UNBOUND

FOR
FOOD
ENERGY &
WATER
IN TRIBAL
COMMUNITIES

Recommendation Report for Understanding Needs to Broaden Outside Use of NASA Data for Food, Water, Energy in Tribal Communities (UNBOUND-FEW)
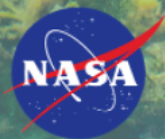
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Acknowledgements

Land Acknowledgement

We acknowledge the Alaska Native nations upon whose ancestral lands our University of Alaska campuses reside. In Fairbanks, our Troth Yeddha' Campus is located on the ancestral lands of the Dena people of the lower Tanana River. Members of the UNBOUND-FEW team strive to value and be mindful of this relationship. We worked across cultures and knowledge systems in this project to continue to make NASA Earth Data products more findable, usable and useful for navigating changing food, energy and water conditions on all lands.

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Project Website and archived workshop recordings:
https://sites.google.com/alaska.edu/unbound-few/

Cover photo: *Migrating sockeye (red) salmon approach their spawning grounds near the headwaters of the Gulkana River near Summit Lake off the Richardson Highway in mid-August. UAF photo by Todd Paris*
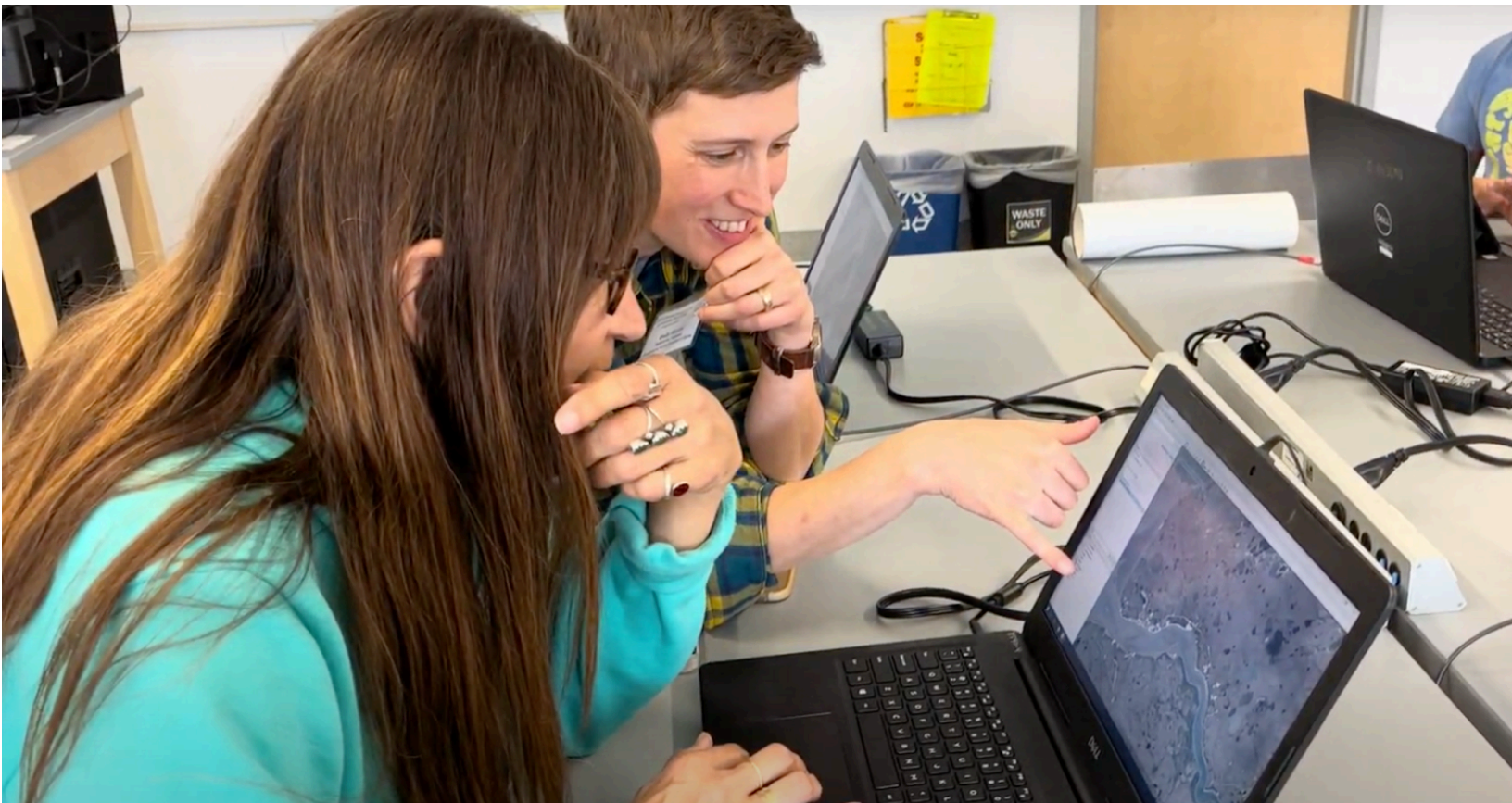
Emily Sousa, UAF project lead, works with Malinda Chase, Deg Hit'an from Anvik and project collaborator from the Alaska Tribal Resilience Learning Network, to access river data from NASA Satellites. Photo by Katie Spellman, UAF.

Overview

Community ground observations paired with remote sensing data can provide Tribal organizations and colleges with resources and tools needed to confront climate challenges and plan for resilient futures. NASA has rich and free data that can be used in planning for climate change; however, access to and use of this data can be challenging. UNBOUND for Food, Energy and Water in Tribal Communities engaged current and future data users in workshops to help NASA improve accessibility and use of data products in Tribal communities.

The "food-energy-water" (FEW) framework is a holistic view of environmental impacts that affect quality of life. The FEW nexus is sensitive to changes in climate, and tracking it can help communities better understand the adaptations needed to become more resilient. NASA data is ideally suited to meet this need. Designed for use by the scientific community, however, it is unclear how accessible NASA data is to users outside of academia. This workshop series brings together scientists and community leaders to test and explore different NASA data tools that are relevant to the FEW framework and have great potential for use in community resilience efforts.

What is UNBOUND-FEW?

NASA's Understanding Needs to Broaden Outside Use of NASA Data (UNBOUND) Program aims to engage with and better understand the needs of data users who may be interested in or currently using NASA data in their work.

UNBOUND for Food, Energy and Water in Tribal Communities is a partnership between NASA ESIP, the University of Alaska Fairbanks' (UAF) International Arctic Research Center (IARC), the Tribal Resilience Learning Network (TRLN) at the UAF Alaska Climate Adaptation Science Center (AK CASC), the UAF Alaska Satellite Facility (ASF) and Northwest Indian College (NWIC).

Tribes have identified numerous priorities, challenges, and solutions to climate adaptation and energy resilience (Hossain et al., 2016; Meeker, 2017). These priorities align with the "food-water-energy nexus" framework, which allows for a more holistic view of environmental and energy priorities facing Northwestern and Alaskan Tribes (Huntington, et al., 2021; Whitney et al., 2019). We conducted a virtual listening session followed by three virtual workshops to assess challenges in identifying, accessing, interpreting and using NASA data. These workshops focused on the food, water, and energy nexus central to many Tribal climate adaptation priorities and emphasized NASA tools and datasets available to communities through the ASF DAAC and other online NASA platforms.

Top- Berry picking area in Alaska Range,
Middle- Wind farm in Nome, Alaska.
Bottom- Wood River at the village of Aleknegik.
Photos by Todd Pari, UAF.

The UNBOUND - FEW effort grew out of prior collaborations with NASA at the University of Alaska Fairbanks that spanned Indigenous and Western Science knowledge systems and collaborators to address pressing climate change issues in rural and Indigenous communities. These included the Arctic and Earth STEM Integration of GLOBE and NASA (SIGNs) through the NASA Science Activation program and the Fresh Eyes on Ice community and citizen science project through the NASA Citizen Science for Earth Systems program. Through these projects, the gap between NASA data and our current and prospective Tribal community data users became evident. The NASA UNBOUND program was a natural fit for helping to address this gap.

The UNBOUND - FEW team built on existing networks to solicit participation from Tribal communities, colleges and organizations throughout the United States who use earth data in their work on food, energy, and/or water projects. Participants joined for a four-part workshop series to identify barriers that users in Tribal organizations and colleges encounter when trying to use and access NASA data.

UNBOUND-FEW was a four part workshop series from December 2023 through March 2024. The workshop series began with a Listening Session for participants to identify food, energy and water priorities in their communities that could benefit from NASA earth data. Building on what the UNBOUND team learned during the Listening Session and building upon the workshop model established in previous UNBOUND Workshops, we organized three sessions designed around data discovery, data exploration, and data use with each focusing on applications and data products identified by participants in the Listening Session. Workshops followed a general format of one or more tutorials of NASA data tools given by a NASA subject matter expert, followed by 1) a synchronous opportunity to explore tools or data with the UNBOUND FEW team and provide feedback, and 2) an asynchronous "homework" assignment designed to give participants a chance to work through the data or tools on their own and provide feedback outside of the virtual sessions.

Teams from Tribal communities across Alaska and the contiguous US gather annually at the University of Alaska Fairbanks to braid Indigenous Knowledge and NASA science for climate change learning in their community. Photos by Sarah Clement, UAF (Left), and Nicole James, Association of Interior Native Educators (Right).

Key Recommendations for NASA

1. Increase training opportunities

   ○ When possible, provide in-person and/or synchronous online training opportunities where users can ask specific questions and get assistance on projects. Provide easy to find contact information for who to reach out to with questions or troubleshooting. Continue to provide webinars for data users to view.

2. *Provide tutorials, site guidance, and additional resources*

   ○ Data platforms should include easy to find and accessible training and tutorials that guide users through the process. Additional resources and training links should be easy for users to identify. Data tutorials should be in common language and made available in easy to follow formats such as Esri StoryMaps, YouTube, and as static pdfs for users with poor data connectivity. Resources should serve two distinct purposes: 1) quick tips available via embedded links so that users can get assistance as they are working with the data in real time; and 2) detailed tutorials that allow users to advance their skills and experience.

3. *Modify data products for low-internet access*

   ○ Many Tribal communities experience low internet connectivity. Having to download large data files makes accessing data challenging. NASA should improve user's ability to download data files specific to smaller regions of interest. GIS-ready files and file extensions should be made available so that users can download smaller usable files.

4. *Improve search and filter functions*

   ○ Dates, resolutions and extents of data available should be made clear in simple terms at the beginning of a workflow, so that users do not download files that are not relevant to their time frame or region. In addition, when a region, resolution, or time frame is not available, NASA data platforms could suggest the next best availability - for example, if data is not available for March of 2023, it could then identify April 2023 or February 2023 as dates when data are available.

5. *Use common language*

- Make NASA data searchable with common language and applied uses. File names should be clear so that users can easily identify which data to use or download. Data should be searchable by application rather than satellite and clearly define search parameters such as granules. In cases where an acronym or specific scientific language is necessary, give options to hover or click for further information.

6. *Make steps re-traceable*

- Users experienced frustration when they were unable to retrace their digital steps when encountering a problem in accessing or using data. Many NASA platforms lack back or undo buttons, or the ability to see what steps a user has taken already to access the data. Platforms that provide opportunities to adjust filters, retrace steps, or undo would allow users to be able to troubleshoot challenges.

7. *Enhance data availability in Tribal regions*

- Users are eager to apply NASA data to Tribal food, energy, and water priorities but frequently found that data was not available for the time period, parameter, resolution, or region of interest. NASA should work directly with Tribes to co-create targeted data collection campaigns and to create user-friendly tools for Tribal members to access and use NASA data.

8. Increase compatibility with GIS and other software

- Data should be made available in common formats, including GIS-ready data that is compatible with Esri's ArcGIS which is made freely available to Tribal communities, and open-source software such as QGIS. Participants working in Tribal land and environmental management and government wear many hats and while some tribes may have remote sensing expertise, many rely on other staff to acquire relevant earth science data.

9. *Increase interlinking resources with other NASA data and publicly accessed media*

- Both when searching through google and public media news articles as well as when searching through NASA data, participants expressed a desire for more interlinking between resources. NASA Education and Public Outreach content should provide links to the NASA datasets referenced, and in NASA data portals, participants would like to see datasets that may link together for applied applications hyperlinked for intuitive and quick access.

UNBOUND-FEW Project Objectives

1. **Design and implement a workshop series** for Tribal organizations and colleges in Alaska and the Northwest US.

2. **Examine the usefulness and accessibility of NASA data** for geospatial data users in Tribal organizations and colleges through iterative user feedback in the workshops.

3. **Provide recommendations** for improving NASA data and tools through a project report.

Project Methodology

Participant Selection

We specifically sought out participants affiliated with a Tribal college, organization, or community through multiple channels. The Tribal Resilience and Learning Network at the University of Alaska Fairbanks was our central point for advertising through long established networks with communities throughout Alaska as well as through directly reaching out to known earth data users in Tribal communities. Northwest Indian College advertised to Tribal communities in Washington State as well as with partners at Blackfeet Community College in Montana. NASA ESIP advertised through their networks as well. We received 39 applications from across Tribal communities, academic and research institutions, non-profit organizations and private companies, and Tribal, local, state, and federal government.

We selected 15 paid participants, based on the following screening criteria:

- The goal of UNBOUND FEW is to solicit feedback from Tribal users. As such, applicants with active ties to Tribal communities as Tribal members, Tribal employees, Tribal college students, or Tribal community members were prioritized. Applicants not affiliated with a Tribal organization, community or college were not selected.

- We selected applicants with a broad range of experience using earth data, with roughly equal numbers of participants who self-identified as no experience or beginner with those who self-identified as intermediate to advanced.

- We selected applicants who were able to identify community food, energy, or water priorities for which they currently use or would hope to use NASA data products.

- Due to the nature of the project's funding, UNBOUND participants from outside the U.S. could not be compensated and were therefore not selected.

Applicants not selected to be paid participants were invited to join in sessions as unpaid participants and were welcome to submit homework assignments and contribute as much or little as they chose to. Participant recruitment and application materials are available in Appendix A.

Affiliations of Participants

Private Companies 6.7%
K-12 Educators 6.7%
Community-Based Organizations 13.3%
Indigenous Students and Tribal College Students 20.0%
Tribal Government 53.3%
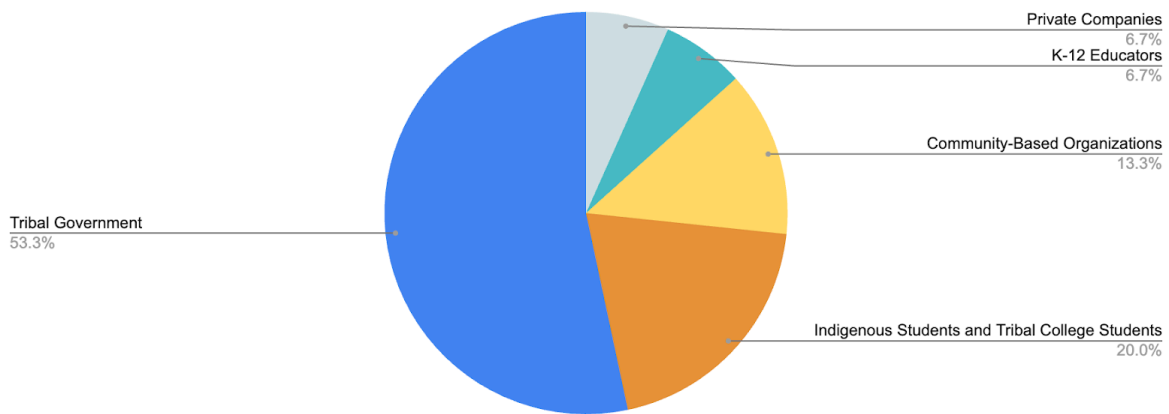
Figure 1. Of the fifteen participants, over half represented Tribal governmental organizations. Others included Indigenous and Tribal college students, Indigenous private sector employees, community-based organizations serving Tribes, and a K-12 educator in a Tribal community school.

Participant Experience Level with GIS and Earth Data Prior to UNBOUND

None 26%
Advanced 27%
Intermediate 27%
Beginner 20%
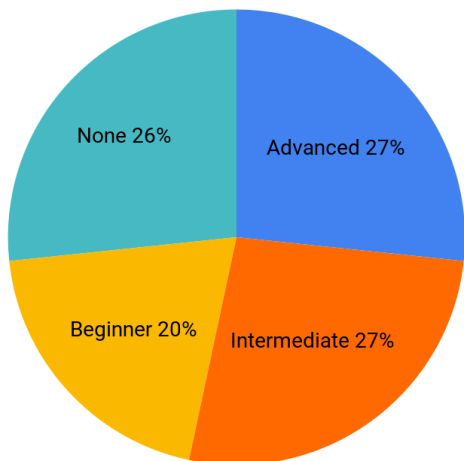
Figure 2. Of the fifteen participants, experience with GIS and Earth Data prior to UNBOUND was evenly split between participants that were very comfortable with GIS and Earth data, those who felt their skills were intermediate and novice, and those who had not previously used GIS or Earth Data products.

