBSERVING SYSTEM  
DATA AND INFORMATION SYSTEM

# End-to-End Solution for Data Customization with NASA's Earthdata Search

## 2018 AGU Fall Meeting

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# The Challenge

- “there is very little consistency of the tools available to perform subsetting, and there is very little consistency with services across the DAACs.”<sup>1</sup>

<sup>1</sup>CMR End-to-End Services Study, 2016

# The Challenge

- September of 2016, of over 90 interview subjects, a prevailing issue was that regardless of their experience level, they all had difficulty in finding the right data set and preparing the data to get it in the desired format.

*“Perfection is achieved, not when there is nothing left to add, but when there is nothing left to take away.” – A. de Saint-Exupery*

# THE VISION

# The Vision

- User is required to provide a minimum of input for service invocation.
- Optimization for the majority of the user population, not the totality.
- Use the user's jargon, i.e. options not services; files not granules.

*"No one can whistle a symphony. It takes a whole orchestra to play it." – H.E. Luccock*

# THE PIECES

# The Pieces

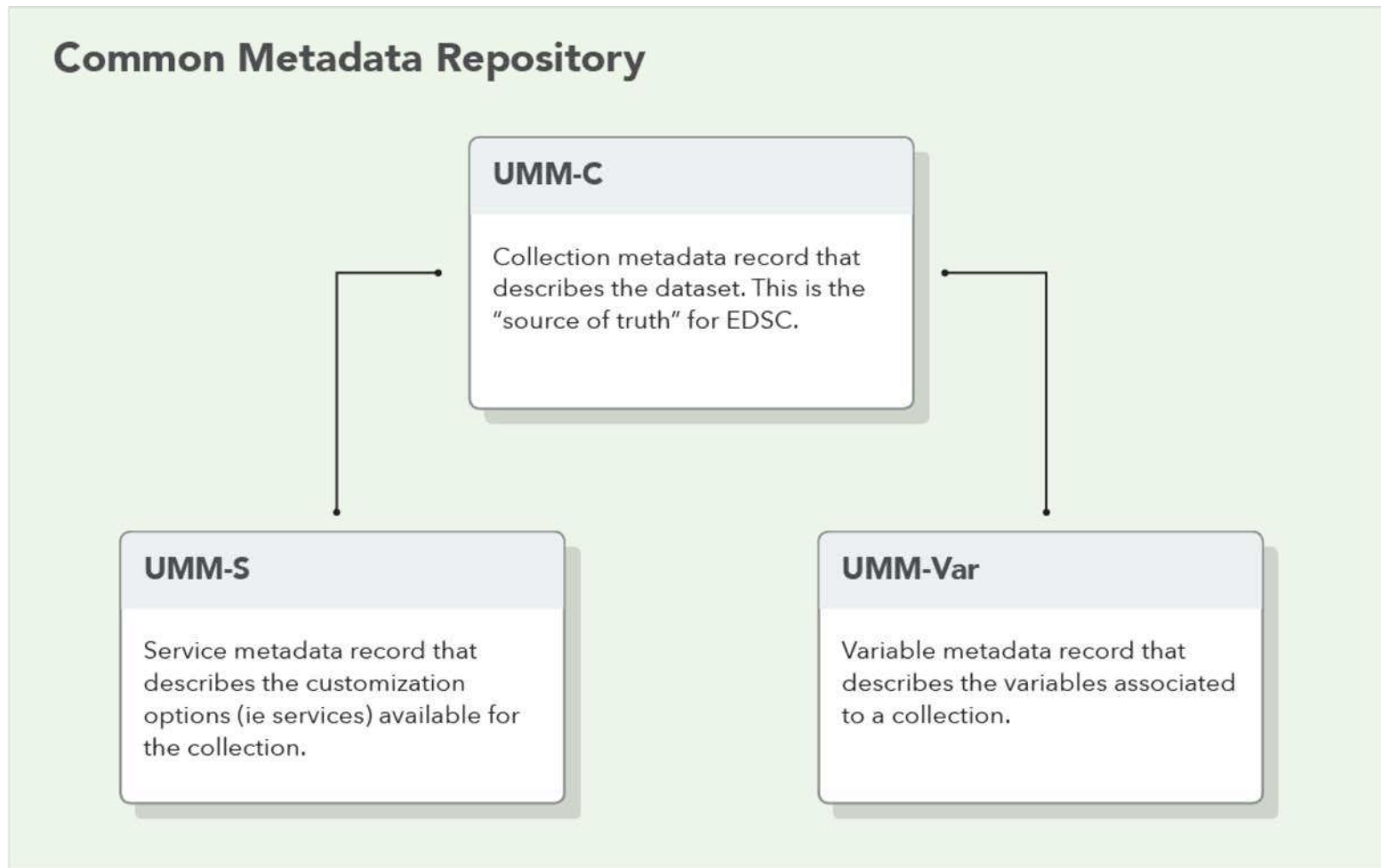
- “If you wait until the last minute to complete the user interface, it only takes a minute.” -Anonymous

