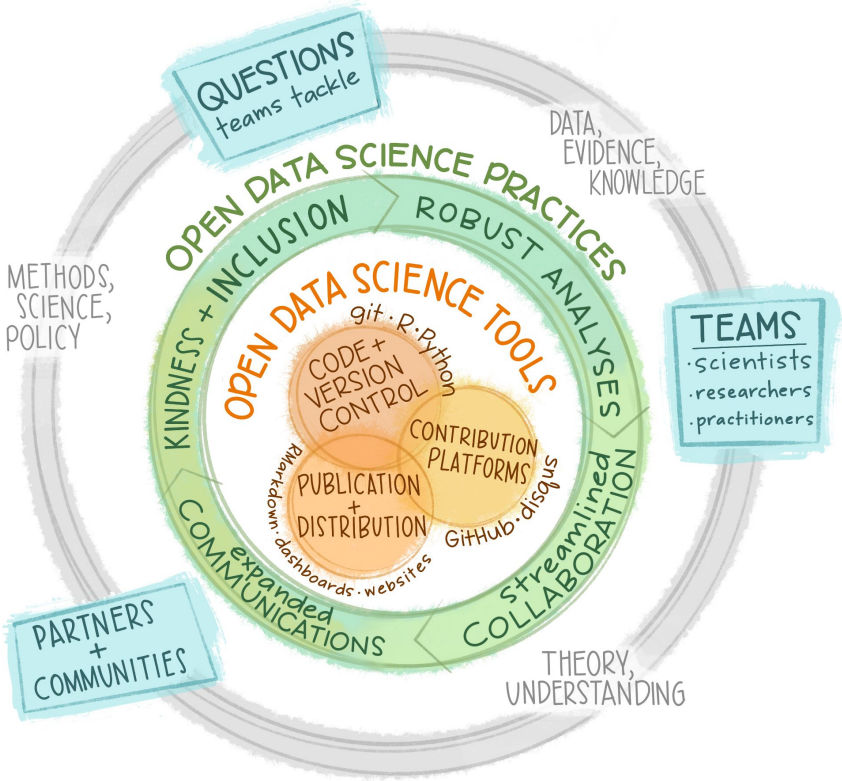