Workshop Design

We designed the workshop series based on the outcomes of a listening session, which brought together all the selected participants to identify the issues that they wanted to prioritize to address Food-Energy-Water issues in their community using NASA Earth Data. The listening session outcomes informed the types of NASA tools that were selected for the three workshops in the UNBOUND FEW series. The FEW framework recognizes the interconnectedness of all these food, energy, and water issues. As a result, we chose to highlight a mix of NASA data access and visualization tools that could 1. Be applied to a specific Tribal organization application such as NASA POWER for alternative energy planning or NASA SWOT data for flooding and water level monitoring, and 2. Be applied to a broad suite of issues such as NASA Worldview and NASA's Earthdata Geographic Information System (EGIS) for addressing multivariable issues like food security and food production.

We organized the resulting workshop series to align with different phases of the NASA data use life cycle: finding the right dataset ("Data Discovery"), accessing and exploring data using existing tools ("Data Exploration"), and using NASA data for community food, energy and water problem solving ("Data Use"). Dates, goals of each session and the NASA tools highlighted are shown in Figure 3.

Listening Session
December 5, 2023

1

Centering Tribal Priorities

Goals: Share participant priorities on food, energy and water issues in their communities. Determine NASA tools and datasets most relevant to Tribal communities and organizations represented.

Work Session #1
January 30, 2024

2

Data Discovery

Goals: Assess "findability" of NASA datasets. Demonstrate and practice using NASA products and tools. Reflect on data access strengths and challenges.

NASA Tools: Worldview and EGIS

Work Session #2
February 20, 2024

3

Data Exploration

Goals: Facilitate participant practice using NASA tools to access, explore and visualize data. Reflect on data usability strengths and challenges.

NASA Tools: POWER

Work Session #3
March 5, 2024

4

Data Use

Goals: Facilitate participant practice using NASA data for community issues. Provide feedback and recommendations for improving accessibility & usability of NASA data.

NASA Tools: SWOT, ASF SAR

Figure 3. Workshop design timeline.

Data Collection and Analysis

We employed a mixed methods approach to capturing feedback using both qualitative and quantitative data collection tools. This enabled us to capture rich feedback in terms of participant experience. Throughout the workshops, we used Google Forms, Google Jamboard, small group and large group discussion, and email feedback to solicit input. Zoom sessions were recorded and notetakers documented discussion in breakout rooms. We used content analysis to determine the frequency of themes recorded in textual data collected from these tools. We also used likert-scale surveys to assess the comfort level and likelihood of using the NASA tools explored during the workshops.
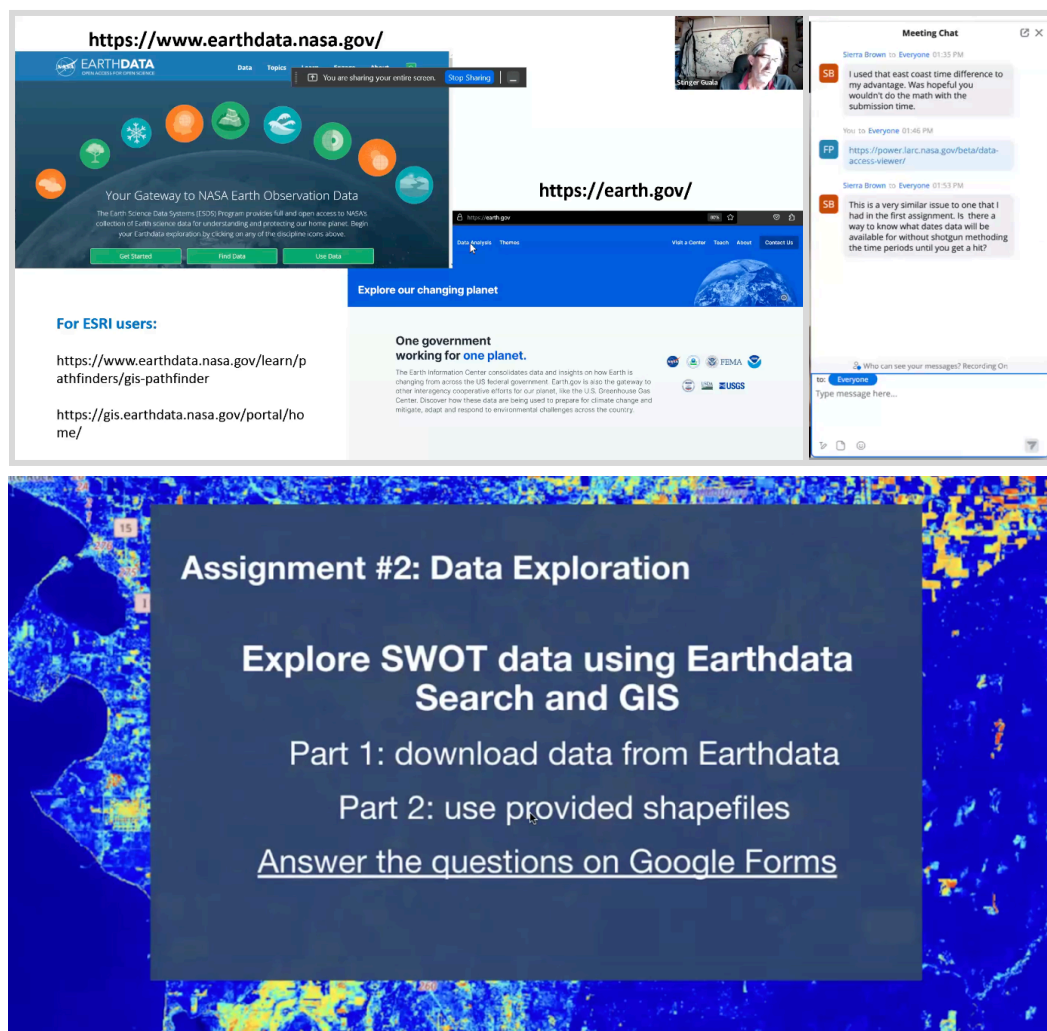
Figure 4. The Zoom platform was used to conduct the online workshop sessions, and written discussion notes and zoom chat (top) and written feedback from NASA Earth Data assignments (bottom) were used as some of the different data sources for feedback.

Workshop Series Outcomes

Listening Session

In the listening session, we invited participants to introduce themselves and share what brought them to the workshop. We then had participants join mixed-experience level breakout rooms with a facilitator and notetaker from the UNBOUND-FEW team. Participants were given two prompts on a jamboard and asked to discuss their thoughts and place comments on the jamboard. Jamboard is a Google-based collaborative webtool that operates as a sticky note and brainstorm poster would work in an in-person workshop (Figure 5). The two prompts were:

> **Prompt 1-** What current concerns or impacts are you facing around food, energy, and water in your community?

> **Prompt 2-** What satellite data, maps, earth data or imagery do you think might be helpful for you and/or what would you like to focus on in these workshops?

Over 80 unique concerns and impacts were identified by workshop participants in prompt 1 (Appendix B). We used content analysis to quantify the most common themes among the responses. We used the Food-Energy-Water framework as the apriori top level thematic clusters and then coded the responses by emergent subthemes. The decision to frame these workshops under a food, energy, and water nexus is to acknowledge the overlapping and interconnected nature of issues, which is more relevant to the worldviews of many Indigenous cultures. Within that context, we acknowledge that when grouping into themes, we are not suggesting that flooding events do not impact food systems, or that alternative energy sources are not connected with water, but that these emergent themes may span many categories.
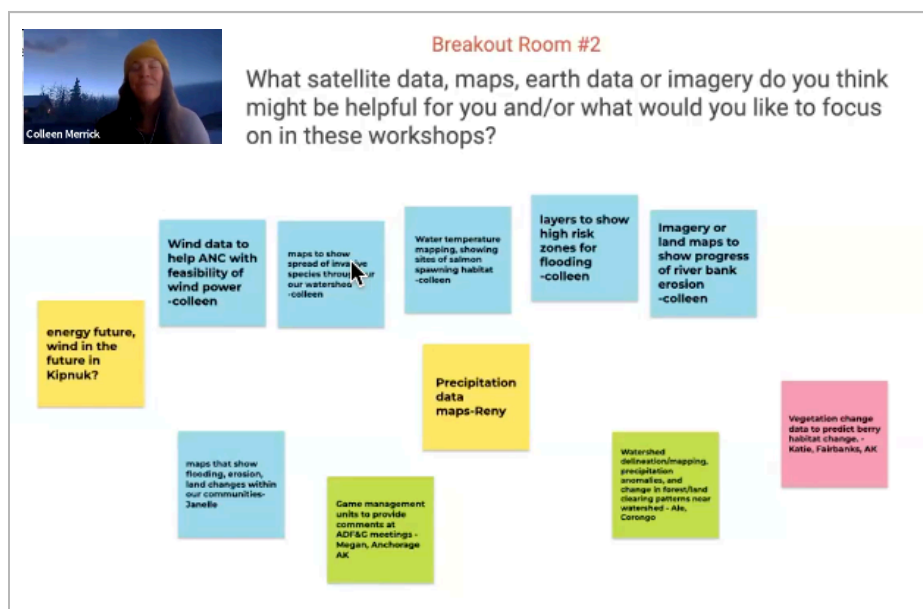
Figure 5. Colleen Merrick, Copper River Native Association, discusses priorities for NASA data products from a breakout room Jamboard during the listening session.

Overall, water issues were the most common responses for the concerns of participants during the listening session (46%), followed by food issues (37%) and energy issues (17%). Participants' most frequently mentioned food related concerns were changing traditional plant, fish and wildlife foods and how changing habitats could affect the access to and availability of local foods (Figure 6). Energy concerns centered on planning small-scale tribally run alternative energy solutions for their communities, power outages, and the accessibility and cost of energy (Figure 6). Water issues spanned a greater number of sub-themes, with changing precipitation patterns, the effects of changing hydrology on erosion and ground subsidence, flooding, and planning or improving water infrastructure such as plumbing and sewer (Figure 6).
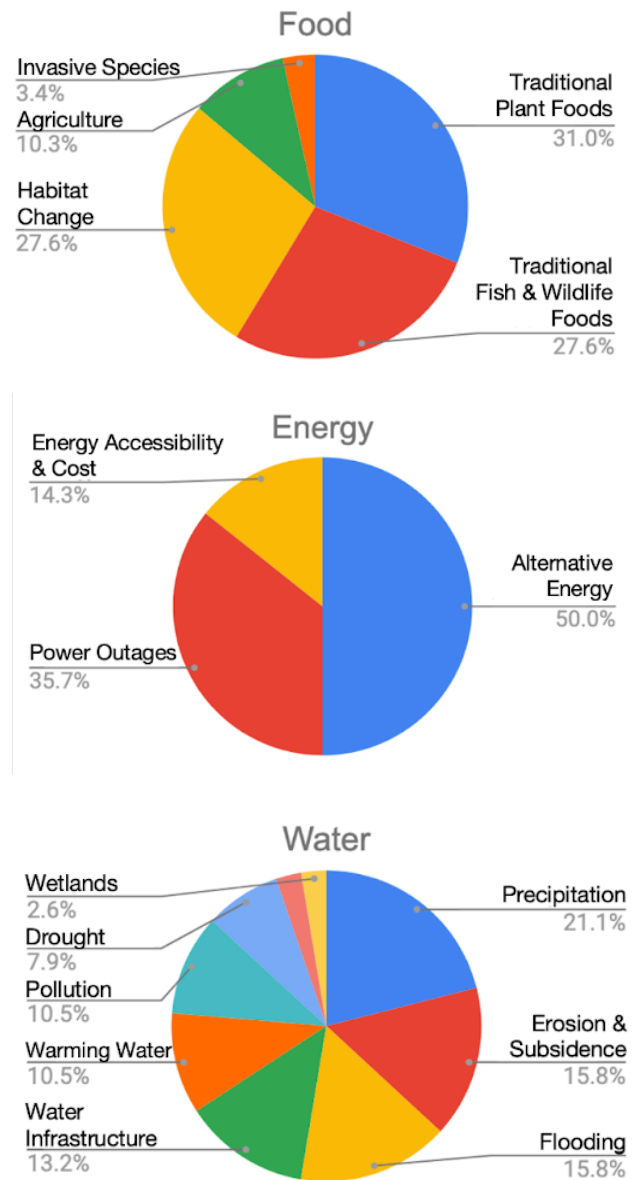
Figure 6. Subthemes in participant responses to the listening session question "What current concerns or impacts are you facing around food, energy, and water in your community?"

Selected representative responses to prompt 1- What current concerns or impacts are you facing around food, energy, and water in your community?

We can't rely on traditional native foods as much anymore. As a food gatherer for my community, I have difficulty finding safe spaces to gather our food. We are seeking good spots for a future farm.

Our village's land along the riverbanks is eroding causing loss of land, loss of fish wheels, loss of cultural sites. Quinhagak needs clean energy. We are dealing with erosion and other sensitive soil concerns, vegetation transition. We are planning to build an education garden and have hopes to build a larger production site.

The second prompt asked participants to brainstorm possible tools and datasets they are interested in and/or would like to focus on during these workshop sessions. Responses were varied, yet clear themes emerged.

The most frequent category of requests was to gain more insight on NASA tools and data that could be obtained at finer spatial and temporal scales to address local issues (Figure 7). Other top NASA datasets and assets that people sought were data for vegetation mapping for food resources, marine habitat data, energy potential data, and flooding and storm risk and damage assessment (Figure 7).
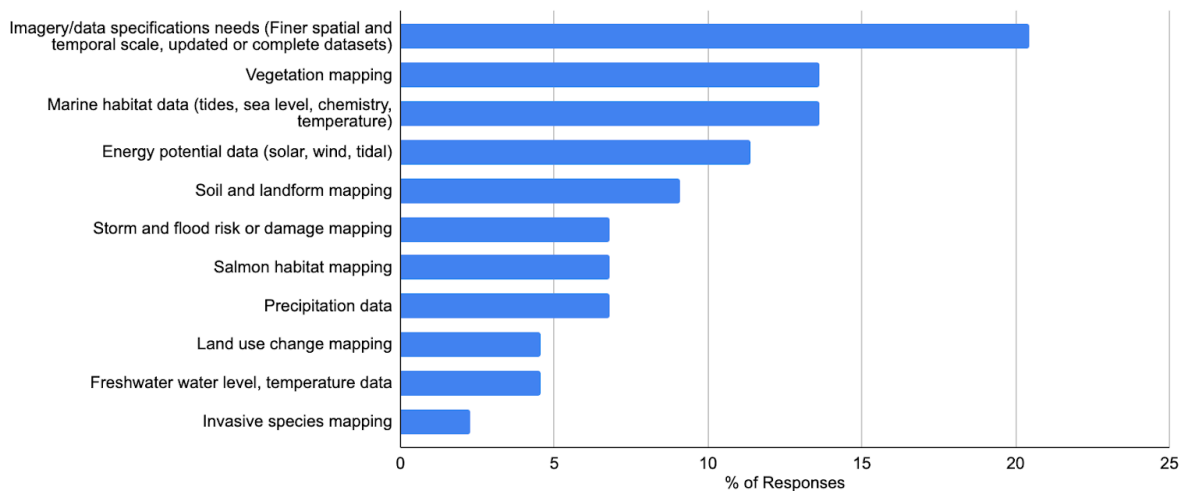
Figure 7. Emergent themes from responses to the listening session question "What NASA satellite data, maps, earth data or imagery do you think might be helpful for you and/or what would you like to focus on in these workshops?"

Selected representative responses to prompt 2 - What satellite data, maps, earth data or imagery do you think might be helpful for you and/or what would you like to focus on in these workshops?

> *Updated, clear satellite imagery to compare previous years imagery so that we can track changes in our region or complete damage assessments caused by storms.*

> *Energy potential for micro-grids of our tribal lands. Which energy type would be most cost effective for us to set up based on our resources?*

> *Percentage of our reservation is wetland compared to buildable.*

As a result of the listening session, we decided to focus on four different NASA datasets and tools with some being more broadly applicable to many different needs (NASA Worldview, Alaska Satellite Facility's Vertex SAR platform) and some with more specific applications to the issues of planning renewable energy projects (NASA POWER) and monitoring and mapping water level and flooding (NASA SWOT).

Workshop Day One: Data Discovery with NASA Worldview

January 30, 2024, 9:30 am - 11:30 am AKST

Workshop one focused on NASA Worldview and NASA's Earthdata Geographic Information System (EGIS), introductory tools with broad applicability. The introduction and demonstration of these tools led by guest presenter Leah Schwizer. Prior to the presentation and demonstration, participants were placed in breakout rooms and asked to find data pertaining to flooding on the Yukon River in May of 2023 and to document the process they took, including what went well and what challenges they encountered. Following a main room debrief, Leah Schwizer presented on NASA Worldview and GIS, answered questions from participants. At the end of the session, participants were given Assignment 1 which asked them to develop a research question relevant to their community's needs in food, energy, or water, and then use NASA Worldview and EGIS to identify and view 2-3 relevant datasets.