# The Pieces

- User Experience Driven Design (UXDD)
  - Start with the end in mind
  - Consider users over architecture and current capabilities
  - Favor simplicity above all



# The Pieces



# The Pieces

- UMM-Var
  - Answers the question “What measurement and variables are available within this collection?”
  - Can be auto-generated!

# The Pieces

- UMM-S
  - Answers the question “What can I do with this collection?”
    - What formats can I output this data to?
    - Can I reproject this data?
    - Does this collection support spatial subsetting?

# The Pieces

The image displays three overlapping browser windows from NASA EarthData. The top window shows the Metadata Management Tool interface. The middle window shows a 'Related URLs' section. The bottom window displays a JSON metadata record for an AIRS3STD.006 dataset.

```
1 // Z0181102200938
2 // https://cmr.sit.earthdata.nasa.gov/search/concepts/S1200278989-E2E_18_4
3
4 {
5   "Name": "AIRS3STD.006",
6   "LongName": "AIRS/Aqua L3 Daily Standard Physical Retrieval (AIRS-only) 1 degree x 1 degree V006 (AIRS3STD) at GES DISC",
7   "Description": "Access the AIRS/Aqua L3 Daily Standard Physical Retrieval (AIRS-only) 1 degree x 1 degree V006 (AIRS3STD) at GES DISC
8   through OPeNDAP",
9   "Type": "OPeNDAP",
10  "Version": "1.9",
11  "AccessConstraints": "None",
12  "UseConstraints": "None",
13  "RelatedURLs": [
14    {
15      "Description": "OPeNDAP Service for AIRS3STD.006",
16      "URLContentType": "DistributionURL",
17      "Type": "GET SERVICE",
18      "Subtype": "OPeNDAP DATA",
19      "URL": "https://f5e1l01.edn.ecs.nasa.gov/opepdap/hyrax/DEV01/user/FS2/AIRS/AIRS3STD.006"
20    }
21  ],
22  "ServiceKeywords": [
23    {
24      "ServiceCategory": "EARTH SCIENCE SERVICES",
25      "ServiceTopic": "DATA MANAGEMENT/DATA HANDLING",
26      "ServiceTerm": "TRANSFORMATION/CONVERSION"
27    }
28  ],
29  "ScienceKeywords": [
30    {
31      "Category": "EARTH SCIENCE",
32      "Topic": "ATMOSPHERE",
33      "Term": "ATMOSPHERIC CHEMISTRY",
34      "VariableLevel1": "CARBON AND HYDROCARBON COMPOUNDS",
35      "VariableLevel2": "METHANE"
36    }
37  ]
38 }
```

# The Pieces

- CMR Magic

```
1 {
2   "boxes": [
3     "-90 -180 90 180"
4   ],
5   "time_start": "2002-08-30T00:00:00.000Z",
6   "version_id": "006",
7   "updated": "2014-12-18T00:00:00.000Z",
8   "dataset_id": "Aqua AIRS Level 3 Daily Standard Physical Retrieval (AIRS+AMSU) V006 (AIRX3STD) at GES DISC",
9   "has_spatial_subsetting": true,
10  "has_transforms": true,
11  "associations": {
12    "variables": [
13      "V1200265916-EDF_OPS",
14      "V1200266510-EDF_OPS",
15      "V1200266548-EDF_OPS"
16    ],
17    "services": [
18      "S1200245793-EDF_OPS"
19    ]
20  },
21  "has_variables": true,
22  "data_center": "EDF_OPS",
23  "short_name": "AIRX3STD"
24 }
```

