



National Aeronautics and
Space Administration

2023

NASA's Year of Open Science

Supporting a more equitable and impactful
scientific future

Dr. Chelle Gentemann
Lead Transform to Open Science
NASA Headquarters
chelle.gentemann@nasa.gov





2023



Policy

Infrastructure

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

Funding

Community



NASA Transform to Open Science (TOPS)

A \$40 million, 5-year mission to accelerate adoption of open science

Strategic Goals:

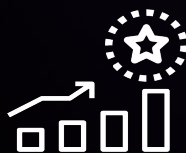
- Support 20K researchers to earn NASA's open science badge
- Double the participation of historically excluded groups across NASA science
- Enable five major scientific discoveries through open science principles



Engagement



Capacity Sharing



Incentives



Coordination



The United States White House announces 2023: A Year of Open Science

A multi-agency initiative across the US Federal Government to spark change and inspire open science engagement through events and activities that will advance adoption of open science.

◆ CDC ◆ DOC ◆ DOE ◆ DOT ◆ GSA ◆ NASA ◆ NEH ◆ NIH
◆ NIST ◆ NOAA ◆ NSF ◆ SI ◆ USDA ◆ USGS ◆

Agency Updates: <https://open.science.gov/>
Graphics [toolkit](#)

More announcements coming soon...



Open Science

is the principle and practice of making research products and processes available to all, while respecting diverse cultures, maintaining security and privacy, and fostering collaborations, reproducibility and equity.





Who am I? Dr. Chelle Gentemann
Why am I here talking to you?
More: [@ChelleGentemann](https://twitter.com/ChelleGentemann) 



My path.....



1998
RSS

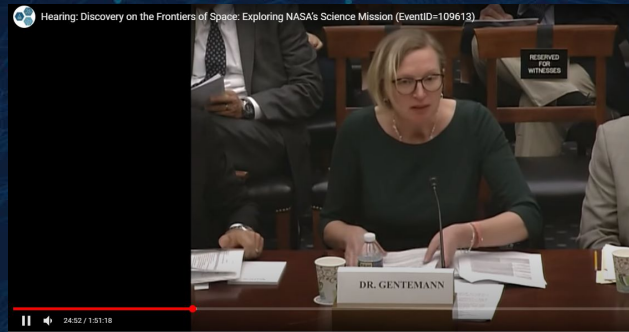
2020
Ballon

2022
NASA

1995
B.S.
MIT

1997
M.S.
UCSD

My path.....



2012
NASEM
CESAS

2016
JPL
Mission
Invite

2018
Co-chair
NASEM
CESAS

2022
NASA HQ

2013 AGU
Falkenberg
Award

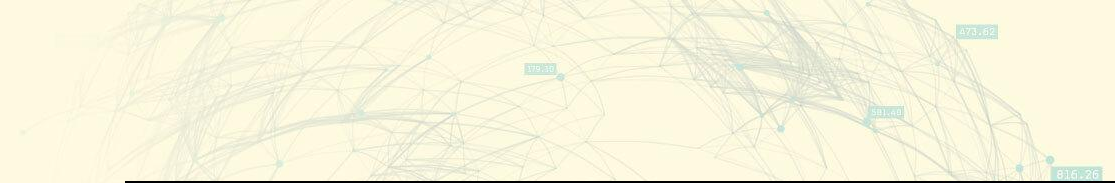
2017
NASEM
Co-chair
OSS policy
for NASA

2019
Testified
House
Committee

2021
\$190M
Butterfly
Mission

NOAA
SAB

A NASA OPEN SOURCE SCIENCE INITIATIVE: TOPS: TRANSFORM TO OPEN SCIENCE



Pangeo



Ryan Abernathy
Nov 7, 2018 · 2 min

AGU
100
ADVANCING EARTH
AND SPACE SCIENCE

FALL MEETING

Washington, D.C. |

how to use some of
for their own data a

Scientific Worksho

You come to AGU Fall
advances, expand you

fallmeeting.agu.org

The Details

Pangeo: Scalable Geoscience Tools in Python — Xarray, Dask, and



Pangeo

Following

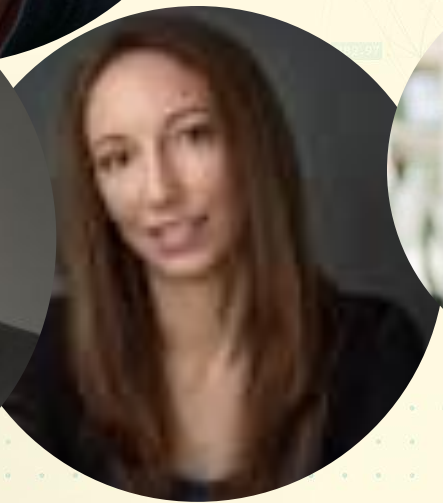
12, 2018

gu18 workshop! Here @HammanHydro
peed up geoscience.