Presentation Topic: NASA Worldview and EGIS

Guest Speaker: Leah Schwizer, NASA Earth Science Data Systems GIS Team

Summary of Participant Feedback: Participants were eager to explore NASA datasets relevant to tribal food, energy and water priorities. Prior to the Worldview data, many participants were unsure of where to begin, and breakout activities showed that many began by typing keywords into google. Participants found it easy to identify news media articles that referred to data, but challenging to access the raw data itself. Some participants did find themselves on NASA Worldview or NASA Earthdata websites but were dissuaded to explore by the registration requirements. Following the Worldview and EGIS demo, participants were then asked to apply those tools to their own interests.

Overall, participants found the Worldview was a useful tool, and highlighted search and filtering functionality and data descriptions to be the most helpful when using the tool. Participants reflected on multiple challenges, including trying to sift through a large volume of data without being able to easily discern the relevance of each dataset, understand the acronyms and language, and incomplete data descriptions and metadata. Many felt that their lack of experience in earth data hindered their abilities to use the tool, and felt it was better suited to users with more expertise. Participants liked functions that allowed for downloading, but ran into trouble downloading the files due to bandwidth restrictions, unfamiliar file types, and files broken into many files rather than one. Participants encountered difficulty bringing downloaded data into GIS and having the visualization match that which they saw on Worldview. Topically,

some participants expected to be able to find data relevant to their community priorities and found that either the data did not exist or, in some cases, contained inaccurate data from what they knew from being on the ground. Assignments and feedback are available in Appendix C.

Selected Representative Quotes:

- It was very helpful that the data search provided a description of the data before I put it in. Also selecting it automatically put it on the map which was slick. I liked the time slider feature on the bottom to sort the data. I liked how it was clear on the period of time the data were binned for.

- The feature in Worldview that shows a list of dates that the data is available for. While it wasn't perfect and did not show the dates the data was available for specifically for the zoomed extent only, it did save me from either clicking through one date at a time and/or randomly clicking through.

- I couldn't tell if datasets weren't loading over the area I was looking at because of some buffering issue or if the data actually wasn't there. I had to reload Worldview several times. There is no "back" button to go back to your previous extent (that I could find) if you accidentally click something that zooms you over to Indonesia or something.

- Not too much, just a lot of data to look through and see if it was applicable. My question was pretty simple and direct so it wasn't a huge hindrance. If I wanted to use multiple datasets for inference, it would take a long time to learn which datasets are best for my purpose.

- There was a "blackout" of data over our reservation. There was data once "off reservation" line, and it showed there was not any type of material in the air, when there were clear clouds in the sky that day. The data was deleted or inaccurate according to the sky.

- The sheer number of files for such a short timeframe. There were no customization options for this dataset to leave out portions that were unneeded. The files each download as .tif files and there is further management the end user needs to do.

- Downloading was easy. Uploading it was not possible in the arcgis. Was I using the wrong software?

Workshop Day Two: Data Exploration with NASA POWER

February 20, 2024, 9:30 am - 11:30 am AKST

Workshop two began with a reflection on assignment one and opportunities for participants to offer verbal feedback. Following the assignment recap, Dr. Falguni Patadia, Deputy Project manager of NASA's Prediction of Worldwide Energy Resources (POWER) project provided an introduction and demonstration of POWER's Data Access Viewer (DAVe). Participants then self-selected into breakout rooms based on an energy need most relevant to their community priorities - wind, solar, or hydro. In breakout rooms, participants were asked to work together as a group to select a parameter of interest and explore the data using the POWER DAVe tool, guided by two questions: what is typical variability of that parameter over the past 30 years in your region? How would that parameter be projected to change under a high emissions scenario in the next 30 years? As participants worked through the exercise, they were asked to take notes on a shared jamboard of what they found either easy or challenging in using the Data Access Viewer, what recommendations they could offer for improving the tool, and what projects in their community could benefit from POWER data.

At the end of workshop two, we introduced NASA Surface Water and Ocean Topography (SWOT) mission with a YouTube video and introduced the assignment, which asked participants to look at an example of SWOT data through two different lenses - one through data download via Earthdata and one through a set of simplified shapefiles from Dr. Tamlin Pavelsky. Because SWOT is a newer satellite and at the beginning of data collection and currently only available through Earthdata, assignment two asked users to bring both datasets into GIS and explore their features, offering feedback on how SWOT might better create data access for users as more SWOT data is collected.

Presentation Topic: NASA Prediction of Worldwide Energy Resources (POWER)

Guest Speaker: Dr. Falguni Patadia, Deputy Project Manager

Summary of Participant Feedback: Investment in small scale renewable energy projects is of increasing importance to many tribes facing climate change, high energy costs, frequent power outages, and unreliable energy sources. As such, participants expressed enthusiasm for being able to access energy data through POWER's DAVe platform. Many participants found it much easier to work with than Worldview, and liked the functionality of searching and filtering, easy to use and understand graphs, and easy to visualize maps. Participants ran into difficulties when trying to use drop down menus on a tablet, and unclear errors when trying to use the regional search tool. While it was easy for participants to identify what applications this data could have for their region, some participants were dismayed that the resolution was too coarse to be of use for smaller reservations and tribal lands, and found that it was difficult to assess the dates of data availability and, in cases where data was missing, to understand why. Participants suggested that increased guidance on the website that users could click to as they used the tool

would be beneficial in aiding their use of the site and data. Assignments and feedback are available in Appendix D.

Selected Quotes:

- I found it user-friendly and easy to use and understand

- Like that you can view the data without having to manipulate it

- Easy to pinpoint on a map

- Liked that you could hover over a data point on the graph to get that day's data

- It was challenging to get the "regional" to work even after I tried different zoom levels and extents

- The dates of available data aren't readily discernible w/out trying dates shotgun method. It says "near real time", but data wasn't available for my region post 11/1/23

- I wish that you could convert the scale from m/sec to mph.

- It would be nice to label download types with what they'll actually give you rather than acronyms (csv = spreadsheet).

- It would be nice to have an example of layers that are commonly used and what data this could be used for.

- If there is "no data is available for this time range," it would be nice if the system could output a message with the nearest dates that data *is* available for.

- I would want better use case guidance on what temporal level to choose and what type of summary stats we should focus on.

Workshop Day Three: Data Use with NASA SWOT and SAR

March 5, 2024 9:30am-11:30am AKST

Workshop three introduced two NASA products with broad applicability for tribal food, energy and water use. The workshop began with an introduction and overview of NASA's relatively new SWOT mission and gave participants opportunities to provide verbal feedback and ask questions of Dr. Tamlin Pavelsky, hydrology science lead for SWOT. Following discussion of SWOT, Heidi Kristenson introduced Synthetic Aperture Radar (SAR) and the OPERA (Observational Products for End-Users from Remote Sensing Analysis project. She then gave a hands-on demonstration of how to access SAR and OPERA data products through Alaska Satellite Facility's Vertex platform. Assignment three asked users to follow instructional

StoryMap tutorials to access, download, and view SAR and OPERA data through Vertex, and asked participants to provide feedback throughout the process.

Presentation Topics: NASA Surface Water and Ocean Topography (SWOT) and Synthetic Aperture Radar data through Alaska Satellite Facility's (ASF) Vertex platform

Guest Speakers: Dr. Tamlin Pavelsky, Hydrology Science Lead (SWOT) and Heidi Kristenson, Senior GIS Specialist (ASF)

Summary of Participant Feedback: Overall, participants found SWOT data and SAR products to be highly relevant and applicable to a broad range of tribal food, energy and water priorities. Because SWOT data is still relatively new, users expressed some difficulties in working with and understanding the data, but were able to provide feedback for how to make the data more user friendly as data acquisition increases, including using common language, providing detailed metadata, increasing the geographical availability of data, and ensuring compatibility with GIS software. Participants found SAR data to be highly technical but applicable and were appreciative of the StoryMap and YouTube tutorials which provided guidance throughout the process of acquiring and working with the data. In both cases, participants reflected on a need for simplifying language and increased guidance and opportunities for further learning. In both SWOT and SAR cases, participants suggested that as their experience level increased, so would their understanding and abilities to use the products, but delivered as they are now, they are still very technical and require a fair amount of further learning to understand them. Assignments and feedback are available in Appendix E.

Selected Quotes (SWOT):

- I was able to bring it into ArcGIS Pro, but I don't understand the abbreviated names in the attribute table. I was looking for an index to understand what they meant, but couldn't find one.

- Have a "SWOT" button and then be searchable by river name, and use plain words that humans understand

- It would be useful for the download page opens in a new tab so the metadata/documentation was still accessible and folks wouldn't have to return to the search catalog to look for it; this is especially useful where Internet may be spotty or analysis may be remote

- For some reason I was unable to open the zip files from Earth data. I think if the SWOT files could be open on an MS Excel sheet, that would be helpful.

- Most people's brains are not full of GIS terminology and for those not using this information on a regular basis having a start here-gis 101 and a list of terminology to print to refer to when navigating

- It was easy to use the search section. The dates and filters were easy to understand. It was easy to login and download the data. The uploading into ArcGIS online website was not working. I tried many different ways and I couldn't get it to upload.

- More frequent satellite imagery. Include metadata in your products available to download, catalog of field names to better understand the data.

Selected Quotes (SAR):

- The SAR are useful, but still very technical. I would need to work with people who had a firm understanding of what is possible and the analysis methods. I could follow a set of instructions based on the tutorial, but I do not understand enough about the datasets or analysis methods yet to know what is possible and how to accomplish tasks outside of the tutorial. I thought the Story Map was a very good way to create the tutorial.

- The StoryMap tutorial made this assignment really clear and fun. It made gathering the data on the ASF Vertex web portal relatively easy with what data and files to choose from. Having the two options for either Esri ArcGIS or QGIS to do your work makes that accessible especially for those that don't have ArcGIS. I haven't used QGIS, but when I find some more time, I will come back to this and give it a try to get myself familiar with QGIS as well. Miigwech.

- Lack of data availability in the area of interest (Shinnecock Reservation). Which is a real shame because this is exactly the kind of analysis we'd like to be able to do before and after coastal flooding events. There is a need!

- A time estimate would have been extremely helpful. I was requesting mine in the hopes to use them as part of a figure for a proposal I was putting together. I thought the process would take about an hour, but after the data still weren't ready before I went to bed that evening, I needed to move forward without them and come back to this assignment later.

- The Vertex portal isn't intuitive. Its strength, i.e., that it offers several data products at different temporal and spatial scales, also makes it challenging to interact with for data exploration like the instructions in the StoryMap suggested. I think the YouTube videos under the Search Help were friendlier than the StoryMap (could this be a pop up when one opens Vertex?)

Overall Workshop Series Data Summary

We grouped together all responses from assignments and in class exercises and coded them first as the type of feedback (challenge, strength, process, relevancy, general recommendation, specific recommendation). From there, we coded the feedback within groups to find emergent themes. Figure 8 below shows coding within the subgroup "challenges". Many people were able to use the platforms, but encountered challenges in trying to understand what the data meant or how they would apply it. An equal number of participants commented that the highly technical language and acronyms were a barrier to their use of NASA data.
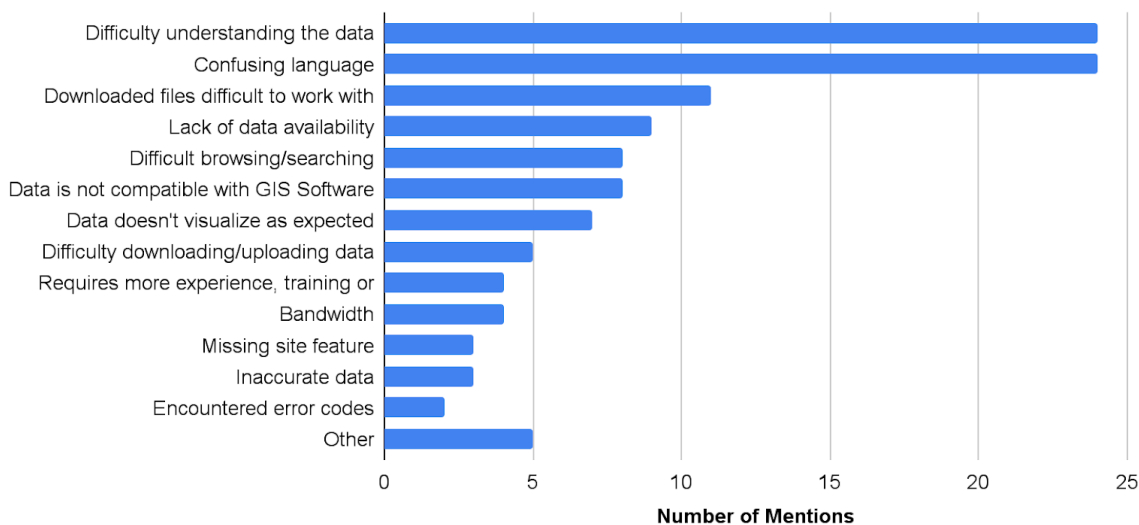
Figure 8. Emergent themes from participant feedback coded as "challenges."

General recommendations that NASA can apply across all data products include increasing opportunities for learning, training, and guidance on using NASA data and tools, using common languages and file types, including easy to access tutorials, guidance and resources while users are working with NASA data products, improving metadata and data descriptions, improving search and filter capabilities, increasing the data available for tribal communities and providing GIS ready data (Figure 9).
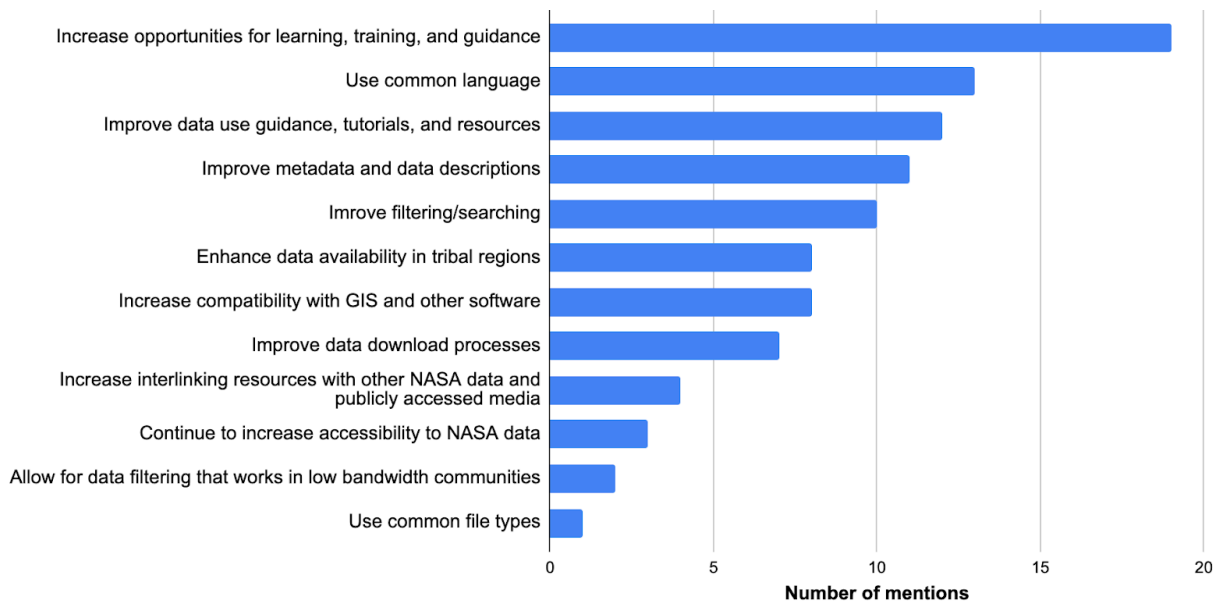
Figure 9. General recommendations synthesized from feedback across all data platforms and workshops.

Dawn breaks in the eastern sky beyond an antenna operated by UAF's Alaska Satellite Facility. The dish gathers NASA Earth Data data captured from polar-orbiting satellites several times per day. Photo by Todd Paris, UAF.

Post-Workshop Survey

Following the entire workshop series, we asked participants to fill out a post-workshop survey via google forms to summarize and offer additional feedback. We received 8 of a possible 15 responses. Overall, participants found the workshop interesting and applicable to their community priorities. Many participants had not previously worked with NASA data and/or did not realize how much freely available data that NASA provides. Themes of common strengths and challenges emerged throughout the workshop, and were used to devise the key recommendations.

Most participants see themselves using one or more NASA tools or data products in their future work. Overall, participants are likely to use NASA data and tools we shared in the UNBOUND-FEW workshops in their work. Participants were most likely to use Worldview, followed by SWOT and SAR for their food, energy and water work with their Tribal organization or community (Figure 10). Participants were somewhat evenly split on the ease or difficulty of working with different NASA tools (Figure 11), which may be related to experience level. SWOT data is still relatively new which may have contributed to the number of participants who ranked it neither difficult nor easy.