# The Pieces

- CMR Magic

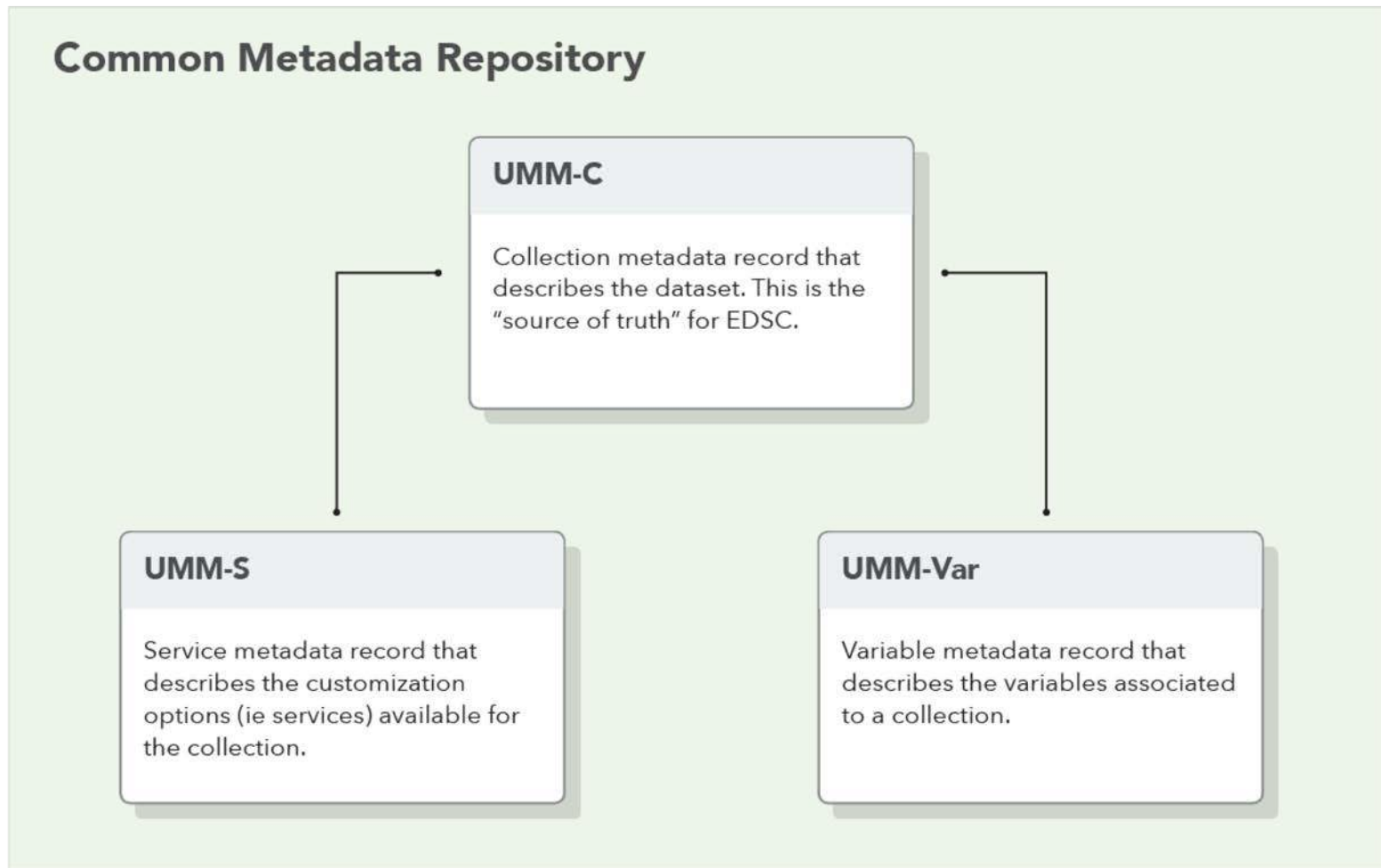
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1 {
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3     "-90 -180 90 180"
4   ],
5   "time_start": "2002-08-30T00:00:00.000Z",
6   "version_id": "006",
7   "updated": "2014-12-18T00:00:00.000Z",
8   "dataset_id": "Aqua AIRS Level 3 Daily Standard Physical Retrieval (AIRS+AMSU) V006 (AIRX3STD) at GES DISC",
9   "has_spatial_subsetting": true,
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17    "services": [
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# The Pieces