13

39





How to:

- 1) Ensure that you will never get a job at JPL until several people retire
- 2) Follow your 

Can we share writing advice so that the best science ideas get funded? If having an old proposal makes it easier to write a new proposal and this will help new people participate, I'm all in.

The secret to writing a great NASA proposal



Dr. Chelle Gentemann

Published in NASA Butterfly Mission (proposed) · 9 min read · Jul 22, 2021

24



Use a real NASA proposal as a roadmap and follow these tips for clearly presenting your research ideas. A link to our proposal is [here](#).

I'm a 100% soft money-funded research scientist primarily funded by NASA research grants. I teamed with the Jet Propulsion Laboratory (JPL) to lead a

of

ls,

posal

ber to

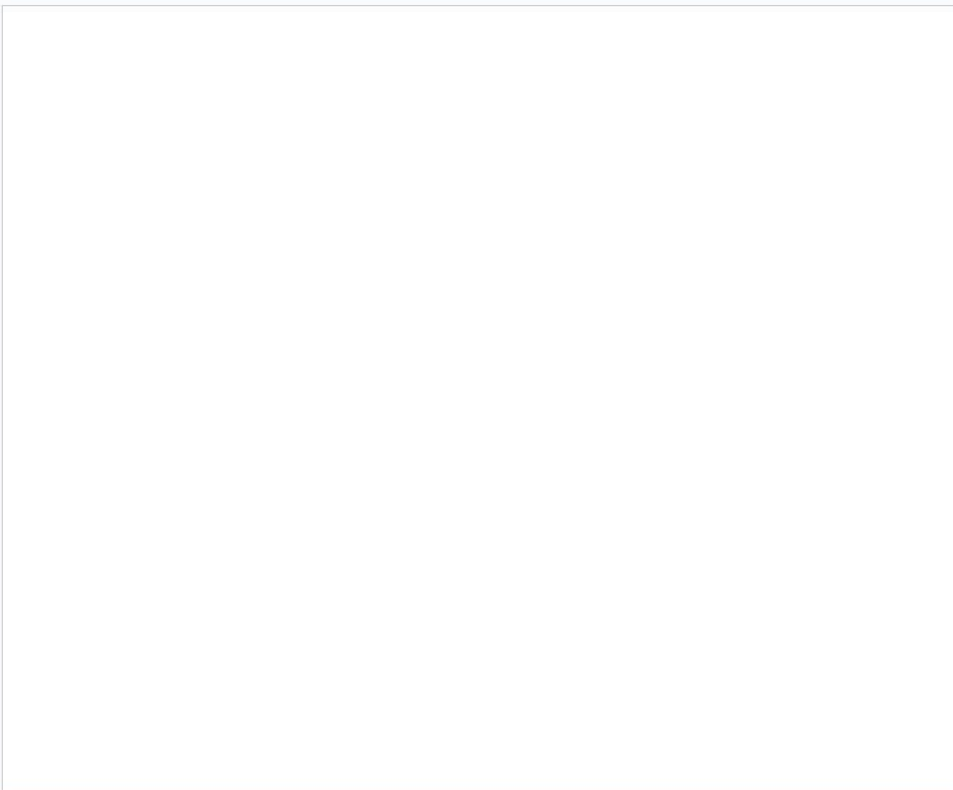
review the [checklist](#) before you start writing and again before you submit your proposal. [Volunteering](#) to sit on a review panel can really help you understand the process. NASA provides a [launchpad](#) to help write proposals along with a workbook that helps you refine your science. Understanding

A NASA OPEN SOURCE SCIENCE INITIATIVE: TOPS: TRANSFORM TO OPEN SCIENCE

← May 7, 2021, 5:09 PM

Restore this version

🖨 100% ▾



Version history

All versions ▾

- All anonymous users
- Chelle Gentemann

▶ May 17, 2021, 10:46 AM

- Chelle Gentemann

▶ May 17, 2021, 9:37 AM

- Chelle Gentemann

▶ May 14, 2021, 10:53 AM

- Chelle Gentemann

May 14, 2021, 9:10 AM

- Chelle Gentemann

▶ May 12, 2021, 11:50 AM

- All anonymous users
- Chelle Gentemann

▶ May 8, 2021, 7:53 AM

- Chelle Gentemann

▶ May 8, 2021, 7:05 AM

- Chelle Gentemann

▶ May 7, 2021, 5:36 PM

- Chelle Gentemann

May 7, 2021, 5:09 PM ⋮

- Chelle Gentemann

Show changes

A NASA OPEN SOURCE SCIENCE INITIATIVE: TOPS: TRANSFORM TO OPEN SCIENCE

The screenshot shows a document viewer interface with a version history sidebar on the right. The document content is highlighted in light blue. The version history sidebar lists several versions of the document, with the most recent one selected.