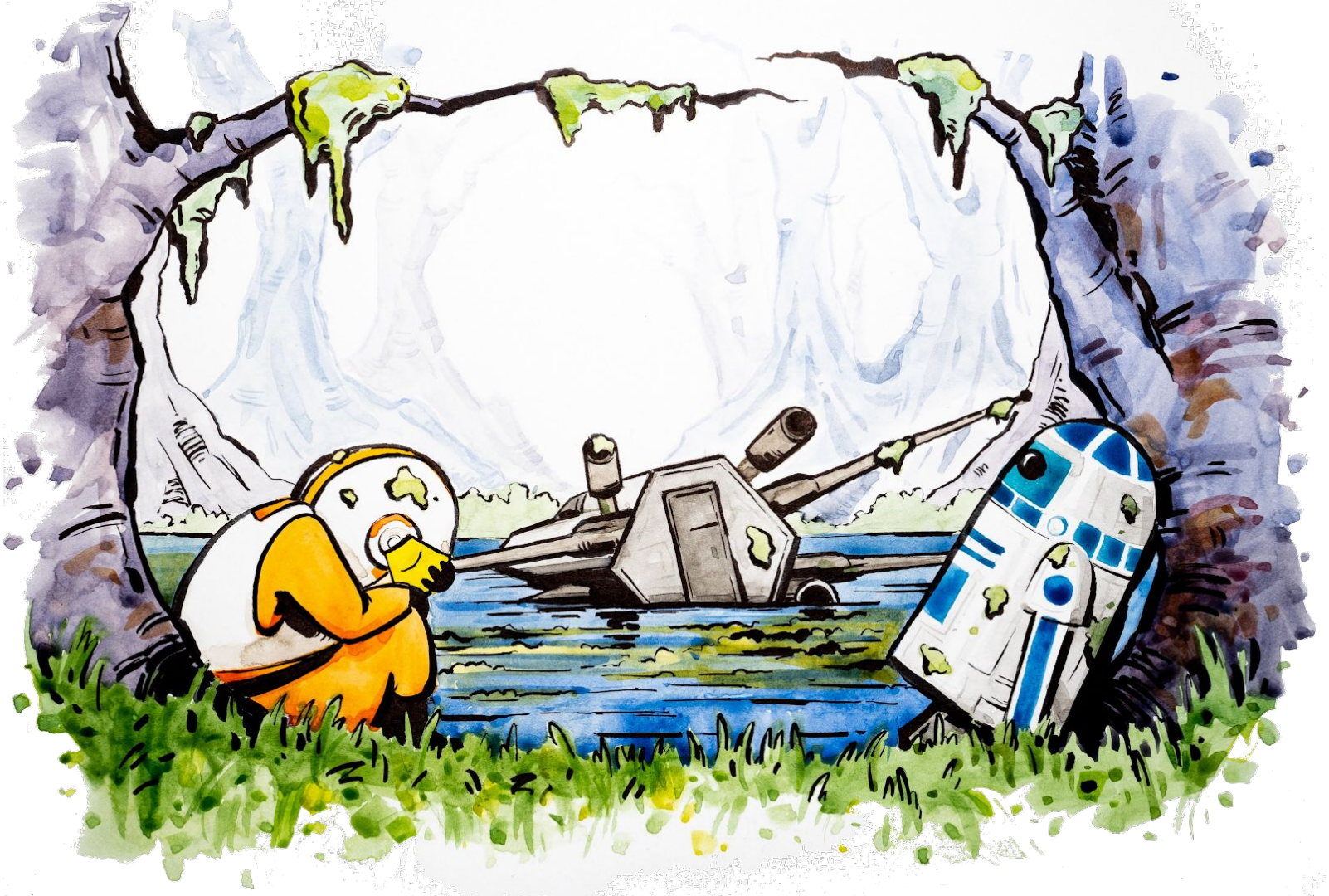