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# The Pieces

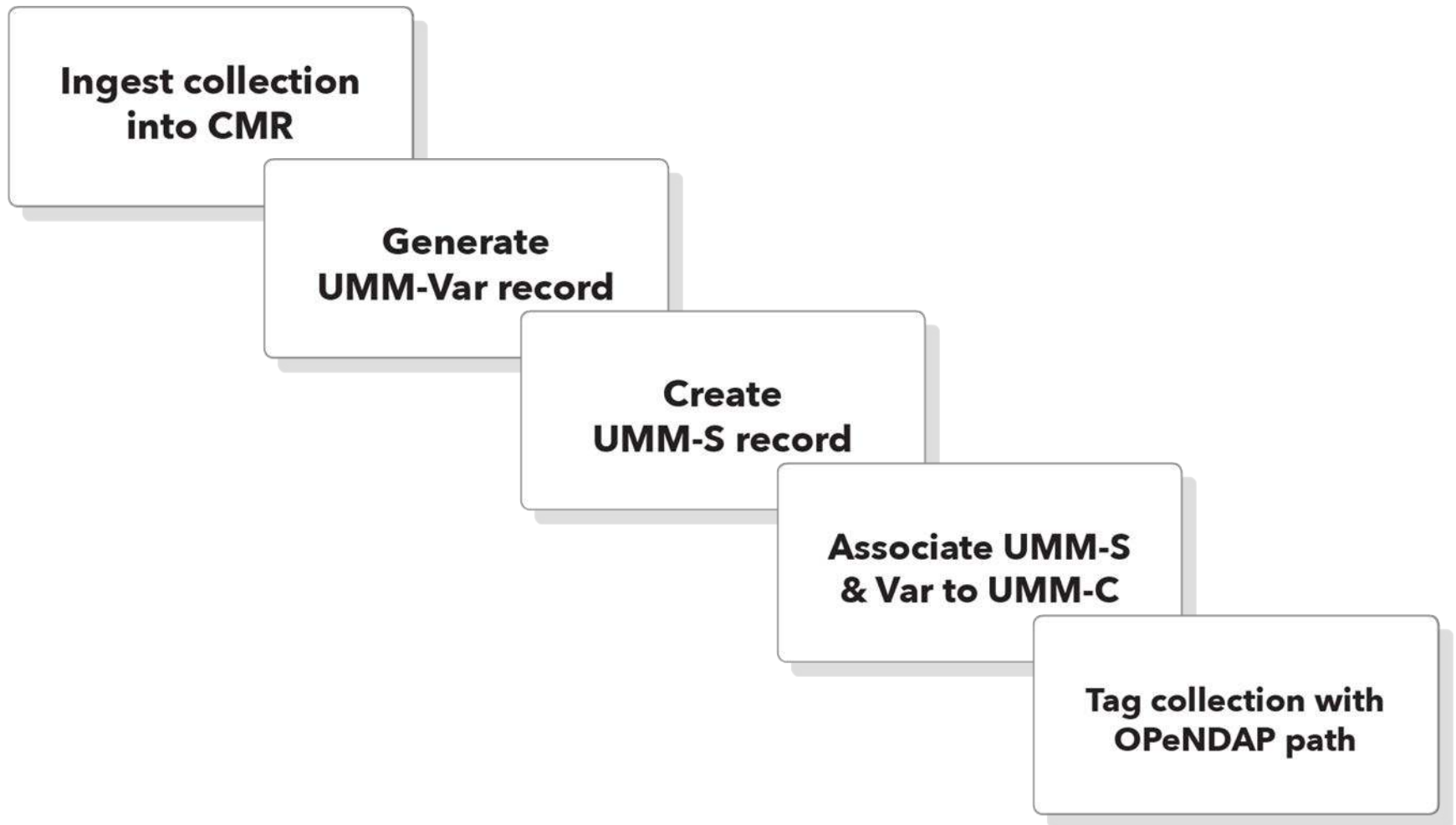




*“Data is a precious thing and will last longer than the systems themselves.” – Tim Berners-Lee*

# THE PROVIDER WORKFLOW

# The Provider Workflow



*“And I knew exactly what to do. But in a much more real sense, I had no idea what to do.” - Michael Scott*

# THE USER WORKFLOW

# Search and Add to Project

The screenshot displays the NASA Earthdata Search web application. The search query is "aqua airs" and the results are sorted by Relevance. A red circle highlights the green plus icon in the top right corner of the first search result, which is used to add the collection to the current project.