The full post-workshop survey is in Appendix F.
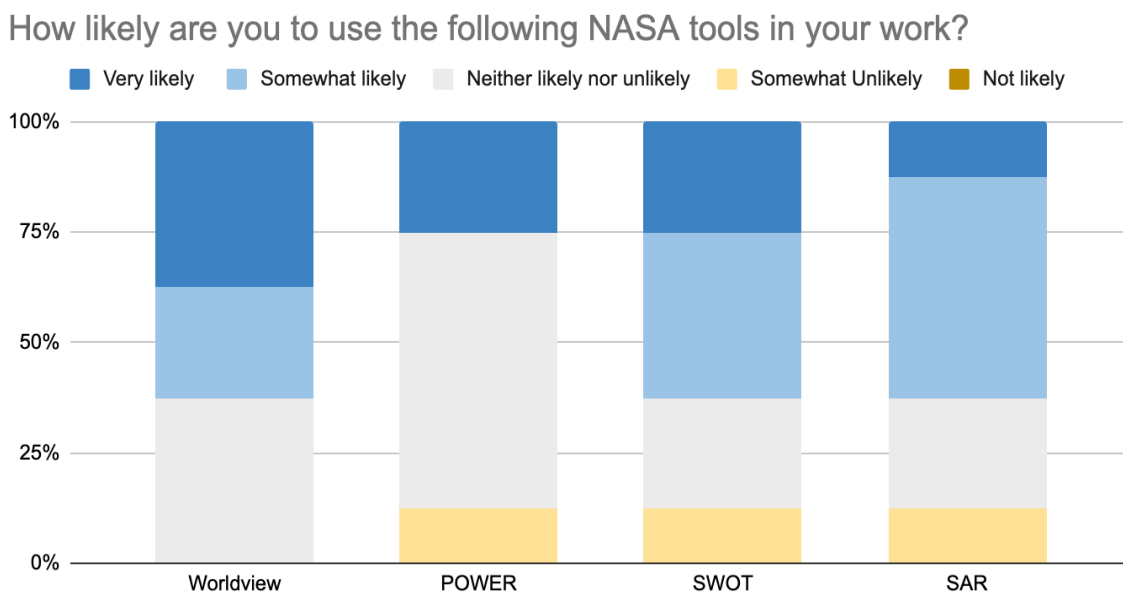
Figure 10. Likert scale responses to the post workshop survey question, "How likely are you to use the following NASA tools in your work?"

How easy were the following NASA tools to work with?
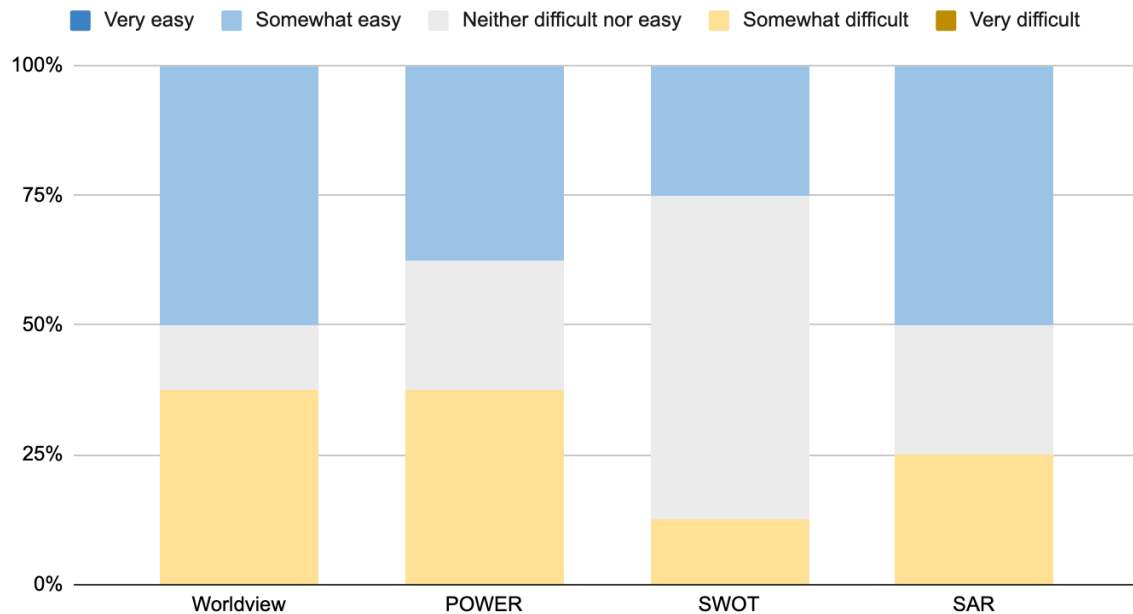
Figure 11. Likert scale responses to the post workshop survey question, "How likely are you to use the following NASA tools in your work?"

Selected Quotes

- SAR [was the most user-friendly] because of the detailed step by step tutorials that went over both working with the data itself as well as how your GIS software should be set up to use it. The SAR data also had images with each of the steps that made it really clear and easy to check lots of the extra things like "hmm my units don't look like they're the same as those in the tutorial, I may have requested these products with the wrong units for this"
- I find Worldview and POWER the most user friendly, especially while using with high school students for their research projects. I found the single point tool in POWER |DaVE very helpful to access data products to a single point location.
- NASA Worldview was incredible and an untapped resource I did not know about for data exploration.
- SAR and POWER were difficult to use due to my access rights and passwords and work internet connection interfering with the sites.
- All of the data was not transferring into my ArcGIS online program. I couldn't get any data downloaded to upload into the program. It could only view it on each individual origination site.
- At this point, I am still trying to figure out how to use SWOT. I am finding it difficult at this time.

The Post-Workshop Survey sought to identify further barriers and recommendations beyond the assignments. Many of the themes that formed the key recommendations emerged in the post workshop survey. For example, under the question "What would prevent you from using NASA data in the future?" participants again made note of internet access, data availability and the challenge in navigating the complexity of multiple websites and data access portals.

Selected quotes - What would prevent you from using NASA data in the future?

- Accessibility; lack of data over my ROI or within my date range of interest.
- If our tribe lost Starlink internet, that would be the main reason for preventing the use of NASA data/tools.
- If anything that would prevent me from using NASA data tools would be complexity in accessing data.
- If I did not have access to the saved link on my bookmark. I wonder if looking it up might be difficult if I forgot the names of the website and programs that I found most useful. Losing this information would be difficult if I didn't have access to my current work computer, bookmarks, and information.

We also gave participants another opportunity to offer recommendations for improving NASA tools and data accessibility for tribal communities. These recommendations echo themes presented throughout the workshop about simplifying language and download times, and improving data coverage.

Selected quotes - What additional feedback do you have on how NASA could improve the usefulness and accessibility of NASA data and tools?

- There needs to be more links between data and their descriptions; especially example use cases and/or tutorials for using the data. Especially within Earthdata, once I'm already at the download I can't easily go back and try to figure out why this isn't meeting my needs.
- Downloading the data to be more simplified and could save time.
- An issue that I encountered was that some data are not available during certain periods of time for our location.
- One thing I suggested to one of the scientists who were gathering data from the satellites was to potentially do a data summary to the individual reservations they were gathering data on and notifying the reservation and sharing the report of the results.

Additionally, researchers and federal agencies have a history of extracting data from tribal communities and without clear communication and permission from tribal governments. One participant reflected that NASA could be doing more to improve communication with tribes, as stated in the following quote:

- One thing I suggested to one of the scientists who were gathering data from the satellites was to potentially do a data summary to the individual reservations they were gathering data on and notifying the reservation and sharing the report of the results. The

report including potential damaging materials, potential mineral resources, and general report with information. They gave the tribes the standard 30 day notice to respond no with a lawyer and stuff. I told him tribes are slow and not all emails on the websites are up-to-date or accessible. Some may have even gone to the spam folder. Their thinking was they notified them and didn't need to contact them any further. I found this disrespectful for not following through contacting them in-person attempts were not attempted, maybe not affordable. Tribes are very concerned with this access being shared on the website without their consent. It seems very contradictory to share this data about tribal lands with the world.

Product Specific Recommendations

NASA Worldview and EGIS:	- Allow for additional download options - Allow for batch download of different layers - Allow for smaller size downloads for low bandwidth users - Clarify and streamline download process for single files and batch download - Clarify which data is available for download - Improve data completeness - Provide more detailed metadata - Have a back button for users to retrace their steps when using the platform - Improve filtering by date - Make dates of data availability filterable - Provide a filter option to exclude dates for which data isn't available - Provide after download assistance - Offer a Jupyter notebook (maybe an ArcGIS Notebook that pulls directly from the EarthData Cloud or Living Atlas), following a use case, to help get past download issues. - Provide the layer symbology file as displayed in Worldview - Provide video tutorials for working with NASA data in GIS - Increase compatibility and transferability between Worldview and ArcGIS online - Identify GIS-ready datasets pre-download - Allow for data downloads in common GIS file formats - Allow for data downloads in csv format when possible - Provide more satellite data on Tribal and rural lands - Use common language for data descriptions and file names - Acronyms should be explained - Label by application rather than by satellite or sensor

NASA POWER:	● Improve accessibility on mobile devices
	  ○ Modify parameter list scrolling function so that it works on a tablet; resize the scroll box?
	● Increase user guidance throughout
	  ○ Use common names for models
	  ○ Offer use cases as examples
	  ○ Provide examples for how data can be used
	  ○ Offer guidance for what temporal levels and summary stats are best used for different applications
	● Increase download options for graphics
	  ○ Allow for .jpeg in addition to .png
	● Increase options for units
	  ○ Allow users to choose mph or m/sec
	● Offer file type descriptions
	  ○ Identify that a csv will display as a spreadsheet
	  ○ Provide a description or link to resource for how to use JSON
	● Offer descriptions of available resolutions and regions
	  ○ Provide better explanations for how to use the regional select tool so as not to get error messages
	  ○ Clarify resolutions available
	  ○ Clarify differences between selection by point or regional select tool
	● Clarify temporal data availability
	  ○ Simplify filtering by date
	  ○ Identify data lags on datasets
	  ○ When data is not available for a user's timeframe, offer an option to select closest available dates

NASA SWOT:	● As data comes online, offer in person trainings for how to use the data to Tribal communities
	● Provide standardized metadata
	● Include data descriptions for files and attributes
	● Use common language or explain when acronyms are necessary
	● Link SWOT data with drought data sources
	● Label fields with no data as NO DATA instead of -999999
	● In Earthdata, allow for batch data downloads
	● Increase user guidance
	  ○ Offer data use tutorials
	  ○ Increase connectivity with ArcGIS online
	● Increase support for low bandwidth users
	  ○ Provide a help center phone number for users
	  ○ Provide option to save data visualizations as a pdf
	  ○ Decrease file sizes for download
	  ○ Provide data in csv format
	● Provide change detection tools (e.g. erosion over time)
	● Provide multiple options for filtering and allow for filtering by applied use

ASF SAR:	• Continue to provide on-site tutorials in easily accessible formats - YouTube, Storymap
	○ Add tutorials and YouTube links (under Search Help) as pop ups when opening Vertex
	○ Have tutorials available as static pdf files for low-bandwidth users
	○ Continue to provide tutorials for both ESRI products as well as QGIS
	○ Begin the title of tutorials with the word "tutorial" so it is clear to a user that they can follow along to learn
	• Allow for smaller sized file downloads so low-bandwidth communities can still access SAR data
	• Clarify acronyms and technical language or offer popup links to explain terminology (ie VV, VH, single look complex, detected high-res dual-pol)
	• Provide an 'estimated time remaining' timer for file downloads
	• Add more information on how OPERA RTC and RTC on demand products differ, or explicitly state if there is not a difference
	• Provide a quick explainer on the start page of the data types, their origins, differences, applications, and how to decide which data to use based on applied need

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Appendices

- A: Participant Recruitment and Application
- B: Listening Session Agenda and Materials
- C: Workshop 1 Agenda, Assignments, Feedback
- D: Workshop 2 Agenda, Assignments, Feedback
- E: Workshop 3 Agenda, Assignments, Feedback
- F: Post-Workshop Survey and Feedback

Appendix A: Participant Recruitment and Application

Figure A1. The Alaska CASC Tribal Resilience and Learning Network created a flier which was shared through multiple avenues. The flier directed applicants to a website for more information and to apply via Google Forms.

Workshop Series Application: Broadening the use of and access to NASA data and tools for tribal food, energy, and water priorities

Community ground observations paired with remote sensing data can provide tribal organizations and colleges with resources and tools needed to confront climate challenges and plan for resilient futures. NASA has incredibly rich and free data that can be used in planning for climate change; however, access to and use of this data can be challenging. NASA wants to make the data easier to find and access, especially for tribal organizations and colleges.They do this through supporting UNBOUND workshops: Understanding Needs to Broaden Outside Use of NASA Data where participants learn about and test NASA data and tools.

We invite applicants affiliated with a tribal organization or college to participate in a four-part online UNBOUND workshop series for participants to identify challenges and opportunities for improving accessibility and usability of NASA data tools for tribal food, energy, and energy applications and priorities. The workshop series aims to engage relevant issues for individuals who are not currently using NASA data products or would like to increase the use of NASA data for food, water, and energy applications.

Participants will :

1. Explore how NASA data products can be used for tribal food, energy, and water planning
2. Make connections with people and organizations using GIS for food, energy, and water issues
3. Provide feedback to NASA to enable the data to be more accessible and useful for tribal food, energy, and water priorities

Stipends Available:

Fifteen individual participants selected will receive $1,200 each. Interested participants should have some experience working with GIS (geographic information systems) and/or satellite data. Additional interested participants (not receiving a stipend) will be notified of selection to participate based on selection criteria and number of applications. To be eligible to receive a stipend, the applicant must be associated with a U.S.-based organization or institution. Priority for a stipend will be given to applicants affiliated with or working for a tribal organization or college.

Participants are expected to test NASA Earth data and develop a series of practical recommendations to improve NASA Earth Science Data Systems through guided workshop activities. See previous UNBOUND reports [HERE](#).

For questions or more information, please contact Emily Sousa at eesousa@alaska.edu or 907-474-6927

UAF is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination

* Indicates required question

First Name*   Your answer

Last Name*   Your answer

Email Address*   Your answer

What organization, tribe, or consortia do you work for? *   Your answer

What is your job title or role?*   Your answer

What is your experience level with using GIS and/or geospatial data (for example GPS, drones, or satellite data)?

- ☐ I regularly use GIS and/or geospatial data
- ☐ I have some experiencing using GIS and/or geospatial data
- ☐ I have a little experience using GIS and/or geospatial data
- ☐ I have not used GIS or geospatial data but would like to learn
- ☐ Other:

How do you currently use GIS, mapping, and/or satellite data in your work?*   Your answer

What types of data would be helpful in your work but you have had a hard time finding or accessing (such as air quality maps, current satellite images, elevation data, flood risk assessment, etc)?

Your answer

What food, energy, water and/or climate issues that could benefit from geospatial tools in your community would you most be interested in covering in this workshop series? (choose all that apply)

- ☐ Erosion
- ☐ Flooding
- ☐ Landscape assessment for infrastructure development and maintenance
- ☐ Permafrost
- ☐ Climate (temperature, wind, precipitation, snowfall, etc)
- ☐ Air quality
- ☐ Renewable energy development

- ☐ Wildfire
- ☐ Food security
- ☐ River and lake ice
- ☐ Vegetation coverage
- ☐ Other:

If you would like to expand on any of the issues you selected above, please do so here.

Your answer

Do you use NASA data in your work?*

- ☐ Yes, I currently use NASA data
- ☐ Yes, I have used NASA data in the past
- ☐ No, I have not used NASA data
- ☐ I am not sure if I have used NASA data

What do you hope to get out of the UNBOUND FEW workshop series?

Your answer

Do you have sufficient internet connectivity to participate in this workshop?

- ☐ Yes
- ☐ No
- ☐ Not sure

Are you able to attend all four workshop sessions?

- ☐ Yes
- ☐ No
- ☐ Not sure

Appendix B: Listening Session Agenda and Materials

UNBOUND - FEW Listening Session Agenda

Time	Activity
10:30am	Welcome
10:35	Introductions - verbal from participants & team, larger group in chat
10:45	Grounding & Significance of Tribal Priorities
10:50	Intro from UNBOUND
10:55	Overview of this project, flow of workshops, note about openness of recordings and share-outs, aka this is public info. Roles of stipend participants and of observers
11:05	Orientation to Jamboard tool (How to Add Sticky-note, etc.) Describe break out room activity
11:10	Break-out rooms Introduce yourself including - In your work what maps, satellite data, and/or imagery are you currently using and what tools do you use (ie google earth, ArcGIS?), if any? Q1: What current concerns or impacts are you facing around food, energy, and water in your community? Q2: What satellite data, maps, earth data or imagery do you think might be helpful for you and/or what would you like to focus on in these workshops?
11:40	Session debrief
11:50	Next Steps General format for the three work sessions UNBOUND participant expectations
12:00	Listening Session end

What current concerns or impacts are you facing around food, energy, and water in your community?