← May 7, 2021, 5:36 PM [Restore this version](#)

100% Total: 1 edit

2022 Year of Open Science

Chelle Gentemann and Erin Robinson

Many of the barriers to open science are rapidly falling away with recent technological advances, creating an opportunity to transform science. This shift in paradigm has the potential to lower the threshold for entry, expand the science community, and increase opportunities for collaboration while promoting scientific innovation, transparency, and reproducibility. This will increase the pace and quality of results.

Collaborative science needs easy access to data, software, computers, and the sharing of results, allowing scientists to focus on science. Data are moving from archive centers to vast cloud data storage, adjacent to massive server farms. Advanced interdisciplinary open-source software analysis

change is rapidly impacting everyone. Earth science must change just as rapidly. Designating 2022 as the Year of Open Science will provide federal agencies and science associations a target to organize activities to transform their agencies and science.

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Science associations: designate 1 day of annual meetings to be focused on open science education, including workshops, tutorials, showcases on all the aspects of 'doing' open science. This would reach a large percentage of the science community and create an urgency around learning to use these new tools to do science. Advance ability to publish software research notebooks alongside research results.

Federal agencies: Update agency guidelines to enable open science (e.g. outdated software release protocols are applied to all code instead of only sensitive code). Set agency workforce training goals aligned with doing open science, learning the tools to work collaboratively and openly.

Institutions: Update evaluations to include open science activities. Update intellectual property guidelines to align with open initiatives. Develop open science cohorts within departments to support the move towards openness.

Version history

All versions


- May 17, 2021, 8:21 PM
 - Chelle Gentemann
- May 17, 2021, 4:01 PM
 - Chelle Gentemann
- May 17, 2021, 12:36 PM
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Show changes

A NASA OPEN SOURCE SCIENCE INITIATIVE: TOPS: TRANSFORM TO OPEN SCIENCE

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Got a min? 📧 Inbox × personal folders/picts × ✕ 🖨️ 📧

 **Murphy, Kevin J. (HQ-DK000)** [redacted] Wed, May 12, 2021, 1:01PM ☆ ↶ ⋮
to me ▾

 **Chelle Gentemann** [redacted] Wed, May 12, 2021, 1:10PM ☆ ↶ ⋮
to Kevin ▾
yes. [redacted]

On Wed, May 12, 2021 at 1:01 PM Murphy, Kevin J. (HQ-DK000) [redacted] wrote:

↶ Reply ↷ Forward


A NASA OPEN SOURCE SCIENCE INITIATIVE: TOPS: TRANSFORM TO OPEN SCIENCE

← May 7, 2021, 5:36 PM [Restore this version](#)

100% Total: 1 edit

2022 Year of Open Science

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the year of activities to

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● Chelle Gentemann

Show changes

A NASA Open-Source Science Initiative:

TOPS: Transform to Open Science

Accelerating Scientific Discovery

These activities are designed to **support and strengthen** other NASA SMD initiatives on Inclusion, Diversity, Equity, and Accessibility (IDEA) and work for environmental justice.

- *Protecting & improving life on Earth*
- *Life on other planets*
- *Mysteries of the universe*