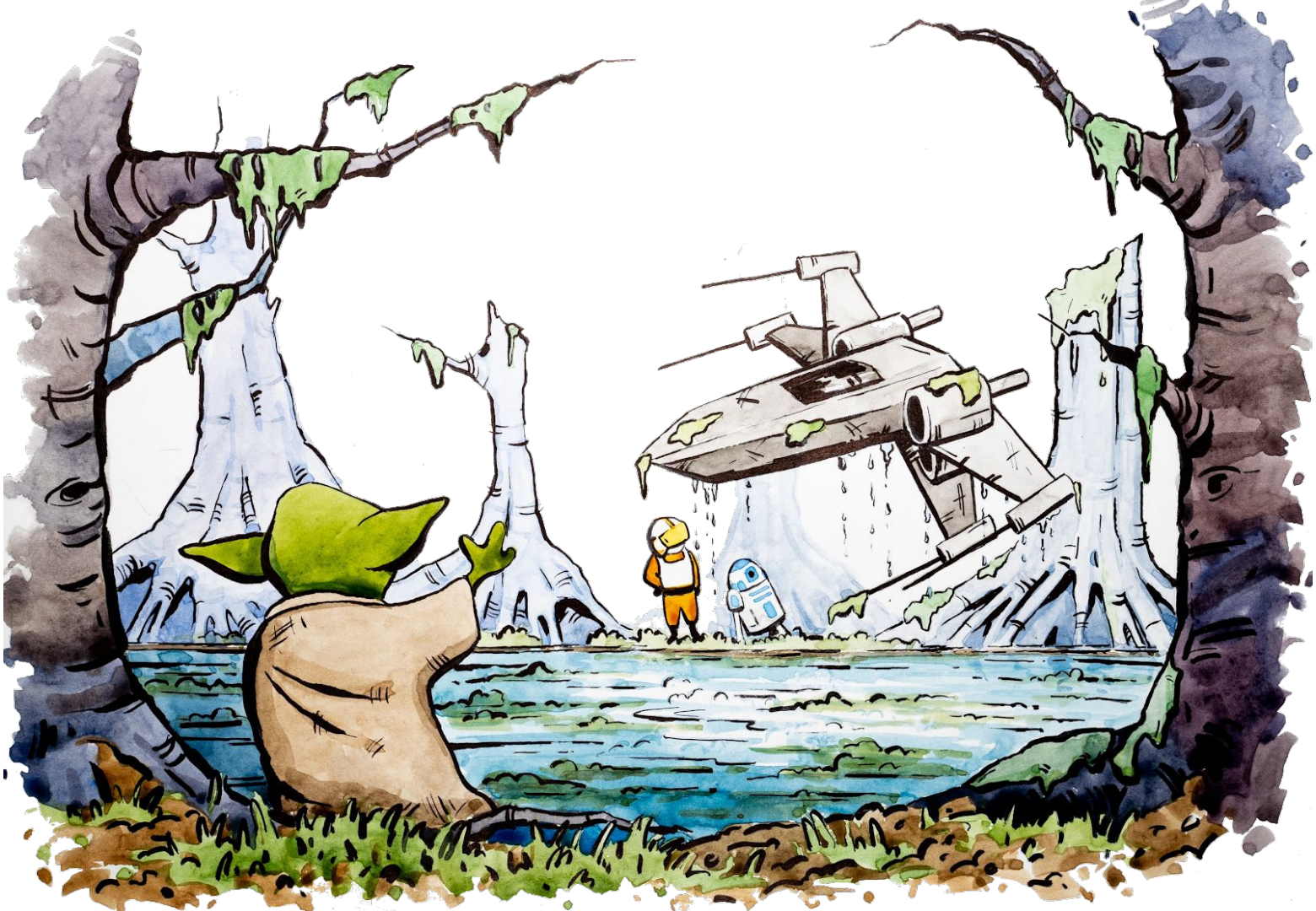
Communicating impact: NASA Openscapes

We believe open science can accelerate data-driven solutions and increase diversity, equity, inclusion, and belonging in research and beyond.

Today's Purpose: to share movement building with NASA Openscapes and discuss impacts

Julia Stewart Lowndes, Erin Robinson, Justin Rice,
NASA Openscapes Mentors,
and the Openscapes community
ESDSWG, Baltimore, Maryland, March 22, 2023
Artwork by Allison Horst
Slides: https://nasa-openscapes.github.io | openscapes.org





NASA Openscapes Mentors

A mentor community across NASA Earth science data centers

Andy Barrett • Chris Battisto • Brandon Bottomley • Aaron Friesz • Alexis Hunzinger • Mahsa Jami • Alex Lewandowski • Bri Lind • Luis Lopez • Catalina Oaida Taglialatela • Celia Ou • Jack McNelis • Cassie Nickles • Brianna Pagán • Sargent Shriver • Amy Steiker • Michele Thornton • Makhan Virdi • Jess Welch

Support researchers as they migrate analytical workflows to the Cloud:

- Co-creating common tutorials; review & reuse process
- Community of practice for teaching, mentoring, facilitation
- Scaling open science leaders

Slow down to speed up: deep investment in small numbers 1st. Combine practices from many places - open source software dev, community, facilitation (incl. rOpenSci, Turing Way, Carpentries, Mozilla, ESIP)

