



Year of Open Science

National Aeronautics and
Space Administration



A NASA OPEN-SOURCE SCIENCE MISSION: **T O P S**: TRANSFORM TO OPEN SCIENCE

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Why Open Science?

We are facing **Big** Challenges:

Covid, Climate change, ...

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
- Demonstrated to expand participation in science



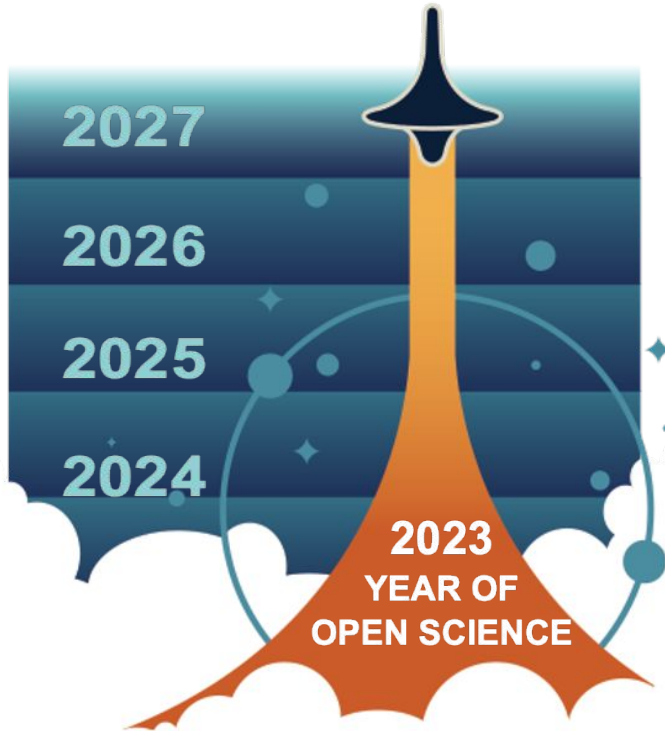
Image credit: NOAA



Image credit: Twentieth Century Fox



Leading the Path to Open-Source Science



Transform to Open Science (TOPS) is a \$40 million* 5-year NASA Science Mission Directorate mission geared towards accelerating the adoption and understanding of open science

Key Goals:

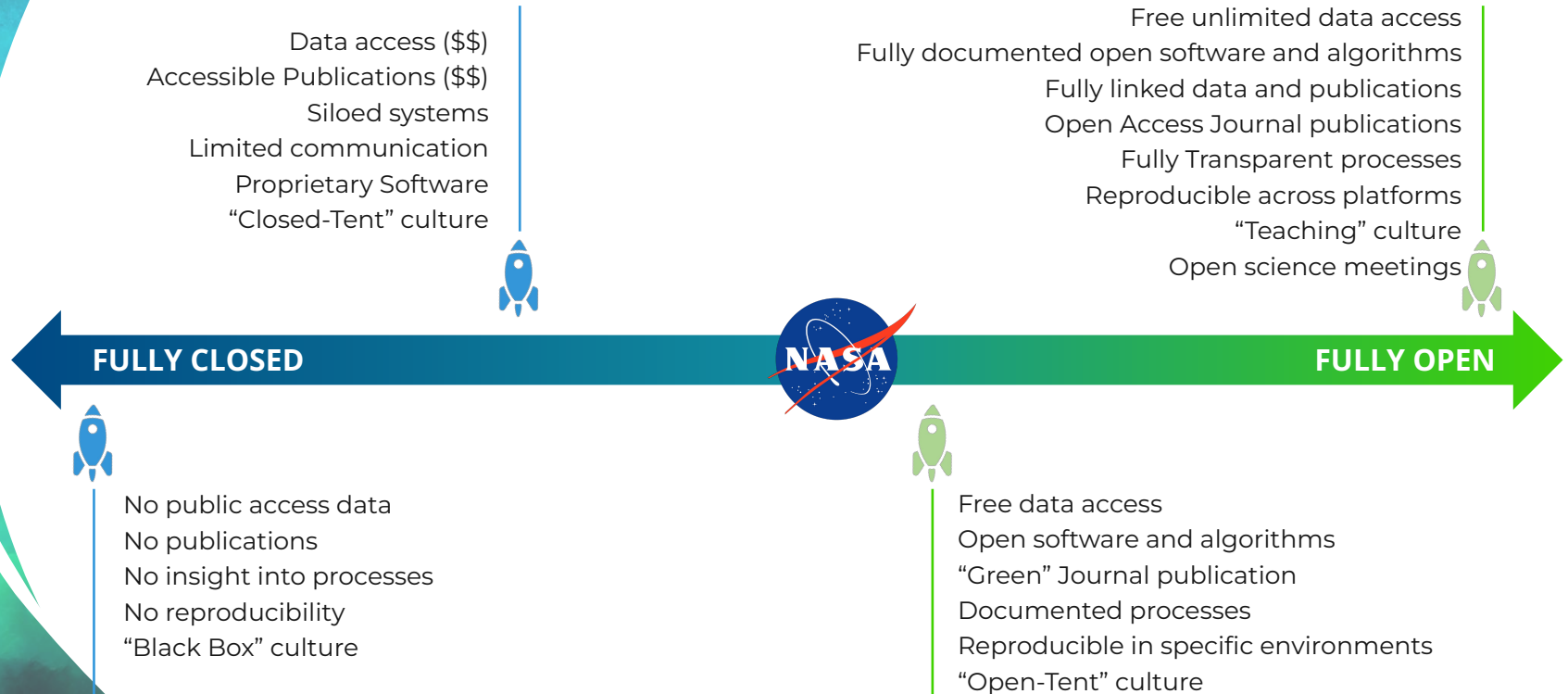
- 20K earn open science badges
- 5+ major discoveries based in open science practices
- Increase participation of underrepresented groups by 2x

