



An Open Science Platform

Built with an open source software community

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Development Seed/NASA IMPACT

Credits:

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Indiana University, EIS, 2i2c, SMCE

Agenda

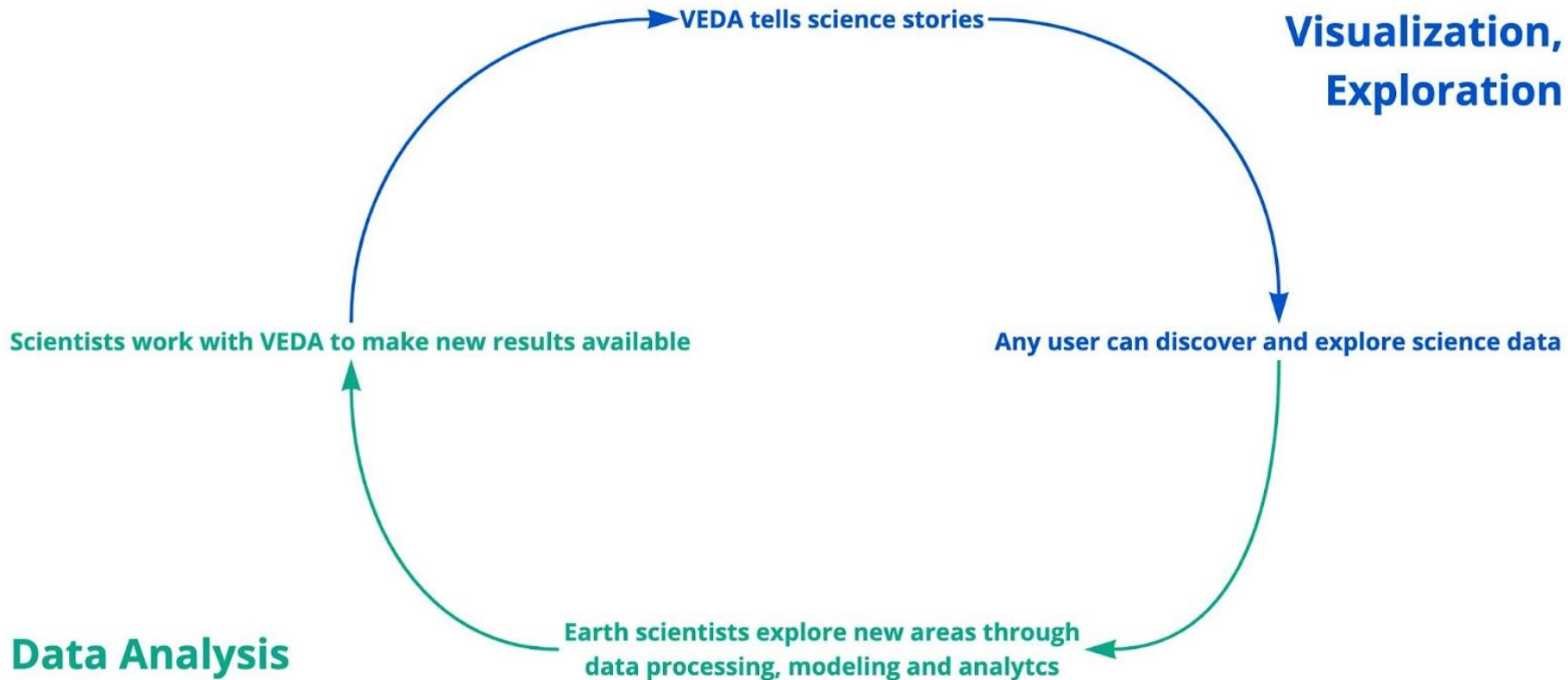
- VEDA in relation to EO Dashboard and Euro Data Cube
- Overview of VEDA
- Demo of creating content in the VEDA Dashboard: Fire Tracking Story
 - VEDA is an open science platform, not just a story telling dashboard
 - Scientists can:
 - Scale their science
 - Contribute documentation
 - Contribute datasets
 - Contribute discoveries
 - Users can reproduce analysis via VEDA's Jupyterhub.
- How to deploy VEDA
 - eoAPI + veda-ui + veda-config = Dashboard
 - Dashboard + JupyterHub = VEDA as an open science platform
- Questions?

VEDA in relation to EO Dashboard

- Through a trilateral collaboration ESA-JAXA-NASA, the 3 agencies have been exploring how to share content and reach users to benefit from the combined wealth of Earth observation information.
- VEDA is the NASA platform for data storytelling with open-source software and open-standard interfaces.
- VEDA provides NASA data to render in the EO Dashboard via STAC and dynamic tiling (TiTiler).

Overview of VEDA

The **VEDA** Science Lifecycle



An artistic illustration on the left side of the image shows a young child with long brown hair, wearing a purple t-shirt and dark shorts, climbing a white staircase. The child is looking upwards with a sense of wonder. The staircase leads to a large, circular opening that reveals a vibrant cosmic scene. Inside this opening, there is a bright orange sun or star, a crescent moon, and a large, colorful galaxy with blue and purple hues. The background of the entire scene is dark, filled with numerous small, glowing yellow and white stars, creating a sense of depth and vastness.

NASA's Open-Source Science Initiative

NASA's approach for putting Open
Science into practice.