NASA Award# 20-TWSC20-2-0003 Leads: Julia Stewart Lowndes & Erin Robinson

https://nasa-openscapes.github.io

2021 Cloud Hackathon - teaching researchers early on

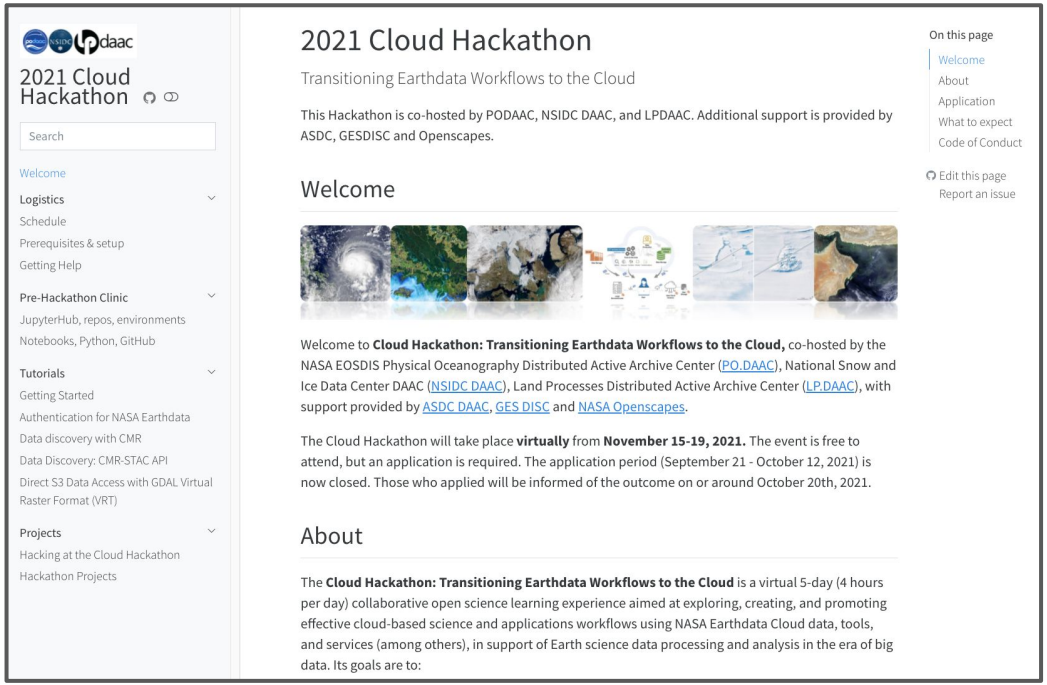
https://nasa-openscapes.github.io/2021-Cloud-Hackathon/

Preparation:
9 co-created tutorials for data access
User-friendly book with Quarto
Notebook review, teaching dry runs
Shared facilitation & teaching practices

The event:
65 2i2c JupyterHub AWS instances
50 forks of the GitHub repo
8 hack-team projects presented on Day 5

"It was a really great week. The tutorials were AMAZING. Everyone did a great job, and everyone was very nice. I really appreciated welcoming environment. I don't have a strong python background. But i was supported in learning all around"

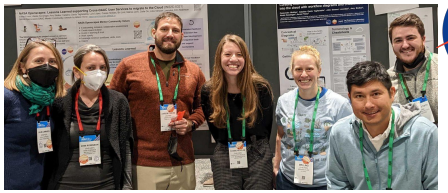
Blog summaries:
earthdata.nasa.gov/learn/articles/2021-cloud-hackathon
podaac.jpl.nasa.gov/announcements/2021-12-15-The-2021-Cloud-Hackathon

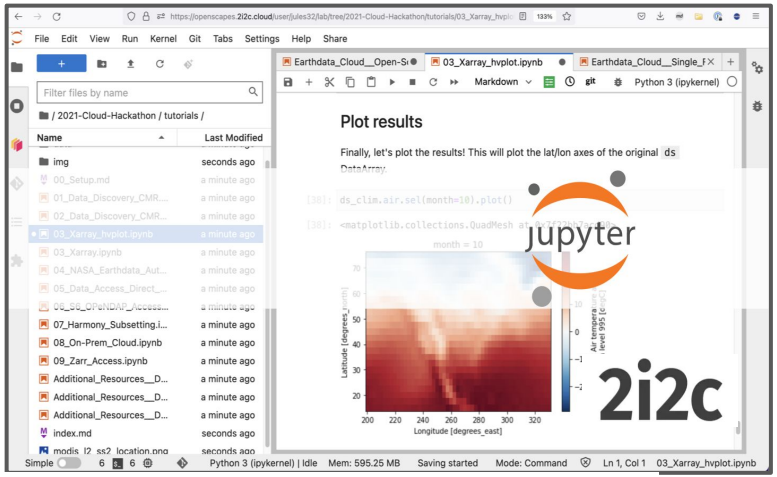


On Day 1, Mentors stepping in to teach due to an emergency: trust + teamwork + familiarity with the material

Identifying & responding to user needs

15+ workshops & talks led by Mentors since: reusing & extending tutorials with software & conceptual solutions