**Search Results:**

- 97 Matching Collections**
- Sort by: **Relevance** (dropdown),  Only include collections with granules,  Include non-EOSDIS collections
- You have 1 collection in your current Project
- Result 1:** Aqua AIRS Level 3 Daily Standard Physical Retrieval (AIRS+AMSU) V006 (AIRX3STD) at GES DISC  
1 Granule • 2002-09-30 ongoing • The AIRS Level 3 Daily Gridded Product contains standard retrieval means, standard deviations and input counts. Each file covers a temporal period of 24 hours for either the descending (equatorial crossing North to South @1:30 AM local time) or ascending (equatorial crossing Sou...  
CUSTOMIZABLE: [icon] [icon] [icon] [icon] AIRX3STD v006 - GESDISC [Add to Project]
- Result 2:** AIRS/Aqua L3 8-day Standard Physical Retrieval (AIRS-only) 1 degree X 1 degree V006 (AIRS3ST8) at GES DISC V006  
2 Granules • 2002-09-01 ongoing • The Atmospheric Infrared Sounder (AIRS) is a grating spectrometer (R = 1200) aboard the second Earth Observing System (EOS) polar-orbiting platform, EOS Aqua. In combination with the Advanced Microwave Sounding Unit (AMSU) and the Humidity Sounder for Brazil (HSB), AIRS constitut...  
AIRS3ST8 v006 - EDF\_DEV01 [Add to Project]
- Result 3:** Aqua AIRS Level 3 Daily Standard Physical Retrieval (AIRS+AMSU) V006 (AIRX3STD) at GES DISC [Testing Variable Dimensions] [Add to Project]

# Customize Output

The screenshot shows the Earthdata Search web application interface. The browser address bar indicates the URL: <https://searchlab.earthdata.nasa.gov/search/collections?projectId=4009334615>. The page title is "AGU 2018". The search results summary shows "2 Granules", "2 Collections", and "286.7 TB".

On the left sidebar, there is a map with a "Rectangle" selection, and sections for "Variables" (listing "C1200268801-EDF\_DEV01 analysed sea surface temperature"), "Transformations", and "Output Formats". A green "DOWNLOAD DATA" button is located at the bottom of the sidebar.

The main content area displays two granules:

- Granule 1:** AIRS/Aqua L3 Daily Standard Physical Retrieval (AIRS-only) 1 degree x 1 degree V006 (AIRS3STD) at GES ...  
Estimated Size: 286.7 TB | [View Granules](#)  
**Edit Options** (circled in red)
- Granule 2:** GHRSSST Level 4 MUR Global Foundation Sea Surface Temperature Analysis (v4.1) V001  
Estimated Size: 368.0 MB | [View Granules](#)  
**Edit Options**

At the bottom of the page, there is a footer with version information: "v.62e-services-18.4.3.1" and a link to "Earthdata Access, & Section 508 accessible alternative".

# Customize Output

The screenshot shows a web browser window with the URL <https://searchlab.earthdata.nasa.gov/search/collections?projectId=4009334615>. The page title is "AGU 2018". A modal dialog box titled "Edit Options" is open, showing the following sections:

- Delivery Method**
  - Customize & Download (OPeNDAP)**

Select options like variables, transformations, and output formats to customize your data. The desired data files will be made available for access immediately. Files will be accessed from a list of links in the browser or by using a download script.

[Edit Delivery Method](#)
- Additional Options**
  - Variable Selection**

Use science keywords to subset your collection granules by measurements and variables.  
*No variables selected. All variables will be included in download.*

[Edit Variables](#)
  - Spatial subsetting is inherited from your search session. [Click here](#) to modify.

The dialog box has a "Close" button in the bottom right corner. In the background, the Earthdata Search interface is visible, showing a map of the study area, a sidebar with "Variables" (C1200268801-EDF\_DEV01, analysed sea surface temperature), "Transformations", and "Output Formats", and a "DOWNLOAD DATA" button at the bottom.

# Customize Output

The screenshot shows the Earthdata Search web application interface. A modal dialog titled "Edit Variables" is open, displaying a list of variables for selection. The "EMISSIVITY" variable is circled in red. The background interface shows a map of a coastal region, a sidebar with navigation options like "Variables", "Transformations", and "Output Formats", and a "DOWNLOAD DATA" button. The browser address bar shows the URL: <https://searchlab.earthdata.nasa.gov/search/collections?projectId=4009334615>.