<https://science.nasa.gov/open-science-overview>



Policy and Governance

**Core Data and
Computing Services**

**NASA's
Open-Source
Science
Initiative**

**Open Science
Incentives**

**Community
Engagement**



Overview of VEDA

4-Pillars of NASA open science

1. **Policy and Governance:** Implement policies that advance open science, support Science Mission Directorate (SMD) open science activities.
2. **Core Data and Computing Services:** Develop SMD-wide data and computing infrastructure.
3. **Open Science Incentives:** Grants, prizes and challenges to enable groundbreaking scientific discoveries using open science principles and tools.
4. **Community Engagement:** Advance open science practices in the SMD community and build strategic partnerships for innovation in open science.

VEDA puts these initiatives into practice.

NASA has always had open data policies.

VEDA is moving NASA forward in its open science policies.

VEDA attempts to make NASA's earth science data mean more. Data has been openly accessible for anyone to use, but NASA hasn't exposed it in friendly interfaces or analytics platforms.

VEDA is making Earth data computing more accessible.

This presentation is a part of our community engagement - we want to know from you!

Demo creating content in
the VEDA Dashboard.

VEDA is an open science platform, not just a story telling dashboard.

The VEDA team worked with the EIS Fire team to automate and scale the Fire Event Data Suite (FEDS), near-real time fire perimeter tracking for the continental united states (CONUS).

Learn more: Nature article describing the algorithm developed by the EIS Fire team

“We develop a novel object-based system for tracking the progression of individual fires using VIIRS active fire detections”

EIS Fire FEDS Team: Douglas Morton, Melanie Follette-Cook, Yang Chen, Tempest McCabe, Elijah Orland, Jim Randerson, Lesley Ott, Alexey Shiklomanov, Shane Coffield

California wildfire spread derived using VIIRS satellite observations and an object-based tracking system

[Yang Chen](#) , [Stijn Hantson](#), [Niels Andela](#), [Shane R. Coffield](#), [Casey A. Graff](#), [Douglas C. Morton](#), [Lesley E. Ott](#), [Efi Foufoula-Georgiou](#), [Padhraic Smyth](#), [Michael L. Goulden](#) & [James T. Randerson](#)

[Scientific Data](#) **9**, Article number: 249 (2022) | [Cite this article](#)

3686 Accesses | **5** Citations | **219** Altmetric | [Metrics](#)

Abstract

Changing wildfire regimes in the western US and other fire-prone regions pose considerable risks to human health and ecosystem function. However, our understanding of wildfire behavior is still limited by a lack of data products that systematically quantify fire spread, behavior and impacts. Here we develop a novel object-based system for tracking the progression of individual fires using 375 m Visible Infrared Imaging Radiometer Suite active fire detections. At each half-daily time step, fire pixels are clustered according to their spatial proximity, and are either appended to an existing active fire object or are assigned to a new object. This automatic system allows us to update the attributes of each fire event, delineate the fire perimeter, and identify the active fire front shortly after satellite data acquisition. Using this system, we mapped the history of California fires during 2012–2020. Our approach and data stream may be useful for calibration and evaluation of fire spread models, estimation of near-real-time wildfire emissions, and as means for prescribing initial conditions in fire forecast models.

VEDA supported the scaling of EIS fire tracking ability to near real time

EIS fire team had an algorithm for tracking fire events in California.

They wanted to scale this algorithm to 1) run routinely in near real time and 2) expand the spatial domain to cover the Continental United States.

Spread of the Caldor Fire - 2021

Released Wednesday, June 1, 2022

Updated Wednesday, April 19, 2023 at 1:44PM

ID: 4992



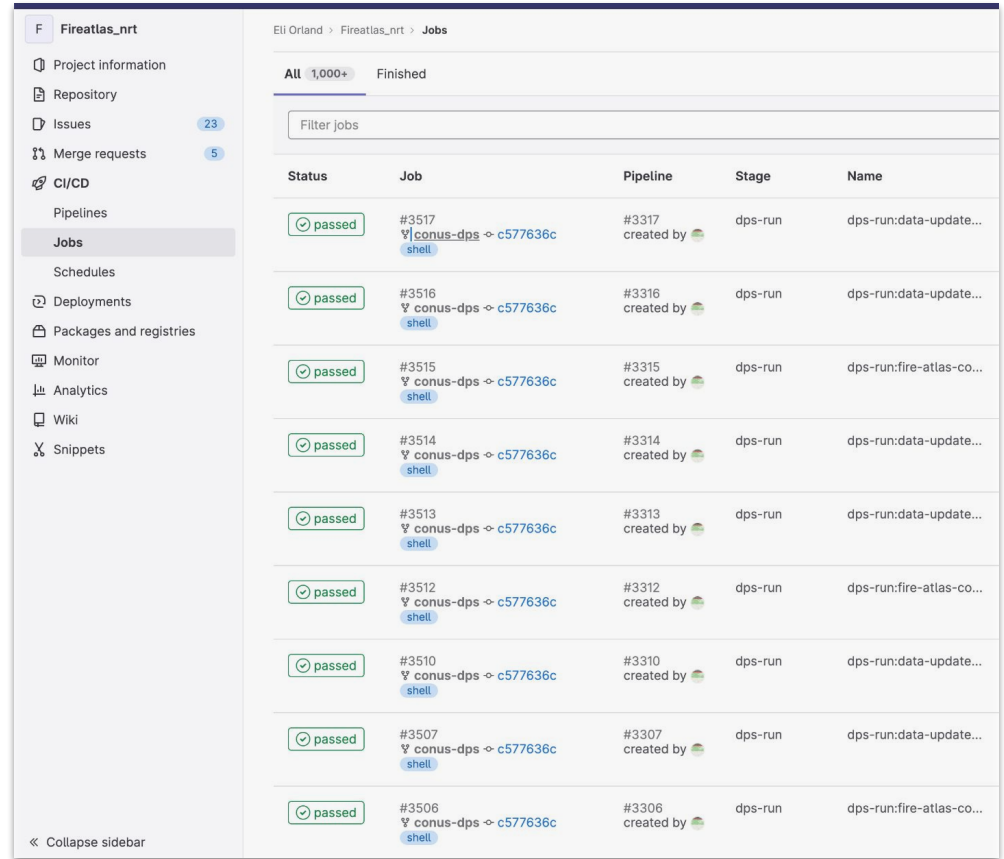
Visualizations by: [Cindy Starr](#) Scientific consulting by: [Doug C. Morton](#) [View full credits](#)



