NASA Transform to Open Science Community Panel 2022-05-17-09...

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SPEAKERS

steve crawford, chelle gentemann, Qiusheng Wu, Jim Colliander, Logan Kilpatrick, Malvika Sharan, Monica Granados, Kelsey Hightower, Fernando Perez, Kevin Murphy, Pen-Yuan Hsing, Yvonne Ivey, Karla Mastracchio, SherAaron Hurt, Gloria Washington, Moritz Gunther, Brian Nosek

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K **Karla Mastracchio** 00:00

One with respect and consideration, valuing diversity of views and opinions. Be considerate, respectful and collaborative, communicate openly with respect for others for taking ideas and not individuals. And that's super important to emphasize. Avoid personal attacks and directed towards other participants. So no flaming no Daxing or anything like that. And be mindful of your virtual surroundings and your fellow participants. So just be mindful of the digital space that you take up and make sure that you leave room for your fellow participants, and also alert a host if you notice a dangerous situation for you or someone else in distress, and please respect the policies of this virtual meeting space. Okay, so unacceptable behavior, no harassment, no intimidation, no discrimination of any form will be tolerated. physical or verbal abuse of any participant will obviously not be tolerated. And examples of unacceptable behavior include, but are not limited to verbal concerns related to gender or sexual orientation, disability, physical appearance, or race, class, gender, or religion, national origin, etc, etc. And this eruption of proceedings and panels and discussions will also not be tolerated. Next slide, please. All right, so anyone requested to stop unacceptable behavior is expected to comply, immediately, hosts may take any action deemed necessary appropriate, including removal without warning. So if you are a victim of unacceptable behavior, or you notice it going on, please immediately notify a meeting host. And notification should be done by contacting a host directly via chat or emailing your concern to shell which I'll introduce in a second. So anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety is advised to call 911 or your local emergency number.

M **Monica Granados** 01:54

Next slide, please.

K Karla Mastracchio 01:58

And back to the fun stuff. Okay. So we would encourage you to submit questions and really participate in this discussion, your inputs are essential to the success of our mission. So over here, on the bottom right corner of the slide, you have a QR code, and you can use the QR code to access the feedback tool. And then what you do is hold up your phone when you're like you're taking a picture, and then that should catch the QR code, and a website should pop up and you can access it. And I'll leave it up for one second. So people can capture that. Yeah. And now it is my pleasure to kick it over to show.

chelle gentemann 02:41

Right. Thanks, everyone. I am Chelle gentemann. I am the Transform to Open Science Program Officer at NASA headquarters. And I just I really want to thank all of you so much for attending today for volunteering to be on this panel. your input and your feedback is just going to be critical for us as we move forward building community and working with the science community to adopt open science. Thank you. So today, we have three days to go over a lot of information. And we're hoping to have a lot of discussion with you. So we have lots of discussions time. First, we're going to hear from Kevin Murphy, about NASA's open science vision. We're going to talk to the panelists and have introductions. Next, we'll have a short break. We'll then be going over an overview of the tops project. So top stands are transformed to open science, you're going to have an introduction, and then we're going to talk about our four areas of action. That's going to be myself and Yvonne IV will then be discussion again. And at the end of the day, the final hour will be just really discussion with all the panelists on several questions and anything else that they'd like to talk about or bring up with us and Steve Crawford will be joining us. Steve corporate is the Program Executive for the open source Science Initiative at NASA headquarters. Thank you. Excellent. So our meeting objectives. Were really here today to get a constructive feedback on the top submissions, plans and recent activities from the panel. Again, we really appreciate your time. This group, we're looking for you to serve as representatives from the open science community and these conversations, speak to your experience with open science lessons learned and really provide input on our future steps as we're developing this project. And at the end, they'll be will give minutes and a summary text to you all and hopefully we'd like to get written report and feedback. Within four weeks. We'll work together with you from the panel to have that. And all of this will be public and open and all meeting materials Republican opening on GitHub. So Thank you Next slide. I want to introduce Kevin Murphy, NASA's Chief Science Data Officer. Thanks

K Kevin Murphy 05:01

Thanks Chelle and thanks, Karla, I don't have any slides prepared for you today, I think it'd be better if I just kind of talk about what's going on, and maybe introduce myself a little bit. I'm Kevin Murphy, I'm the Chief Science state officer for the Science Mission Directorate. I'm also the program manager for the Earth Science Data System Program. at NASA headquarters. I'm actually the first Chief Science state officer ever at NASA, which is pretty cool. Because I get to see a lot of really interesting things. And my journey to get here has been, you know, one that's taken quite a few years. And I was originally kind of a land cover remote sensing researcher, using, you know, satellites that kind of pointed at Earth to look at how the landscape changed. And one of the big things that I encountered when I was trying to do that is I was also, you

know, working full time, at the same time, it was hard to access some of the resources necessary to do science, because I didn't have, you know, the institutional licenses and support and everything else necessary. So I really wish at that point in my life, I had access to a lot of open source software tools that exist now. And the open science methods, including kind of publications at that time, I started at NASA, as a civil servant back in 2009, where, you know, I really was committed to making our data openly accessible, and freely accessible. Don't things like the world view, visualization tool and metadata repositories. And, you know, one of the things I really wanted to do in that position was made sure that our software was open so people could access it. Anyhow, long story short, I moved to headquarters, about six years ago. And in that capacity, I've increasingly made a lot of our capabilities open. All of our core systems software is open. I instituted open software policies, open data policies, working with international partners. And, you know, I think I think one of the most important things though, over the past, you know, 10, or 15 years, has has really been the recognition by the community at large, that, you know, openness, in terms of the scientific endeavor is critical to support not only kind of innovation, but also kind of inclusion, as we kind of face some significant challenges, from environmental change, and significant opportunities in terms of scientific discoveries, both on the earth and within the universe. So I'm really, really excited that we've kicked off this community forum, I'm really also excited that NASA has really recognized the importance of open science within the Science Mission Directorate. And to that end, we've initiated this activity called transformed open science, that shells leading for us, and she's doing a great job, she's got a lot of experience and how this works, but she's going to be relying on the community, especially to help guide this program. You know, we're we're obviously not starting from scratch here, the community around open science has been growing and growing for years. So we're really building on the shoulders of all the work that has been done, and really do appreciate our panel members participating in this, as well as the wider community and helping us make sure that we align our capabilities with what exists, and reinforce those things that are, are, are well done already. And not necessarily create something brand new. You know, we're really here to co develop these activities and and, and your support is vital for it. Some of the things and keep it some of the commitments that we've made in in terms of openness are that our meetings will be primarily open. You know, we're applying that to even our scientific meetings, starting in the Earth system observatory era. We're developing our capabilities much more openly in terms of commitments to open source software, open documentation, open journals, so on and so forth. And, you know, this is all really to one recognize that, you know, there isn't one group of specialized people that have all the answers, but but really, that it takes all of us to help understand the massive amounts of information that we're beginning to collect with our variety of different satellites and grow offers and, and other capabilities. You know, NASA, within our science alone has around 60 petabytes of information that can be used to evaluate the environment and plan for disasters and look at agriculture. And with kind of James Webb Space Telescope coming online, we have, you know, vast amounts of new capability in terms of of looking beyond our solar system. And all the data from Mars and in the inner planets, the sun as well. So, you know, we really need a lot of different perspectives as we look at information about our universe and explore how we are, you know, learning new things about it all the time. So, you know, Topps is just kicking off this year, we have a year of open source, open science coming up in 23, or 2023. So I'm sure we'll be talking about that quite a bit. We want to make the science that we do accessible, reproducible and inclusive. So we'll have dedicated efforts and all of those areas. And Topps is just the start though, right? We this is a good start. But but it's just the start of what we need to do. So we really do appreciate the community participating in this discussion and helping us dot our way forward. So thank you all again, man, maybe get a bond I handed over to you, and have a good day.

Y Yvonne Ivey 11:37

Thanks, Kevin. So I have the honor to sort of introduce our incredible group of community panelists. I think you have seen in a lot of our communications, we had almost 400 applicants applying for our first NASA transformative open science panel. And we were only able to select 15 Folks, that I kind of want to pause for a moment to quickly point out that two of our representatives are not able to join the panel this week due to prior conflicts. And so in the place of Dr. Kelly Cruz, we have Hans good there, representing Kelly Cruz from Astro pi. And in the same case for Dr. Corey Jordan, who represents the carpentries. We have Dr. Sharon hunt, representing for that group today. But I'll sort of kick this over to our community panelists and have them actually introduce themselves. We selected a fun little game where they'll have to describe themselves in three minutes. We tried to do this ourselves, and it was a little bit difficult. So I'm happy to kind of see what our panelists can do with that. And so if we could go to the next slide and have folks begin introducing themselves. If you are in on the community panel, you should have been moved up toward the panelist section. So feel free to come off mute in the order that we have names listed. So first, I'll sort of kick it off to Jim, if he wouldn't mind, you know, coming off mute and introducing himself.

J Jim Colliander 13:38

Thank you very much. If I'm My name is Jim Colliander. I'm a professor of mathematics at the University of British Columbia. And in a previous role, I served as the director of the Pacific Institute for the mathematical sciences. And while I was serving in that role, I established a Jupiter hub service with help from some fabulous collaborators nationwide across Canada called Syzygy. And I also again with fabulous collaborators established an open education resources platform called Callisto spelled with a why. And Callisto delivers Jupiter backed education resources for students and teachers in grades five to 12. I volunteered to work with NASA tops, because I find the leadership and work of that shell is springing forth to be truly inspirational. And I think that openness really does have the potential to transform the way that we discover new ideas, the way that we train new scientists, and the way that funders can get a better return on their investment in science. I'm really excited about participating with all of you. And I look forward to learning together over the coming years as we unfold this change in the way that we do science. How'd I do? Am I under three minutes?

Y Yvonne Ivey 15:00

Thank you. So with that I'll sort of move on to Hans.

M Moritz Gunther 15:07

Yeah, I'm not carried proofs on my hands go into our hands more, it's good. I usually use my middle name. I'm an MIT. But I'm really here to speak for the Astro Pi project. And so the Astro Pi project is started as like a ground up software development effort for Python in astronomy, therefore, Astro pi. And while I think it's unfair, it would be unfair for anybody to claim claim to speak on behalf of the project without vetting the verb. There's all the community, there's all the people who are contribute contributing to that, we do have a group that we call the

Coordination Committee on which gala is on. And I'm too. And so one of our tasks was to act kind of as the outward phase of astropay, to the rest of the community, community. And so that's, that's why I'm here today. I am an astronomer, as most of the people in Astro pi Oh, that's why it's astronomical software. And they believe astronomy has been not as specifically NASA astronomy missions have been a great example on how to do open data for a very long time. astropay is a good example on how open software works. But I think we also community that we can see that challenges are what doesn't work that well. And when maybe NASA can support us in some way. So I hope that we can carry that into into this panel and see what both sides can learn from that. I'm going to refuse to answer the question, why open science because I think it's posed the wrong way round. If people don't want open science, I should justify why science is closed. Or vice versa. Science should be closed, although in practice, I mean, I My feeling is that in practice, many people who have closed signs unnecessarily there's a large group was closed signs, because they're missing the tools and resources. Yeah, mostly the tools to make it as open or as easily open as they want to. And I'm sure that's something we'll get a night.

Y Yvonne Ivey 17:12

Thank you in under three minutes. All right. Well, we'll kick this over to Monica.

M Monica Granados 17:19

Thanks, Yvonne. I'm Monica Granados. I am the open climate campaign manager at Creative Commons. And I'm also on the leadership team at PRI review. So the what I'm doing at Creative Commons is trying to make climate change and biodiversity research more open. And what I do with the wonderful team at PRI review is making the review of peer review more open and more equitable. So why did I volunteer with NASA tops? I think for a really long time, open science was really like siloed. And people sort of were doing it in like small communities, you know, within your own institutions. I love that NASA is taking this initiative and investing resources, personnel, financial resources to bring all of these people together. And having that platform is really essential, I think, to moving us forward to making open science the default. So I'm so happy to be a part of of this, like big movement towards open science that I think people will get on board for. And why open science. I mean, I really think that it's a moral imperative. The world's knowledge belongs to everybody. And we have to make it easier to make that knowledge accessible to everyone. Regardless of what geographical area you are, what education level you're in that science and just knowledge is more open and more accessible.

