National Aeronautics and Space Administration

A NASA OPEN-SOURCE SCIENCE MISSION: TOPS: TRANSFORM TO OPEN SCIENCE

Supporting a more equitable, impactful, and efficient scientific future

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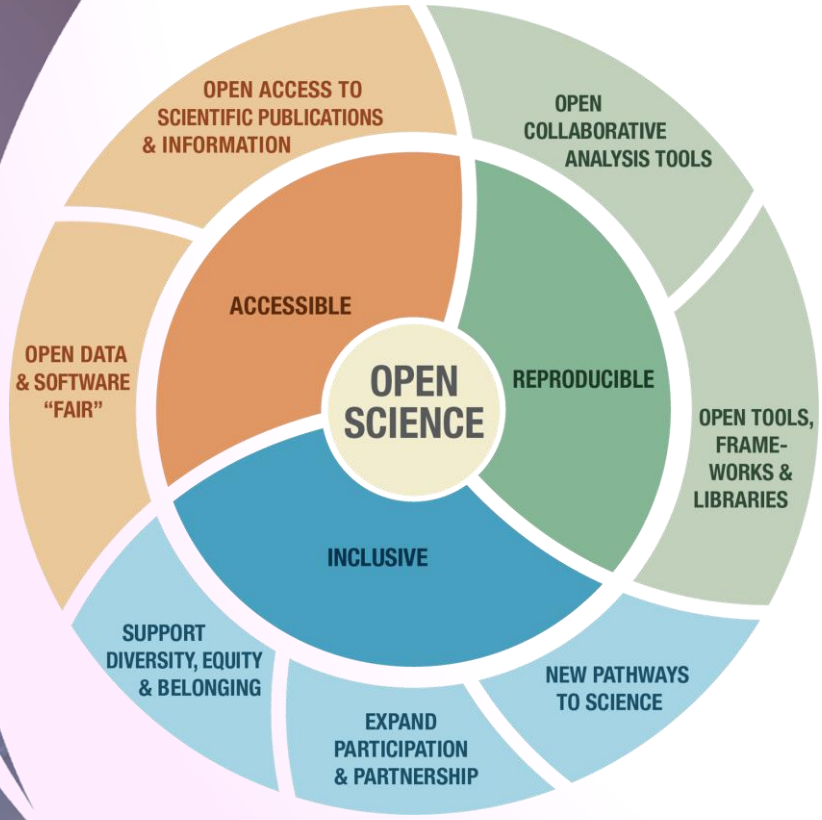
Open Science: Accessible, Reproducible & Inclusive…



Creates research that is:

- Cited more
- Creates a bigger impact
- Increases transparency
- Generates more scholarly collaborations

Inclusive science means more:

- Collaborative projects
- Access to 'hidden knowledge'
- Equitable Systems
- Participation

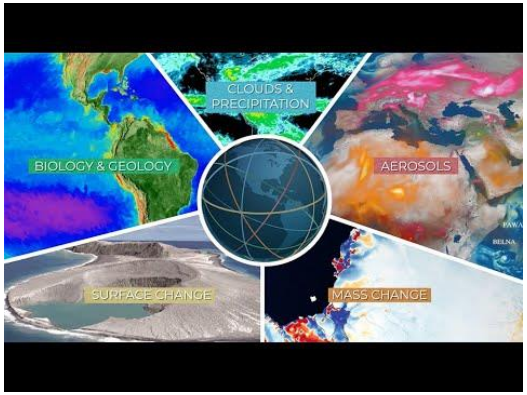
NASA is looking ahead at really big challenges

We need ***more*** WE science rather than ME science[1]– sharing data, software, results openly

We need ***more*** people - more hands, more eyes, more brains - with diverse experiences to participate so that we ask the best questions and find the best solutions

Open Science:

- Accelerates the pace of science
- Increases the impact of science
- Expands applications of data and science
- Shares hidden knowledge & expands participation in science

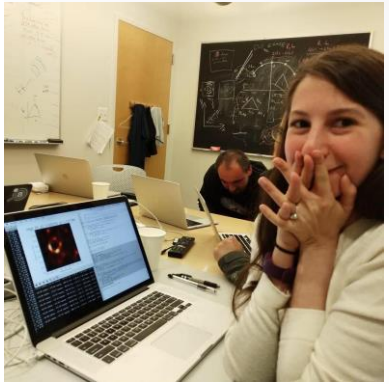


Video credit: NASA

Image credit: Twentieth Century Fox

1: quote from Harlan Krumholz, Yale School of Medicine at 2022 CZI meeting

Open Science Results Speak for Themselves….