<https://svs.gsfc.nasa.gov/4992>

VEDA Analytics Platform Team supported the scaling of EIS fire tracking to near real time

- [Crontab schedulers](#) schedules DPS runs every 4 hours
- All of CONUS
- Output to the VEDA features API
- Kudos Greg Corradini, Alex M and Julia Signell

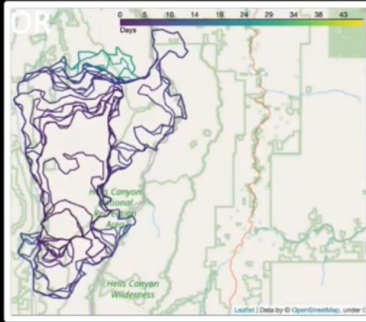


The screenshot displays the GitLab CI/CD interface for the 'Fireatlas_nrt' project. The left sidebar shows navigation options: Project information, Repository, Issues (23), Merge requests (5), CI/CD, Pipelines, Jobs (selected), Schedules, Deployments, Packages and registries, Monitor, Analytics, Wiki, and Snippets. The main content area shows a list of jobs under the 'Jobs' tab, filtered to 'All' (1,000+) and 'Finished'. The jobs are listed in a table with columns for Status, Job, Pipeline, Stage, and Name. All jobs shown have a 'passed' status.

Status	Job	Pipeline	Stage	Name
passed	#3517 conus-dps -> c577636c shell	#3317 created by	dps-run	dps-run:data-update...
passed	#3516 conus-dps -> c577636c shell	#3316 created by	dps-run	dps-run:data-update...
passed	#3515 conus-dps -> c577636c shell	#3315 created by	dps-run	dps-run:fire-atlas-co...
passed	#3514 conus-dps -> c577636c shell	#3314 created by	dps-run	dps-run:data-update...
passed	#3513 conus-dps -> c577636c shell	#3313 created by	dps-run	dps-run:data-update...
passed	#3512 conus-dps -> c577636c shell	#3312 created by	dps-run	dps-run:fire-atlas-co...
passed	#3510 conus-dps -> c577636c shell	#3310 created by	dps-run	dps-run:data-update...
passed	#3507 conus-dps -> c577636c shell	#3307 created by	dps-run	dps-run:data-update...
passed	#3506 conus-dps -> c577636c shell	#3306 created by	dps-run	dps-run:fire-atlas-co...

Where EIS Fire is now: Routinely producing fire perimeters in near real time for the continental United States (CONUS).

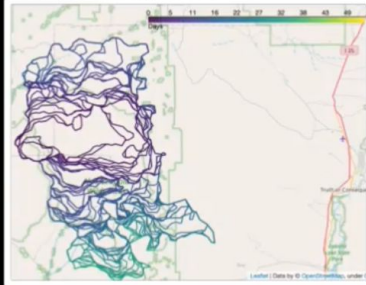
Double Creek Fire,



2022 Fires > 5 km²



Black Fire, NM



What was the impact of being able to scale?

FEDS data can be routinely access through an API. This enables the EIS Fire team to share the data with FEMA. It may be added to FIRMS as an experimental product.

The team is working with FEMA, USGS and Forest Service to develop value-added products such as fire direction, speed of fire spread, and fire severity metrics.

Science impacts: better understand of factors which contribute to fire intensity and air pollution.

- Melanie Follette-Cook

Cross-functional expertise was critical

“We would not have been able to do this without VEDA and its team.”

“This would not have been possible without research scientists across disciplines, data systems and cyber infrastructure experts.”

- Melanie Follette-Cook

Scientists can contribute documentation about their analysis to veda-docs

Tess McCabe submitted this mapping fires notebook:

<https://github.com/NASA-IMPACT/veda-docs/pull/79> which is previewed https://nasa-impact.github.io/veda-docs/pr-preview/pr-79/notebooks/tutorials/mapping_fires.html.