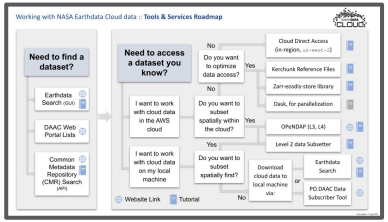


2i2c JupyterHub: Python, R, Matlab, `corn` base image: built on Pangeo stack

Cookbook: current tutorials & onboarding

`earthaccess` Python library

Cheatsheets & guides



Value of Hosted JupyterHubs White paper / RFI

The Value of Hosted JupyterHubs in enabling Open NASA Earth Science in the Cloud

Response to Aspect 1, the question on user needs and use cases for scientific data and computing in support of Open Science at SMD

Relevant NASA SMD scientific Division: *Earth Science*

NASA Openscapes: Supporting Open NASA Earth Science in the Cloud

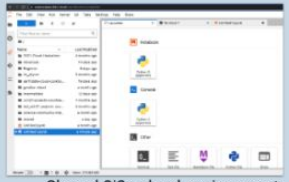
NASA Openscapes: Lessons Learned supporting Cross-DAAC User Services to migrate to the Cloud (IN22C-0321). Aaron Friesz, Alexis Hunzinger, Amy Steiker, Catalina Oaida Taglialatela, Luis López, Cassandra Nickles, Bri Lind, Mahsa Jami, Celia Ou, Julia Stewart Lowndes, Erin Robinson, NASA Openscapes DAAC Mentors.

nasa-openscapes.github.io

NASA Openscapes Mentor Community

DAAC Staff

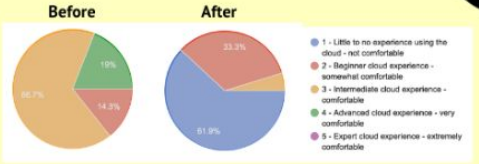
- Lay a foundation with **cloud terminology and concepts**
- Provide resources that are **easy to revisit**
- **Continued support** and education are critical
- Significant **learning curve and time investment** required for cloud adoption



Shared 2i2c cloud environment featuring JupyterHub

End-Users

- Improved **conceptual understanding** of why and when to use, or not use, the cloud
- Inconsistent data and service availability leads to **difficulties reusing** a given workflow
- Lack of common and robust resources
- Earthdata Cloud ecosystem is **complex and overwhelming**



Sentiments from cloud workshop

Open Science Community

- Recognizing **easy cloud access as a core service**
- Continuing to close the loop between the users we work with and our engineers to **build solutions together**

Cheatsheets are a one-stop shop for cloud data access vocabulary & roadmaps *(see poster IN22C-0320 for all cheatsheets)*

NASA Earthdata Cookbook is a central resource for common tutorials, use cases, and self-guided learning

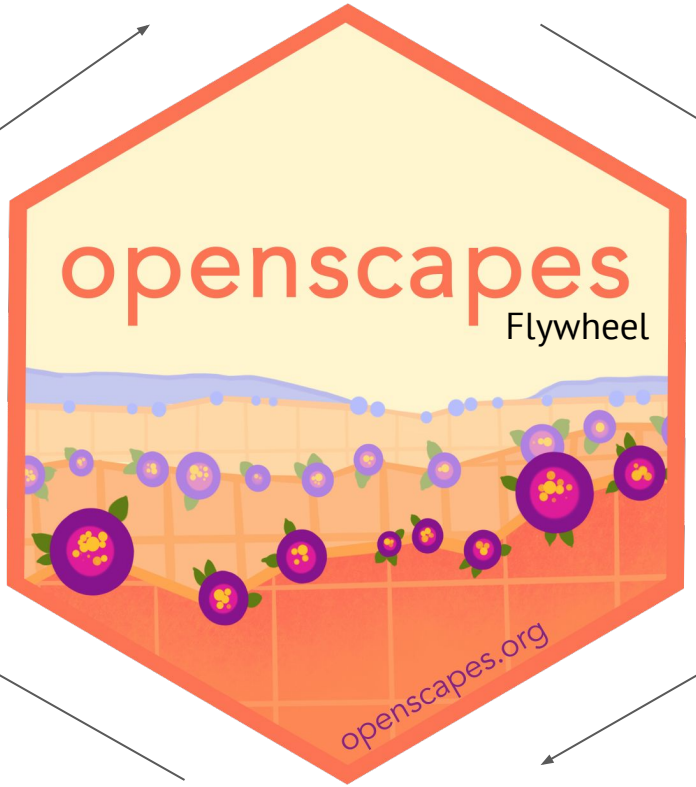
earthaccess Python library is an open-source library to simplify Earthdata Cloud search and access