*pending appropriations



NASA's Open-Source science is the *activation* of an open science community

A continuum of open-source science



Increase understanding & adoption of open science

There are basic skills that all scientists need....

but rarely are trained on

How do you share your research to maximize its impact?

- Basic open science skills
- Discipline-agnostic



OpenCore



- Additional discipline-specific, advance modules available



Increase understanding & adoption of open science

- *OpenCore* - an introduction to open science
- Completed in person, independently, and in virtual cohorts
- Earn certification for completion

Gradually
mandate

What is open science, why does it benefit me, and why does it benefit the greater scientific community?



How to 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 effectively use and share open data



Earn Badges at Each Level

Complete All 5
& earn TOPS
Open Science
Badge &
Certification

Increase understanding & adoption of open science

Engagement with the Community



TOPS Champions

Scientists to help teach modules at events and act as Open Science champions



Cohorts

Engage with learners through a virtual cohort model to increase Open Science Badge achievement



Summer Schools

Institutions selected to run ~6 weeks of teaching the 5 modules to selected science teams + open competitive under-represented researchers



Curriculum Expansion

Groups funded to migrate/create discipline specific modules and data science skills modules to Open edX TOPS platform



Hackathons

More hackathons that advance data science skills and open science



2023 Year of Open Science

High level visibility

- Publications, articles, working TOPS into HQ comms
- Announce new Open Science awards
- Announce recognition of Open Science activities

Conferences

- Targeting domestic meetings (EGU only exception)
- These meetings will have TOPS representation at NASA booth, town halls, OpenCore workshop, high-visibility in society comms and at conference
- We will also be at other meetings - eg. AAS winter with TOPS champions organizing activities and workshops (with support)

Virtual Cohorts

- Learners who complete part of OpenCore will be followed up with an enrolled in virtual cohorts to encourage completion of course

Summer Schools

- 3-4 institutions funded to run 6-8 weeks of OpenCore / Science Team summer schools - train entire science teams all together in 1 week.

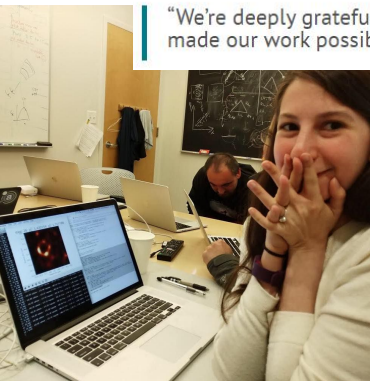
Targeted Workshops

- In-person workshops with strong outreach to historically underrepresented communities to learn open science and build community at the same time

Conference	Date	Size	BPS	PDS	Helio	Earth	Astro	HUGS*
AGU Fall	Dec	25K	x	x	x	x	x	
AMS/AAS	Jan	6K			x	x		
AAAS	Mar	9K	x	x	x	x	x	
LPSC	Mar	2K		x				
EGU	Apr	18K	x	x	x	x	x	
AAS	Jun	3K		x	x		x	
IGARSS	Jul	3K				x		
Soc. Asian Sci&Eng	Oct	3K						x
Amer. Indian Sci&Eng	Oct	2K						x
SACNAS	Oct	6K						x
ASGSR	Nov	1K	x					
AGU Fall	Dec	25K	x	x	x	x	x	
Targeted workshops	May/ Sep	200						x
Totals		~100K	5	6	6	6	5	4

*HUGS- historically underrepresented groups

Accelerate major scientific discoveries....



"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"

First image of black hole

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 :)



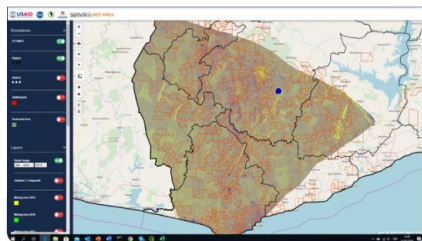
Belize GEO
@BzGEO · Mar 11

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. 🌍

simonestalger @simonestalger · 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 @BioIntCIAT_eng



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

7:41 AM · Mar 11, 2022 · Twitter Web App

Pierre de Buyt
@pdebuyt

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 Web App

Ricardo Barros Lourenco
@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 @PyART, 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





Broaden participation by historically underrepresented communities

Open science makes the gatekeepers irrelevant and has a **documented impact** on participation and credit for underrepresented communities. This is about changing the framework of science so we aren't just making room at the table - we are creating a new, more equitable table.