Y Yvonne Ivey 18:56

I love that my read it down so I can steal that for later. All right. So with that we'll sort of move to Kelsey, it looks like we don't have Dominique on the meeting right now.

K Kelsey Hightower 19:09

Awesome. I'm Kelsey Hightower, Principal Engineer at Google Cloud. I work on a lot of our cloud platforms, mainly these ones that are backed by open source projects like Kubernetes that Go programming language, etc. Why did I volunteer for the NASA TOPS program? I'm a taxpayer

programming language, etc. Why did I volunteer for the NASA TOPS program. I'm a taxpayer. And as a taxpayer, I would love for the organizations we help fund to be as efficient as possible. And open source is just one of the things I've been contributing to for 15 years. And I think we've managed to out class even the enterprise proprietary space, by working together and sharing our results that now underpin many of the things we've seen in the tech industry. And when it comes to open science, I can't think of a better way than to democratize another area to bring more people on board to do the same thing.

Y   Yvonne Ivey   20:02

Thank you, Kelsey. All right, next up is Pinyon.

P   Pen-Yuan Hsing   20:07

Thank you. Yes. I'm really excited to be here with you today. My name is Pen-Yuan Hsing, it's a complicated name. So you can just come the Pen, as most people do. My original background is in academic research in the field of ecology and biodiversity conservation. And I've been doing this for more than 10 years, during during that time, I started a citizen science project for a wildlife monitoring. And doing citizen science really challenged my preconceptions when it comes to the institutions of science and how science is done. And after that, I've also become a really active member in all sorts of open source communities. For example, I was among the first to receive certification, from the Creative Commons on open source licensing. I do my postdoctoral research in a project called open nuxt, funded by the EU, on how people work together on open source projects. And I am a elected community councillor, for the gathering for open science hardware, which has, which is a global network of people working on the hardware side of things and making open science work for that. And during this whole time, I've obviously been a strong advocate for open science, including contributing to the UNESCO recommendation on open science that was just ratified by the United Nations in November of last year. So why am I here today? Well, first of all, I think science is a fundamentally iterative process where we are always building on what came before. And because of that, we have a responsibility to this process where we also have to share everything we've learned to everyone else. If we don't do this, then I think we're just doing alchemy, and I don't want to be an alchemist. So open science, I think is a necessary condition for doing good science. And when faced with all of the global challenges of today, we don't have time to wait and only open science will allow us to meet those challenges. So two reasons why that brought me to Tufts. One is that NASA has really, really high global visibility. So I think when NASA does really good open science, it can be an example for people across the world. And the last bit, is that I think there is an unfortunate trend right now, where a lot of people think that space is like a playground for billionaires and oligarchs. I happen to disagree with that view. And I hope, therefore we achieve together or two tops will show how the amazing science done at NASA and other places can be valuable and indispensable for all of humanity. So that's why I'm here today. It's a great honor. And I hope to learn from all of you. Thank you.

Y   Yvonne Ivey   23:02

Thank you. So next up, we have SherAaron.

SherAaron Hurt 23:09

Hey, hey, hey, everyone, I am SherAaron, you can call me Shar. I am in Detroit, Michigan. I am the director of workshops for the carpentries and I am here in place of our executive director, Dr. Kari Jordan. Why did we volunteer with NASA top. So in the carpentries, we teach NASA scientists and researchers how to analyze data using open source software. And from the time of our inception, we have grown tremendously. We focus on community building, but also curriculum, developing curriculum, but also making sure that you know, novice researchers and scientists that they don't have those barriers to you know, make it while they're in teach as teaching assistants or, you know, in their careers. And so for us being a part of a group of this caliber will allow us not only to share, you know, our resources to share what we do, but also to help us scale and to grow in a fashion that is applicable to the community. So not just you know, the carpentry is but what's happening open science all together. And why open science? I'll tell you, for me, I kind of stumbled upon open science that is not my background. However, starting with the carpentries four years ago, I absolutely love it. It allows you know, when I think about open science, it allows us to be a team, you know, it's community. It's collaborative. And you know, it's almost like no secrets and I'm a team player. So for me, this is always a fun thing. So it is it's not reinventing the wheel. A little secret I love to tell people when I first started with the carpentries I was so far removed from open science, data science. I thought that the shell screen equated to the blue screen of death. But now I know definitely that that's not the case. But it's definitely an honor privilege to be here today with everyone.

Yvonne Ivey 25:15

Thank you for that. Next step, we have Logan.

Logan Kilpatrick 25:21

Awesome. Hey everyone, how's it going? My name is Logan Kilpatrick, I am on the board of directors at an organization called them focus, which is the nonprofit behind a bunch of open source projects that you all are likely familiar with, like Jupiter pandas, NumPy, the Java programming language, which I'm also the, I lead advocacy for over education, partnerships, outreach, stuff like that. So really excited to be here. And I think the reason why I wanted to volunteer with NASA tops, I think my career actually started at NASA, I was an intern and a contractor at the NASA Ames Research Center. So I got a bunch of really amazing experience there and got to sort of experience firsthand, you know, some of the places where NASA was doing open science, some of the places where it wasn't. And I can vividly remember, you know, at the end of a NASA internship, a huge part of it is this poster presentation and the people at NASA, you have to go through all these meetings and approvals to like have your poster finalized. And they tell you at the end of this poster presentation, that it's actually a federal crime for you to take a picture of the poster in which you create as part of your NASA internship. And I think that sort of opened my eyes to you know, many years ago, like, hey, there's actually all this amazing stuff that's happening that's as healthy said, funded by the taxpayers of the United States. And to be really amazing if all this work and all the science that was being created can be shared publicly and available to everyone. So I think it's, I think someone else said, it's a moral imperative for open science to happen. I completely agree. I think it's, you know, there's so much amazing stuff happening at NASA and other places. And it's, it's really sad that it's not open to everyone and accessible to the world. So I'm really

excited to help sort of push that initiative forward. And I'm also really excited. There's so many people from the from the open source scientific computing ecosystem, here today, and this will be a ton of fun. So Thanks for Thanks for being here.

Y Yvonne Ivey 27:13

Thank you. Next up, we have Brian.

B Brian Nosek 27:19

Hi, thanks for having me. Here. My name is Brian Nosek, I am a faculty member at the University of Virginia, and executive director at the Center for Open Science. My background is, as a psychologist, my substantive area of research is implicit bias. If you've been to the project, implicit, or Harvard website, where you can measure your own biases, that's what I created in my first stage of my career. And the core interest from that is in the gap between values and practices, we may have intentions and ideals that we want to behave by, but we end up behaving according to other things that are a consequence of thoughts and feelings outside of our awareness or control, and the systems in which we are embedded that may encourage or sustain practices that are quite contrary to our values. And wow, the psychological research focused on social features of that racism, sexism, homophobia, etc. When we launched the Center for Open Science, it was taking that same lens to apply to scientific values and the gap between those and what is incentivized in the culture for scientific practice. And a big part of that is the recognition that we are rewarded for things that are not necessarily aligned with what we're trying to do in everyday science, be open, be reproducible, provide confidence in findings. Instead, it rewards based on exciting results, novel results, suppressing negative results, etc. And so the core interest that we have organizationally is to promote openness, integrity, and reproducibility of research. The reason that I'm excited to be part of the Topps effort is that the real challenge for any system change is coordination. There are many different stakeholders and science is highly decentralized. And so the only way that we will create a culture that is aligned with the values that we have for it, is by working together as a community, a collective action to realign those incentives and reward systems. So that openness is not just something that we do because it's a good thing to do, but it's also what the culture reinforces and, and supports. So thanks very much for having me.

Y Yvonne Ivey 29:48

Thank you. Next step, Fernando.

F Fernando Perez 29:51

Hi, Vaughn. Thanks for having me. My name is Fernando Perez. I am a faculty at UC Berkeley in the statistics department. I teach courses in data science and act we open science and group risk research and particle theorists by training. And I am a co founder of Project Jupiter, which kind of evolved out of a project that I started in grad school, I Python and a co founder of non focus. So it's great to see Logan here and with my colleague, Jim Calliandra. himself earlier, we are also co founders of an organization called to A to C, which tries to provide open source

based infrastructure for research and education. And I'm gonna answer the next two questions kind of in the reverse order. Because, for me, open science is what has made my life possible I did my undergraduate I grew up and did my undergraduate work in physics in Colombia, with very limited access to scientists scientific literature and resources. And it was only because the archive had been created by physicists that I could at least access scientific literature, despite our limitations in Colombia, later in graduate school, IPython NumPy. Well, in America at the time that populate the scientific Python community, is what made my entire career possible. I couldn't be here if it wasn't, because some people embraced open science ideas early on before me. And they provided a community that combined technical work and community work to make that that path possible. So for me, science is not about learning. It's about participating in discovery. It's about being actors, not just being consumers. And that's what that community enabled. And why I volunteer for NASA tops. Because the work that chelle and Kevin and Yvonne and the team are doing is basically my dream come true for 2030 years, we have been fighting these battles, often with not just limited resources, but active dis encouragement from senior folks in our fields, that we shouldn't be doing this and that we should just play the game and go back to what doing real work. And you folks have really embraced these ideas with a holistic perspective that we hadn't seen up until now. That includes the technical work, the educational work, the community work and the governance aspects. And it's a privilege to be here. I see a lot of new faces that I'm excited to learn from, and thanks for having me.

Y Yvonne Ivey 32:14

Thank you. Next up we have Malika

M Malvika Sharan 32:18

thanks everyone. Hi everyone. I am Malvika Sharan, my pronouns are she first, I'm a senior researcher at the Alan Turing Institute, where I work on open research and community building in data science and AI. I co lead the Turing Way Project and open source open collaboration and community driven handbook on reproducibility data science and research. I lead a team of community manager and collaborate with domain experts in the Tyrian way community that represent represents over 20 core members over 300 co authors, and 1000s of project users from around the world. Our mission is to involve and support a diverse group of researchers in making data science reproducible, ethical and collaborative for everyone. I'm also a co director of open life science with my extremely supportive colleagues. Open life science, or OLS is a training and mentoring program to apply open research practices across different projects and local communities. As we have already heard, we all are positioning openness very differently and apply openness in our work in a different context. For me, open science is a way to create global opportunities for collaboration, democratizing access to knowledge, and ensuring inclusion and all the work we do. The goal is to work in solidarity with researchers across the global south and north, and collectively advanced, responsible and quality research practices that benefit the society. I hope through my participation in the NASA tops, I will be able to bring experiences and lessons learned from working with several communities and projects in open science. Some areas of discussions and activities that I am really excited about are around capacity building and community engagement. Furthermore, incentivizing working in open and not purchase perpetuating exploitative nature or culture of free labor, in volunteerism. I know that sitting in this panel is a huge, huge privilege. And I would like to use this opportunity to

share knowledge that NASA tops gathers more widely. Most importantly, my intention here is to also fairly represent collective efforts from champions in open science, who may not always be represented in the room and advocate for interests that are marginalized in open science. Really excited to be here. Thank you so much for having

Y Yvonne Ivey 34:35

me. Thank you. Next up we have Gloria

G Gloria Washington 34:45

Hello, everyone. So my name is Gloria Washington and I am an assistant professor at Howard University located in Washington DC. And today I just am going to tell you about my really quickly about my research group and why I volunteered for this Topps program. So I lead a small research group at Howard University called the effective biometrics lab. And we are really concerned with giving voices to marginalized individuals by answering specifically for questions, who is that? What do they feel? What are they thinking? And how are they going to react or behave? And what can we possibly build through technology to positively impact their feelings without harming them. So I'm excited to be a part of this initiative. Because in my lab, we focused on projects, as mentioned, that can help humans become better. And specifically, these projects relate with identifying racist, micro aggressive or socially biased language that may sometimes be prevalent in everyday human conversations, and developing technology to culture so that we can possibly get away from that. And I think that this initiative that the tops initiative is very important, because being an HBCU, like Howard University, one of the things that we were founded on was open science. So some of the top researchers and scientists who you guys have possibly thought of before in the past, Charles Drew, George Washington Carver, were all the originators of open science, everything was available to everyone. And if we think of like, what could possibly have happened to society, if these types of things that they developed or patented or not given away to the public, we will truly be at a loss. So at a faculty member at a HBCU, I think it's very important for me is to keep that sort of tradition alive, to expose my students to the Open Science Initiative. And also give them access to top projects, data sets, AI data science that they can possibly use. And I just want to make sure that I am a contributing member. So if you are interested in any of the things that I'm saying, please reach out to me GLORIA That washington@howard.edu And also on this panel, thank you so much.