How we work: Openscapes' Flywheel for movement building

Engage
A Future Us mindset

Create space and place

Welcome



Invest in learning and trust

Empower
Learning culture

Inspire

Work Openly

Amplify
Open leaders

Leverage common workflows, skills, tools

The Openscapes Flywheel:
A framework for managers to facilitate and scale inclusive Open science practices
Robinson & Lowndes 2022 (preprint)

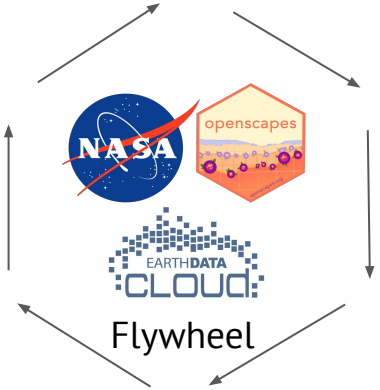
Openscapes Flywheel: Our hands-on role supporting NASA Openscapes Mentors

Engage
A Future Us mindset

Create space and place
- **Scaffolding & facilitation:** regular meetings (Cohort Calls, Coworking, Clinics, Hackdays)
- **Manage software**: Google Drive, Slack, GitHub Org, 2i2c JupyterHub, AWS Credits (remove Cloud cost), Quarto & notebooks
- **Time as part of their jobs**

Welcome
- **ESDSWG invite**
- **Nomination form**; opt-in; sign up as pairs or trios

Inspire
- **Storytelling & artwork**
- **Teach researchers together**
- **Slides, blogs, language for reuse**
- **Braveness** sharing details with different audiences



Leverage common workflows, skills, tools
- **Reuse resources from open science communities** (Posit, RLadies, Pangeo) **and each other** (corn, earthaccess, cheatsheets)
- **Support communicating, dev'ing rapport** in giving and receiving feedback and not having to ask where things are or to reuse

Invest in learning and trust
- **Role-modeling** to build trust, growth mindset & psych safety via live notes, screensharing, making mistakes, sharing early
- **Teach & learn technical collab skills** w/ GitHub, 2i2c JupyterHub, Quarto, etc
- **Teaching & mentoring skills** w/ Carpentries, coaching

Empower
Learning culture

Work Openly
- **Promote & support live coding, tutorial review,** onboarding docs, teaching dry runs
- **Planning & organizing**
- **Support infrastructure** for Cookbook (Quarto, GitHub, Docker, 2i2c, Slack, GDrive)

Amplify
Open leaders

Robinson & Lowndes 2022

Communicating impact of movement building: NASA Openscapes

"Openscapes has created a collaborative environment for DAAC staff to collectively support open science initiatives for NASA Earthdata users. It enables us to work more openly with other DAACs toward our common goal of making the Earthdata ecosystem more accessible and inclusive. **We've developed awesome material to help Earthdata users** such as workflow cheatsheets, a python package (earthaccess), and data recipes hosted in the cross-DAAC NASA Earthdata Cloud Cookbook.

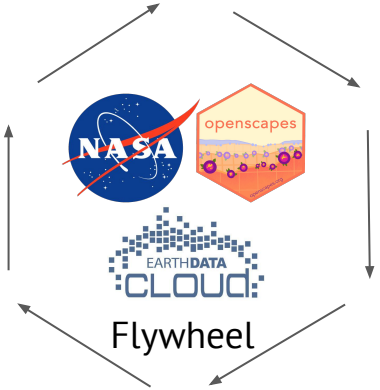
Perhaps just as important as what we've done however, are mindsets we've grown into along the way. It's okay to share imperfect works in progress. The virtual environment can be conducive to laughter and connection. Ideas are not too big or too small to share. **We are better at dreaming and implementing the future together."** –Cassandra Nickles (PO.DAAC)