Overview

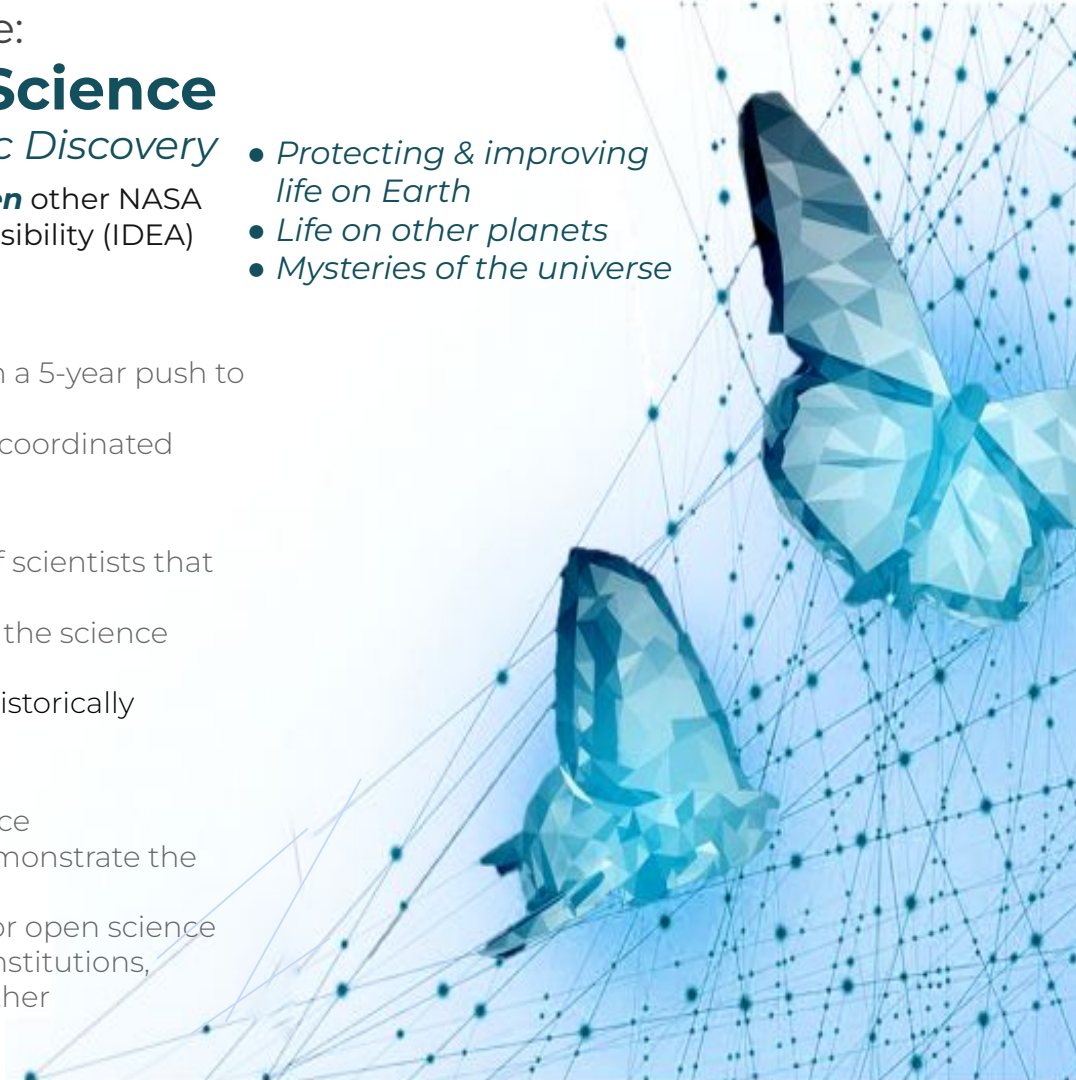
- Designate 2023 as the Year of Open Science within a 5-year push to Transform to Open Science.
- TOPS will act as a catalyst to **jump-start** a suite of coordinated activities designed to rapidly transform science

Objective

- **Normalize** open science for the next generation of scientists that will participate in ESO missions
- **Accelerate** science by motivating and supporting the science community's move towards open science
- **Broaden participation** in science and empower historically excluded groups and institutions

Implementation

- **2022** - Targeted investments to enable open science
- **2023** Kick off challenges and other activities to demonstrate the power of open science
- **2024 and beyond** - Continue to harden support for open science
- **Coordinate** activities with scientific associations, institutions, philanthropic organizations, & move forward together





Open Science: Intersections with Diversity, Inclusion and Equity



Why am I here? We need a 'mosaic of voices'