Try it out

- Go to <https://nasa-impact.github.io/veda-docs> and launch one of the notebooks with a mybinder link, such as <https://nasa-impact.github.io/veda-docs/notebooks/quickstarts/no2-map-plot.html>. Warning: mybinder.org is not reliable.
- **Solution?** Request access to the VEDA 2i2c jupyterhub. (<https://nasa-impact.github.io/veda-docs/services/jupyterhub.html>) Many tutorials have links to launch from there.

The screenshot shows the NASA EarthData VEDA BETA interface. On the left is a navigation sidebar with a search bar and a menu including: Welcome, Services (with a dropdown arrow), Dashboard, APIs, JupyterHub, Usage Examples (with a dropdown arrow), Quickstarts (with a dropdown arrow), Accessing the Data Directly, Using the Raster API (with a dropdown arrow), Get map from COGs - NO2 (highlighted), Get timeseries from COGs, Get tiles from COGs, Tutorials (with a right arrow), Datasets (with a right arrow), Contributing (with a dropdown arrow), Example Notebook Submission, Dataset Ingestion, Dashboard Configuration (with a right arrow), and External resources. The main content area is titled "Get map from COGs - NO2" and includes a description: "Demonstrates generating a map for a given area." It lists the authors as Leo Thomas and Julia Signell, published on February 7, 2023. There is a "Run this notebook" button with a MyBinder icon and a link. Below this, it says "You can launch this notebook using mybinder, by clicking the button below." and features a "launch binder" button. The "Approach" section lists three steps: 1. Fetch STAC item for a particular date and collection - NO2, 2. Pass STAC item in to the raster API /stac/tilejson.json endpoint, and 3. Visualize tiles using folium. A code block shows: `import requests` and `import folium`. The "Declare your collection of interest" section states: "You can discover available collections the following ways:" followed by three bullet points: • Programmatically: see example in the `list-collections.ipynb` notebook, • JSON API: <https://staging-stac.delta-backend.com/collections>, and • STAC Browser: <http://veda-staging-stac-browser.s3-website-us-west-2.amazonaws.com>. Another code block shows: `STAC_API_URL = "https://staging-stac.delta-backend.com"`, `RASTER_API_URL = "https://staging-raster.delta-backend.com"`, and `collection_name = "no2-monthly"`. The "Fetch STAC collection" section is partially visible at the bottom.

Try it out



 **EARTHDATA**
VEDA BETA

Get map from COGs - NO2
Demonstrates generating a map for a given area.

AUTHOR
Leo Thomas, Julia Signell

PUBLISHED
February 7, 2023

Run this notebook [↗](#)

You can launch this notebook using mybinder, by clicking the button below.

[launch binder](#)

Approach

1. Fetch STAC item for a particular date and collection - NO2
2. Pass STAC item in to the raster API `/stac/tilejson.json` endpoint
3. Visualize tiles using `folium`

```
import requests
import folium
```

Declare your collection of interest

You can discover available collections the following ways:

- Programmatically: see example in the `list-collections.ipynb` notebook
- JSON API: <https://staging-stac.delta-backend.com/collections>
- STAC Browser: <http://veda-staging-stac-browser.s3-website-us-west-2.amazonaws.com>

```
STAC_API_URL = "https://staging-stac.delta-backend.com"
RASTER_API_URL = "https://staging-raster.delta-backend.com"

collection_name = "no2-monthly"
```

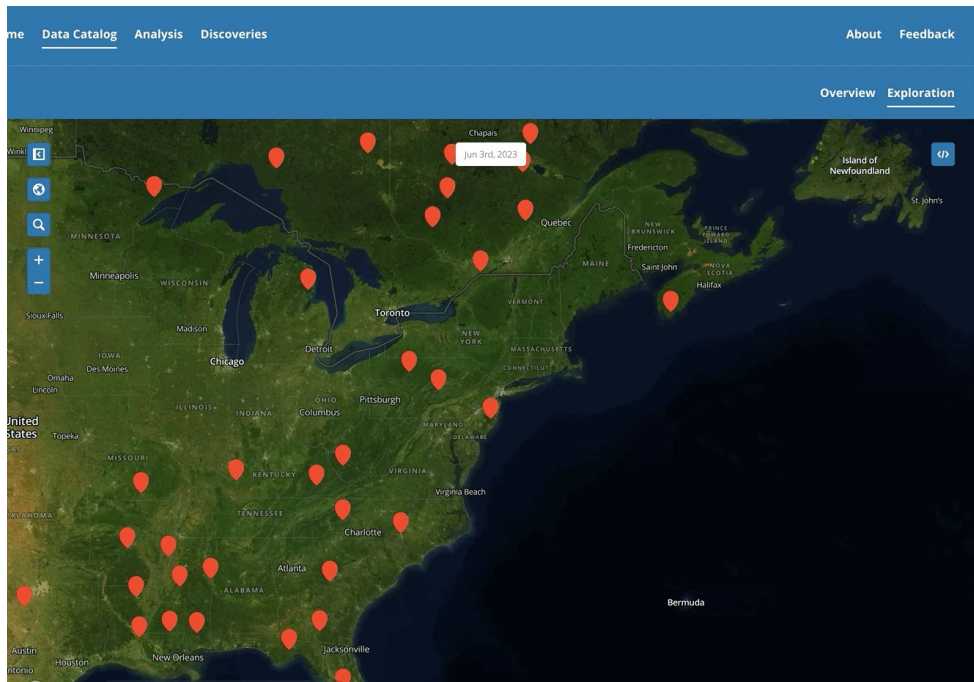
Fetch STAC collection

<https://nasa-impact.github.io/veda-docs/>

Scientists can contribute their datasets and discoveries to the dashboard.