Y Yvonne Ivey 37:16

Thank you. Next we'll go to Shu Xiang. Doctor, Washington, in Woodley are unable to join today's meeting.

Q Qiusheng Wu 37:30

Hi, my name is Quisheng Wu. I'm a faculty member in the department Geography at the University of Tennessee, Knoxville. And so for the two questions, similar to Fernando, I'd like to answer why open science first, because I'm an advocate of open science and reproducible

research. And during the past few years, especially after the pandemic, I've been actively involved in the community and I enjoy creating tools, packages, tutorials for the community and making it free and accessible. And so I create some of the Why did the package? Why did he use packages in the geospatial community for example, G map, live map and geospatial. So those are all built on top of the open source and Jupiter ecosystems. And so some overall packages have been way wider use and go I think over 1000 github stars and I also create a lot of video tutorials, teaching people how to use intake, mapping geospatial analysis, so go like over 20,000 What's our so everyday goal over is 5060 hours of people watching my tutorials or learn how to do and geospatial cloud computing and also open source software development and assume believing open science because we can communicate come together we can fix things that we are not able to do, we will use closed source software, for example, somebody and GSM software because you are waiting to find a bug and then you might never hear back from the company to fix the issue. So I'm happy that we can work together to fix things quickly. Especially the Jupiter ecosystem. A lot of active participants that if you have any problem people can help you out. Ask questions on Twitter, you get the answers almost very quickly. So and there are a lot to learn from the open source community in terms of the soul question why to volunteer with NASA tops and I'm so inspired by share shell because she's doing fantastic work in the community and and always sweating things that you commonly will not see for exam multiple people working in the government agency. So, for example, she'll share her experiences where even for example, proposals they will rejected by NASA, but making those things available that we can learn. And also, for example, just like for the NASA tops, everything is on GitHub, you can contribute. And also several examples as the PowerPoint for today, those things you don't really see in government, SSC, meeting or seminar, or in or even in academic institution. So I'm truly inspired by her leadership. And I want to be engaged with the community and also contribute to the movement of the open side, our open, open science movement. Thank you. Thank you.

Y Yvonne Ivey 40:49

And again, thank you to all the community panelists who joined today. And for those who weren't able to join due to various conflicts, we really appreciate you all taking the time to not only contribute to our mission, but also the broader community's involvement with open science. So with that, we're a little above schedule. And I want to sort of open this up to the panelists, if you wouldn't mind sort of turning your cameras back on. And either wanting to share either a, a further story around sort of some challenges or areas of opportunity around open science, which we're looking forward to bringing to our panel over the next three days. Or I see the chat is a little active. If folks either heard something from another panelists and wants to sort of either pose a question or extrapolate on something that they said, I really want to really get the panelists involved in this, we don't want to just talk at you, over the next three days, we want this to truly be an opportunity for us to co develop with you. Because I think, as Sean said, so beautifully. I think we're all inspired to engage and work together on this incredible mission around open science and the folks who are experts and have been doing this for decades, we are holding space for you and wanting to get on board with the work that you've been doing. Because I think I can speak for Shell in this we are truly inspired as we were reading through all of them, almost 400 applications. I'm in awe of the work and the passion and the drive that y'all bring to the table. And so I'm excited to learn from y'all. And so with that, would anyone like to come off mute and either share anything I'd see

chelle gentemann 42:51

Kelsey has his hand up. So maybe we can go to him. And this is just again, I want to double down on what Yvonne said, we were most of you are not from NASA, or haven't been funded by NASA for 20 years. And part of what we're so excited about is to bring you all together. When we're reading through these resumes, we're like these people have to meet each other, because they're all so amazing. So I'm gonna let Kelsey talk. Thank you.

K **Kelsey Hightower** 43:20

Yeah, I will say this, you know, I've been on a couple of advisory panels for, you know, companies or organizations doing, you know, work in the open, the University of Michigan has a large National Science Foundation grant to do reproducible research. And I think one thing you know, about all these initiatives, we can't forget the user experience component. You know, like, even though you've threw all this stuff on GitHub, even if you put all the data in some assessable database, a lot of times it's not accessible to the average person, they don't know what to make of it, right? You could put all the machine learning models up. But I think we forget the user experience, what are people supposed to do with this data? Where can they build on top of, I think there's a lot of education that needs to go into, like helping people read the results of this data, what's behind it, what's the motivating force. So I'm hoping that as we go to not just do open science, but to democratize it. And in some ways, there's going to be opportunities to productize it so that other people can just take the research continue building from there, versus having to rewind the clock on their own careers and like, Oh, now I need to become a data scientist to even consume this information. So I'm hoping we can just push that bar to that next level to go beyond just the polarity outcomes of most science research.

Y **Yvonne Ivey** 44:43

Thank you, and I can't see hands raised. So

👤 44:45

I'll go.

M **Monica Granados** 44:50

So just to add to this, that this idea of like we have to bring all these people together. It's one of the things that I really am looking forward to being as part of this panel that there are people here that I haven't met? Generally, like the Open Science spaces is small and like we a lot of people know each other. So I love that that sphere is getting bigger. There are some faces here that I don't know. And I'm looking forward to talking about, like, what has worked well, amongst these, you know, these this diverse group of people and group of projects? I think we've talked a lot about What are barriers to open science? What are reasons why we're not doing open? And I'd love to, to shift a bit and to talk about where hasn't worked? And what are the things that have worked? And how could we make those things easier? And, you know, it often will may require resources, maybe it requires outreach, but to sort of identify where, where it's

been working, because I think we've done a lot of thinking already about what the barriers are, I would love to sort of shift to, you know, how can we let's overcome these barriers? And let's see where, where we have and when we've done well,

K Kelsey Hightower 46:04

I'm still at what is open science, you know, I know what open source is, right? Open source software, you know, it's a lot like normal software software, there's a very collaborative model, clear governance, we have this concept of reproducibility, anyone can build that software. And sometimes we even manage that software to make it easier for people to adopt the use. So when I think about Open Science, I'm thinking like, yes, maybe there's people that are publishing their science in real time, versus before it's gone through all the peer feedback. So maybe early in the process. And in my mind, I'm thinking there's some form of reproducibility, like, here's what you need to reproduce these results? Is that what open science is? Or could someone kind of fill in the gaps of what I'm thinking here?

chelle gentemann 46:48

So, Kelsey, this is great. Are you in? Okay, so we're, we have a slide coming up to sort of set the stage for that what we're defining open sciences is accessible. So you know what, what you just talked about earlier was sort of lowering barriers, making data software and publications more accessible so that you don't run into a paywall, you have access to software, you have access to data, and you don't just have access, let's go to the next stage and really make it accessible. And that's software, right. That's where you put it, that's how you access it. That's the software tools, that things that groups in the people in this community have helped with, like Fs spec, and X ray, the NetCDF data standards. And so we first we talked about accessibility. Next, we talk about reproducibility. And with that we want to be using, there's a lot of proprietary tools out there. And if you're doing science with proprietary, you know, commercial off the shelf tools, like Fernando said earlier, it makes it very difficult for other scientists to build on your work. So we want to be using tools that are open frameworks, open software libraries, on open platforms, that you can then create reproducible science, those two things then work together, so you have accessible and reproducible, that creates a more inclusive science, where we're broadening who is participating in science. And you're, I think Fernando said it again, we instead of just being act, you know, consumers who start to become actors and participating in science because it is accessible. And that by just it expands, you actually have a seat at the table. And that table becomes much larger and. To doing even science, and just expand our community, it using open science as a tool to do that.

K Kelsey Hightower 48:54

I have one quick follow up there. In the open source community, I think the other thing that makes it really go is the accessibility to the people who create the project. So my next question will be, how accessible are the scientific forums where the talks are happening, where the work is being done? And then the people behind that word that can add that additional context? Answer the questions and the nuance behind it all?

chelle gentemann 49:19

I think a great question. And Kevin is where he talked about opening up our assignments needing a lot of time has been happening, people email code back and forth, rather than using GitHub. They're sharing it and they're open, but they're not sharing it in a way that's really allowing people outside of their circle of colleagues to participate. So one of the things that we're working towards at NASA is to call for all of the meetings to be open, open to participation, recorded people, people were trying to open those doors, but also recognize just opening the door or isn't enough, that's not just saying, you know, come into this environment that hasn't maybe been very friendly to people on the outside, but open those doors and then try to actually go outside and meet people where they're at. So opening the software, opening the data, and opening access to the scientific process. And I think Pena has his hand up.

Pen-Yuan Hsing 50:24

Of Thank you. Yeah, so Well, first of all I would love to be able to help do over the next couple of days is to have some level of discussion around the involvement of, you know, none kind of institutional, we're non traditional practitioners of science, in this discussion around open science by people outside of you know, NASA, or universities or research institutions. But to respond to the comments earlier about what it means to be doing open source open science, I think a really important thing to to, for us to remember is that, for us to do all of the things we want to do, right? They are underlined by, you know, the basic freedoms, allowing other people to, you know, make use of the open sense outcome. Learn from it, build upon it, and continue to share, right. But I think it's important for us to keep in mind that we unfortunately, live in a very restrictive legal environment, where everything is restricted or presumed to be closed source by default, or unless you use open source licensing to explicitly you know, give other people those freedoms, then it is actually, you know, criminal to do open sites. So I think, this kind of policy and legal environment, that is, in my opinion, unfortunately, a barrier to being good open science should also be an important part of our discussions over the next few days, and weeks and months.

chelle gentemann 52:01

Thank you so much pinion. And so I see that Steve Crawford has joined. And, Steve, do you want to jump on and talk about that a little bit? Steve, do you want to introduce yourself?

steve crawford 52:12

Hi, everyone. And yeah, once I'm Steve Crawford, I'm the science data officer as part of the Science Mission Directorate, and helping with the overall open source Science Initiative. We'll be talking more about policy, I believe, on Thursday. And so I'm not going to go and delve too much into it. But I think, you know, you're absolutely right, we have to actually look at all the different angles and and different applications. And I think, you know, one thing that will be important for tops is including the aspects of training, you know, it's an area, you know, my background is, as an astronomer, things like open source licenses, and open, or even copyright terms is not anything I ever got training on during my graduate career or any other period of time. But these issues can can come up and be very complicated. And so you know, how we,

you know, what is the level of information scientists do need, and do need to consider when they're when they're handling this, but I'm also very happy to continue this conversation on on Thursday, at least, I think it's on the agenda on Thursday. So