**Closed data.
Closed software.
Closed cyberinfrastructure.**

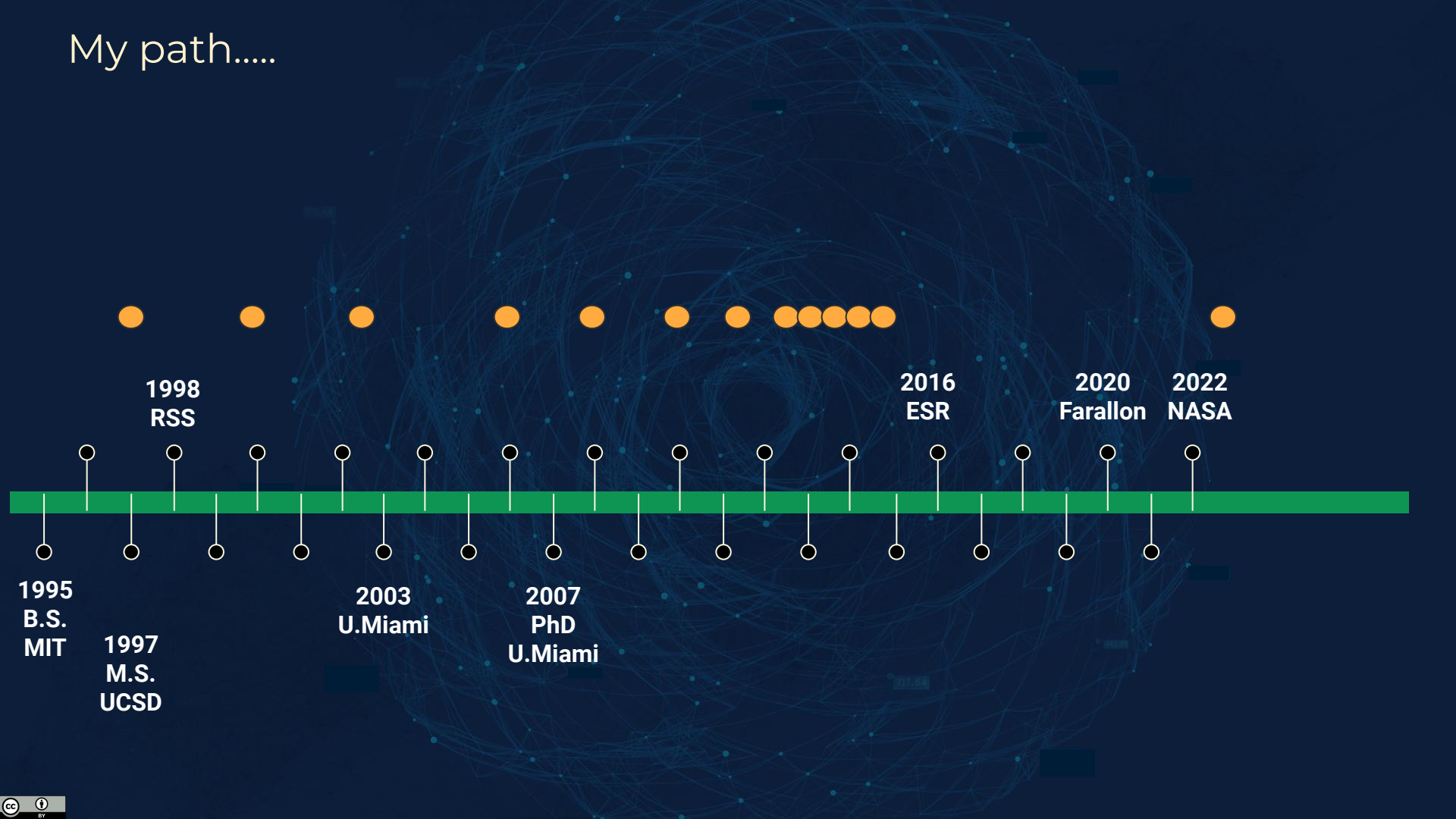
How does the existing closed organization of science perpetuate barriers to participation?



Image credit: Twentieth Century Fox

***Open science reduces power differentials and
advances an inclusive community***

My path.....





What is
NASA
going to do
about it?

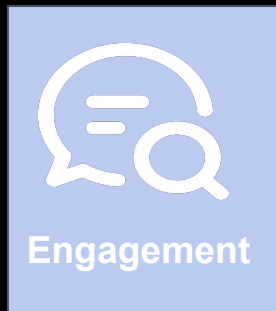


NASA Transform to Open Science (TOPS)

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Strategic Goals:

- Support 20K researchers to earn NASA's open science badge
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- Enable five major scientific discoveries through open science principles



Engagement



Capacity Sharing



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TOPS is raising visibility of open science!



In person workshops to teach basic open science skills



Sessions to showcase open science research



Booth to sign up for virtual Open Science workshops

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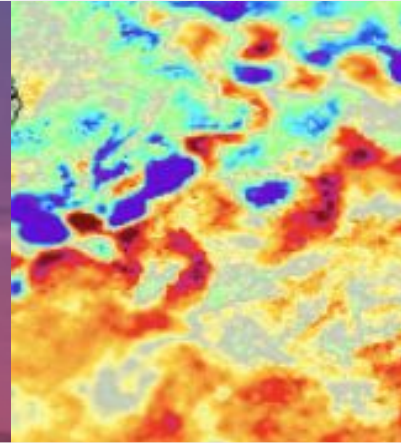
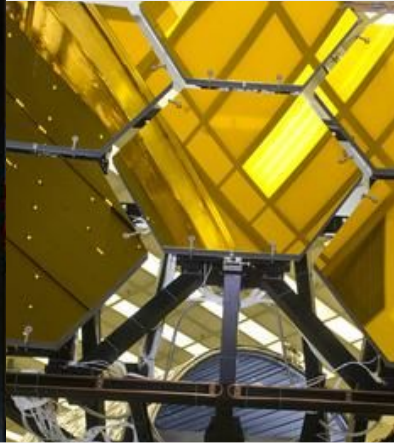