Tess McCabe also submitted a PR to veda-config to add the fire perimeters dataset: <https://github.com/NASA-IMPACT/veda-config/pull/260/files>. Which can be seen in the staging site: <https://visex.netlify.app/data-catalog/fire/>

Try it out: Click “Explore Data”



<https://visex.netlify.app/data-catalog/fire/>

However, MDX hard to edit for less technical audience not used to markup so we have an **experimental** live editor.

Try it out

<https://tinyurl.com/veda-mdx-editor>



A screenshot of the NASA EarthData VEDA Dashboard. The top navigation bar is dark blue with the NASA logo, "EARTHDATA VEDA Dashboard BETA", and links for "Welcome", "Data Catalog", "Analysis", "Discoveries", "About", and "Feedback". Below the navigation, it says "SANDBOX Discovery Editor EXPERIMENTAL". The main content area is split into two panels. The left panel shows a map of China with a legend for "Feb 2020 VS Feb 2022" and a "No2" label at the bottom. The right panel is the "MDX Editor" showing XML code for a map block. The code includes a <Figure> block with a <Map> sub-block containing attributes for datasetId, layerId, center, zoom, date, and compareDate. A <Caption> block follows with author and URL information. The text "in NO2" is visible on the right side of the screenshot, and "return to pre-pandemic levels." is partially visible below it. The page number "24" is in the bottom right corner.

in NO2

ted shutdowns in the
an to reopen and
urned to the road, and
se resumption
es in nitrogen dioxide
r quality levels began to

return to pre-pandemic levels.

This demonstrates how quickly atmospheric nitrogen dioxide responds to reductions in emissions. They will persist as long as emissions persist and decline rapidly if emissions are reduced.

NASA scientists will continue to monitor nitrogen dioxide

How does it all work?



NASA IMPACT and Development Seed develop a modern STAC tool set. Storing STAC in postgres with pgSTAC means item discovery via the STAC API can be exactly transferable to rich visualization and data APIs: stats, OGC features and tiles for both raster and vector data.



developmentSEED

s3

1

Put data on the cloud

pgSTAC

2a

Catalog it

s3

1

Put data on the cloud

stac-fastapi

2b

Make it discoverable

pgSTAC

2a

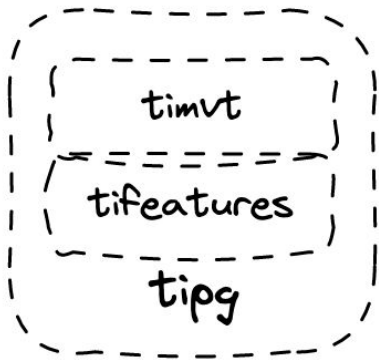
Catalog it

s3

1

Put data on the cloud

- titiler-pgstac 3 Make it visualizable
- stac-fastapi 2b Make it discoverable
- pgSTAC 2a Catalog it
- s3 1 Put data on the cloud