- Inclusive accessible *OpenCore*
- Workshops and events designed for underrepresented
- Science team meetings / Summer Schools / Events at MSI
- Science team meetings open & funded participation by underrepresented communities
- Sharing hidden knowledge
- Equitable access



New Funding Opportunity!

~\$3 Million/yr

F.14 Transform to Open Science Training ([TOPST](#))

- 1) Develop ScienceCore
- 2) OpenCore Summer Schools
- 3) OpenCore virtual cohorts

Oct 13, 2022 – Ask questions at forum ([Register](#))

Nov 10, 2022 – (Optional) Notice of Intent Due

Dec 8, 2022 – Proposal Due

Scan to Learn





NOAA Strategic Plan 2022-2026

OPEN DATA DISSEMINATION/OPEN SCIENCE

NOAA will ensure the agency's data and information are broadly available on a **free and open basis and easy to use** across economic sectors, geography and socioeconomic context to realize the full value of NOAA's data. NOAA will continue to share its knowledge by keeping open its **data, codes, algorithms, models and research outputs, including manuscripts, publications, processes and methods**. NOAA will invest across the organization in infrastructure and the data workforce needed to provide appropriate data management throughout the entire data lifecycle from collection to broad data access and associated information services



NOAA Science Advisory Board

December 2021: Science Advisory Board - [Priorities for Weather Research](#)

Embrace open science - to provide uniform access to all communities, support a geographically distributed, diverse workforce, broaden access to talent, and increase agility and innovation

Current - Science Advisory Board - Open data / open science working group

How YOU can Get Involved:

To change everything we need everyone.

Agencies, Scientists, Mission partners to **co-develop** activities

- Develop mission [open science action plans](#)
- Participate in *OpenCore* development
- Create open science events

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



TOPS Email List



TOPS Website

Q&A

Learn more and
collaborate with us!



TOPS Email List



TOPS Website

How YOU can Get Involved:

To change everything we need everyone.

Scientists and Mission partners to co-develop activities

- Propose open science hackathons
- Participate in *OpenCore* development
- Signup your science team for *OpenCore* summer school
- Develop mission open science action plans

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



TOPS Email List



TOPS Website

Accelerate major scientific discoveries



	Title	Description	Details
F.2	Topical Workshops, Symposia, and Conferences	Events , Hackathons, un-conferences, and challenges that build open science skills, Training in open science	<ul style="list-style-type: none"> Rolling deadline
F.7	Support for Open Source Tools, Frameworks, and Libraries	Support and maintain open sources tools, frameworks, and libraries that are significantly used by the SMD community	<ul style="list-style-type: none"> \$2M awarded in ROSES20 to 8 programs Once every 3 years
F.8	Supplemental Open Source Software Awards	Supplemental award to encourage the conversion of legacy software to open source	<ul style="list-style-type: none"> \$200K awarded in ROSES20 to 6 awards Yearly, \$250K available, rolling deadline
F.14	Transform to Open Science Training	TOPST : Tutorials showcasing open science in action and NASA cloud data, summer schools, virtual cohorts.	<ul style="list-style-type: none"> Budget of \$4.5M per year Once every three years
F.15	High Priority Open-Source Science	Supporting innovative open source tools, software, frameworks, data formats, and libraries	<ul style="list-style-type: none"> Budget ~\$1M Yearly, rolling deadline
F.16	Supplement for Software Platforms	Supplemental support to existing awards for usage of scientific platforms.	<ul style="list-style-type: none"> Budget TBD -
F.??	TBD	High risk / high reward science that are based in open science practices	<ul style="list-style-type: none"> Budget TBD -



How YOU can Get Involved:

To change everything we need everyone.

Agency partners to co-develop YOOS activities

- Host and fund prizes and challenges,
- Participate in *OpenCore* development,
- Develop open science action plans
- Budget for Year of Open Science activities to increase adoption of open science
- Ask about open science activities
- Create funding opportunities

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



TOPS Email List



TOPS Website



Leading the Path to Open-Source Science

NASA's Transform to Open Science (TOPS) is a \$40 million* 5-year NASA Science Mission Directorate mission

Goals:

- ★ Increase understanding & adoption of open science.
- ★ Accelerate major scientific discoveries.
- ★ Broaden participation by historically underrepresented communities.

Metrics:

- ★ 20K earn Open Science Badge
- ★ 5+ major discoveries
- ★ Increase participation of underrepresented groups by 2x



*Year of Open
Science*

*pending
appropriations