Coordination





Open Science 101: Benefits of open science presented as a scientific workflow



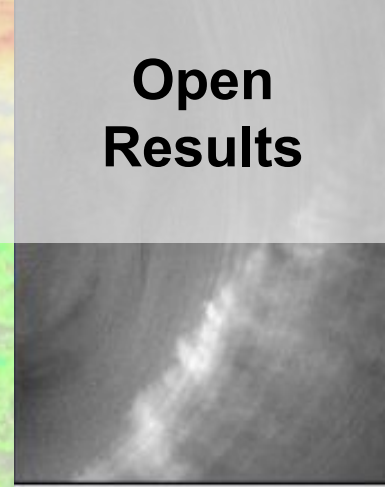
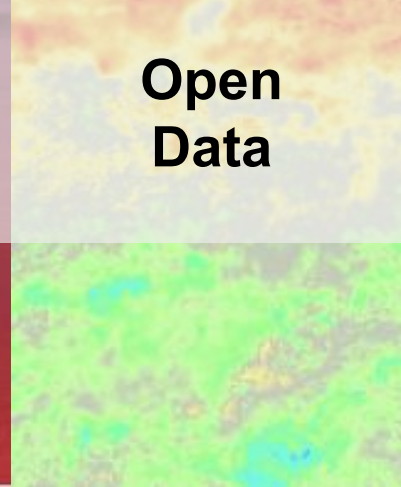
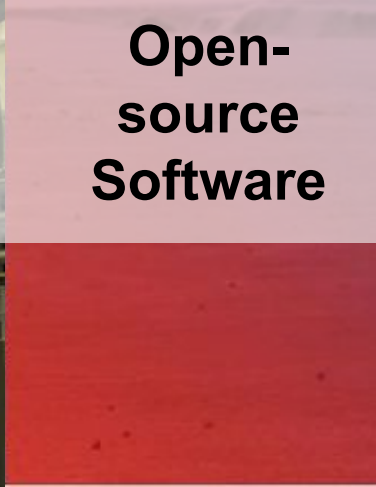
**Ethos
of Open
Science**

**Open
Science
Tools**

**Open-
source
Software**

**Open
Data**

**Open
Results**



Images: JSC, JPL, & MSFC





What am I going to learn in Open Science 101?

What is open science? Why should I do it? How should I do it?



How to use, make, & share software



Best practices for sharing all results and analysis, as well as peer reviewing

ETHOS OF OPEN SCIENCE

OPEN TOOLS & RESOURCES

OPEN SOFTWARE

OPEN DATA

OPEN RESULTS



How to use popular open science tools



How to use, make, & share open data



Complete All 5 & earn NASA Open Science Badges & Certification

Earn Badges at Each Level



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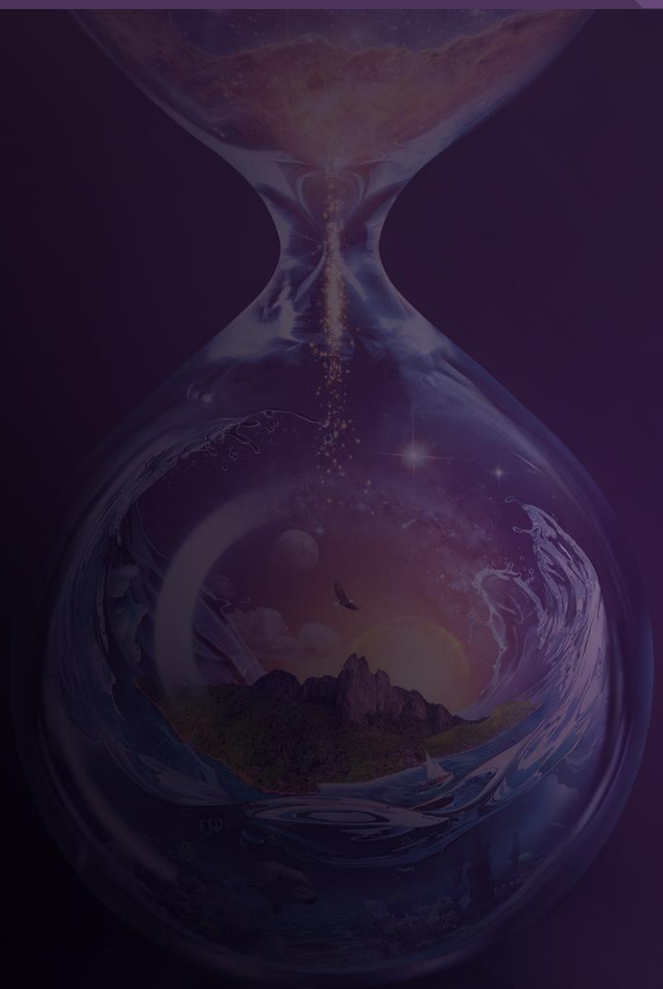