4 Make it accessible (in development)

titiler-pgstac

3 Make it visualizable

stac-fastapi

2b Make it discoverable

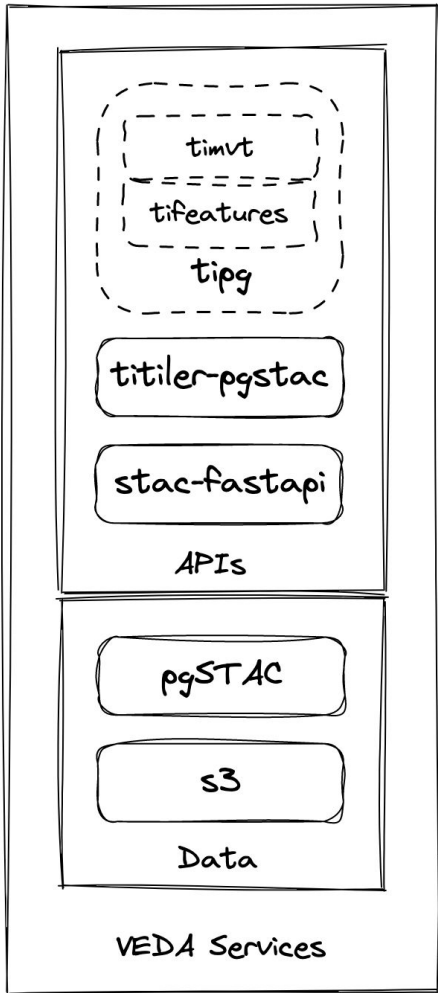
pgSTAC

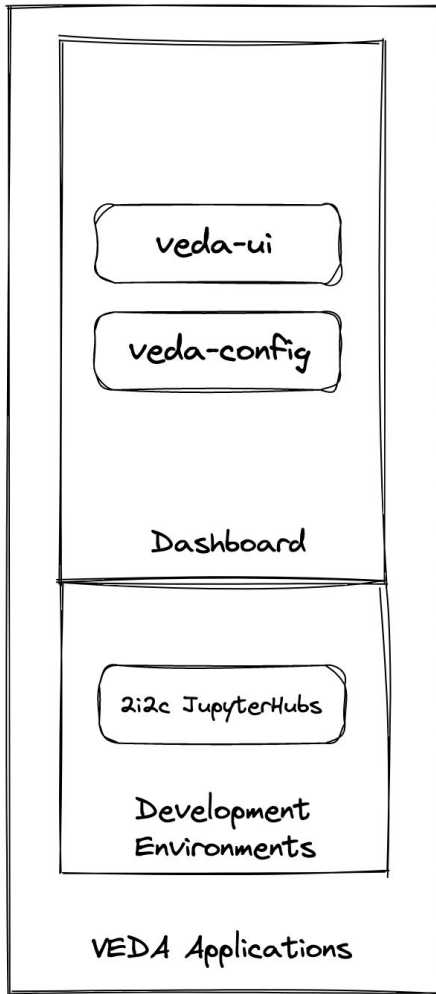
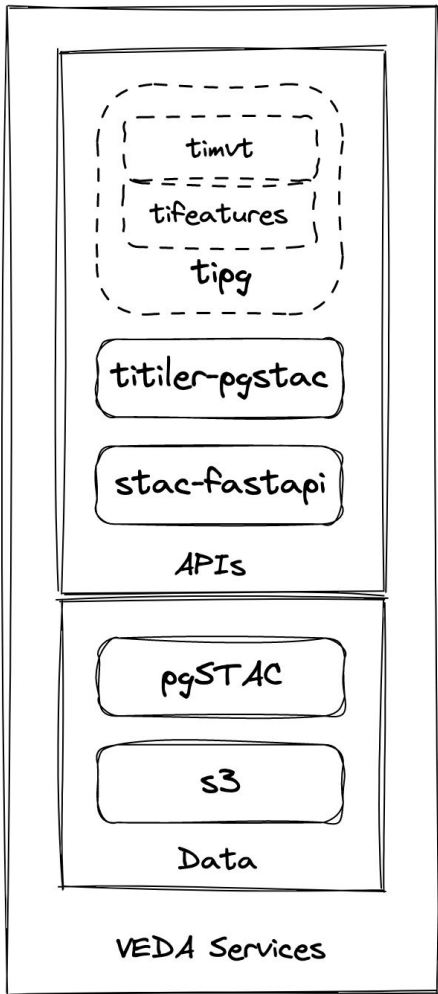
2a Catalog it

s3

1 Put data on the cloud

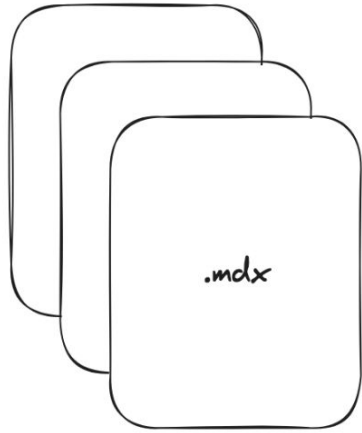
With these core data services, you can layer on applications.





`veda-ui` is configurable react.js components
`veda-config` stores the configuration: markdown files which point to STAC collections, items and queries.