Y Yvonne Ivey 53:22

thank you for the sneak peek, Steve will be joining everyday, but also, we're holding time on Thursday to really dive into how NASA is looking at policy and kind of some of the shifts that are currently happening and where we're going forward. Um, and so we'll also have a q&a afterwards. Sort of being in charge of moderating today. I am going to shift this into our break so that we stay on schedule. Thank you all for kind of jumping in. I know we didn't have this on the agenda, but I think the questions and the conversation that's been happening over the past 15 minutes has been incredible. So with that, we'll shift into a quick 10 minute break. And we'll see you back at 110

chelle gentemann 1:04:34

Hi everyone. Welcome back. Let me turn on my video. There we go. Okay. Thanks so much for joining us. I hope everybody had time to grab some tea. And now I'm going to give a short introduction to tops. So this was actually exactly a year ago. So if you look At the Google the version history on this document, on May 7, I was frustrated, not as frustrated as some of the people who have been doing open science for decades. But still, in my own little short way, frustrated. That morning, I had been on a call with a group of European hydrologists, and open science researchers, we had all participated in an open science section, like a special session at the European Geophysical Union the previous month, and someone said, Hey, let's continue this conversation. So they organized a call for May 7. And on that call, it was really interesting because it was scientists from the US scientists from Europe, I'm not sure that any scientists from Asia were present. But everyone was just sort of struggling to do open science within their institutions within the framework of science. And on that call, we were sort of all throwing around ideas and brainstorming about how to advance open science. And I said, Well, hey, like, let's have a year of open science. And so that day, like starting at five o'clock, I started writing up this idea about how we might work with societies and federal agencies and what we could do to have a year of open science. And that was actually exactly a year ago. Oh, I'm sorry, go back, please. I didn't see that change. So I may at the next day, I happened to be on a call, I was part of a funded research for impact, which is the inner agency implementation and advanced concept team at NASA. And there was this weekly call, and I sort of mentioned this idea. And Kevin Murphy happened to be on the call. And he said, Hey, this sounds really interesting. Let's create a meeting next week to brainstorm a bit around this idea. And I needed my short write up to have a name. So I was like, Okay, let's call it transform to open science. And the next day that document was sent out to the group. And, and so that, we started brainstorming, and immediately I was told that to 22,022, you're just completely dreaming. We got to talk about 2023. So we compromised on 2023. And now a year later, go ahead. We have this wonderful project, this wonderful team. We have Yvonne who you've met, we have Cindy all who's our community coordinator, and Carla Mastracchio, who's our communication strategist. AGU is partnering with us to develop open core curriculum. And you'll hear about that tomorrow. We have this whole plan with four areas of action. And this project now called tops that has a snazzy logo and GitHub presence and a webpage. And I just, I just wanted to sort of pause like in a year, we've sort of really brought this all together. And it's been, it really

was inspired by the work that everyone in the open science community has done over the past two decades. And part of the reason that we were able to create this project so quickly, was because people have been openly documenting all of their research and all of their ideas and plans. And we were able to go to national academies reports to the UNESCO draft recommendations, which the UNESCO draft recommendations essentially set out a work plan, like, hey, we know open science is great, here is all the different things that we need to do to advance it. And I really, that document had a huge impact on how we started developing this project. So what is open science, this is what we were just talking about earlier with calcium. So this is this accessible, reproducible and inclusive. And that's those three parts that we really see to open science. And there's a lot of different definitions out there. This is what we're using. And we like to talk about the sort of inner circle and outer circle, because there's open data and open software, but you can also go further and you can make it fair, which is findable, Accessible, Interoperable and reproducible. You can make it open access to scientific publication and information. And this is part of exposing that hidden knowledge, and the reproducible and the inclusive, like I discussed before in this. This is just so important because it creates research that is cited more that has a bigger impact. It increases transparency in science, and it generates more scholarly collaborations. It expands who we're working with. And this inclusive science means more collaborative projects. Really, really critical this access to hidden knowledge that as scientists sometimes when you're on Lean inside, and you're existing in this castle, you just don't even recognize how much access you have to knowledge that people on the outside don't have. And this all works to create more equitable systems, and increases participation in science. So NASA has this open source Science Initiative. And that's what Steve Crawford is the Program Executive floor. And Kevin has really been putting together this comprehensive program. The idea is to build like Kelsey was talking about this open source software. And he knew what that was. And we sort of wanted to take that and say, all of the success of open source software, the way that it opened up the process, broadened community, increased accessibility, and facilitated inclusion, let's take that open source and activate it within science. And so this is our way of making open science to activate it to put it into practice. And we also want to recognize some people who already talked about some of the barriers both in policy or within their institutions, to sharing data to sharing software's financial rewards for publishing. And we want to recognize that open source science like open heights, it's really a continuum, there's never just a box that we're going to check and say, okay, everything we do is open. And what we found is that what open science means varies hugely across all the different communities that we've been doing outreach to and engaging with. And for some communities, open source software, you know, they do that, and they're great at it. But maybe their data isn't so open, or they don't share so much of it, or it's a little restricted. And we like to say as open as possible, as restricted as necessary, as there are some things that can't be shared because of export controls or privacy concerns. But we just want to keep continuing moving to the right to becoming more fully open. And as we celebrate all of those steps moving to the right. And as we reward and recognize moving from siloed systems into open systems, accessible systems, we really do want to reward and recognize all of that work, because it is work. And we want to do this now. And we've talked about this a lot in the project. And there's so much there's people on this panel who I think have been doing this for decades. And they've been working either within open software or open science. And we need to do this now. Because we're facing some really big challenges we saw within COVID, that the science that was open really helped us find a vaccine quicker, it helps save lives. We also are facing climate change. This is really critical, big problems that we can't solve alone. And we know, we know we need more people more hands or eyes, more brains, with diverse experiences to participate so that we ask the best questions to find the best solutions. And we know if we don't have those diverse people in the room, and those diverse voices, we're going to ask questions, but they're only going to be reflective of our experiences. And we want them

to be reflective of a broader experiences, that we get solutions with broader applications. Open Science really does this because it accelerates the pace of science, it increases the impact of science, it expands applications of data and science, especially through partnerships with commercial companies. And it shares hidden knowledge and expands participation in science. We want to do this now. Because it's not just that there's COVID and UN Climate Initiative, there have been a decade of people developing open science, publishing open science ideas, working towards opening policies, creating this, you know, playground that we can now do science in. And it's this two decades of work, that it seems to be coming together now. And it's coming together now because we really have the tools. I mean, we have Fernando Perez, right, so Jupiter on this panel, and I want to thank him and everybody else who's working in open source because we're making open science a reality. And it's these advances in technology that have really, all of a sudden opened up this world of accessible, reproducible inclusive science, also at a scale with cloud computing and access to cyber infrastructure that just really wasn't available to the general public until quite recently. Now through cloud computing, science can be done at a scale by almost anyone. And then this just wasn't possible a few years ago. There's this national implement global momentum to the move to open science. And there's this we know equal and oh and access benefits the public. And NASA is really taking this and trying to create momentum around it. So Kevin Murphy has the open source Science Initiative. And this is Steve Crawford as well. And Katie Baines is Deputy and Kevin's deputy. This is the idea of what we've talked about today. It's not just saying, hey, everybody go do open science. Because we know that that doesn't work. We haven't done the policy development. So everyone does science within some sort of ecosystem. So Steve Crawford is leading the charge to update the NASA Science policies on scientific information to enable the activation of open science. And we hope to see that spread across other institutions and agencies. Kevin Murphy is working right now with Elena Stephanopoulos, Elena Stephanopoulos to develop core services for science discovery, developing core data and computing services to enable open science. This is the computational resources that we need more people to have access to. And the roses elements. So roses are NASA competitive calls, this is how we get money out to the community. Roses elements are available now that are supporting open source software, tools, frameworks, libraries, and supporting the training for open science with over $5 million in grants per year now. And the final piece of this puzzle is the tops it's the transform to open science, it's the community to building the partnerships, the trying to coordinate and work to change the culture together. And to accelerate the adoption of open science. We know we know that science is moving to open science, and it will happen over the next couple of decades. So let's just push a little bit. Let's try and do it in five years. And I'm gonna pass it to you. Thank you.

Y Yvonne Ivey 1:16:58

Thank you shout. So with this, we'll move into sort of the transform to open science areas of action. So shell sort of set the the scene, the sort of providing the overview of what Topps is and kind of how we aligned with NASA's broader open source science mission. So I think many folks are asking, So what's next? What are we going to do? Next slide. So Topps is a $40,000,000.05 year NASA Science Mission Directorate mission. Our objectives are to increase the understanding and adoption of open science, accelerating major scientific discoveries and broaden participation by historically underrepresented communities. Traditionally, left out of the science process, we are kicking off and designating 2023 The year broken science. So buckle up this five year initiative, which we are calling a mission, because of the level of importance it is to NASA science. We have major goals that we intend to meet by 2027. So 20,000 scientists, regardless of where you sit, and sort of the the scientific workflow, we're

aiming to have 20,000 of us earn open science badges. I'll talk a little bit about that in a moment. We're also aiming for five major discoveries across NASA Science domains. And so whether that's cross disciplinary work, interdisciplinary work, whether that's leveraging data that is already out there, we're aiming for five major discoveries. And then lastly, increasing the participation of underrepresented groups. We're aiming to double that participation. We'll talk a lot about this on day three, and really hitting on what we mean when we talk about doubling participation. Next slide. So how are we going to do this for 2023? NASA this year for open science, we're focusing on four areas of action, to uplift the Open Science, practices and principles across the scientific community. So we're aiming to really shift into engaging with the community through all of the major conferences, leveraging capacity sharing resources, we're looking to amplify the voices. And you can really look at our community panel who are on board for the next year to really dry if the work that they've been doing and the work that their partners have been doing around open science and kind of amplifying that. We're focusing on incentives. So how do we really sustain this effort and get a cultural shift and change across the science community across all levels, and then lastly, really pushing beyond 2027 and really move Moving toward more open across our data, our software, our access our community, our teams. Excellent. So the first area of action is engagement. We're having focused targeted community building activities. So leveraging all of the upcoming large science meetings, launching a tops open science curriculum, which we're calling open core. Having targeted outreach with minority serving institutions, whether that's through a Rose's solicitations, or various meetings and events and workshops, were focused on truly broadening opening up and listening to better understand the those barriers for a lot of minority serving institutions to really engage with NASA's scientific process. We'll be hosting monthly community forums we had our first last week. And we'll be doing this on a monthly basis. If there are topics, success stories, challenge stories that you think would be engaging and want to share with the community, please drop us a, a pull request on GitHub. And we're moving into discussions on GitHub shortly. So please tell us what you want to hear what you want to share. This is truly a shell mentioned and open process. And so lastly, we will be developing a website will folks can share and communicate with NASA tops. So the next area of action is capacity sharing. We'll be developing our open core open science curriculum, which will have five modules organized around the scientific workflow, I'm happy to announce that we'll be engaging with one of our partners at AGU on this effort to really have our open core curricula designed to really replicate the scientific workflow and really leveraging this incredible group of panelists to provide feedback around the framework and process implementation of this curricula. So as you can see on the slide, I won't walk you through all of the modules, but we're really aiming to educate folks on the ethos of open science, shifting into the open tools and resources. Then moving on to open software. Next step is open data. And then lastly, open results. We recognize that you'll, there's folks who have been working in the open for a wicked long time. And so we're aiming to have various levels of engagement around the curriculum. So folks can have a fast pass, maybe you've never truly taken a course on open science, but you've been actually working in open source tools. And so you can get a micro badge at every level, and sort of move through the process to complete all of the open core curriculum and get a badge and a certificate. We'll talk more about this tomorrow. But we're really excited about the development of this open core curriculum with this community panelists. And so a little bit more about open core. So open core will be hosted on Open edX, which is a high quality, interactive open source course. Many folks know them as MOOCs, Massive, open online courses, open core will be free, it will be open, it'll be made available to anyone who would actually like to engage with NASA science. There will be a base in a learning management system. So an LMS to track your progress, your completion, as well as provide analytics on your success throughout our open core. Our primary goal is to make this as easily discoverable and accessible for all we realized that there are already enough barriers to entry into the scientific process. And so we're looking

to take a sledgehammer to that throughout this entire Topps mission and really engage folks at various levels. So whether that's at one of our upcoming society meetings, our goal is to have a workshop and every society meeting, so that if you have a breaking your day, or maybe you show up early to the meeting, you want to take our open core, we'll make that available for you. But also, if you are a sort of individual learner in doing it at home, we'll make that available through the open edX course. We'll also have virtual cohorts. So if you're at a science team meeting And and you have a day where you can either do the open core in the mornings, or maybe we just have a day, we're looking to make this as easy as possible for for everyone, you know, earlier, someone said that science and knowledge should be for all. And so that's truly our core objective for this curriculum. And continue on sort of how we'll deploy the curriculum, we're looking to have tops champions, in looking at the train the trainer model, as well as how to truly have professors take our open core into the classroom, we'll have various cohorts, where you can engage with whether they're virtual or in person, but you can engage with other learners and really build that community around open science together as you work for your badge. We're looking into summer school, so June, July, August, September, regardless of where you are, in the world, really sort of standing up structured courses, where you can engage for six weeks through the modules, as well as looking into open competitive various opportunities to engage with minority serving institutions around the summer schools. Next, I'll sort of note that as the open core is very sort of focused specifically on open science, we are looking to expand our curriculum and make it more science, discipline specific. And so that's sort of our effort. We have the open core moving into sort of that next phase, but I do want to note that we recognize that a lot of our panelists and also community leaders and open science have discipline specific curriculum already set and so we hope to further engage with you through various roses elements, as chelle mentioned earlier in the slides. And then lastly, Hackathon is my favorite piece on engagement with the communities. Our goal is to have an engaged our data science community, and data engineers and computer scientists around our curriculum, getting folks together in a room to solve challenges and problems is sort of one of the more exciting engagement opportunities that I'm looking forward to, to jump on. So incentives, this is the fun one. So, you know, we were looking into how to truly create systemic change around open science. And so recognizing that, depending on what level you are in your career, recognizing that incentives means something different for everyone. And so whether you're early career, really pushing our building your CV and your resumes and looking at how do we structure the incentives for early career scientists, through badges and certificates, but also, our more senior scientists looking into the reward structure that societies can actually play a role in an establishing transform to open science, open science, prizes, and awards. So we hope to really work with our society partners. And many of them are on the call right now, to evaluate and update their existing award structured recognition processes. Again, the transforms are open science mission is very much focused on cultural systemic change. So we don't want to just show up and you know, teach folks about open science, our goal is to educate folks on the open science practices and principles and truly make this a sustainable component of how we do science on a global scale. And recognizing that the incentive structure is different depending on where you are in your career. I know for myself, getting a badge would be awesome. But I recognized for other folks, awards are awesome. So we're, I want to note that we're truly trying to be creative in establishing the incentive process. And then our last area of action is is really so once we've set up and established these incredible plans for the year of open science and how we're going to support the science community on being more open, where are we going next? And so as we look toward 2027, our goal is to really build the systemic changes in science that, you know, maybe in 2023, the requirements of who are doing open science, it might just be one person on that science team. But the goal is to every year as we're holding these open meetings and sharing some science and knowledge and being more collaborative. We have a reward system that's actually recognizing these practices. And more