Coordination



Incentives

- Open Science Awards from agencies and others
- Open science activities recognized in other awards
- Open science certifications, achievements, and badges
- Prizes and challenges and cross-division science use cases
- Open science activities recognized in NASA reviews
- Support opening domain-specific course materials
- Support open learning resources
- Support to attend TOPS activities and events



Why get a digital NASA Open Science Certification?



Designed to provide researchers with **core open science skills**:

- Use digital tools to perform open science (e.g., ORCID, Zenodo, Github accounts)
- Familiar with data management and software management plan best practices and resources
- Grow connections across a community of open science practitioners

Open Science 101: A **community-developed** introduction to open science with inclusivity, accessibility, and diversity at the forefront.

Enroll now !



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◆ NIST ◆ NOAA ◆ NSF ◆ SI ◆ USDA ◆ USGS ◆

Agency Updates: <https://open.science.gov/>
Graphics [toolkit](#)

More announcements coming soon...



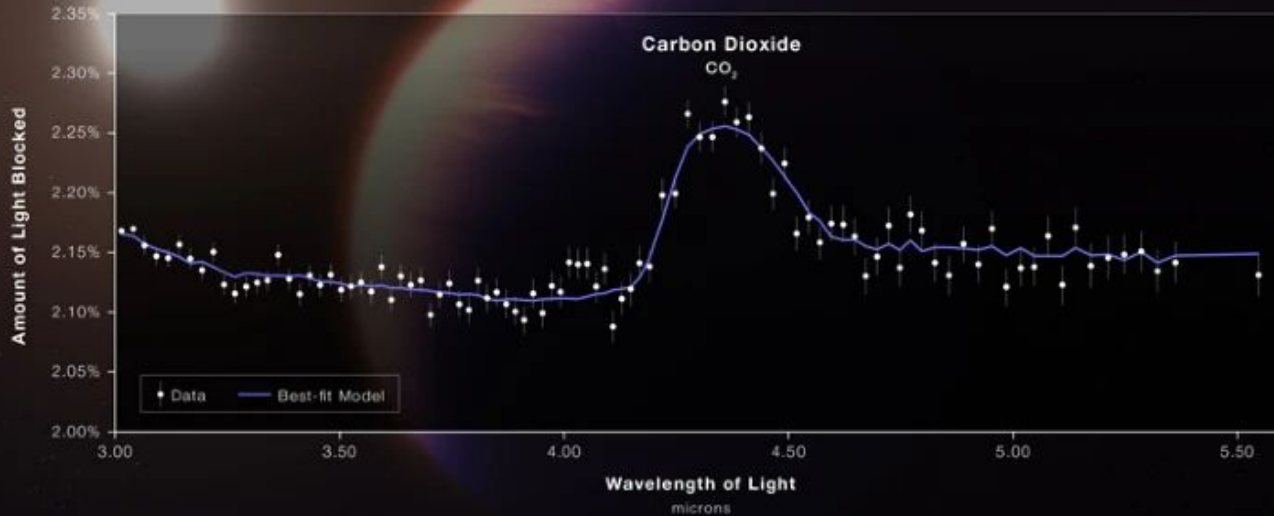


First evidence of CO₂ in exoplanet atmosphere



HOT GAS GIANT EXOPLANET WASP-39 b ATMOSPHERE COMPOSITION

NIRSpec | Bright Object Time-Series Spectroscopy



"NASA's open science guiding principles are centered in our Early Release Science work, supporting an inclusive, transparent, and collaborative scientific process."
- co-author Dr. Natasha Batalha

Early Release science data leads to major discovery & Planned 40+ publications

WEBB
SPACE TELESCOPE

Policy

Infrastructure

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

Funding

Community



Open Science Policy

SPD-41a Scientific Information Policy, released Dec. 5, 2022

- Peer-reviewed publications openly available with no embargo
- Research data and software shared at time of publication
- Mission data released as soon as possible; mission software developed openly
- Science workshops and meetings held openly

Forward-looking: Applies to ROSES-23 and new missions

Open Science Infrastructure

To enable Open Science, SMD is coordinating existing and new data and computing capabilities that can be reused by all SMD Science Divisions.