Participant Response	Theme	Sub-Theme
Alternative energy	Energy	Alt Energy
clean energy	Energy	Alt Energy
fuel breaks for alternative energy	Energy	Alt Energy
need for alternative energy - hydrogen, tidal, biomass	Energy	Alt Energy
Solar microgrid	Energy	Alt Energy
watershed storage potential modeling for hydro	Energy	Alt Energy
Windmill	Energy	Alt Energy
high poverty and high energy costs	Energy	Costs
increased fuel and electricity costs	Energy	Costs
community members without power	Energy	Power Outages
Energy - power outages	Energy	Power Outages
energy shut offs for community members	Energy	Power Outages
extended power outages	Energy	Power Outages
Power outages	Energy	Power Outages
Hunting birds	Food	Birds
farming	Food	Farming
gardening	Food	Farming
change in fish species	Food	Fish
fewer salmon, increased parasites	Food	Fish
Fish and birds with sores	Food	Fish
nickel mining risks to wild rice & fish	Food	Fish
river erosion losing fishwheels & cultural sites	Food	Fish
warm sea temps impacts on fish and shellfish sea gardens	Food	Fish
green crab migrating in	Food	Invasive Species
changes in berry distribution	Food	Plants
changes in berry production	Food	Plants
Less berries	Food	Plants

less predictable berry abundance	Food	Plants
less predictable timing for berries	Food	Plants
mapping kelp forest change	Food	Plants
Native Plants	Food	Plants
Native plants for food gathering	Food	Plants
petrol pipelines - risks of leaks to wild rice	Food	Plants
Plant mapping for ecological restoration	Food	Plants
Flood risks to traditional food harvest	Food	Traditional Foods
fuel breaks to grow food	Food	Traditional Foods
water pollution impacts to traditional foods	Food	Traditional Foods
forest change	Food	Vegetation Change
hemlock and spruce mortality	Food	Vegetation Change
Increasing wildfire	Food	Vegetation Change
tree death due to pests	Food	Vegetation Change
vegetation transition	Food	Vegetation Change
crashing caribou populations impacting subsistence hunting	Food	Wild Game
Drought	Water	Drought
droughts	Water	Drought
water shortage	Water	Drought
Erosion	Water	Erosion
erosion & sensitive soils	Water	Erosion
landslide risk	Water	Erosion
river erosion	Water	Erosion
invasive fish species	Food	Fish
Flood risks	Water	Flood
Flooding	Water	Flood
flooding	Water	Flood
Flooding	Water	Flood
Floods	Water	Flood
high flood risk	Water	Flood

increase in marine traffic	Water	Pollution
nickel mining risks to waterways	Water	Pollution
petrol pipelines - risks of leaks to waterways	Water	Pollution
Water pollution	Water	Pollution
Increased precipitation	Water	Precipitation
Increased rain on snow	Water	Precipitation
lack of snow	Water	Precipitation
low precipitation	Water	Precipitation
Precipitation changes	Water	Precipitation
students interested in rainwater/precipitation projects	Water	Precipitation
super storms	Water	Precipitation
water from tundra and rain	Water	Precipitation
Rising Sea Levels	Water	Sea Level
Ground Sinking	Water	Subsidence
Permafrost	Water	Subsidence
Sea temps warming	Water	Temperature
Warming Sea Waters	Water	Temperature
warming water	Water	Temperature
warming water	Water	Temperature
lack of potable water	Water	Water Infrastructure
lack of running water	Water	Water Infrastructure
Out of Date Sanitary Systems	Water	Water Infrastructure
poor water infrastructure	Water	Water Infrastructure
Traditional water management	Water	Water Infrastructure
Wetlands	Water	Wetlands

Appendix C: Workshop 1 Agenda, Assignments, Feedback

Workshop #1 Agenda: Data Discovery
Tools: Worldview, EGIS
Guest: Leah Schwizer - NASA GIS Team

Time	Activity
9:30 - 9:40	Welcome Review Listening Session Preview Workshops
9:40 - 9:45	What is Data?

9:45-10:15	Working individually
	
	Find NASA data or a visualization of the Yukon River in May 2023.
	
	    Where did it flood?
	
	    When did it flood?
	
	    What was the extent?
	
	Fill out Google Form
	
	Discussion: where did you end up? What were you able to find? What would've made this easier?

10:15-10:20	Break
10:20-11:00	NASA Worldview and EGIS Demo with Leah Schwizer
11:00-11:25	Small Groups - try the tools out Think back to the listening session - what was one of the issues most interesting/relevant for your community? What question can you use Worldview/EGIS to find data for?
11:25-11:30	Wrap-up, Introduce Assignment #1 Reminder of next workshop Use Worldview/EGIS to find data relevant to your question, provide feedback in the google form

In-Class Assignment with Participant Responses in italics

Find NASA data or a visualization of the Yukon River in May 2023

Using the NASA map, data or imagery you found:

Can you identify where it flooded?

Can you identify when it flooded?

Can you identify the extent of flooding?

If yes, how did you get there? If not, why not?

Answer the following questions to help guide the improvement of NASA data products.

What steps did you take to try to find the data? Details are helpful - including if and where you got stuck or alternate things you tried. What worked or didn't work?

Googled on Google Chrome "NASA Yukon Flood 2023" followed this link https://earthobservatory.nasa.gov/images/151379/a-tumultuous-spring-breakup#:~:text=The%20melting%20of%20winter%20snowpack,widespread%20impacts%20on%20riverside%20communities.
Googled NASA data map May 2023 Yukon River
google search found tumultuous spring breakup nasa data
Entered dates, entered land structure, surface water, floods, couldn't figure it out.
Googled Yukon River Flooding 2023 NASA, came up with an article https://earthobservatory.nasa.gov/images/149996/living-with-floods-in-the-innoko-lowlands with 2022 flooding. Followed link from there to https://earthexplorer.usgs.gov/. Tried searching through data
Started with googling "water data river nasa"; first link is "Water Measurements rivers and wetlands" (blueice.gsfc.nasa.gov); clicked on a dot in Alaska that was the Yukon, got to this graph which shows a peak in May 2023: https://blueice.gsfc.nasa.gov/gwm/river/8019. Wanted to find imagery to show the extent. Tried to google for sentinel 6 data (based on its mention in those graphs). Found data descriptions here: https://podaac.jpl.nasa.gov/Sentinel-6; no link for downloads or existing online visualization tools. Lots of data that shows where rivers are (shapefiles) but nothing that I can easily and quickly find with the actual satellite data despite knowing the name of the satellite I was interested in seeing. I did try more generic "river satellite data". Several EPO articles that talk about how NASA data is so great and can be used for this; no links to data in articles. Found this tool: https://webmap.ornl.gov/ogc/index.jsp but the categories are opaque and I didn't find what I needed through that either.
apply dates, look for flooding layers, events, precipitation

I struggled with this. My internet may be slower, so everything was taking awhile to load. I am on NASA worldview, but that's about it.

I visited earthdata.nasa.gov > Find Data > Browse by Topic > Terrestrial Hydrosphere and clicked the "Find Data" green button. This prompted me to a pre-selected view of the catalog, which included the data product names but no descriptions (I then referenced my NASA ARSET fundamentals training notes to identify what the data products were). In the search query, I defined the "project" filter to "Yukon River, AK". I removed the "topic" filter to view results for the AIRSAR data product. This yielded no relevant results (temporal range was off). With the knowledge that it likely was a SAR data product, I returned to the data catalog I am most familiar with: Google Earth Engine. My next step is to identify the long/lat or bounding box location of the Yukon River to obtain the images for my region of interest over the month of May 2023 through a Jupyter Notebook.

I used the citation on the bottom right of photo to do research within the Alaska public media site, skimmed through to see when it happened, internet searched for earthexplorer with USGS and they had datasets

I went to NASA's Open Data Portal and searched for May 2023

geospatial data on yukon river in May of 2023

Google search for articles. Article has links to data used.

Started by googling "NASA Earth Data Yukon River 2023". I ended up with news articles that led me toward the SWOT mission. The image that showed was for their validation mission in June. I then saw a link to NASA Earth Data and got to the search tool. I was able to click on "terrestrial hydrosphere", and then "surface water" but then everything was named by the satellite, and I wasn't sure what the jargon meant with all the acronyms. It would be great if there were suggested uses of the datasets listed there rather than the satellite information. https://search.earthdata.nasa.gov/search?fsm0=surface%20water&fst0=terrestrial%20hydrosphere

I started with Google search and reached earthobservatory.nasa.gov. I got stuck with finding data though

I searched with Google for publications of flooding events matching the description provided

Were you able to find a NASA visualization or data....
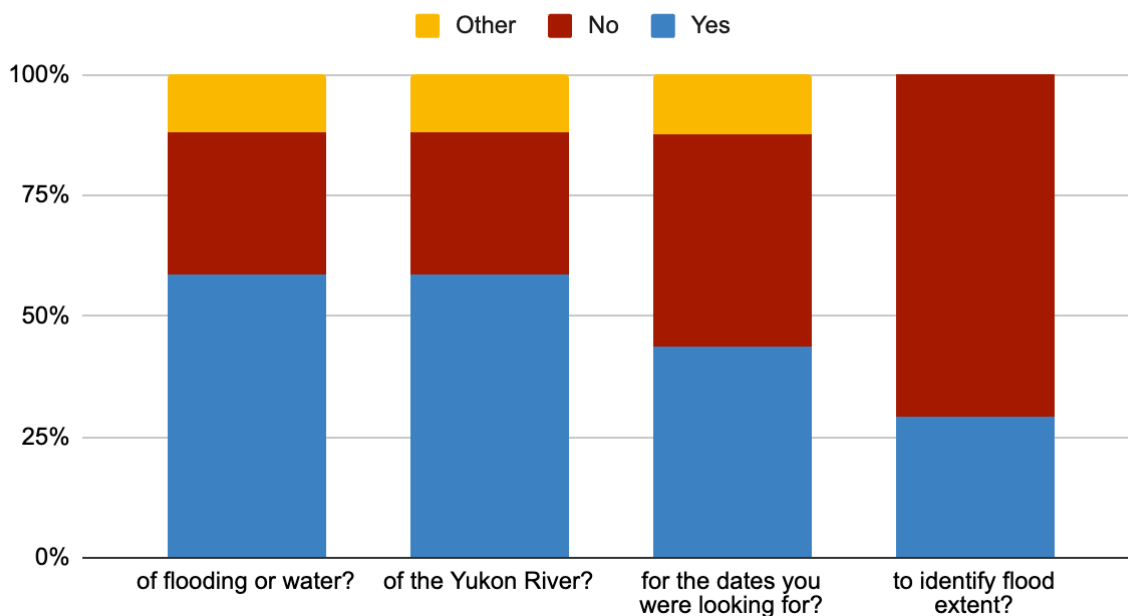
Figure C1. Nearly 60% of participants were able to find a NASA dataset for visualization of flooding or water and specifically of the Yukon River. Participants found it more challenging to identify the dates of interest (44% yes) or flood extent (31% yes). Participants who answered 'other' wrote: "I don't know. I found a lot of data, but geo-referencing it was hard" (flooding or water), "Kind of. I got to a bunch of datasets of river level on NASA Earth Data, but didn't know which one was the most relevant" (flooding or water), "Yes but i would have needed to create a NASA account which I have not done yet" (of the Yukon River), "Kind of. I got to a bunch of datasets on NASA Earth Data, but didn't know which one was the most relevant" (of the Yukon River and for the dates you were looking for), and "it was hard to pinpoint" (to identify flood extent).

What would have made this data easier to find?

An enlarged picture of the town of Circle in the topical images.
The data was easy to find in Google
location search. the location by river required a number?
Breaking down acronyms in data set names, Was relatively difficult to filter by a specific location in earth explorer - to find the extent of flooding requires a location which we did not have
More interlinking resources. Links to the datasets and online viewers in descriptions of data and especially in public outreach articles. I find this in my own work as well all the time. An EPO article showing exactly the kind of thing I want (because they are more likely to hit with layman's terms in search engines) with then no links for resources on how to get there.

if I knew which layers to apply in what order? if my computer could process everything, seems to be getting stuck loading information
A little more knowledge about the application and a faster internet on my end.
better wording
an area where we can input dates
identifying clear words to google for the data I want
Labeling and format improvements.
I was able to click on "terrestrial hydrosphere", and then "surface water" but then everything was named by the satellite, and I wasn't sure what the jargon meant with all the acronyms. It would be great if there were suggested uses of the datasets listed there rather than the satellite information. *https://search.earthdata.nasa.gov/search?fsm0=surface%20water&fst0=terrestrial%20hydrosphere*
If I could find a NASA website information for water only,it would have been easier.
I think when we get to using the tools, it makes better sense, but I'm still figuring out the UI from the landing page.

Anything else you'd like to expand on about your process:

Everything was in the short report.
Any models that can be used to determine the actual size of affected areas.
I was wondering how to look up a river number? Was I even in the right spot?
which pieces are the most critical and order to add layers
Once I become more familiar with the source, I think it'll be easier to find the data.
I feel like having some experience with gathering data from past courses helped.
more practice
I'm unfamiliar with the vocabulary needed for GIS mapping, I would love to dig deeper into GIS mapping to learn the lingo needed to properly research
Relevant keywords to use storyline as a means of conveying routes to access data
The news articles gave clues on what datasets to go to. Perhaps link specific datasets to the news articles?
I am still learning and getting used to NASA data
Not at the moment

Homework Assignment #1 with Participant Responses in Italics

NASA UNBOUND Assignment 1- Data Discovery

Using Worldview or EGIS to for Food, Energy, or Water in your Community

Think back to the Listening Session and consider one topic important to your community. Are there datasets that would be beneficial to that topic? Using Worldview or EGIS, attempt to find 2-3 datasets relevant to your question. Answer the questions, including as many details as you can.

What was your question?

What data is available to show the effects of floods to the Lummi Nation and food security? Due to flooding is the Lummi land impacted for growing crops, traditional foods and native plants and are they being damaged?
How much snow did we get in December 2022 compared to December 2002?
With a lot of heavy rain that is uncommon for the region, how much rainfall encountered during the summer of 2023 that caused more vegetation growth?
My question was related to water availability in my community
How can precipitation data be utilized to design and implement effective rainwater harvesting initiatives in the arid regions of Arizona, ensuring optimal utilization of available resources and maximizing water conservation efforts?
Climate change is threatening Manoomin (Wild Rice) and impacting the waterways. How has land use changes affected Manoomin growth and development?
What was the increase in surface water on the Kenai Peninsula from 2022 to 2023
Find arable land dataset
Over time how has the flood risk and impact changed over the Shinnecock Reservation?
What are the drivers of land cover change in Corongo?
Can we quantify past precipitation events? How much rain fell in the infamous "december 2020" event that triggered the landslide event and dozens of landslides in Hoonah?
What is the change in fiber quality of forest stands impacted by spruce bark beetles
I did not attend the last workshop, I was traveling
Native plants soil temperature
My original question could not be answered. So I searched for a new question: "Air quality on the reservation of Warm Springs. There was a strange fog that lasted over a month. I was curious on

the quality of the particles. It was a "gas" in the air, slightly hazardous.

What datasets were you searching for?

flood hazards, frequency and distribution, economic risk and mortality risk. I also searched population density from the year 2000 to 2020. curious to see how much the Lummi Nation is growing population wise.
raster datasets that show snow coverage
Precipitation Rate: IMERG and Vegetation Index: Aqua/MODIS
I was looking for datasets related to water sources, water quality, and water usage in my community
I am looking at 2 data sets -surface precipitation rate(daily) and Snow Cover (Normalized Difference Snow Index, L3, Daily) in the Tuba city area in Northern Arizona. The data should cover the month of January in 2003,2007 and 2011.
Precipitation events, lake ice, snow rate, Human Built-up and Settlement Extent, Surface Precipitation Rate, Dams.
surface water data for Alaska, Kenai Peninsula
Datasets whose can help to compute arable land
Flood hazard data, data that can show water/flooding extent over the last decade, economic impact data.
I am searching for vegetation indices.
Layers that allowed me to look at rain or snowfall totals in a specific period of time to compare to reported totals. I was looking for rainfall and snowfall related records.
Wildfire Risk due to Wildland fiber quality
digital elevation models
I don't know what data sets are
If for sale properties in the area can sustain a native plant restoration
Air quality

What was your process for searching? What tools did you use?

The first step was to google world view, I then searched Lummi Nation and clicked on the Tribal school. I clicked the "Layers" button and searched all flood data. I then added population density from 2000 to 2020. My thought process on this search was to see if we are losing lands due to population density.

I clicked on the data button at the very top of the screen and noticed a link that stated "downloading data will be performed using NASA Earth data search application. I clicked on the link and attempted to search and was prompted to sign into Earth data which I don't have an account with.