folks on our various science teams are open science certified and truly having a process where it's required to have these open science certificates to work with NASA science data through our various solicitations. So I know I kind of sprinted through the slides, I will let you know that all of our slides will be made available as chelle mentioned, and you'll hear this over and over and over again, we are doing this all in the open. So bear with us, we're all learning how to sort of put ourselves out in the open and whether it's a messed up calendar invite, or a slack that shouldn't have gone out at the time that it went out, or, you know, a pull request that should not have been merged. We appreciate your patience, and collaboration in this. We're sort of embarking on new territory, as we support the NASA transform to open science mission. And we really appreciate you sort of jumping on board and being in this with us. And so I do want to sort of point again to open science results speak for themselves. Um, this is this is just a compilation of screen grabs of folks who have that we know are doing this work. But as you'll you'll see from our panelists, there are so many more voices that aren't highlighted on the slide. And so if there's something that you want to share, again, we don't want to just talk about the success source, we also want to talk about the barriers, we want to be as transparent as possible. And that's because we're all at different stages in sort of working toward this open space. And so please submit a pull request on our GitHub repo. We would love to highlight more voices in this and amplify the stories that are true. And so with this, I think we're moving into the discussion. Yeah. So

chelle gentemann 1:32:23

thanks, everyone. I hope I know that was a lot of information. The slides are available on Zenodo. We've been putting some links in the chat. And I wanted to jump in really quickly. So we're going to if you want to turn your cameras on, that would be great. And we'll have a group discussion, I wanted to answer a couple of questions or try to address a couple of questions that I saw in the chat that I thought we could go through quickly. First, I plans for engagement outside of the US. Yes, we have several international members on our panel specifically for that reason. Also, you know, this started with a conversation with European scientists actually. And I want to also point out, you know, one of the things that's great about working with NASA is science is international. But also NASA has been able to have relationships with other space agencies around the globe. And so those conversations have started with other space agencies to try and talk about open science with them. And it's, it's interesting, because again, just like different science communities have different parts of open science of their comfortable, different cultures, different countries have different parts of open science, that they're comfortable, but we were are working to start those discussions. And the scientific societies really play an important role there, again, because of their international membership in many cases. The next question was about having both summer and winter schools. So for the curriculum rollout, we're thinking to have in the summer is when a lot of university facilities are available to have summer schools, at least in the northern hemisphere. And initially, that's our focus. But we're going to be holding winter workshops all winter long at all different types of science TVT and society meetings so that the the material will be available at workshops to your round. And it'll also be available through virtual cohorts or just learning independently. And finally, the group crisis chat, I want to recognize our partner here AGU. But it's so important that we recognize that science is not done alone, and that we give credit, especially to the early career people that participate in our science and often aren't included on papers or in presentations. And we want to highlight those people who are doing the work and give them credit. And part of that is recognizing that this myth of a hero scientist, right. None of us worked alone. None of us we may all look like we're in a room alone now because of zoom. But I guarantee you that we're all on slack with our colleagues talking and working together. And

AGU just This year updated their fellow requirements. So if you want to become it's sort of a different level of a general membership. It's for the very top 1% of scientists, and you can nominate your fellow scientists to become a fellow of AGU not going to discuss the name. But if you want to become a fellow in the nomination process, now, you're asking about open science activities. And that it's these steps, right? We have to ask about what people are doing. And that is part of incentivizing it and recognizing it, and then rewarding it with fellowships. So fellowships, if we're saying that the best scientists don't need, we don't care whether or not they do open science. And that's a problem. And having AGU include that in their sort of rewards, and there is a great start. So now I want to open it up to the panel to see if you have any comments. And I also have the IO tool where I can give some questions from the IO to for discussion. Oh, and I can't see the hands up, I should look for hands up. So I don't see any hands. Oh, Leo, you have oh, that's a attendee. So you can't talk sorry. So I see Jim has his hand up. Sorry for not doing it in order. Oh, no problem.

J Jim Colliander 1:36:36

So I wanted to just complement the slides that Yvonne had. The, the way that the slides evoked exponential growth, from 2020 to 2027, was really subtle and encouraging. So the baseline here is massive. So the United States spends something like 3% of GDP, on research and development. So that's $600 billion dollars a year. And let's just suppose that these open science efforts, increased science productivity by I don't know, 20%, then compounded over five years, 1.2 to the power five is 2.5x. So the possible returns on investment here are truly massive. And my hope is that NASA has leadership efforts here catalyze a change in research and development efforts across the entire federal government. And then also, these international partnerships may be able to do the same thing. So we're at the beginning of something that can be transformational at decade, if not centuries scale. And I think we should pat ourselves on the back and get excited about how much work we have to do. Keep in mind that it's only been 75 years since the transistor was invented. So we have a lot of opportunity in front of us.

chelle gentemann 1:38:08

Thanks, Jim. I think Logan and then Fernando.

L Logan Kilpatrick 1:38:14

Yeah, I was just really quickly looking for some clarification on sort of how much of the tops initiative is really focused on sort of developing NASA as an agency's open science capacity versus sort of more broadly supporting sort of the open science community in general, I saw a bunch of things that yeah, I don't know if there's, I'm not looking for a right or wrong answer. I'm just curious about sort of the relationship and the balance there. But as far as resources and all that sort of stuff goes.

chelle gentemann 1:38:46

Yeah, I think that part of this is why we have the panel here. I don't think so NASA funds NASA scientists. But we can also use that funding to develop to expand who is in the NASA

scientists. But we can also use that funding to develop to expand who is in the NASA community, and who is able to use our data, because there are a lot of people who do science, who aren't directly funded with NASA. We want to encourage open, we can only encourage open science with the people that we fund. And we can require that with policies and funding incentives. But we do want to support the open science community. So what what's the best path for that? Because as a federal agency, when you come in and maybe give 100k grant to an open source software community that's been developed over the last decade and has a thriving volunteer, like what is the right way for NASA to try and support open science? And I think that that's a question like we're, we are developing this or putting the wheels on the bus. And we want to make sure that we have feedback from the community who's been doing this for decades so that we don't unintentionally disrupt something that is been incredibly successful. Does that help at all? We can figure

1:40:04

out your

chelle gentemann 1:40:21

to logon, I don't know if you want to say anything in response.

Logan Kilpatrick 1:40:25

No, that that makes complete sense. That to me, makes complete sense to me. Again, I think, as you mentioned, there's probably some stuff that needs to be figured out. But I think I, you know, I'm in, I'm in complete agreement. And I'm glad that NASA is doing this and getting this committee feedback. So I think it would have been easy to just sort of do it yourselves and not have the community around and involved in the process. So I'm glad that the decision was made to get folks involved.

chelle gentemann 1:40:50

Thank you. And we're really looking forward to the written comments that hopefully will come after this. So that's part of the panel sort of work is to provide some written comments. I think it's federal agencies maybe have a reputation of like, I'm the federal government, and I'm here to help. And we thought it was so important with this community to really reach out and ask for their help in developing this because, again, the efficiencies that open source has brought to software, we want to bring that to science. We want to expand who participates and we want to do that without disrupting the existing successful communities. I think Fernando I saw your hand up next and then maybe sharing your

1:41:39

your

Logan Kilpatrick 1:41:44

Fernando we can't hear you and your audio is making a weird, like I'm alarm is going off. Sounds like

1:41:51

your

chelle gentemann 1:41:54

computer over and over beer, beer, beer, beer, beer,

1:41:57

your your.

chelle gentemann 1:42:10

Okay, Fernanda is gonna leave and rejoin. So maybe Sharon, do you want to say something? Please?

Malvika Sharan 1:42:21

Would that mean me? Yeah. Yeah. So I actually really love the response question and response to Logan's question. What I was thinking that when we talk about Open Science, we're not really talking about a localized knowledge, we're really talking about what are the practices that can be transferred across different domains? And, you know, it's really great that you know, NASA is supporting I absolutely, you know, believe what you're saying that when you're funding someone, you can really give recommendation around what open science practices we would like to see. But I think through that process, if we can keep lens of how this knowledge and how this process can be transferred across different communities, I feel that that would be a great success for us as individuals from different communities. I really admire that you're, you know, very actively looking for feedback. And I see loads of charts from members from different parts of the world living in different parts of the world thinking about, you know, how this transferability nature of open science works in different places. So I think just keeping that mentality that even though we're talking about research happening in the US funded in the US, but we're building practices, which we will put forward as recommendation for global use.

chelle gentemann 1:43:46

And I, I love that the UN draft recommendations, 193 countries signed those draft recommendations, not draft, it's the Open Science recommendations. And that's really powerful on a global basis. I think there's Sharon, did you were you able to unmute because I there's a

little explanation point, but I think she had a comment. So let's go to Monica. And then if Fernandez rejoined, so Monica, and then great ponds.

M   Monica Granados 1:44:27

I think actually, if Fernando needs to be added as a panelist, he said in the chat case, indeed, just to let you know. Okay, perfect. So, so I wanted to add to Logan and at Logan's comment about the you know, what's the scale of this? And, you know, before I moved over to Creative Commons, I was working for the federal government in Canada as a senior policy advisor on open science and some of the things that I saw worked well, that even if we look at just you know, You know, look at just the scale of the federal government in the United States, whatever documents you put together, whether it's policy or training, having those documents be open, will make it a lot easier for other federal departments to take that remix it in and reuse it for their own use. So it would be helpful, you know, it's gonna be super helpful just to have these documents available, and having them you know, licensed with, you know, a CC by license so that people can reuse them in other departments. But I think there it also was really helpful for us in the federal government to have like a coordinating effort from from, you know, for you folks, it might be the office of the White House Office of Science Technology Policy. For us, it was the office of the chief science advisor. And because basically what they did for, you know, some policies was to, like put together a model policy, and then have the individual departments sort of change them for their individual use, and would say, you know, there was a, we had a roadmap for open science that was like, at the federal level, and then each individual agency had to put together a roadmap, or had to put together a action plan for their department. So you know, you're, you're still working at your own individual, you know, agency level, but if you produce all of these materials, and then you have direction from from, you know, like a higher organization can be so much easier for these other federal governments to be like, well, we're just going to, we're going to take the NASA policy and just adapt it a bit for our use. And so, you know, even if your influence is just to other departments or agencies within the federal government, that still is going to be huge.

chelle gentemann 1:46:48

Thank you. Yeah, Monica, we're, we're really trying, we hope that that is what's going to happen. And we've been doing a lot of outreach to other federal agencies. I think every week or twice a week, I have different calls or talks, and every agency is a little different. But that is part of our goal with doing this openly, is still allow them to select the pieces that they want, because again, it's the spectrum. And if we can, we can get everybody moving towards open science. But also, I think it's really important that we don't just have one federal agency change the rules, because that's going to disrupt science. So we need all I would love to see all federal agencies move more in this direction. And, and many other federal agencies are, you know, NIH has some really great open science initiatives. They've been leaders in open data. NSF has wonderful they've been really promoting open science within their community. There's DOD, there's DOI, and all of these different agencies, if we can try to change the incentives, change the funding structure, so that funding people who are funded, again, you start asking about open science, you start rewarding open science as to who gets funded. I think that's how we really could across federal agencies move to open science. We need to replicate it. And that's part of the reason also, I want to say, we're asking for help. Right. So we have the GitHub and we're trying to do things openly. But we're also looking for partners to co develop. And so if you

have relationships with those agencies, please, our sides are open. They're openly licensed, they're available on Zenodo. Feel free to go and talk to any agency that you work with about tops. And we're happy to help support that. And I think, Fernando you've reached, Shall we try it again? Your beer Beer? I think you might have to call in. I think there's a phone number. So I think I saw Brian. And then ours I'm sorry. Yeah. Brian, and then Hans.