Engage
A Future Us mindset

Create space and place
- **7 DAACs participating** (Cohort Calls, Coworking, Hackdays)
- **2i2c, Quarto, Notebooks, GitHub**
- **Onboarding documentation** - Flywheel pub, Approach Guide

Welcome
- **Community events, talks, & blogs** (ESIP cross-gov takeaways 2022, 2023)

Inspire 💫
- **Internal workshops** (DAAC staff)
- **Career advancement**, bringing mindset to new places
- **Speaking up in other meetings** (TIM, TRAIN, Cloud Playground)



Flywheel

Leverage common workflows, skills, tools
- **External workshops (**e.g. Cloud Hackathon, 💫 Champions Unis, Science Teams, SWOT, EMIT)
- **Connecting & consulting based on experiences** (Pathfinder for 2i2c, compare w/ SMCE; AWS)
- **Engaging beyond** (Pangeo, Ladies of Landsat, rOpenSci, Posit, Carpentries, pyOpenSci)

Amplify
Open leaders

Invest in learning and trust
- **"I made my first pull request"**
- **Co-create consistent tutorials**, teaching style, less reinventing
- **More awareness cross-DAAC**
- **Coworking** - eg someone brought a Q, Mentors from 4 DAACs discussed, tested in 2i2c ✨🚀

Empower
Learning culture

Work Openly
- **Reuse**: tutorials, slides, art, facilitation & open practices
- Earthdata Cloud Cookbook
- Cheatsheets
- `earthaccess` library
- `corn` base image
- Value of Hosted JupyterHubs (White paper RFI)
- "Cheatsheets helped visualize all the steps, now we're reducing the 'time to science' with earthaccess"

Communicating impact of movement building: Openscapes

Openscapes is a community and a movement to support kinder science for future us

We work with environmental and Earth science teams in government, academia, & NGOs, including NASA Earthdata, NOAA Fisheries, California Water Boards, EPA

"To address our climate emergency, we must rapidly, radically reshape society. We need every solution and every solver".
Ayana Elizabeth Johnson & Katharine Wilkinson, All We Can Save

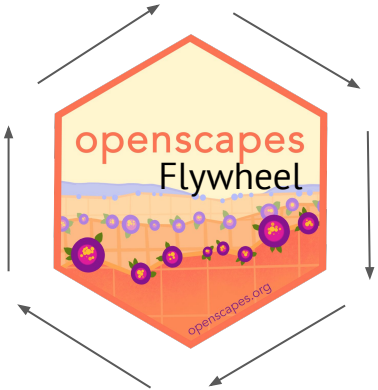
Engage
A Future Us mindset

Welcome
- **Art, storytelling**
- **Talks & keynotes** RStudio::conf, WIDS, NASEM, NASA, ESIP, etc

Inspire
- 💫 **Ileana Fenwick, Eli Holmes**
- **Morale -** "I'm staying in the job because of Openscapes"
- **Workforce dev, succession planning, org resilience**
- **Policy change**, NOAA GitHub
- **Forked Programs** - Pathways; Cal Water Boards; Tidepool Digital

Amplify
Open leaders

Create space and place
- **NASA Openscapes Framework**
- **Champions Program** (17x, 160 teams)
- **Mentors Community**
- **Pathways to Open Science** for Black marine scientists
- **Reflections** (upcoming May 2023)



Leverage common workflows, skills, tools
- **Open educational resources & software**
- **Connecting open communities:** rOpenSci, RLadies, Carpentries, Pangeo, Turing Way, Black in Marine Science, BWEEMS, NCEAS, ESIP cross-gov sessions

Invest in learning and trust;
- **Technical skill building** "I've saved 400 would-be emails in 4 months"
- **Teaching, mentoring, coaching skill building**; don't have to be an expert to share what you know
- **Team building** where people have felt alone