I used the link that was provided for the EOSDIS Worldview, looked through the list of layers and found the snow coverage by month within the lists.

In worldview.earthdata.nasa.gov, Click Add Layers. Under Precipitation Rate: clicked each option. Chose the IMERG option since it seemed like the best option for the dataset I am searching for. Clicked the dates on the bottom left to select the option for the days in June 2023 where a lot of rain happened. Under the Vegetation Indices tab, checked each option and chose the Aqua/Modis Vegetation Index (L3, Monthly) since this looked to be the best option based on the description. Checked the dates within the months of June-July 2023 since there were a lot of changes in vegetation growth during that period.

I used the search functionality in Worldview and EGIS, entering keywords related to water resources in my community

I started off with the link from the resource list from the workshop.
Accessed NASA Worldview: https://worldview.earthdata.nasa.gov/ .
In the search bar, I typed the location of interest. Clicked on the +Add Layers button. Selected Drought and then Precipitation rate. Since multiple filter options are also available, clicked on the Snow Cover (Normalized Difference Snow Index, L3, Daily) data sets. Additional data set information was also displayed on the right side of the search window.
Data field: surfacePrecipitation
References: AE_Rain doi:10.5067/IR85TKB5BLM3. Created and downloaded an animated .GIF

I used EOSDIS Worldview. I figured out an idea for what I was searching for and kept it during a certain time frame. I could embed the map and add it to a storymap, but if I wanted to transfer the map, say to ArcGIS online would I be able to do that? I couldn't figure that out without downloading the layers.

Google search, NASA and surface water found earthdata and searched that led to some older data at; https://cmr.earthdata.nasa.gov/search/concepts/C2162118169-ORNL_CLOUD.html

I use Worldview and EGIS

After the presentations in our recent session, I started on Worldview and read through the full list of datasets available to start. Perhaps there was something there that would be different from what I would initially have looked for that would be helpful. Normally I would have started with a Google search and not limited myself to only NASA datasets (there are other government agencies out there with great data too!), but for this purpose I am looking at a NASA proposal call that also specifically calls for the use of NASA data, so it makes sense to limit it to what these can offer.

I visited Worldview and Earthdata > Topics to obtain an idea of what land cover data products are available and their current use. However, Earthdata > Topics wasn't too helpful and I ended up clicking around Worldview and reading the data product descriptions without much idea of their application without Googling.

Started with worldview https://worldview.earthdata.nasa.gov/. Identified layers in there related to snowfall and precipitation. I added them to the map to visualize them. I did some searching online to pin the exact date of the storm. The maximum of the storm was December 2nd and 3rd.
https://www.pbs.org/newshour/nation/landslide-slams-into-remote-alaskan-community-killing-3-people
https://storymaps.arcgis.com/stories/611c5690489d46d09ef4e27555e9688c
This story map reports rainfall totals at the stations in Haines which were the highest ever recorded. 18 cm in 1 day.

Using the EJScreen tool to search for leads on the right information

I went to the worldview to mainly explore and look, i have previously downloaded data from USGS

I did not attend last session

googled Lummi maps, redfin search of properties for sale in the are

WorldView

How many datasets were you able to find?

17 responses

Figure C2. Nearly 90% of participants were able to find at least one relevant dataset for the question they were looking for.

The datasets I found were:
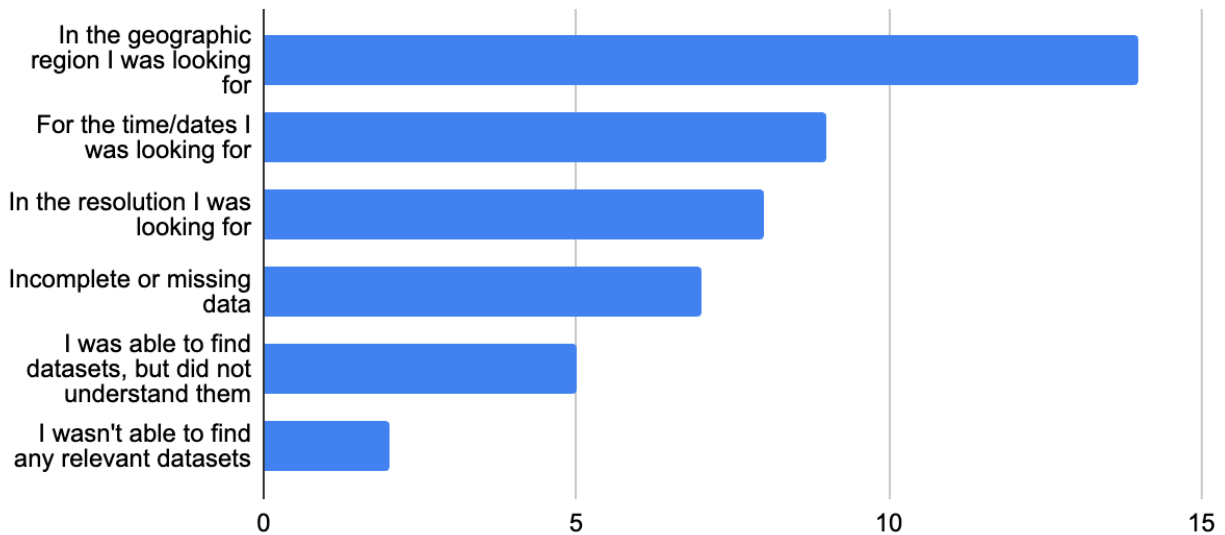
Figure C3. In response to the question "the datasets I found were (check all that apply)", most participants were able to find relevant datasets for their geographic region of interest, but had more difficulty finding them in the time and dates and resolution. For many, they were able to find some data that partially addressed their question, but did not fully answer it, and some participants were able to find data but not understand it or found data to be incomplete.

What helped you as you searched for data?

figuring out the right question to ask which made it a little easier to search. Getting a better understanding of GIS is a learning experience for me.
clicking through each one to see if they were in Alaska or not.
Reading through the "About Vegetation Indices" where it describes what the data has. Some datasets were from older dates which I did not need. The coverage map under the description.
The search filters in both Worldview and EGIS helped me narrow down relevant datasets.
The https://worldview.earthdata.nasa.gov/ website is user friendly. Also the help center: https://nsidc.org/data/user-resources/help-center/visualize-and-download-nsidc-daac-data-nasa-worldview
Getting familiar and acquainted with Worldview and figuring out what satellites had potential coverage during the time frame that was searched. If I searched for a longer time frame, such as a 30-year time frame there were less satellites available, or I was just doing it wrong. I changed the time frame and searched for the proper satellites during those time frames and what would work with my research question.
ability to narrow down subjects eg. surface water world wide to north America to finding Alaska
Worldview, EGIS and Google Earth Engine
The feature in Worldview that shows a list of dates that the data is available for. While it wasn't perfect and did not show the dates the data was available for specifically for the zoomed extent only, it did save me from either clicking through one date at a time and/or randomly clicking through.
I visited the "Vegetation" sub-topic and after a lot of clicking under more child links, I ended up finding a use case: https://www.earthdata.nasa.gov/learn/pathfinders/biological-diversity-and-ecological-forecasting-data-pathfinder. It would be nice to see the Data Pathfinders highlighted more clearly with the "Topics" page instead of being buried under "You Might Also Be Interested In" links.
It was very helpful that the data search provided a description of the data before I put it in. Also selecting it automatically put it on the map which was slick. I liked the time slider feature on the bottom to sort the data. *I liked how it was clear on the period of time the data were binned for.*
EJScreen layer under Climate Change Data, Wildfire Risk
search box
N/A
Knowing where to look for native plants on the reservations already

> *I found while adding layers - there is the option with detailed information next to the category explaining in detail what that category means. It was very helpful in selecting what I wanted to search for.*

What hindered you as you searched for data?

> *Overall learning GIS and navigating worldview and Earth data and having login information to access the sites.*

> *There are not a lot of datasets for Alaska*

> *Just searching through each dataset and reading through each description.*

> *Some datasets were incomplete, and others lacked detailed descriptions, making it hard to determine their relevance.*

> *It took me some time to figure out that the different layers have different starting dates for data availability. For example, the precipitation rate for Northern Arizona was available from 2002 JUN 01-2011 OCT 04 whereas snow water equivalent data was available from 2012 JUL 02 - Present. So I was not able to include these two layers for comparing the change over time. Instead, I chose snow cover data which has coverage from 2002 July 03-Present.*

> *At first it was getting a black map, and all the layers were an exclamation point. I just had to do a little more figuring out why that was, and now I have a decent map with layers to work with.*

> *Not enough data on Alaska and data was focused on surface water of lakes, rivers and ponds in relation to loss of water not increased ponds in wetland areas, and the data was old. The data specifically left out the vegetative wetlands.*

> *I couldn't tell if datasets weren't loading over the area I was looking at because of some buffering issue or if the data actually wasn't there. I had to reload Worldview several times. There is no "back" button to go back to your previous extent (that I could find) if you accidentally click something that zooms you over to Indonesia or something.*

> *In the "Topics" page, the "Related Data Archives" section includes acronyms, which required further clicking for me to understand. This was confusing as I expected data products, not archives, to be linked to each topic.*

> *Not too much, just a lot of data to look through and see if it was applicable. My question was pretty simple and direct so it wasn't a huge hinderance. If I wanted to used multiple sets for inference It would take a long time to learn which datasets are best for my purpose.*

> *Wildfire Risk shows proximity of properties at risk, but the area is covered in spruce bark beetle-kill*

> *being new to NASA worldview*

N/A
N/A
There was a "blackout" of data over our reservation. There was data once "off reservation" line, and it showed there was not any type of material in the air, when there were clear clouds in the sky that day. The data was deleted or inaccurate according to the sky.

What would have made the data easier to find?

Learning and practicing and understanding the language on the sites.
It would have been easier to find data if I knew how to properly read the types of satellites being used.
Possibly filtering out bad data for a certain area we need? That is only what I can think of.
Improved metadata and more specific search categories would have made the data easier to find.
I think being more familiar with https://worldview.earthdata.nasa.gov/ will make data easier to find.
Again, just getting familiar with NASA Worldview. The more I use it the easier it'll come by.
Starting with a map to click on for location of data on surface water including vegetative wetlands.
Based on my approach I don't think there could have been a much easier way to find the data. However, for my usual approach (using google to learn about datasets rather than going right to NASA's sites); the economic data was still difficult to find, there doesn't seem to be socioeconomic data built into Worldview, instead that's a completely separate tool(s).
In the "Topics" page, the ability to view/filter use cases by dataset (i.e., similar to the filter by "Article", "Blog", "Data Users", "Events", etc.) in addition to the "Find Data" button.
Fuller list of layer attributes with an adjusted designation of the area's risk.
I'm not sure, I'm still exploring.
N/A
Key word search
If the data blackout didn't occur on the reservation. Nearby it showed that it was in hazardous conditions right near us, but it didn't show us when there was clear thick coverage that lasted for maybe 3 months straight.
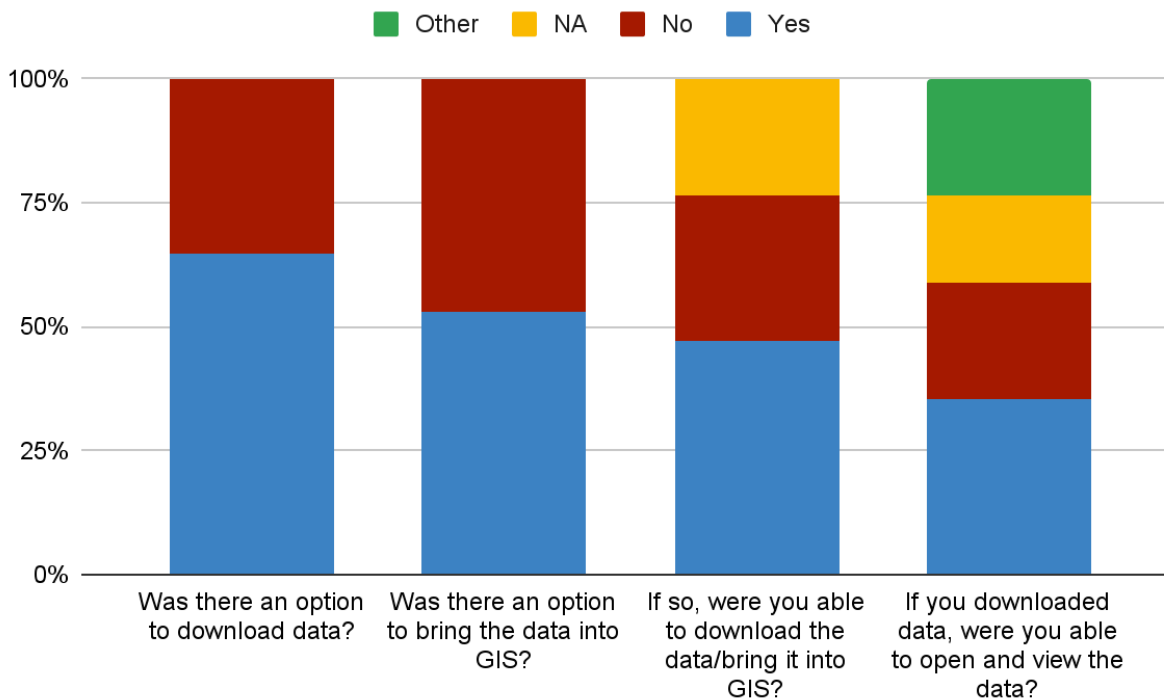
Figure C4. While 65% of participants were able to find an option for downloading data from Worldview, less than half were able to complete the process of downloading the data and opening and viewing it in a GIS.

If you weren't able to open or view the data, why not?

Didn't get this far.
I was able to open and view the data for the area I was looking for.
The data looked different than what it appeared in Worldview.
N/A
I was unable to open data as my computer was not supported by Acrobat Pro 2017.
Having issues logging onto EarthData, but once I was able to get that sorted, I was able to start downloading the data. Is there a way to bring all the data that was selected together rather than having to bring in the layers individually. That would save so much time.
I was able to view/open it; however each layer was in its own .tif file instead of being managed in a manner that would make it easily accessible from a non-power user.
I think there needs to be increased data collection and increased uploading of data
i may have downloaded a wrong file, i'm not sure, but i was able to open in GoogleEarth and view
I did not attend last session

I was confused on the data I was receiving, I couldn't get the data to show what I wanted
When I opened the arcgis software, I was not able to upload the downloaded data. I tried via url and upload. I tried a few different ways the few different layers I had, but it would not load. I thought maybe it was the length of the data, so I tried uploading, then I waited for many hours to see if it uploaded and it wasn't the slow internet with large data. It just wouldn't load.

What helped you as you downloaded or viewed data in GIS?

N.A
researching what the file type it was and having previous knowledge of the file type
The download process was simple. But viewing the data as it appears in Worldview isn't the same
The data was well-organized and compatible with GIS software, making it easy to view and analyze.
I did not get a chance to view the data
Viewing was a lot easier than trying to figure out how to download the data that was found.
Import data in GEE
NASA earthdata allows the time bracketing of data, worldview directly links to it and from worldview you can specify a spatial extent so you are only looking at relevant granules which is _such_ an improvement over the usual data searches I have done.   *I also made use of the worldview gif function to see the changes over short timeframes.*
I followed the NASA Openscapes cookbook and verified with Worldview that it was the intended dataset.
The map legend
the fact that we have Starlink and I was able to download in 2-3 hours rather than 8+ hours
N/A
Having the right resources, I interviewed a member of our natural resources and gained knowledge of where I wanted to bring my questions.
Downloading from Worldview was easy. It just wouldn't load into the software.

What hindered you as you downloaded or viewed data in GIS?

N.A
different file names, i could not find the right data
The issue is that the data I added to my ArcGIS pro software, it doesn't look the same
Some datasets had complex file formats that required additional processing before use in GIS.
I registered and created an account at https://www.earthdata.nasa.gov/ I downloaded data but could not open it due to technical issues.
Downloading the data was interesting. I downloaded the data, then do I have to click on each file individually for them to finish downloading, and save on my computer? And it looks like what I have downloaded are .tif files.
The sheer number of files for such a short timeframe. There were no customization options for this dataset to leave out portions that were unneeded. The files each download as .tif files and there is further management the end user needs to do.
Data did not come in with symbology from online. Was not intuitive
Lack of data
I can't think of any
N/A
I was having issues with our IT department and gaining access to the app needed, and once we downloaded the app, our web access was still limited
I couldn't get it to load the gis software

What would have made the data easier to download or view in GIS?