First image of black hole

> "We're deeply grateful to all the open source contributors who made our work possible." –Dr. Katie Bouman

> "The open source community is very important for scientists; imagine if we had to do everything from scratch every single time." –Dr. Chi-Kwan Chan

> We "greatly improve[d] our own work by adopting well-tested community packages that contain the collected wisdom of many other projects." –Dr. Lindy Blackburn

> "with the open source projects in NumFOCUS, we were able to iterate our algorithms so fast that they enabled us to finish our work in two years"

Scott Collis (He/Him) @Cyclogenesis_au

Replying to @ChelleGentemann @openscience and @theNASEM

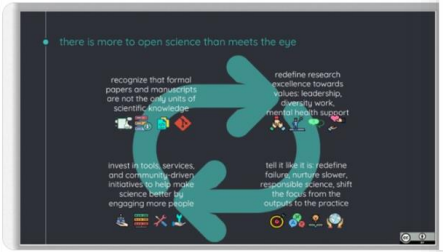
Being an open scientist has:
1) accelerated my career. It has allowed me to choose projects which benefit more people.
2) Has created long lasting collaborations and friendships. When you are open you are… open!
3) Made me a better scientist. "Show your working!"

6:36 AM · Mar 12, 2022 · Twitter Web App

Paola Masuzzo @pcmasuzzo

Replying to @ChelleGentemann and @theNASEM

An aspect we should talk more about, open research practices as a driver to a real reform in the research endeavour. I try to depict it in this image :)

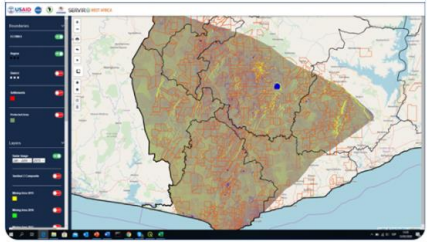


Belize GEO @BzGEO · Mar 11

Replying to @ChelleGentemann and @theNASEM

Our friends @SERVIRGlobal have many examples of how algorithms + code from one region have been customized for use in another. An example is gold mining monitoring, where Amazonia + W. Africa have collaborated in an #OpenScience context, leveraging #GEE.

> **simonestaiger** @simonestaiger · Apr 8, 2020
> Reducing illegal gold mining in the tropical forests of Ghana and Peru: A forthcoming collaboration across the Atlantic #SERVIRamazonia servir.ciat.cgiar.org/illegal-gold-m… @USAIDPeru @SERVIRGlobal @CERSGIS_GH @NovoaSidney @amazonacca @sig_gis @BiovIntCIAT_eng



Dr. Julia Stewart Lowndes @juliesquid

Replying to @ChelleGentemann and @theNASEM

Congrats Chelle!
The welcoming, inclusive, collaborate-and-reuse culture of the #rstats community is something that changed my science-life and my life-life. Hard to distill but here are a few attempts:
openscapes.org/blog/2020/02/2…
openscapes.org/blog/2019/02/1…
openscapes.org/blog/2019/08/2…

3:15 PM · Mar 11, 2022 · Twitter Web App

Lucas Sterzinger @lucassterzinger

Replying to @ChelleGentemann and @theNASEM

Probably the most common answer, but using @xarray_dev, @dask_dev, @ProjectJupyter, and matplotlib has been the backbone of my research since day 1. Working with these tools also motivates me to make the data and code for my plots open source, making my science more reproducible

11 AM · Mar 11, 2022 · Twitter Web App

Pierre de Buyl @pdebuyl

Replying to @ChelleGentemann and @theNASEM

In remote sensing: using @PyTrollOrg satpy as a comparison point for reading geostationary satellite data, @scitools_iris and panoply from @NASA for plotting said data.

12:15 PM · Mar 11, 2022 · Twitter Web App

Sam Ehrenstein @elasticsnake

Replying to @ChelleGentemann and @theNASEM

In computer science, research moves very fast. It would not be possible to keep up with the latest work if not for the arXiv and open-access conferences.