SMD is supporting the development of new search and discovery tools to increase findability of scientific resources:

- **Science Data Portal:** a scalable website for finding all NASA science data and cross-divisional services
- **Science Discovery Engine:** search engine for NASA data, code, software, and documentation
- **NASA Science Explorer:** expansion of the Astrophysics Data System digital research library portal to other science discipline areas

OSSI
Open-Source
Science Initiative

Community Engagement

Transform to Open Science (TOPS) - A \$40 million 5-year mission to accelerate adoption of open science.

Goals:

- Support 20K researchers to earn NASA's open science badge
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TOPS has sessions at 13 national conferences in 2023 with workshops, townhalls, panels, the NASA booth and more.

Open Science Awards

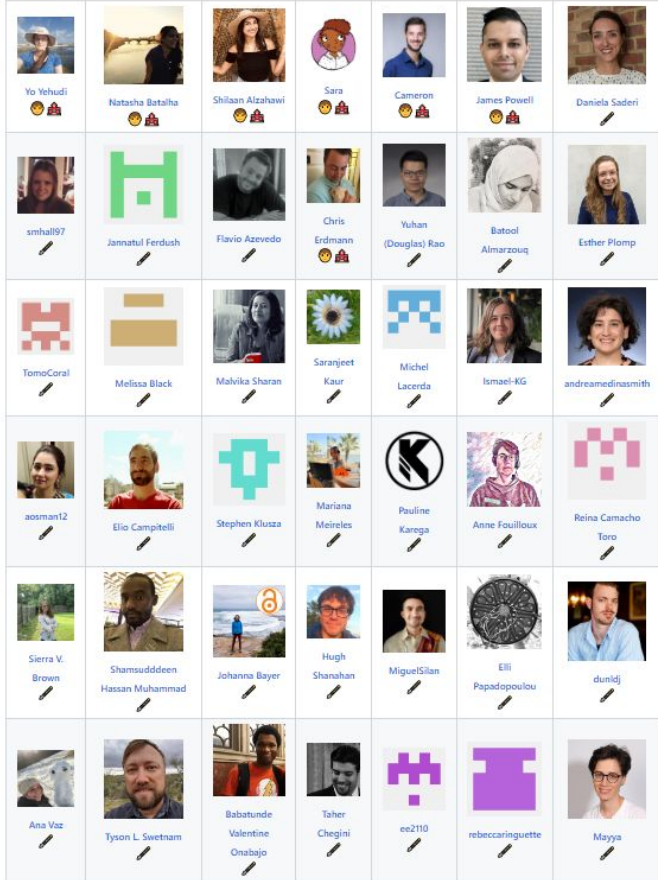
NASA is awarding \$11.7 million to 8 Historically Black Colleges and Universities (HBCUs) through the new MUREP Data Science Equity, Access, and Priority in Research and Education (DEAP) opportunity.

Cross division awards [ROSES-22 & ROSES-23] to support discipline specific training, summer schools, virtual cohorts, innovative open source tools, software, frameworks, data formats, and libraries.

- F.14 Transform to Open Science Training
- F.15 High Priority Open-Source Science
- others to be released under ROSES-23

Funding for Open-Source Science in ROSES-2023

F.15	High Priority Open-Source Science	Innovative open-source tools, software, frameworks, data formats, and libraries that will have a significant impact on the SMD science community (<i>Rolling deadlines in ROSES-22 & ROSES-23</i>)
F.7	Support for Open Source Tools, Frameworks, and Libraries	Improve and sustain open source tools, frameworks, and libraries that are significantly used by the SMD community (<i>ROSES-23 dates TBD</i>)
F.8	Supplemental Open Source Science Awards	Supplemental award to support open science including the conversion of legacy software to open source. (<i>Rolling deadline in ROSES-22; ROSES-23 dates TBD</i>)
F.16	Supplement for Scientific Software Platforms	Supplemental support of existing awards for use of scientific analysis platforms (<i>ROSES-23 dates TBD</i>)
F.2	Topical Workshops, Symposia, and Conferences	Events, hackathons, un-conferences, and challenges that build open science skills. (<i>Rolling deadline in ROSES-22; to be released as standalone ROSES-23 element</i>)



This project follows the all-contributors specification. Contributions of any kind welcome!

Many thanks to the global community of open science experts who shared their knowledge and experiences with us!



“Somewhere,
something incredible
is waiting to be known.”
-Carl Sagan





Open Science 101 Future Offerings

To be released online
this summer



[Fill out this form](#) to receive
updates on
Open Science 101 Workshops