Common language would be easier to read.
Having knowledge of what data is viewable on ArcGIS pro would have made it easier to view in GIS. Other than that, it was fairly easy to find the data.
How to have the data look like it is in Worldview. Would be helpful to have a session on how to use it in ArcGIS Pro software
Providing the data in standard GIS formats would have made it easier to download and view.
I think it would have been easier if I could open the file on an MS Excel sheet or Word document.
Being able to download all the layers that I selected for my map within my area of interest once rather than having to select and download them separately, not to mention it seems like this has

to be done twice if there is a comparison between years. Is there an easier way to do this that I am missing?
Some API
While download scripts are provided, and so appreciated, there is no after-download assistance that I could easily find. I am a software engineer and can write something to manage this data, but when I'm still in the triage stage that isn't something I want to do a multi-week time investment for. Having linked resources for typical workflows specific to various datasets would be extremely helpful. Maybe that's something the NASA Transform to Open Science program can assist with or that might be helpful to link to once more of their resources are built out.
A well-commented Jupyter notebook (maybe an ArcGIS Notebook that pulls directly from the EarthData Cloud or Living Atlas), following a use case, would help get past download issues. While it may not be as intuitive as WorldView, it may help with internet connection hiccups?
Provide the layer symbology file as displayed in Worldview
Accessibility
I can't think of any way at the moment because it is similar to USGS and other websites.
N/A
Downloading was easy. Uploading it was not possible in the arcgis. Was I using the wrong software?

What is on your wishlist? What datasets or improvements do you really hope to see?

Changing the language of the data so the common person can read and understand.
I hope to see more datasets and satellite images of Alaska.
Data that is simple to use in ArcGIS pro software, since I had trouble on why it doesn't look the same inside the ArcGIS Pro software
I hope to see more up-to-date and comprehensive datasets related to water resources in my community.
Accessing data on Air quality on the reservation community would be next on my wish list.

I was struggling with downloading the data. Once I was under the download data tab, I would've loved to have been able to select all my granules at the same time. Also, what would be way cooler is if say doing a comparison to be able to select both years or whatever years are chosen for the map created and being able to download all those layers at the same time. After downloading a layer, do you have to click on this layer again to finish the download? There are many steps in having to download say a single file, and if it's a bit confusing for me with just a couple of years of gis and remote sensing under my belt there is no way someone that is lacking in these skills would be able to access it. They may struggle a bit more.
Is there a way to access this map without downloading the data and just connecting it through the / a network or just online, and are you able to save this map that is created through worldview to be able to come back to it or access it at a later time?

How the increase in rainfall and cooler temperatures where I live are changing the flora

Updated flood hazard data that extends over time and beyond 2003. That's 20 years of data, the 20 most recent years, that have shown the most rapid increase in climate change related incidences without coverage.
More ability to navigate dates that are specific to the data availability. There were flooding/storm events that I was very interested in seeing the data for, however these were not available. With how much Worldview is doing, and especially considering the widely underserved internet capabilities in Indian Country, anything that allows filtering of dates down so there is less that it is trying to load would be welcome.

The Anthropogenic Biomes layer's temporal range extends from 2001-2006. For folks without an environmental data science or GIS background, I think they would benefit from having this classification easily accessible for the latest available data.

I feel the datasets were there to look at my basic question, but I was disappointed that I could not bring the precipitation data in via download. Could you make it evident that a layer cannot be downloaded before getting to the download screen?

I think the data can be best collected through USDA-FS and private landowners. I wish we could initiate a local data collection for advanced uses of localized data in NASA systems

I know it is difficult, but more Alaska region data

N/A

dreams of returning our river to its natural course

The data felt altered and inaccurate.

NASA seeks specific feedback on what doesn't work with their products and what could be done to improve it. If you have more feedback and/or suggestions, please include them here:

getting rid of acronyms and using plain English for the common person to understand.
I think a video tutorial on how to add data, which specific type of data that can be used inside ArcGIS Pro. I had issue with the data that was downloaded and didn't look right when added to the ArcGIS pro software
Improving data completeness and providing more detailed metadata would enhance the usability of the datasets.
I am a high school science teacher in a tribal community. This is my first time accessing a wealth of NASA data which I am planning to use with my STEM students. As of now, I do not have any suggestions regarding the improvement of NASA tools as I am still in the learning process and trying to familiarize myself with the tools. I think there is an overwhelming amount of data available to the public which will be helpful for community members to make informed decisions regarding their environment.
Being able to download the data was the struggle. If someone doesn't have the space on their computer or internet speed could the map and layers that were created be shared through the / a network?
Add data on vegetative wetlands in Alaska, for us it might just look like increased ponds.
Worldview needs to have some kind of selection for excluding dates without data in a given dataset. Especially helpful would be if it were able to be limited to some view, but the dates with valid data menu is so buried, and loading/navigation of it is very slow and difficult to just triage which dates would be relevant for what you're interested in before doing the earthdata download.
I feel polar datasets always come with caveats and I'm not sure how to accommodate for those in AK. For instance, the snow cover layers did align with my on the ground observations of snow cover. How do I know when a dataset is accurate enough for my use in Alaska?
Chin'an, thank you.
I will have more answers to this after more time exploring.
N/A
It was hard for me to go back and forth between the data I was receiving and I couldn't figure out how to review what I was looking for, and the first time I wasn't sure of common questions I should be asking.
There is a clear list of colored variants - however, the color variants do not seem to be explained in "dummy" terms anywhere. You have to hunt and find or search the levels of individuals to research their meaning. It would be helpful to click to know the variant data meanings in dummy terms.

Appendix D: Workshop 2 Agenda, Assignments, Feedback

Workshop #2 Agenda: Data Use
Tools: POWER, SWOT
Guest: Dr. Falguni Patadia, NASA POWER

Time	Activity
9:30 - 10:00	POWER Data Access Viewer Enhanced with Dr. Falguni Patadia
10:00 - 10:30	POWER practice - Choose a breakout room (solar, wind, hydro), a region, and a parameter. Work together to plot or map your data. - Answer the prompts on Jamboard
10:30-10:40	Discuss Jamboard - Whole Group
10:40-10:45	Break
10:45-11:05	Discuss HW Assignment #1
11:05-11:25	Introduce SWOT (video) Introduce Assignment #2
11:25-11:30	Questions/Debrief

In-Workshop Activity - Jamboard

As a group, pick one parameter to explore in a chosen region:
What is the typical variability of that parameter over the past 30 years in your region?
How would that parameter be projected to change under a high emissions scenario in the next 30 years?

What did you find easy or challenging about exploring POWER data?

Took a while to download the data
Takes time to play around to figure out all the buttons
Had to pick time period before parameter
Data opens in text window, confusing
The dates of available data aren't readily discernible w/out trying dates shotgun method. It says "near real time", but data wasn't available for my region post 11/1/23

Resolution isn't clear, with single point the point jumps to specific position far from where you click. What area is this averaged over?
Error comes up in regional tool - " Please select a taller region. The selected region is less than the minimum height of 2 expected by the Regional API at 0.024."
It was challenging to get the "regional" to work even after I tried different zoom levels and extents
Figuring out the time periods with my point. I am only getting the dates back to 2001. This was with the single point method. It works on regional.
Some issues with scrolling through the parameters list.
Issues with seeing the data I wanted displayed.
Easy to pinpoint on a map
Liked that you could hover over a data point on the graph to get that day's data
Like that you can view the data without having to manipulate it
I found it user-friendly and easy to use and understand
It wasn't challenging from my side.

What do you wish or recommend for improving the POWER Data Access Viewer?

wish that you could convert scale from m/sec to mph
would be nice to label download types with what they'll actually give you (csv = spreadsheet)
download graphs as jpgs instead of just pngs
Took a little bit to figure out what model to pick. Could there be more common names for the models? Or a default setting?
JSON use was tricky
It is good for historical data research, not current data information.
If "no data is available for this time range" output a message with the nearest dates that data is available for.
Better use case guidance on what temporal level to choose/what type of summary stats we should focus on
When using regional search on a tablet, the scroll for parameters only shows a few options and scrolls the whole screen rather than the parameters list - resize the scroll box?
Improve guidance
A wee bit more guidance.
Example of layers that are commonly used and what data this could be used for

What current or future energy projects could POWER tool be helpful for in your community?

Where to put wind turbines. What is the feasibility of getting power from wind.
What to expect from the future if we already have wind turbines there.
can we account for changes in wind technology as it changes.
The prediction information could be useful for renewable energy predictions for future project funding.
I'd like to create a priority list for homes to get converted to solar based on economic need coupled with solar potential. But I'm not sure if the resolution is right.
Variability in precipitation over the regions of interest
Hydro development in Hoonah
The precipitation since 1984.

Homework Assignment #2 with Participant Responses in Italics

NASA UNBOUND Assignment 2 - Data Exploration

Exploring SWOT Data

NASA Surface Water and Ocean Topography (SWOT) is a new satellite that can measure surface water height and storage (among other water parameters). You can read more about the mission on a website NASA has developed for it: https://swot.jpl.nasa.gov/. The first data is just now available, although it is currently geared toward scientists and technical users. Eventually, NASA SWOT hopes to deliver their data in a more user-friendly way, and your recommendations will help drive how that is built. On March 5th, Tamlin Pavelsky will introduce SWOT, its capabilities, and host a discussion on how to make the data more useable for tribal communities. This assignment is in two parts - one is the SWOT data in its current form, and one is similar to how SWOT imagines it may be delivered in the future. Your feedback is important in both arenas!

As you're doing these exercises, think of the big picture:

What kinds of water questions do you have for your community that you would want satellite earth observation data for? We'll discuss these in our March 5th workshop.

Part 1 Using NASA Earthdata:

This is an example of SWOT data that is currently available.

Visit earthdata.nasa.gov - if you haven't already, register for a free login. Search for "SWOT Level 2 River Single-Pass Vector Data Product" for pass 013_NA (hint: select the dataset and search for "*013_NA*"). Download the data (river reach and nodes) for April 26th, 2023 and view it. It's in shapefile format, so you should be able to open it up in ArcGIS or QGIS. Explore the data visually and in the attribute tables.
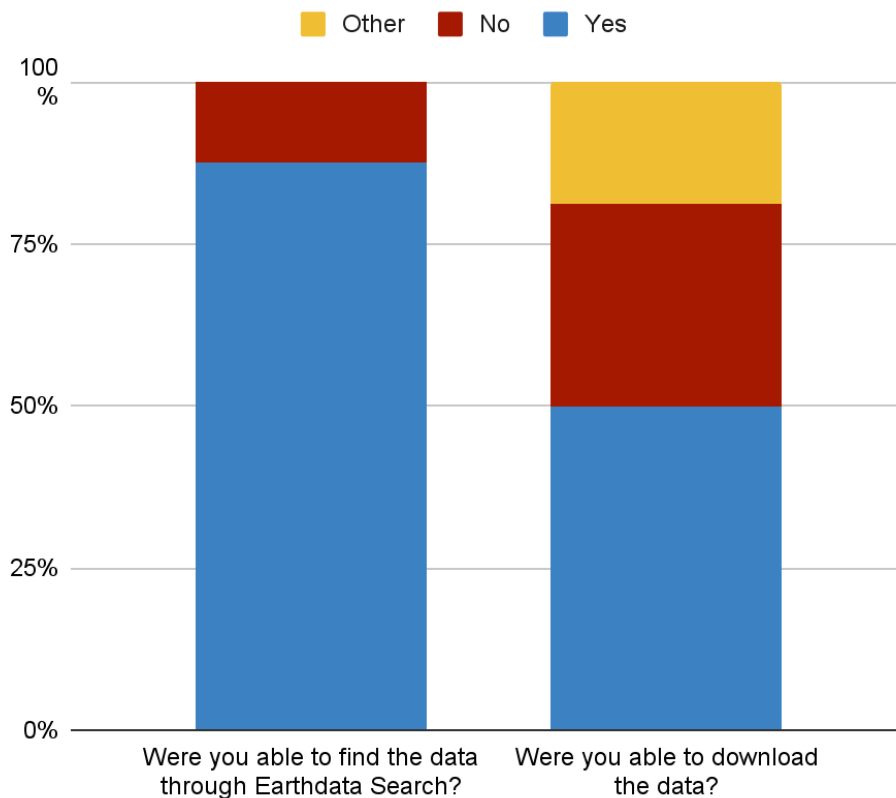
Figure D1. Nearly all the participants were able to find the data through Earthdata Search; however, only half the participants were able to download the data without issue. Those who answered 'Other' responded, "I could open up little pictures, but unable to download any in a format that I could open", "Couldn't preview "013_NA*" results on the web, downloaded a few to test on GIS" and "Able to download, but wasn't able to open file".

Looking at the map and attribute table, are you able to understand the data?

The attribute names are not intuitive, and no aliases have been applied for the attribute table. I would not have been able to know with certainly what field represented the elevation value from the attribute table alone. You can access the feature class metadata through the Catalog pane in ArcGIS Pro, which includes the descriptions of the attributes, but the metadata is not formatted to display in the ArcGIS Pro metadata interface, so you have to click an additional link to open the content in an html viewer (which is not super pleasant to read, but does the trick). That was where I was able to determine that the parameter I was likely most interested in was the wse, but for the river I'd chosen to look at (the Columbia River), most of the wse values were NoData (-999999999999) in the reach feature class.
Some table fields were understandable but some acronyms I did not understand.
no
https://archive.swot.podaac.earthdata.nasa.gov/podaac-swot-ops-cumulus-protected/SWOT_L2_HR_RiverSP_1.1/SWOT_L2_HR_RiverSP_Reach_502_027_SI_20230426T162930_20230426T162932_PIB0_01.zip *I reached the above zip folder and downloaded the file but was unable to open. I can try again.*
Not what I got
Yes, I was able to understand the data to a certain extent.
I would have to look into the metadata to understand the data better. I'm seeing data with tides for inland lakes.
Not at all. I was able to bring it into ArcGIS Pro, but I don't understand the abbreviated names in the attribute table. I was looking for an index to understand what they meant, but couldn't find one.
I do not understand the variable names
Yes
was not able to find the data set
Somewhat I can tell this is a mapped river and is trying to convey information about that river. So, yes.
n/a
no

What aspects of the data and/or the way it is presented make sense?

Once you are able to access the metadata, there are pretty good descriptions of the attributes. The shapefiles can be easily visualized in GIS.
The attribute data. Some parts of the acronyms I do not understand and some parts I understand.
didn't get this far
N/A
nothing
the frequent use of Water Shed Elevation
The lake outlines look good. The points along the river lines make sense.
It did not make a lot of sense to me.
I am able to understand this is the correct data because the geography matches the region code on the file name
When zoomed out, I am able to tell that this is data on rivers. Also selecting each line or point shows where their exact decimal location is.
n/a
The rivers are clearly plotted. Many of the attributes in the attribute table are straightforward. I'm unclear on what exactly makes something a node (set distance, a specific curve, related to physical data collection stations etc.) but I understand they are points along the river.
n/a
Not to me, I'm not sure if I'm cut out for online studies, but I would've liked to attend an onsite class at least once.

What aspects of the data and/or the way it is presented are confusing?

It wasn't clear how the nodes and reach features relate to each other. When would I use a node? When would I use the reach? Why are there so many missing attribute values?
Lat and Lon, do not seem to be accurate. If it is supposed to be Latitude and Longitude. A lot of the acronyms I do now know what they are.
Couldn't download or view any data
Unable to open the file

All of it
The titles of the fields were confusing.
The attribute values were just acronyms. Also, there were line features in the polygon features that did make sense.
It was all confusing.
There should be clearer documentation of the filled values for the NAs
All of the lines and points have single symbology and can't really tell which way the slope goes unless we go to the line directly and zoom in. Or click directly on the line and look at the attributes.
n/a
Many of the attributes in the table are abbreviated. There is not a way I can clearly see within QGIS to find the meanings of these abbreviations. Because I have created xml labeled datasets for archive at NASA before I am familiar with their format and was able to separately open the xml files as text files to see the descriptions of what each of these values are representing by looking at the comments. This data is not pulled into QGIS in a way I can find.
n/a
The lectures went kind of quick and I felt everyone was understanding the material but me, so it was a bit intimidating to ask questions.

Are you able to identify data that relates to slope, water surface elevation, and area?

Yes
In the attribute table yes.
no
No
no
yes
Not immediately from just looking at the data. Would need to dive into metadata.
I was not able to find any of these.
Yes
not with the original symbology, I am not able to. But looking at attributes I can
n/a

Yes, but only after reading this question and realizing the wse abbreviation is water surface elevation.
n/a
no

How hard/easy was it to find slope, surface water elevation and area data?