1:47 PM · Mar 14, 2022 · Twitter W

Ricardo Barros Lourenço @rblourenco

Replying to @ChelleGentemann and @theNASEM

I've briefly returned to the public-private sector (between 2019-21) and the nicest thing about working with OSS during all my career was the ability to show new methods to be applied in that company, which was of clear understanding, helping auditing efforts.

7:56 AM · Mar 12, 2022 · Twitter Web App

Max Grover @mgroverwx · Mar 11

Replying to @ChelleGentemann and @theNASEM

Here's a great use-case of @Py_ART , which is funded by @doescience @armnewsteam ! Over 200 citations so far, with many including awesome code like this paper which enables #OpenScience !

> **Milind Sharma** @Gewitter_Blitz · Mar 11
> The power of open source software! The authors (@jehcssou and @deeplycloudy) also provide a clean code to encourage reproducible science. I could apply their technique to my dataset within a few hours. Neat! Yes to #OpenScience

Quotes from https://numfocus.org/case-studies/first-photograph-black-hole

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.

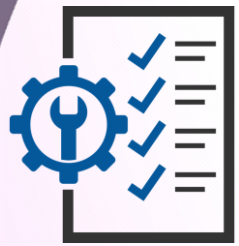
- **Centers for Disease Control and Prevention**
- **Department of Commerce**
- **Department of Energy**
- **Department of State**
- **Department of Transportation**
- **Environmental Protection Agency**
- **General Services Administration**
- **NASA**
- **National Endowment for the Humanities**
- **National Institutes of Health**
- **National Institute of Standards and Technology**
- **National Oceanic and Atmospheric Administration**
- **National Science Foundation**
- **Smithsonian Institute**
- **US Department of Agriculture**
- **US Geological Survey**

& other organizations, including HELIOS

2023: Year of Open Science | NASA TOPS

NASA’s Open-Source Science Initiative

Unlocking the full potential of a more equitable, impactful, efficient, scientific future



Policy development, education, compliance tools

Updating NASA Science policies on scientific information to better enable the activation of open science (eg. SPD-41a)

Core Services for Science Discovery

Developing core data and computing services to enable open science

ROSES Elements

Supporting open-source software, tools, frameworks, libraries, platforms, and training with over $5 million dollars in grants per year

Community Building & Partnerships - Transform to Open Science (TOPS)

Accelerating adoption of open science and expanding participation of marginalized communities in science

NASA's Transform to Open Science (TOPS)

A 5-year initiative to accelerate adoption of open science through:

Visibility

Open Science everywhere: Articles, announcements, Twitter Spaces, conferences

2023 Big annual meetings Open Science Themes, integrated into society comms

Capacity Sharing Resources

Online, free, Open Science curriculum on Open edX

Workshops, events, virtual cohorts, science team meetings, hackathons

Many paths to Open Science

Incentives

Open Science Badge/Certification

High profile prizes and challenges

High profile awards in support of open science research

Changing the Game

Require open data, open software, open access

Funding decisions consider open science activities

Awards, promotions, evaluations consider Open Science activities and teams as well as individuals

Area of Action: Engagement

Focused Community **Building**

- Activities at all large science annual meetings
- Launch the TOPS Open Science Curriculum
- Targeted Outreach with MSIs
- Monthly Community Forums
- TOPS Community Panel
- GitHub (discussions enabled)
- Website

TOPS Capacity Sharing: Open Science 101

5 Modules designed to introduce Open Science

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

How to use, make, & share code

How to use, make, & share your results

ETHOS OF OPEN SCIENCE → OPEN TOOLS & RESOURCES → OPEN CODE → OPEN DATA → OPEN RESULTS

How to use popular open science tools

How to use, make, & share open data

Earn microbadges at every level

Complete All 5 & earn NASA Open Science Badge on Credly

How YOU can Get Involved:

To implement a cultural shift, we need community engagement from the broad spectrum across the scientific community!

We are looking for community partners to co-develop YOOS activities

- Develop open science action plans
- Share your data, software, publications
- Nominate science teams for summer schools
- Organize events
- Join TOPS email list!

Learn more and collaborate with us - we're working on GitHub!

TOPS GitHub

TOPS Email List

Complete NASA's open science curriculum!

Open Science 101:

A community-developed introduction to **core open science skills**

- Know how to write a NASA open science and data management plan
- Learn about tools and best practices
- Increase the impact & visibility of your science
- Earn your digital NASA open science badge

Pre-enroll now !

Q&A

Learn more and collaborate with us!

TOPS Email List

TOPS Website