Brian Nosek 1:49:10

I did not have my hand up. But I will just say since you called on me that I'm very pleased with the convergence sense in this discussion, both on identifying a set of activities that do because those are really the conversation about open science can just be divergent without ever converging on any particular activities. And so I think that the focus of the discussion here is productive in that sense of really trying to identify a couple of sets a couple of actual items that we might be able to make progress on together.

chelle gentemann 1:49:50

Thanks. So I think Hans, did you have your end up?

Moritz Gunther 1:49:54

Yeah, I was similar comment. In that. I think it's helpful to have some in immediate level, things that Topps can do. Because so far we have like, either grabbed very far the Open Science 193 countries in the world as a UNESCO and they change all of the federal government. And that's a, that's a lot. That's a lofty goal, it's vertical. But it's not something that's going to happen in 2023 or 2024, probably even 2027. And on the other hand, there are steps that maybe very big thing for federal agency, like we have a GitHub repository you can comment on, but that for people in the open data or open software world, things that many organizations have done, as you've said, for very, very long time. So I think they can, in terms of how do you show the community that something's actually happening, it'd be good to have like, for example, that cause that you were talking about, or things like things that can happen in a year or two, and that have an impact on people who actually want to use it that say, some tools, some API, some change in funding policies, some some way to curate and store data as part of open science that doesn't have an archival solution. So far, something like that, that kind of in the middle way that someone can point to and say, Okay, there's this large goal, but there's also steps being taken. And so otherwise, I worry that people go with this and say, yeah, and they meet every week, have a meet every month, and there's a lot of talk, but there's nothing that actually comes out of it. And that'd be very dangerous, very, very dangerous impression to leave. So I don't have I don't have the one goals were put in the middle. And so there were some ideas, but I think it's important to not like lose sight of something like a visible deliverable in let's say, two years. So.

chelle gentemann 1:51:51

Yeah, I think that's part of why we're having the 2023 year of open science is we got to get started on this work. And we have to, we were trying to use that year to really motivate ourselves in the motivated community to just galvanize a response, because I do feel in some

ourselves in the motivated community to just galvanize a response, because I do feel in some ways, like I've been in a lot of meetings, there's been a lot of talk, and now it's time to really change things. So Fernanda, do we want to try again? And then I think Sharon, also was able to rejoin. Oh, we can't hear you, Fernando,

1:52:32
your your

chelle gentemann   1:52:42
Devo. It's diva, I think Fernando's listening to diva. Sharon, did you have your hand up? And I think you've reached doing that you want to talk? Thank you.

S   SherAaron Hurt   1:52:51
Yes. I will say for me listening to the presentation was amazing. And thinking about all of the thought process that goes through it. And what really stood out to me was the incentives. And thinking about, you know, the incentives isn't going to be the same for everyone. And thinking about also, you know, she brought it broke it down in the sense of one person may want a badge where you know, for a senior person, there may be another incentive. And so for me that really stood out because that's an issue or something that we're concerned about within the carpentries and just looking at incentives to keep people engaged. So you know, you know, once you get the people involved, recruiting them is one thing but the retention other things to try to tackle for me Just hearing that think about how are we going to keep them engaged, to make sure that we reach a goal is very important. So thank you for sharing that.

Y   Yvonne Ivey   1:53:56
We hope to dive further into what's going on on day two so, Fernando, I think you said that you were able to join via phone is is it connecting Alright, doesn't look like it. So kind of keeping track of time.

chelle gentemann   1:54:31
When sir. Brittany endo Can you hear us? Nope, I don't hear you either. Okay.

Y   Yvonne Ivey   1:54:41
So keeping us stuck on time. I'm going to shift us into our next break. And give folks some time to either grab coffee, tea water or just sort of step away for a second. We'll be back in 10 minutes and thank you so much to the panelists for coming off mute and sharing. Keeping the conversation going

Fernando Perez 2:01:51

Quick audio test quick audio test

Yvonne Ivey 2:01:59

we can hear you Fernanda glad yeah great

Fernando Perez 2:02:05

thank you.

Yvonne Ivey 2:04:57

Alright we're gonna give it just one more minute as far as So are joining back and we have all of our panelists lined up.

chelle gentemann 2:05:08

And I think we'll start with Fernando, who we believe so let's just wait like one more minute as people read you.

Fernando Perez 2:05:15

Can you hear me?

chelle gentemann 2:05:17

Perfect? Can we get the screenshare? Started please? Perfect. Okay, for now, no.

Fernando Perez 2:05:31

Boy, you think by after two years of teaching online and being on Zoom eight hours a day, we'd know how to do this, but evidently not sorry about that. No, just it was kind of a follow up on the conversation that was happening earlier on. I was discussing yesterday with Jim that have been thinking about this, what is happening with open science in from the perspective that I think we're kind of entering a new we're starting a new phase. And I think of Topps as the opening of that new phase. And the sense that for 20 years, plus, it was the rise of open source that came from more from the industry side and began penetrating in terms of its practices, its tools, its values, a lot of academic science, right. And the early conferences, were a bit of a ragtag bands of people working on the fringes often without support, etc. Today, this is coming literally from the top, no pun intended, right? It's coming from the top. It's coming from NASA,

and it's federal policy. And it's absolutely fabulous, what you folks are doing in terms of that leadership. But I think I've been wondering how can we ensure that the values, the ideas, and the ways in which the early you know that first phase that was a bit ragtag and uncoordinated make maintain what was good about that as we enter a phase where we're now working sort of within the system, if you will, right, we now I am now, yes, I now have tenure. I am writing tenure cases from people where I'm kind of justifying how their contributions to open source software and open science should be part of their tenure case, I have to worry that my PhD students still get a PhD that is seen as a proper PhD by their community because they can't bite back on getting a job because they worked on Jupiter, right? They have to be recognized as their as kind of proper scientists in their own right, by a community of others who may or may not share these values. And so I've been thinking a lot of how do we ensure that the things that we did, which we felt were have the right vision and values when we were on the fringes, maintain those values, now that they're happening within a system that has its own dynamics and history and institutional weight. And I don't know, maybe I'm over over worrying about this. But it is a concern that I keep that we don't simply fall automatically under the inertia of existing large, very large institutional systems, but rather that we bring something that's genuinely new, and we find ways of transferring those values to the system. So that's all I have to say, I'm sorry for all the hassles.

chelle gentemann 2:08:12

I think I heard Fernando volunteering to come up with an open science metric for the future. We have a GitHub repository. Fernando, I believe you're familiar with those. And we can start with GitHub discussion? This is a great question, because this is something that I've also been really struggling with. And we don't have a lot about this in our slides yet. Because we talked about changing the incentive structure. And we know that we can do an open science badge like, Okay, if everybody takes 12 and a half hours of curriculum, you have a base level understanding of what open science is. And we can we can reward that badge that work through funding decisions. But what we really want to do is we want to reward open science activities. And as you said, I've you know, I see metrics that reward open publications, I, you know, there also are metrics, like you can go to somebody's GitHub profile and look up how active they are. But there's so many different ways to participate in open science. Some of its coding some of its, you know, making edits and correcting typos and open source documentation. It's also just sharing your data and getting a DOI. So, especially with that spectrum slide, I've really struggled. And I think that this panel in this community could really help us here, which is to try and develop a clearer way that if we asked review panels to reward open science, what questions do we ask the people proposing to NASA? How do we tell them that we want to hear about open science? What should they write about? And how will we value that?

Yvonne Ivey 2:09:56

It looks like Brian's hands up and then Kelsey, I think, yeah,

Brian Nosek 2:10:00

Yeah, that's a great question. And just to build up off of Fernando's point, I wonder if you can say a little bit about the extent to which stakeholders and decision makers that have the

potential to make structural changes are already engaged or committed, or as part of this work, not just grassroots development of the researcher community, but also engagement with some of those stakeholders, so that whatever institutional interventions get placed, are informed by as Fernando was saying, what some of the core values that motivate the work to begin with? Or is this largely grassroots at the researcher level and not directly engaged with institutional reform per se?

Y Yvonne Ivey 2:10:53

I'm happy to kind of speak to this one. So I think we saw in the chat OSTP, which has representatives from all federal agencies, there's a subcommittee on open science, looking to sort of how do we work across our agencies, because we've already been doing this work. So actually, speaking more about it. Also, as chelle mentioned, we have very, very, very, very, very, very targeted outreach efforts to work with major societies who have those relationships with various stakeholders in the academic space, as well as industry. And so we realize, you know, our motto is to be successful in this, we need everyone on board. And so we're, although we're taking sort of a grassroots approach, really working with the research community to co develop this, we recognize that there are systemic changes that need to take place in order to make this a sustainable effort. And so we're truly looking at this from a wide sort of spectrum on how to sort of approach this problem and challenge and kind of move forward with stakeholders from all various stages, which I think you can see a reflective from our community panelists, we don't just have NASA researchers, here. We wanted to truly do a wide call and bring the urban science community to the table. Kelsey?

K Kelsey Hightower 2:12:37

Yeah, I would say, you know, I've worked at Google, where this is a constant struggle, we we make a lot of open source projects, we have competing commercial offerings that are based on those projects. And as a software engineer that works on those projects, yes, there's a performance review cycle. And some people may say, Well, look, open source work may not translate 100% of revenue. And then people may choose not to do that work anymore. But it still needs to be done. It still needs to be maintained. So I think there's a couple of things we've done one way is we try really hard to create like alignment guidance. So if you're a team lead, you can help people articulate this work is what's being used in the commercial product, just to make sure the alignment is super clear. From the industry standpoint, a lot of these open source projects went from kind of grassroots volunteer efforts to industry standards. So even the commercial space is now using the same inputs and outputs, right. So you can imagine a world where you say, hey, the industry standard for a research paper should be in this format, whether you care about the movement or not, if that just becomes the thing that Adobe supports, you know, Google Drive supports, most people will just do the standard thing, because all the products and services will be based on it. So you just kind of get a lot of momentum. So when you do ask the research community to do something, it's like it's already the default industry standard. Why not? So I think there's a clever way to kind of intervene a lot of these innovations into just everyday life where no one's feeling like they're having to twist their arm to do it a certain way. And I think that's what we found. You know, we went through this transition of sustainable open source, consistent funding, making sure people come and

contribute for the right reasons. And even when they contribute, for the wrong reasons, to make sure that those contributions actually benefit everyone. And I think we did it through the guise of industry standards, even for competitive companies. Monica,

M Monica Granados 2:14:46

just briefly, to add to this, I think one of the things we should think about in these panel discussions is to talk about, you know, what's the audience that we're looking at? Are we looking at to NASA researchers, are we looking at academic researchers? Are we looking at, you know, researchers in governmental, non governmental organizations, because I think the, you know, policies and incentives, and all of the like pillars that support open science will be different for these different groups. And to sort of think about them as a whole is probably not as not as productive as recognizing the individual differences between these different communities. And if we're thinking about, you know, researchers and NASA, which is what you folks have the most influence on, because you can change those that incentive structure, you can put in, you know, put the infrastructure in place to support open science within your own within your own agency, and then hope that that inspires other organizations. You know, think about what is what specifically do you need for your organization and think about incentives? How do your you know, you have, you know, researchers, federal researchers that work for NASA, how do they get promoted? What's the framework that you you look at, for them to get promoted, and then changing that policy specifically for those routes for those researchers, and what may work for Google will probably be a little different. But you know, but similar, we're like, we have to align the, you know, the policies towards what the mandate is of that organization. For NASA, you already have that mandate, which is to make this data and information public, you just need the policy that supports that. And so I think to, you know, the two points I wanted to make was like, we do need to think about, but these communities are different. But you have a ton of influence on like making changes at NASA, which is one of the things that I loved working in the Canadian government is that I could change the structures, like the infrastructures to help open science and I could also help change, like the incentives because we could put policies in place specifically for that organization. Thanks for

K Kelsey Hightower 2:17:04

watching how much of this is also about how you consume research, right? Because I think there's a part where you are exporting things. But how would you like to import things? Right? I'm pretty sure there's other research that influences your research. And my guess is you want not to have to support 10,000 different standards. I think that's kind of the reason why Google still is so involved in open source is because on one hand, you will be asked to bring in a lot of things from the outside world. And ideally, if those things were standardized, that helps across the board as well.