**Edit Variables**

Back to Edit Options

**Variable Selection**

- SURFACE PRESSURE
- AIR TEMPERATURE
- SKIN TEMPERATURE
- EMISSIVITY**
- TOTAL PRECIPITABLE WATER
- UPPER AIR TEMPERATURE
- WATER VAPOR
- CLOUD HEIGHT
- CLOUD TOP PRESSURE
- CLOUD TOP TEMPERATURE

Done

# Customize Output

The screenshot shows the NASA Earthdata Search web application. The browser address bar displays the URL: <https://searchlab.earthdata.nasa.gov/search/collections?projectId=4009334615>. The page header includes the NASA logo, 'EARTHDATA Search Lab', and 'AGU 2018'. A 'Back to Search Session' button is visible in the top right.

The main content area is partially obscured by a modal dialog box titled 'Edit Variables'. The dialog has a 'Back to Edit Options' link and a 'Variable Selection' section. Under 'Variable Selection', there are two tabs: 'ALL LEAFNODES' and 'EMISSIONS'. The 'EMISSIONS' tab is active, showing a list of variables with checkboxes and 'View Details' links:

- Select All Variables
- EmisIR\_A\_err  
*Emissivity IR Ascending Standard Error* | [View Details](#)
- EmisIR\_A  
*Emissivity IR Ascending* | [View Details](#)
- EmisIR\_A\_max  
*Emissivity IR Ascending Maximum* | [View Details](#)
- TotalCounts\_A  
*TotalCounts Ascending* | [View Details](#)
- EmisIR\_A\_ct  
*Emissivity IR Ascending Input Count* | [View Details](#)
- EmisIR\_A\_min

At the bottom of the dialog are 'Back' and 'Save' buttons. The background interface shows a map of a region with a red rectangle, a 'Variables' list, and a 'DOWNLOAD DATA' button.



# Customize Output

The screenshot shows the NASA Earthdata Search Lab interface. The browser address bar displays the URL: <https://searchlab.earthdata.nasa.gov/search/collections?projectId=4009334615>. The page title is "AGU 2018". A "Back to Search Session" button is visible in the top right corner. The main content area is partially obscured by a white "Edit Variables" dialog box. The dialog box has a "Back to Edit Options" link and a list of variables for selection. The "EMISSIVITY" variable is currently selected, indicated by a blue "1 selected" badge. The "Done" button is located at the bottom right of the dialog box. On the left side of the interface, there is a sidebar with a map, a "Rectangle" tool, and sections for "Variables" and "Transformations". The "Variables" section lists two items: "C1200278968-E2E\_18\_4" (Emissivity IR Ascending Maximum) and "C1200268801-EDF\_DEV01" (analysed sea surface temperature). The "Transformations" and "Output Formats" sections are also visible. At the bottom of the sidebar, there is a green "DOWNLOAD DATA" button.

# Confirm Output

The screenshot shows the NASA Earthdata Search interface. The browser address bar indicates the URL: [https://searchlab.earthdata.nasa.gov/search/collections?p=IC1200278968-E2E\\_18\\_4/IC120026...](https://searchlab.earthdata.nasa.gov/search/collections?p=IC1200278968-E2E_18_4/IC120026...). The page title is "AGU 2018". The search results show "2 Granules", "2 Collections", and "286.7 TB" of data. Two granules are listed:

- AIRS/Aqua L3 Daily Standard Physical Retrieval (AIRS-only) 1 degree x 1 degree V006 (AIRS3STD) at GES ...**  
1 Granules  
Estimated Size: 286.7 TB | [View Granules](#)  
Edit Options
- GHRSSST Level 4 MUR Global Foundation Sea Surface Temperature Analysis (v4.1) V001**  
1 Granules  
Estimated Size: 368.0 MB | [View Granules](#)  
Edit Options

A red circle highlights the "DOWNLOAD DATA" button at the bottom left of the interface.

# Download Data

**Order Status**

This page will automatically update as your orders are processed. The Order Status page can be accessed later by visiting <https://searchlab.earthdata.nasa.gov/data/retrieve/9608525453> or the [Download Status and History](#) page.

**Direct Download**

Click the "View/Download Data Links" button to view or download a file containing links to your data.