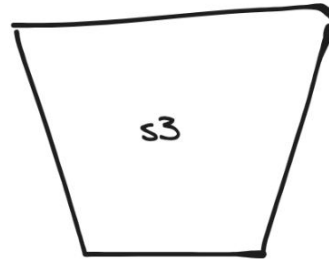
How the dashboard works



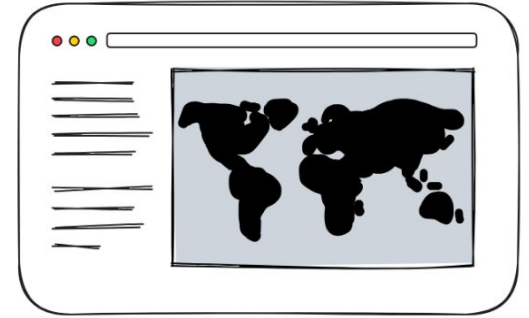
veda-config



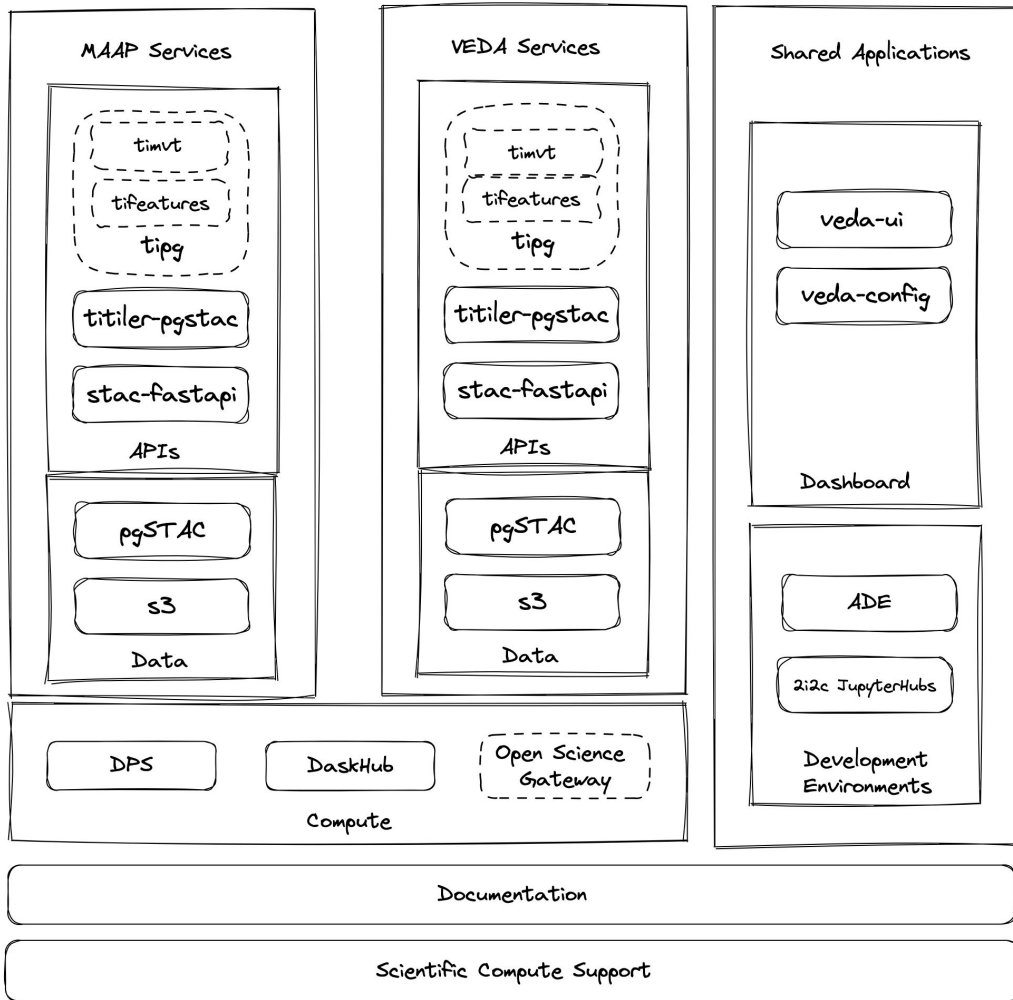
veda-ui



compilation to JS + bundling



earthdata.nasa.gov/dashboard/

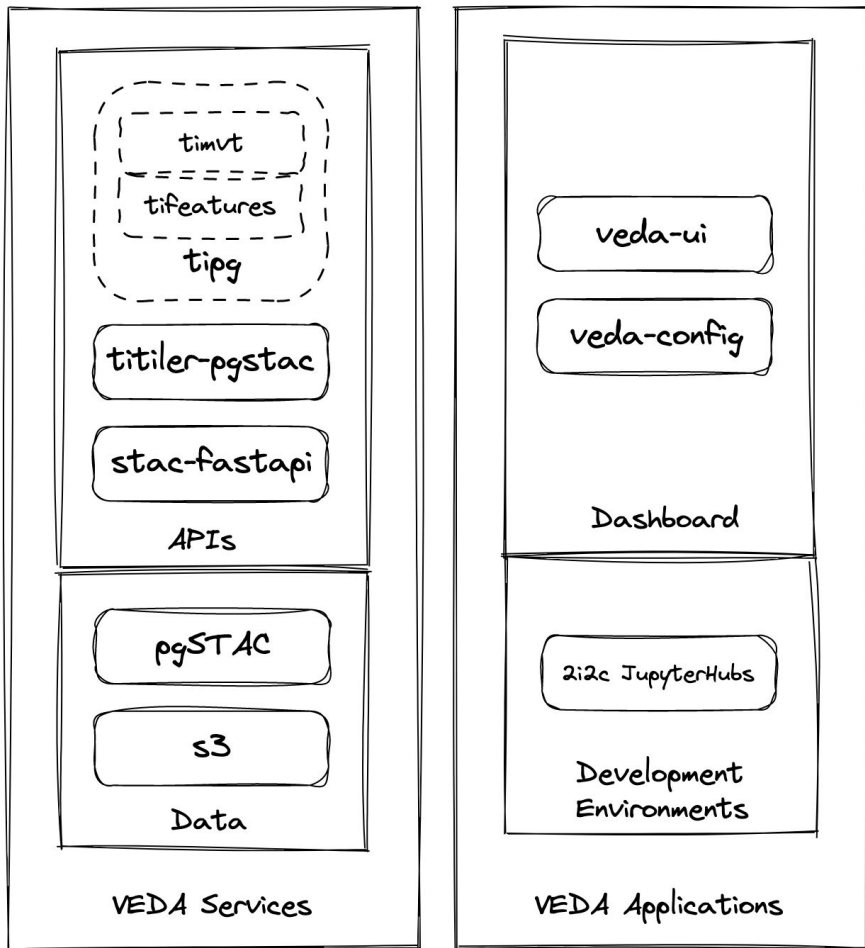


An Earth Observation and Exploitation Platform

data services + compute +
documentation + support

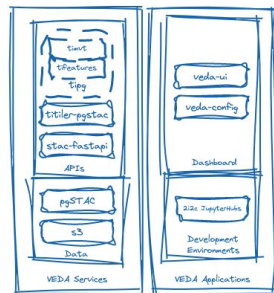
→ end user experiences

Reusable in part or in whole



VEDA Dashboard
earthdata.nasa.gov/dashboard

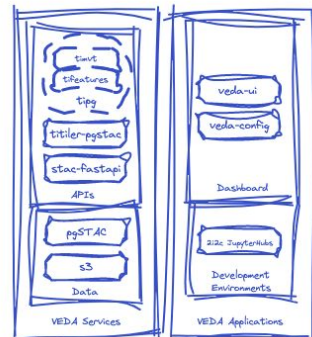
MAAP STAC Catalog



Greenhouse Gas (GHG) Center - July 2023

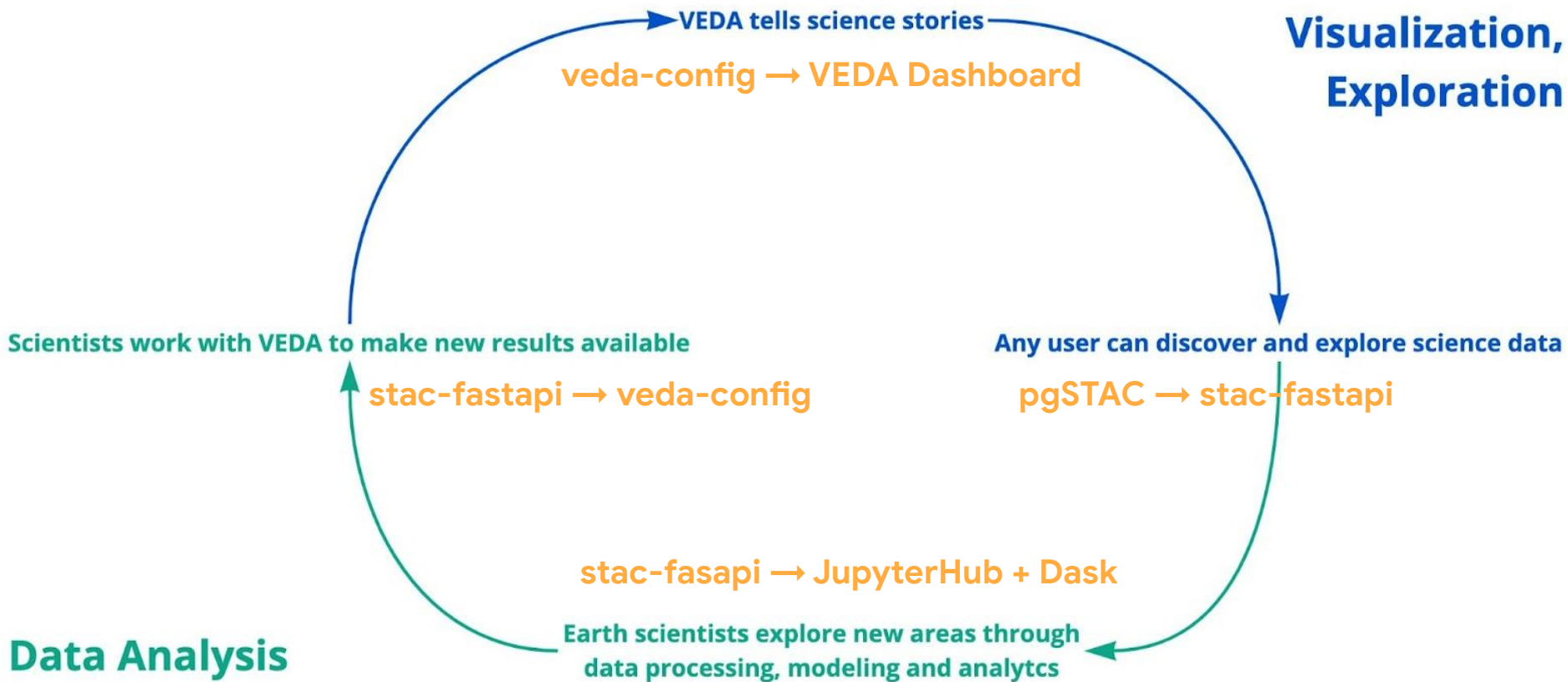
GIBS/Worldview Tiler

FIRMS titiler



Reusable components

Reusable Components



Reusable Components

- VEDA Data System
 - Database: [GitHub - stac-utils/pgstac: Schema, functions and a python library for storing and accessing STAC collections and items in PostgreSQL](#)
 - API: [GitHub - stac-utils/stac-fastapi: STAC API implementation with FastAPI.](#)
 - Image tiling: [Github - stac-utils/titiler-pgstac](#)
 - Features API: [GitHub - developmentseed/typg: Simple and Fast Geospatial OGC Features and Tiles API for PostGIS.](#)
 - AWS Deployment: [GitHub - developmentseed/cdk-pgstac](#)
- VEDA Dashboard
 - Dataset and discovery configuration: [GitHub - NASA-IMPACT/veda-config: Configuration template for the Dashboard Evolution Project](#)
 - UI Code: [GitHub - NASA-IMPACT/veda-ui: Frontend for the Dashboard Evolution project](#)
- VEDA Data Analysis
 - JupyterHub: [2i2c Hub Deployment Guide](#)

Get involved

- Request access to VEDA 2i2c JupyterHub
- Redeploy the VEDA stack of tools for application-specific science projects
- Help us
 - Become a part of the community
 - If you redeploy or need help redeploying, we want to help. This helps us scale the impact.



Thank you!