M Monica Granados 2:17:37

For sure, and you have to have different thinking for both,

K Karla Mastracchio 2:17:40

like, yeah, for the NMD app.

chelle gentemann 2:17:46

Yeah, I think one of the things we've really been working on is for we have different usually our talk ends with a slide, which is the Ask slide. And we have a different ask for every community. And that's part of the reason is, you know, my background is in commercial and nonprofit as a soft money research scientist. But Cindy's background is in geology in both academia and at NASA. Carla is a doctor of rhetoric. And she's our communication strategist who's worked in academia, as well as DOD, and Yvonne contract are working at NASA who's worked with in the library community, and we've been trying to, we have this diverse team. And then we also have this diverse panel. And we're really trying to create value for our different communities in the way that we interact with them a little differently. So we interact and we have different ask for those different communities to try and find meet them where they're at and just start moving a little bit towards more openness. And I agree a lot with the export import research question to like we do. NASA scientists don't work in a vacuum, we we try to build on each other science. And that can come from anywhere, and especially when you're working with satellite data, really enabling downstream applications is so critical. And being able to better enable those commercial applications and generate that whole ecosystem of startup funding and especially around climate change around COVID research that we've seen developing in the past two years. I think it's something that open science can have a big impact on. There's so we deal with questions up. There, hands up, sorry, I don't I've lost track, please come off me or just come off mute.

Jim Colliander 2:19:40

I'll jump in. And this discussion about incentives is kind of focusing on the individual researcher at different career scales. But I think these incentive structures also affect different scales. One University might perceive that it's in competition with another university and the community These that we convene, sometimes involve industrial researchers, NGO participants, as well as academic researchers. And the incentives within those different membership categories within a research community also really differ. I've been in situations where my university did not want to engage in a large community focused national scale project, because it's in some sense, helping out the competition that's trying to secure grant funding from federal agencies. So the incentives are quite challenging. I mean, one other example of this is just a little vignette. So the University of California, Berkeley has more Nobel Prizes than the country of Canada. Now, maybe that's because Berkeley is more proximate to Nobel Prize selection processes. Maybe it's because there's just incredible talent. But if Canada is trying to compete with Nobel Prize winning, maybe collaborating with Berkeley isn't the best move. And we have to break these kinds of systems to bring everybody into alignment. Because the real goal here is what is the return on science? It's not the return to UBC, or the return to Berkeley, what do we get out of science. And if we take that kind of global perspective on science, then I think a lot of these incentives issues become more clear. But the internal structure and all the incentives around, you know, land grant universities versus private universities versus endowment versus trying to raise funding through philanthropy, all these things get in the way, sometimes of doing effective science.

M Moritz Gunther 2:21:39

And like the idea, but Kelsey said, a while that one way to bypass this incentive problem is to just make something the industry standard, and then people just do it, because that's the easiest way to do. And I think I think we've made progress. Like in astronomy, for example, the NASA, the NASA archives that provide the satellite data, have made it a lot easier to get a DOI for a specific data set. So you can that makes it easier to identify what data you actually use this versus manually writing down in text, I'm using data set 178948 Q A, Hubble is particularly like they're very long, like random combinations of strings, that's hard to do AI is good for that. But then there's many other aspects that didn't get quite get that far. So for example, again, in astronomical journals, if I want to publish, they offer the option to publish the what I call the data behind the figure. So if I have a PDF, or my PNG, I can upload let's say, an ASCII table or something like that of the data so that other people can take the data from that pig and continue plotting it without like taking, taking a measuring the inches and re measuring that put my dots. But that's always an extra piece of effort, that's like it, it's actually quite a lot of effort to get that into the right format to move it into the right way. And so there's a number of these Some people try to publish from Jupyter Notebooks, some people like include the data, because if you have the notebook, the notebook doesn't necessarily write in the right format. So I could also provide the right format to the journal or it could mean to separate your ions denodo And then cite that. And so there's ways to these ways to do all of those things, but none of them is is so far the community has agreed on as the standard that makes it easy. And that's why we need those incentives, but be great. If we could bypass that by just having more of the things automatic, then we will need to incentivize people because I do it anyway.

K Kelsey Hightower 2:23:38

Yeah, I think open source, you see this competition where maybe the big players refuse to collaborate, but then sometimes they get forced to, because the smaller players have this bigger forum in which to operate. So while they keep things behind closed doors until it's ready, you have other people working in real time. And if you can get enough momentum, where there are some major players like NASA involved, that's incentivizing the smaller and maybe schools or universities to say, Hey, I'm going to jump on this stage. And so yeah, the bigger universities are like, whoa, why is everyone listening to this quality university on a subject where a year away from publishing a paper for and so they realize that they're going to have to get into these conversations much earlier or left behind. And we saw this in the enterprise software space, where the giants that rule the last couple of decades are no longer in the driver's seat, because open source has surpassed because they couldn't compete with a collaborating community trying to do everything themselves.

chelle gentemann 2:24:46

I'm trying not to reply to everything because I want to engage with all of you but I also want to hear from you so I think Penang you have had your hand up for a while and people please just jump in.

P Pen-Yuan Hsing 2:24:57

Okay, thank you. Um, yeah, so Oh, well, first of all, I can really relate to some of the things that

Fernando and Jim talked about in terms of incentives. So I was coming from the perspective of a relatively early career academic researcher. And I have to admit, throughout the majority of my academic career, you know, I see absolutely no incentive actually more like disincentives for doing open science, because let's say, you know, I mean, I didn't do this, but let's say I create a incredibly useful scientific software package that's used by universities across the world. And I have, you know, a GitHub repository of the software that's, you know, got, like 10,000 stars or whatever, right. But this counts for nothing in my academic evaluations, basically. So so I can really relate to that. And I appreciate the discussion that's taking this to a higher level where even a global level as Jim was talking about, but also, I was I also just really like to appreciate some of Kelsey, his comments earlier on on two points. One is how do we value open source work or open science contributions? Right. And that reminded me of something Jim said earlier, which I thought was really interesting, which is the return on scientific investment in terms of, you know, a percentage of I think it was the US GDP or worrisome GDP, right? 3% resulting, okay, yeah. And I think, you know, statements like that have a advantage of being, you know, a short and sweet and really compelling argument, for doing open science. At the same time, I think we could also really benefit from an additional recognition that a lot of the value of doing open science is not necessarily can be captured or appropriately captured by $1 amount. You know, I think that's also very useful and important to recognize. And I think we can do both. And I think it's important to recognize that, in other words, there might be certain things that are worth doing, even if they might not necessarily immediately produce a value that can be measured as a quantifiable dollar. So I think it's worth recognizing that as well. And lastly, another thing that Kelsey mentioned, was, how a lot of industry standards, right, actually came from outside the industry, maybe from grassroots open source communities. And that reminded me of a lot of the grassroots and non institutional communities that I've worked with who are doing really interesting science. This might be grassroots organizations. And from my experience in the environmental world, they might be, you know, concerned citizens, who want to understand pollution in their community. So they do science to measure, you know, pollutants, and they advocate for policy or social change around that. And, and, and a lot of institutional scientists, they talk to whether it's from universities, or government, they're like an odd this, these people don't have PhDs, they're not associated with universities, you know, there's no value in the science that they do. It can be even called Science, by thinking inspired by Kelsey is common, I think there is tremendous value in understanding how other communities conceptualize and practice science. And, you know, one of the things that was mentioned earlier in terms of engagement is reaching out to different societies. And I think it's important to recognize that these societies shouldn't just be professional, academic societies, there should also be other communities outside of the scientific establishment. So that perhaps one day some of the things they do and value they bring to the table can inspire the next set of quote, unquote, industry standards for doing good open science.

chelle gentemann 2:29:18

Thank you so much for that comment. I completely agree. And there's so much gatekeeping in academia and in science and recognizing citizen science and citizen scientists as just so incredibly valuable to what we're doing. And, and especially, as you mentioned, like studying local problems. This is where environmental justice, you know, the conversations around that start to become really important to which is we may not get the people in traditional NASA Science positions to work on something but if we can expand who's participating in science, who's participate who's using this data and start to track and understand how they're using it and reach out to their communities. I think it really helped with this effort. And we are thinking

about doing that we have reached out to some communities. But I think you're right, that we should expand those outreach. And we do work with the Citizen Science Program, which is incredibly active at a number of federal agencies. And maybe that's the pathway we need to lean into a little bit more.

F Fernando Perez 2:30:27

I was wondering shall if I could ask you and the team, kind of what what your thoughts are in terms of engaging with the library community because they think of the libraries community as one of the original actors who was historically at the forefront of kind of the Open Science debates and battles, right, they fought, the early versions of that work for open access. In libraries were in a sense, the place where science met the rest of the community, right? People, you don't go to people's labs and ask them about their research, you used to read their papers. And those papers were available for libraries. So libraries are kind of the interface between the production of science and the consumption of science by either the rest of the scientific community or even the greater public. And libraries are also I know that because I'm on the library's committee on campus. And I know that they're also kind of thinking hard about what is their role in the future. But there are organizations that have a lot of expertise, and a lot of commitment to ideas of science as a service for society. And I'm wondering how you see engagement with library partners, kind of the participation of their expertise, or their trajectory in this kind of in this space, as they themselves think about reinventing themselves and kind of look, look towards the future. So it's just a question for the team.

Y Yvonne Ivey 2:31:46

I mean, I think Fernando, you know, that libraries are at the core of a lot of the work that we want to amplify. As a data librarian, you know, open access is at the core of why I immediately jumped on board for the transformative open science mission, because there are so many barriers of entry around knowledge and science. And we're just talking domestically, we're not even talking on a global level of those barriers of entry to get not only access to the publications, but the data, being able to log on to a laptop and have access to, you know, the World Wide Web, there are so many barriers around data literacy. And for us, we realize that our libraries are our partners in this. Because depending on what level you are, for many folks even being able to take classes around Python, and then logging on to Jupyter Notebooks, you know, you do that at your local library, and whether you're on a campus or not. And so we recognize that as we move forward, partnering with our librarians, our data archivists, to focus on accessibility to the data, the metadata, and the publications, that's going to be imperative to our success. And I think tomorrow, we'll hear a little bit more about librarians in action around tops and kind of our objectives to kind of move forward with our stakeholders.

K Kelsey Hightower 2:33:25

Like now hearing that I want Livebearers to be like the YMCA of science, right? Where do you go to, like, really just hang out, and just kind of enjoy the community, right. So that would be really dope, because every community has one. And a lot of people, you know, I've got my library card, but I interact mostly on the web. But if you gave me a reason to go in person, to explore

the data, and I think someone put into chat Libraries also teach you how to use the tool and make sense of what you're reading. Just imagine that every city has one of these things that you can create that kind of community center.

chelle gentemann 2:34:01

This has been one of the happiest things for me is I started doing open science and getting into the open source software and the tools. And then I discovered that there were all these librarians that I got to interact with. And it's been this like, dream from when I was a child and hung out at the library, like for hours. And now they're all my friends, which is just, and then you discover like Kelsey, I think it's so critical to point out. These are the people in everyone's communities. And if we want to talk about environmental justice and expanding who's participating in science, I feel like they're the key.

Jim Colliander 2:34:39

I want to jump in on the Live Library thread and maybe say something controversial just to try to get engagement here. So in my life as a scientist, I started off in CD ROMs started coming in and I could find things on CD rom this was kind of pre Internet, and it was transformational. And then libraries started moving Seeing the books out and becoming what they call the Information Commons, or they transformed and called themselves the Learning Commons. But almost all of this aspect of the library was focused on getting access to the collection, either through digital or through personal means. I want to suggest that there should be a larger Commons than the collected works that the libraries have. And this commons, we might call the science Commons. That's things like the granting agencies that provide funding the instruments that provide access to the data, the training programs that create the next generation of talent. All of this is a new kind of Commons. That's more than the, you know, evolution of the Library of Alexandria. And I think there are big risks in the management of this science Commons. And we're trying to redefine what the science Commons is through these discussions, and then figure out how we can manage it and better protect it. I talked about some of this with Fernando and a nice call yesterday. And so I want to echo the work of Elinor Ostrom, celebrated Nobel laureate, who wrote this moving book called governing the commons. Now that was more focused on the traditional commons, like the forest and the pastures outside of the landed gentry is castle. But I think there's a lot of analogies here for us to explore. And it's providing some insights into governance of the Open Science movement.