**AIRS/Aqua L3 Daily Standard Physical Retrieval (AIRS-only) 1 degree x 1 degree V006 (AIRS3STD) at GES DISC**

[View/Download Data Links](#) [Download Access Script](#)

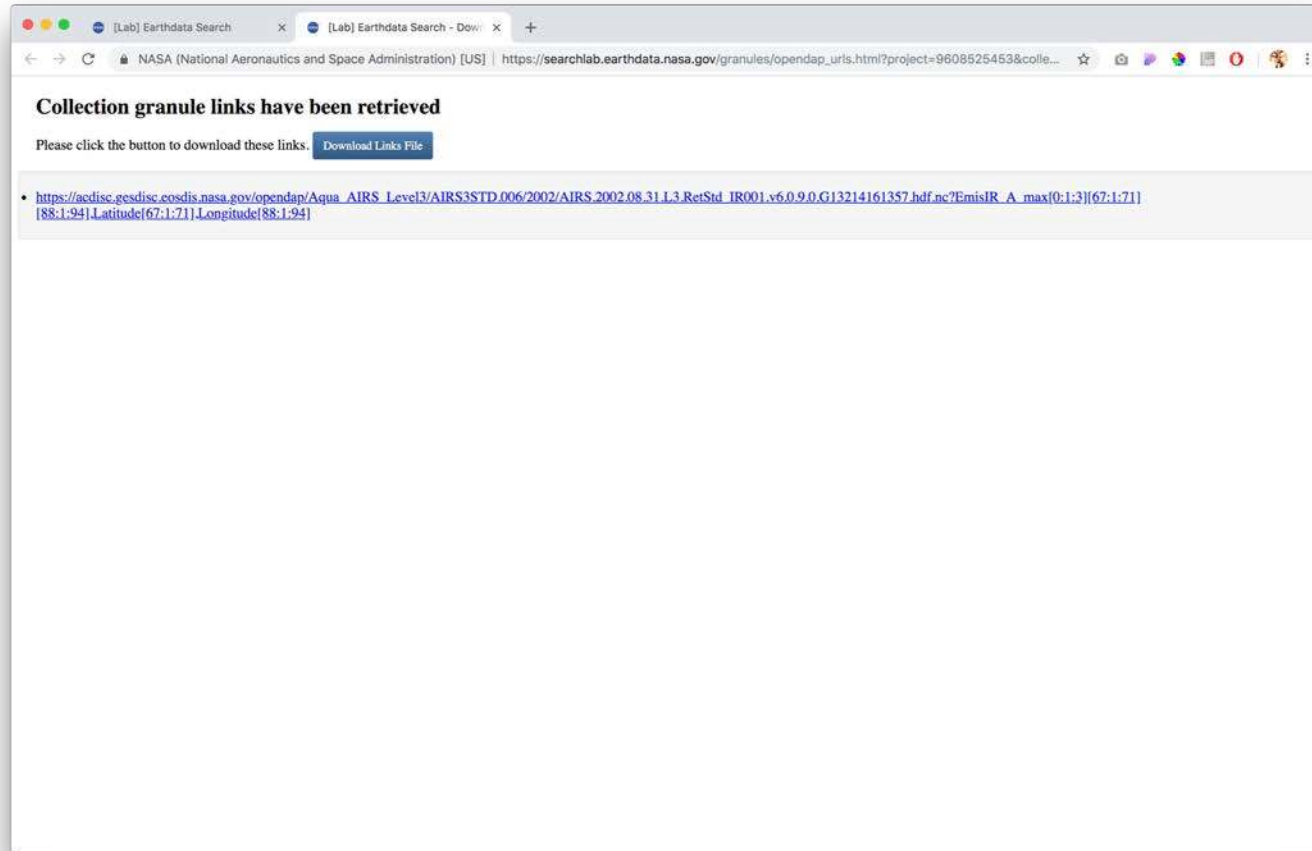
**GHRSSST Level 4 MUR Global Foundation Sea Surface Temperature Analysis (v4.1) V001**

[View/Download Data Links](#) [Download Access Script](#)