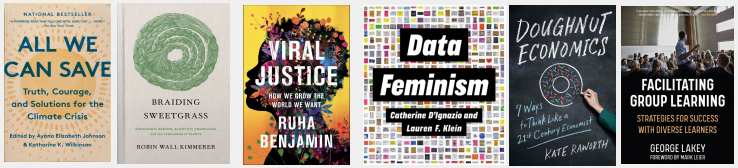
Empower
Learning culture

Work Openly
- **Open educational resources** - Series, Approach Guide, Cookbook, Pathways
- **Publications** - Nature, Sci Am, Podcasts

These impacts aren't easily measured *and that's ok.*

Stories and Depth

- "Small numbers are important" - Dr. Yvette Pearson, TOPS Supporting DEI in Open Science panel
- Learning from other movements



Leverage points in systems - Donella Meadows

2nd most powerful leverage point from a list of 12:

- 2. The mindset or paradigm out of which the system arises.

Leading and lagging indicators

- Leading: Can control, can measure. Lagging: can't control
- Leading: # DAAC Mentors, # hrs deep work contributing to Cookbook & cross-DAAC collaboration. Lagging: # material created, workshops, users moving to the cloud. **"Engage": leading indicators.**

Upcoming in 2023 - the Flywheel turns again

Champions Program - starts April 19

Remote-by-design mentorship for environmental & Earth science research teams to explore ope.. science. **For NASA Openscapes, research teams will also spend time experimenting & planning what analytical workflows with NASA Earthdata are like in the Cloud**. Complements workshops & hackweeks.

Our ask: personal invites to 2 DAAC science teams

Nominations by April 7; https://nasa-openscapes.github.io/champions

*Please come talk with me! I have 2-pagers (and stickers!)

We're partnering with eScience to better support researchers together; **we invite folks to participate in both Openscapes Champions and eScience Hackweeks to deepen skills for modern science**. ICESat-2 Aug 7-11

Mentors Community - onboarding new Mentors in late Summer/Fall

Current Mentors aren't leaving, we're growing the community. Welcoming Mentors from new and existing DAACs! More information upcoming in summer

Benefits of joining:

- Awesome community
- Aligns with DAAC priorities
- Cross-DAAC community of expertise, tutorials, open science leadership
- Carpentries instructor training
- Access to 2i2c JupyterHub

Thank you!

More depth on everything at nasa-openscapes.github.io:

Learn about our recent work: Blog Posts • Presentations • Annual Reports • Flywheel Preprint • White Paper: The Value of Hosted JupyterHubs

Join us & reuse:
openscapes.org, openscapes.org/events, @openscapes

Upcoming events: Mar 28 Community Call:
Designing automated workflows with Dr. Sean Kross. Learn how the kyber R package connects Google Sheets, Markdown, GitHub, and Agenda docs for open education

Diverse, inclusive teams and communities are key

Thanks to the people who made this possible!
Not pictured: more people!

Further resources (incomplete list):

- White Paper: The Value of Hosted JupyterHubs in enabling Open NASA Earth Science in the Cloud - Friesz, Robinson et al 2022
- Openscapes Flywheel: A framework for managers to facilitate & scale inclusive Open science practices - Robinson & Lowndes 2022 (preprint, in review)
- 3 approaches for the year of open science Clatterbuck et al. 2023
- NASA-Openscapes.github.io - NASA Openscapes Mentors
- Hello Quarto: share • collaborate • teach • reimagine - Lowndes &Çetinkaya-Rundel 2022 Keynote (video)
- A Journey to Data Science: Tools for Equity and Diversity in STEM - Fenwick 2022 (video)
- Open software means kinder science - Lowndes 2019
- Supercharge your research: a ten-week plan for open data science - Lowndes et al. 2019
- Our path to better science in less time using open data science tools - Lowndes et al. 2017
- 3 lessons from remote meetings we're taking back to the office - Cabunoc Mayes et al. 2020
- Toolkit for Incentivizing Open Science - National Academies (NASEM) Report; Openscapes blog post
- All We Can Save - Johnson & Wilkinson 2020, eds
- Braiding Sweetgrass - Kimmerer, 2013
- From Open Data to Open Science - Ramachandran, Bugbee, & Murphy 2021
- Unmet needs for analyzing biological big data - Barone et al. 2017