Qiusheng Wu 2:36:39

Can I say something? Yeah. So I want to echo what Kelsey mentioned earlier that about something developer, outside standard become the industry standard. So I'm seeing I'm seeing something very similar right now in the geospatial community. So for example, just like Microsoft, like in the past, consider Linux is a cancer. But right now, they're embracing the idea of having the micros, Linux sat macros subsystem for Linux, why? So you can see it, especially during the past few years, being very active, although I have been using Linux for the past several years. But now I can also use Windows, even sometimes you need to use the NN because it has Linux in that. And so in the geospatial community, I'm seeing something similar momentum, for example, right? Cloud optimized geo TIFF, some of the basically the standard,

also the spatial temporal as a catalog. And this has been embraced by, for example, by Microsoft, for the planetary computer, also for Google for the Google, Google Earth Engine. So I'm very happy to see that we actually have the momentum going in this way. And in terms of how NASA for example, can have an impact on the policy also on the community. I was sinking, for example, for most of the NASA funded research, right, so every year resources, which they funded research, they have to report, but I kind of feel that it kind of a lagging behind, I suppose right now, I really like what you're doing here in terms of tops, because, for example, you post the PowerPoint even before the webinar started, right. So for those funding resource, since they are reporting to NASA, that later being accessible to the public usually lag behind, I would love to see something like more in near real time, right? So wondering, I'm not asking that NASA to make a change. But on my wish list, I was wasting some things like for example, like a newsfeed like to like Twitter. So you have different Teespring or science printed designs, right. And then when we will load resources with funding from NASA, when they publish something, open source project, you can have somewhere to get where and then people can just follow and they can get real time. Basically, the more real time rather than wait until after year, to somehow get the publication or the project or, or whatever, tutorial, something like that. So it'd be nice to have something that people can search can find what other people in parties otherwise, right now, I think you can only go to the funding page and then some of the publication, but what else besides the publication like how other people can utilize the way that the data set and how are people can utilize the algorithm that develop or whatever data product, so be nice to have some kind of those things that to make the funding resource more accessible, and also more reproducible and then people can utilize that. The last comma in terms of the incentive. So for me, I can only talk about my experience as a faculty member in academia. So for me developing those open source projects, it doesn't really count towards my publication. Although I can I published a few papers in the zone of open science of open open source software. But it doesn't really generate a lot of really compared to publicly compare, you've been published in high impact journals because the OSS does not have a DL SS does not have an impact factor. But I still choose to do the work to publish in they also develop the open source project because it has more contribution to the community widening, simply counting the number of citations, okay, I can use the time to actually to write papers to have more citations. But to me, I want to have some impact, real impact, I can see that people can engage people asking questions about your project, people, for example, invite you to have a webinar or workshop or something like that. So although technically, I don't really in my tiny toes here, those efforts won't be counted towards in the least number of publications, because I just don't have that. But I can articulate in other aspects that I'm also contributing to the open source community, also public education. So we have a large impact competitors. So this will be performing public safety papers. But one thing that right now missing in the evaluation of the time you in academia is that we don't really have that one, open science or open source or whatever integrated in the evaluation procedure, it might be very specific to a discipline, but at least for for my geography, we don't really have that one, because not many people doing that. So you need to actually argue, in your tenure dossier, that I'm doing this, I'm having an impact, and I should be granted tenure. So I was hoping that moving into the future, we have more Teespring integrate this one, so that people have more incentive actually to, to open science, and to make things more accessible. Because still, nowadays, when I'm reviewing papers, there are still a lot of papers that are developing algorithms, the brand product, but they never share the algorithm never share the data. And to me, I will always say that the one is more open science. And we produce a resource. If you're using some cloud computing vertebra or some satellite data, if you don't say anything, I don't think your paper should be published unless you make the data accessible. So this was my bottom line, when I'm reviewing papers that if you want to publish, you need to at least, if you can not make it fully public accessible, you need to at least have some sample data set. Because from my some of the experience, it reveals

something common that, okay, it's too big, I cannot make it accessible. And it just is a common that is all Pong data set or open access upon reasonable request. I was asking if I'm, as a reviewer, ask you to make available if you cannot, how can I expect that when a reader doesn't have any power, or the publication that asked you to make something available. So this is just something that I have been seeing is getting better, but it's still not something that everyone's doing. So I was hoping that in the future that the Open Science or the Jupiter ecosystem, whatever, that gives me more momentum. Everyone's just using the same state so they seem to become more open. And accessible. Thank you.

Y **Yvonne Ivey** 2:43:42

We have a couple of more hands raise little again.

L **Logan Kilpatrick** 2:43:46

Yeah, I wanted to touch on the goals for Topps really briefly. And I don't know if we'll have time to fully sort of explore and have the conversation but just interested to get some perspective from the from the top team and from everybody else about like, you know, the actual goals that were laid out, which I think one of them was 20,000 people participating and sort of getting the Open Science badge was one of them. It was five discoveries being made using using open science principles. And the last one was doubling the number of historically underrepresented folks in the open science community, I think was the was the goal for that one. And, again, I think just specifically for the third point, really interested to know, I think the first point I think we could use the platform that's being developed to really easily sort of determine how many people have done the training and things like that, but for doubling the participants of historically underrepresented groups in the open science community, like is there any sort of mechanisms or the like that we've identified for how we're going to be identifying that and same thing for discoveries like how do we know if a discoveries being made using open science principles? What what classifies a major scientific discovery versus something else? So interested to know Thoughts on that as well?

Y **Yvonne Ivey** 2:45:03

Shall Do you want to take the major scientific discovery? I also know that we have Steve Crawford on the line. So I'm Steve, feel free to join in on this question.

chelle gentemann 2:45:16

So, Logan, what we've been talking about is to have some future roses elements, which are funding opportunities for high risk, high reward science questions that are based in open science. So we want them using open science principles. We want them doing open science and to have funding to try and do some major discoveries that that will take time. That's not something that we're probably going to announce tomorrow. But we are setting aside funding and working on Rose's elements so that we can fund this type of work and funding high risk, high reward work is hard in two ways. And, and one is just getting people to propose because it, it takes a lot of work to write a proposal to NASA, and getting people to write proposals that

are high risk, often, you know, is even riskier for them. So we're working to really try to get the word out that we do want these types of proposals and that we will be having an element that's specifically for that so that we can try to within the community spark this change. Steve, do you want to add on to that at

S **steve crawford** 2:46:25

all? Well, I think that's the you know, I think you've you've answered that. Well, the one thing I just wanted to add on was actually related to high risk, high reward proposals. NASA actually already funds those at a higher rate than proposals which are not identified as high risk or high reward. You and when we actually look at all the the overall success rate of proposals, proposals, which are marked as high risk, high reward have a higher success rate than proposals that aren't. And I think, you know, and so it's not just further funding those, but you know, how do we help projects and, and support kind of, and I think a lot of things that are mentioned, here are the sustainability of integrating into some of our different projects, best open science practices. And, you know, but this is an area that I think will will be, as kind of shot mentioned that we'll be looking into more detail over the, you know, the coming months and the next year, and so near to actually give further plans on on exactly how to support that one. I think we have been very focused on the first one, the training the 20,000 people, and definitely getting feedback on whether or not what we're currently planning is is going to meet that goal will be incredibly helpful. And I think we're also here on some of the ways that we're, we're reaching out to help with increasing the diversity of our teams. And I'll hand it back over to Yvonne on on that one.

Y **Yvonne Ivey** 2:48:09

Thank you, Steve. So around our third objective, which is doubling participation, by traditionally excluded groups, we're sort of taking a multi pronged approach. We realize that for different communities, the reasons around engagement with NASA data, there's, there's not one size fits all. And so we're sort of targeting this effort to reach this goal as doing targeted outreach with MSI, I'm an HBCU grad. I attended Spelman College and I realized that a lot of my classmates who were STEM disciplines, had to take courses off the Spelman campus because we didn't have that infrastructure. And I, you know, we look at sort of our panelists who are professors at HBCUs and MSI s and are asking folks to help us sort of address the barriers around sort of engaging with asset data on whether it's pushing out curriculum, whether it's holding listening sessions, whether it's standing up proposal development workshops, we're really trying to sort of meet folks where they are in this effort around engaging with those traditionally left out. As I shared in sort of the the presentation, we're looking at prizes, challenges, hackathons really engaging folks who might not necessarily look at themselves as traditional scientists, um, but have been working with science data, and sort of gamifying the process to kind of bring folks to the table who've been working with NASA data, but also we would I really benefit from those more diverse voices, letting us know where those barriers or challenges or sort of amplifying the work that they've been doing. That just not might not be on our radar. We are also sort of looking at how do we hold various special workshops and meetings and sessions, at our large conferences, where our professional societies, but also the, the smaller societies, you know, who worked with NASA data, but might not necessarily have the infrastructure in place to do sort of these big splash events or edge further take the the NASA Data and educate the community on how to work with it. And I think lastly, one thing I'll note is looking at the various

existing programs and opportunities that NASA already funds. So you know, we have our science activation team that works with this and scientists and all various levels. You know, we talked a little bit about, you know, folks working with more local data, to combat environmental justice and equity issues in their communities, really working with citizen science to figure out how do we hold space to educate them around, you know, more formalized open science principles and practices. But also, on the flip side, you know, we have these global prices, challenges like Space Apps, so ensuring that we have open science throughout our sort of crisis space, where we get more of the crowdsourcing community invoices to really work with NASA data. So we realize, you know, round sort of how do we double that participation, we're going to have to take a multi pronged approach to be successful in this. And if there are things we're missing in this process, please let us know, you know, we're doing outreach, we're going out and talking to communities, but we recognize that there might be folks that we're not sort of engaging with, and so we really need you to sort of send them our way. My emails is open and public, shoot me a note, I'm happy to talk to anyone about this and bring the right books to the table.

steve crawford 2:52:22

And I'll just add, you know, we're not doing this in isolation, either. Inclusion is, is one of the core values at NASA. And we are working together with the ideas group at NASA headquarters, along with a number of other groups. I also know there, there'll be a report coming out from the National Academies. Actually, I think that's tomorrow. And, you know, and, but this is also where it's, we want to engage everyone to help on on all of our goals. But also, particularly our, our increasing our diversity.

Yvonne Ivey 2:53:02

Well, Malvika, I want to try to hit some of the hands raised, I know, we're also getting closer to the

chelle gentemann 2:53:10

time, I want to do one thing, just in case people have to leave right on time, we have recorded this, and we will be at the community panel on the GitHub repo, we will be posting a link to the video. So if you missed part of it, you can always go back and look again. And we'll be posting the slides there as well directly after this meeting. And we're doing that for the next two days as well. So thank you so much for participating and doing all this discussion. And let's have one last comment from Mel Vika and then I think we're going to be done. Thank you, everyone.

Malvika Sharan 2:53:47

The longer I stayed quiet actually think that all of you have covered everything, everyone, I absolutely agree with all the things you've said. And also, when you are about working with grassroots communities, because they are closer to the problem. They understand their community, they know what solutions exist. So I would probably just say one sentence that we have, if we have one year of open science and NASA, probably we should use that year to

identify these local leaders, give them the structure support, mobilize them for longer term. So not putting the burden of change on one institution or one person, but really, you know, decentralizing it sharing the power through open science.

chelle gentemann 2:54:33

Thank you so much for that great ending comment. And I agree, we have to change everything we need everyone. So thanks, everyone, we will see you tomorrow morning. Really appreciate all the great conversations about structural issues and values and metrics and incentives. We will be doing a transcript and providing written summaries by the end of this week. And hopefully then getting written comments back from you within four weeks. So thanks again and we'll see you tomorrow.

Yvonne Ivey 2:55:04

Thanks, everyone.

Pen-Yuan Hsing 2:55:06

Thank you, everyone.