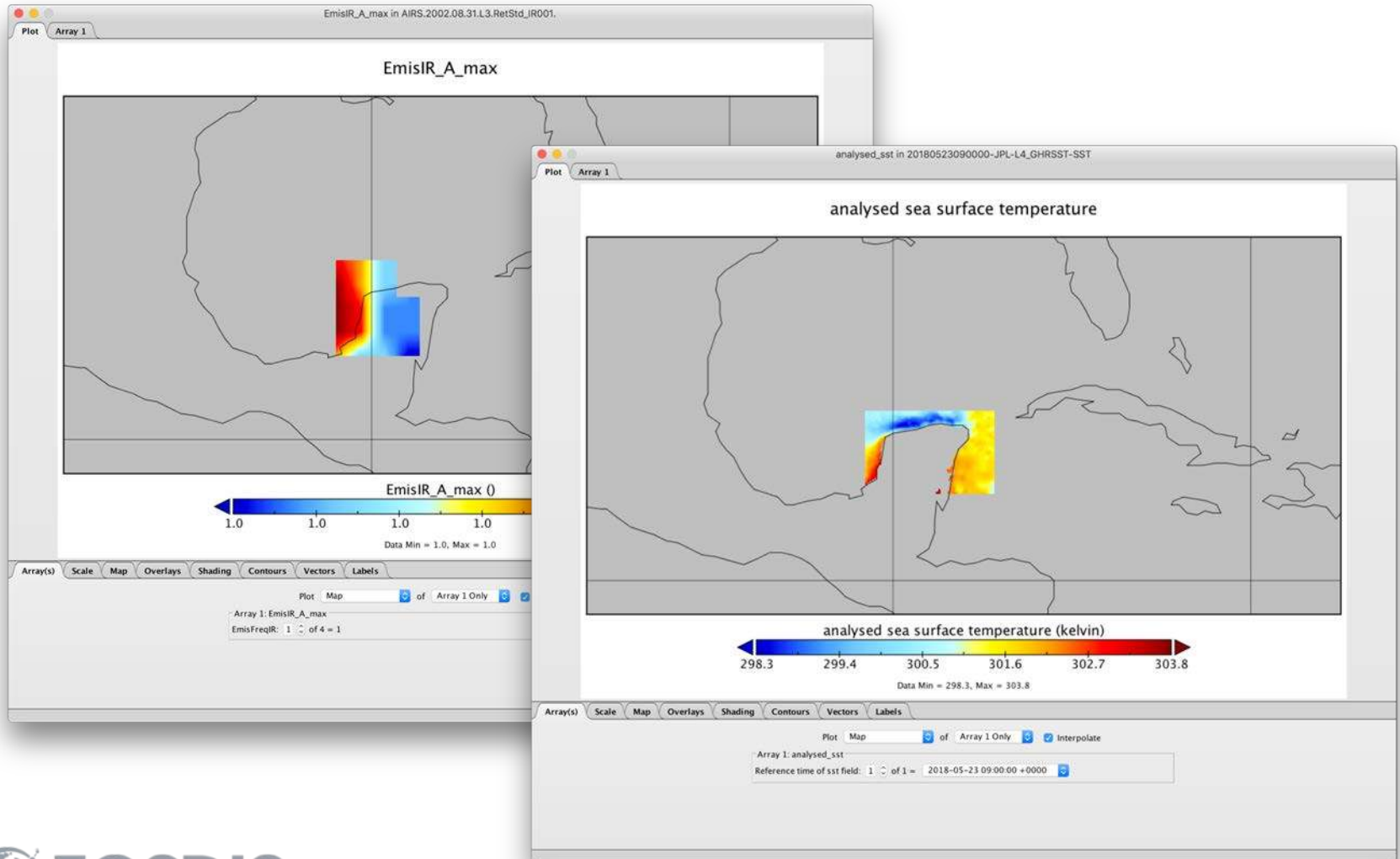
**Additional Resources and Documentation**

- **GHRSSST Level 4 MUR Global Foundation Sea Surface Temperature Analysis (v4.1) V001**
  - [ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic\\_nc\\_readers/matlab/](ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic_nc_readers/matlab/)
  - [https://podaac-](https://podaac-tools.jpl.nasa.gov/soto/#b=BlueMarble_ShadedRelief_Bathymetry&l=GHRSSST_L4_MUR_Sea_Surface_Temperature(la=true))  
[tools.jpl.nasa.gov/soto/#b=BlueMarble\\_ShadedRelief\\_Bathymetry&l=GHRSSST\\_L4\\_MUR\\_Sea\\_Surface\\_Temperature\(la=true\)](https://podaac-uat.jpl.nasa.gov/las/UI.vm)  
<https://podaac-uat.jpl.nasa.gov/las/UI.vm>
  - <https://podaac.jpl.nasa.gov/forum/viewtopic.php?f=5&t=219>
  - [ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic\\_nc\\_readers/idl/](ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic_nc_readers/idl/)
  - [ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic\\_nc\\_readers/R/](ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic_nc_readers/R/)
  - [ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic\\_nc\\_readers/python/](ftp://podaac.jpl.nasa.gov/allData/ghrsst/sw/generic_nc_readers/python/)

# Download Data



# Science!



This work was supported by NASA/GSFC under Raytheon Co. contract number NNG15HZ39C.

# Raytheon

*in partnership with*