14 responses
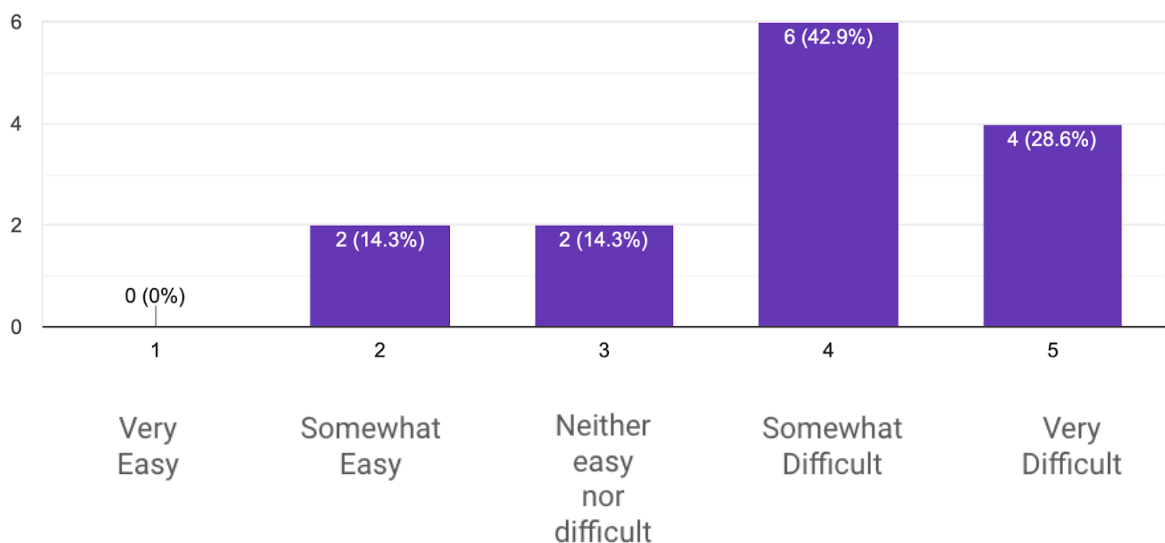
Figure D2. Participants found it challenging to find slope, surface water elevation, and area data.

There are a number of different fields in the attribute table. If you were to use SWOT data for your community, what fields would you be interested in? Are you able to discern what the columns of data are?

Name, Low tide, water surface elevation. Since some areas in our region is facing sinking land due to permafrost, this data would be important for possible relocation efforts to communities that are affected
I was hoping to review data involving the swamp or wetlands. to determine how deep the water gets at times during the seasons. including ponds and streams around our reservation.
No
I had no map showing and no images available

Water elevation at high tide as well as low tide,
Water area, if it is connected to river the vertical fall height over distance,
I struggled with this one.
Time, Lat and Long, river name, slope, and area total. The other data I can tell what they are but most of them are data with acronyms.
I would be most interested in the water surface elevation. I'm not positive which uncertainty column would be most appropriate as I'm not positive what "random-only uncertainty" is.
n/a
no

What can NASA do to make SWOT data from Earthdata more useful to your community?

Show the location of the dataset on the map in Earthdata. All of the datasets showed as being in a location in the South Atlantic off the coast of Africa, so it's hard to know which one to download if I'm looking for coverage in a specific area. Format the metadata so that it can be easily viewed in the metadata interface in ArcGIS Pro (I know this is a big ask; it's a real pain to get it formatted in a way that plays nice with ArcGIS). Also, there were a few attributes that were not listed in the metadata (i.e. lat_u and lon_u. What is that?).
Downloading the data, seems to be there might be duplicates in the downloads? I had 36 different zipped folders. I downloaded each one, but I was thinking there are duplicates. Some acronyms I do not understand and the data in some fields are questionable. Some results have -9999999 as an example.
right now, it seems like a scientist based program, I couldn't download ARCGIS OR QGIS for awhile. I had to get approval from LIBC IT department which was today (03.01.2024) attempted to open files that I downloaded and nothing happened. I tried to drag files to QGIS and open them and it wouldn't open at all.
Have a "SWOT" button and then be searchable by river name, and use plain words that humans understand
It wouldn't download into my ArcGis online web access browser. I tried both URl & file upload. I tried a few other ways and nothing would upload. Making it easier to download and upload the software would be nice.
Include information in the Metadata about the fields in the attribute table, to make it easier to understand what the fields are.
Not sure, I'll have to look into the data more.
At the moment, I cannot answer this seeing how I struggled with what the data was saying.

It would be useful for the download page opens in a new tab so the metadata/documentation was still accessible and folks wouldn't have to return to the search catalog to look for it; this is especially useful where Internet may be spotty or analysis may be remote
Hopefully, there will be data for the areas around rural Alaska that we will be able to use.
If someone searches the title exactly, the data should come up? Using search function I was not able to bring up the dataset we were looking for
Make the descriptions of columns more readily accessible within the attribute tables.
n/a
Maybe a power point of a step by step process.

Part 2: Using the shapefiles provided

This is an example of what the SWOT data could look like to be more useful to a broader group of users.

Download the two shapefiles (river nodes, lakes) provided from your email and add it to a new GIS map. Explore the mapped data and attribute table.

Were you able to download the data and add it to GIS?
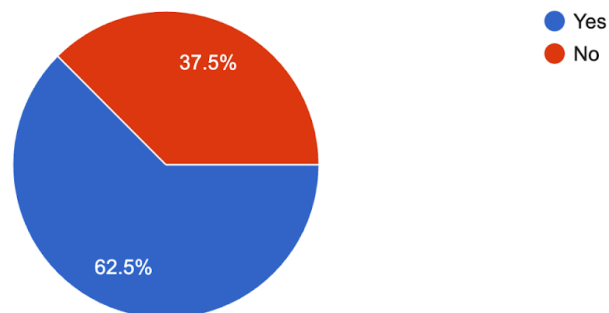16 responses

Figure D3. Two thirds of participants were able to download the data and add it into GIS.

Looking at the map and the attribute table, are you able to understand the data?

If I hadn't already looked up the meaning of wse, I would not necessarily have known that it was the elevation value I was looking for.
Some fields had inaccurate data which made it confusing. Some of the acronyms I didn't know what each were for.
couldn't get this far.
I think I somewhat understood the map. My chosen attributes were wse and area total. The style I chose was chart and size. The pop up on the left side of the map and the charts on the map revealed more information.
yes
Still depends on the field. The data look pretty much the same as the first examples.
Still no.
Yes, assuming it's consistent with the earlier data
I understand what the points are, and had to look closely at the attribute fields to understand what the polygons are.
n/a
Somewhat, same answer as above regarding node selection being unexplained. The lake shapefiles also appear to have long spurious tracks extending in straight lines that likely do not correlate with the actual presence of water in some locations.
n/a
yes

What aspects of the data and/or the way it is presented make sense?

It was much easier on the eyes to have the NoData values displayed as no_data rather than -999999999999
Similar to the data from Earthdata, I can understand some of the acronyms. The results seem better than the data that I downloaded from Earthdata. More consistent results
na
The various styles for visualizing multiple fields made sense
no map

the points of the river, and the polygons of the lakes
Same as above. I can see the rivers and lakes very well. The geography of them makes sense.
This didn't make sense. I was unsure of what the values meant.
When zoomed in, I can see that each point represents a node. I had to look at the attributes for the lakes to know that they are lakes.
n/a
I honestly cannot tell what is different about this dataset than the other one other than including lake shapefiles rather than river reach files.
n/a
the data being presented seemed easy to follow, but I got lost when exploring it on my own

What aspects of the data and/or the way it is presented are confusing?

The attribute table headings are still not descriptive. The metadata is still not rendered through the ArcGIS Pro metadata viewer.
Example is "time", with results that do not really show time digits. I am confused with the results.
na
The abbreviations of different fields were confusing to me. For example, xtrk_dist etc
all
the lack of knowledge of what it actually is (meters? depth? height? what is count?)
Other than bringing in the data, this was pretty confusing. I didn't understand what multiple values for the slope was.
Without looking at the attributes and not knowing the location of the lakes, the polygons were a bit confusing.
n/a
Please see above.
n/a
It was just the hands on part where I got confused and lost

Are you able to identify data that relates to water surface elevation and area?

Yes
Similar to Earthdata, I can tell water surface elevation looks to have an acronym of "wse" and area has the same word in the attributes.
na
I am assuming the fields that I chose, wse and area total are water surface elevation and area. I could not identify the data that relates to slope.
no
yes
Yes, after reviewing I believe WSE is water surface elevation
No.
I was able to identify area
I could not identify at first but after properly reading through the attributes i was able to identify the data.
n/a
Yes.
n/a
no

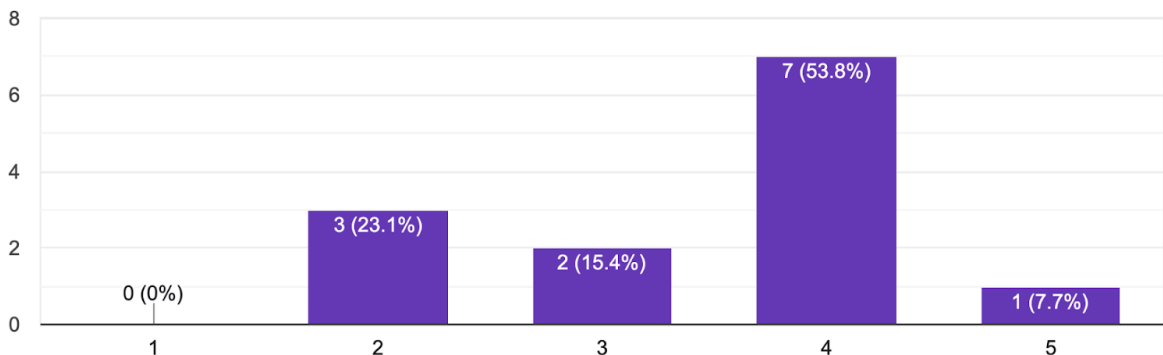How hard/easy was it to find the surface water elevation data?
13 responses

Figure D4. Sixty percent of participants found it difficult to find surface water elevation data.

These shapefiles contain fewer fields than the ones available from Earthdata. If you were to use SWOT data for your community, what fields would you be interested in? Are you able to discern what the columns of data are? Are all the fields of data you identified as useful in the Earthdata dataset still present in these shapefiles or are there ones missing you would like to have?

I don't know enough about this dataset to determine what all the values might be used for. It seems like everything I'd need is probably still there.
WSE, for the remainder of the fields I would need to learn more about the type of data they are. I like the data from the Shapefile since there are more consistent results. Some data from Earthdata was inconsistent with questionable results.
couldn't open data to view and use programs for the Lummi Nation.
I would be interested in water bodies within Arizona.
We would be interested in using the water elevation data. It would be wonderful if the fields had an explanation in the metadata to better understand what those fields are.
Knowing more about SWOT tool
I believe we would use the tide data, the area totals, and after learning more about what the data can be used for using that data. There are data I was not able to discern.
In general I think having less data and metadata available is not a great idea. There is no slope data anymore. I'm not sure if that is because the actual data file is different (Lake Obs vs. River Reach). There are also less water surface elevation columns. I can't say if the ones removed are useful as I mentioned above there is a lack of descriptions of these data.

What can NASA do to make this data more useful to your community?

Some of the data in the attributes didn't seem to have the right data. Example is data was entered as -9999999 on some various fields. Acronym definitions could be useful.
I am sure Lummi Nation is using this data already but for someone like me who doesn't have GIS experience it is difficult to navigate.
I think there is a large amount of data and NASA is trying their best to make it available to the community.
Need to have basic training in person with tribal gis people
Alaska coastal areas are needing lots of water data and DEM, erosion data, etc. This would help

our communities make decisions to keep everyone safe.
Unsure
Know more about how I can use this tool to bring to the community.
To meet FAIR standards, EML standardization of the data may be ideal with at least field aliases
I have yet to see, but hopefully see more data within the rural southwest Alaska areas.
ability to access
Given appropriate descriptions filtering down to the data that is of most relevance to you is a simple task. Including a description of each of the fields easily accessible from the downloads page and a tutorial on filtering out unneeded data for each of the major GIS applications would be a significantly better approach.
a more controlled environment of hands on for the participants

Part 3 Overall Feedback:

What is on your wishlist in terms of knowing more about surface water (rivers, lakes, wetlands) that are important to your community?

How much the tide is rising each year. I have noticed some high tides during storms have been the highest I've ever seen since I moved here in 2007.
Learning about SWOT on YouTube and google searches, it seems very interesting and I would love to understand more about it and potentially use it more once I learn how to navigate the data and or the program changes to a more user-friendly program.
At this point, the community where I live is a drought prone area but I would be interested to know more about the water bodies within the state of Arizona.
Last year all of our thousands of dried ponds filled up with water here and it would be good to see if this is a natural cycling event or if it is related to climate change. For those who travel on rivers and lakes in the winter in Alaska it is always good to be able to check the thickness of the ice on the rivers and lakes, maybe even the temperature of the frozen water bodies. We have more people dying from falling through the ice now, and rougher surges of water on the rivers used for daily transportation in rural Alaska so maybe notices on surges of water in the warm months and notices of warm ice or shifting ice.
Quality of the water
My wishlist consists of flood and erosion data.
The ability to detect change in river channels over time. How reliable are they for that?

They are super important especially in the wild rice community, but a little more knowledge on the SWOT tool would be helpful.
I feel like what is on my wish list is having data on how much the water level is growing each year and how much it will rise in the future. I am hoping to see more precise data within the Alaska waters, oceans and seas.
This is pertinent to salmon spawning habitat, possible food events, could also relate to fish passage projects, macroinvertebrate habitat, management of roads and their locations, how to manage ATV and other man made trails showing how their impact could affect these waters and their connectivity
Prior to working with this dataset I had hoped it would include coastal ocean data. As a coastal community having surface water information for various time spans for the ocean and the wetland migration it is causing would be most helpful for us.
n/a
Natural pathways, river sediment flow, land surface erosion

In comparing the datasets you looked at (downloaded from earthdata vs the provided shapefiles), what elements of them did you find easy/difficult and what would you like to see in future datasets?

It was helpful to have the NoData values indicated by text rather than having all those digits cluttering the attribute table.
Downloading the data from Earthdata, when downloaded to the page, it is time consuming to download each file one by one. It would be better if all can be downloaded at once. The shapefiles were much faster and easier to use. Future datasets would be more accurate data in fields where there were entries that showed numbers that were inaccurate (-99999 as an example).
could not download any data. I even went back to our powerpoint we had last week and went step by step and still did not work for me.
From the provided shape files, the attributes and various styles were interesting. Also the data available at location on the map was helpful for comparing data.
From previous practice with you the visual choices for both the maps and the data sets were excellent. For rural residents who do not have reliable internet access maybe a 1-800 number for support and if possible, sending maps/charts through a fax. And chopping up data in smaller chunks for downloads and emails.

unable to upload into database
I would love to see metadata information provided for the field names in the attribute table so that we can know exactly what each field means.
Unsure
This was difficult.
With the single symbology, they looked very similar, but the data with each was different. Without the knowledge of the acronyms, I was not able to tell what the data was about. I hope to be able to read what they mean just from the attributes.
n/a
The dataset with less fields was slightly easier to scroll through, but still retained the same issues. If the reduced data were made the default available one must ask: if one does need data from the more descriptive products how would they go about getting that? As someone who has had to request data that was deemed "not scientifically useful" and was not as easily accessible as the other data from that instrument it cost thousands of dollars of man hours to get that data accessible and it was only made accessible to my organization and only for a limited period of time. So if someone else needs it in the future the entire process will be repeated. If that same data had been hosted with the other data from that instrument the cost savings to both the hosting organization and my organization would have been substantial.
n/a
River temperature and potential causes

NASA seeks specific feedback on what doesn't work with their products and what could be done to improve it. If you have more feedback and/or suggestions, please include them here:

It looks like the SWOT data is only available for April 2023, but the calendar allows you to pick dates going back to 1960. It would be helpful if, once you've selected a dataset, the calendar only allows you to choose date ranges that are actually present in the dataset. Also, the calendar picker was cut off for me when I was selecting the end date of a date search, so I couldn't see the numbers of the last week of the month. Definitely having the geospatial reference for the data enabled so that you can at least see the footprint of the data on the earthdata search map when selecting products would be a huge improvement. The spatial filter doesn't work with this dataset (I get the same subset of results if I select an AOI in Washington, USA as if I select an AOI in Rwanda), but there is no indication that it's not working.
No additional feedback.
not sure how to fix this on my end. I am assuming it had something to do with my IT department

not letting me download data from Earth data. I mentioned it in the last question. I followed the power point step by step on how to download the data and the file's would not open. Emily also emailed me the files and tried opening them with no luck. I had QGIS downloaded on my work laptop and attempted to open the files in that program with no luck.

For some reason I was unable to open the zip files from Earth data. I think if the SWOT files could be open on an MS Excel sheet, that would be helpful.

Most people's brains are not full of GIS terminology and for those not using this information on a regular basis having a "start here-gis 101 and a list of terminology to print to refer to when navigating"

It was easy to use the search section. The dates and filters were easy to understand. It was easy to login and download the data. The uploading into the ArcGis online website was not working. I tried many different ways and I couldn't get it to upload.

More frequent satellite imagery. Include metadata in your products available to download, Catalog of field names to better understand the data.

Nothing to add

For myself, doing this homework assignment after we learned SWOT and the specifics would've been a lot more useful on my end, and being able to understand what I am reading in the attributes.

The link to https://search.earthdata.nasa.gov/search should be available as a button in the navigation. It was hard to find the catalog without returning the workshop's notes.

I currently have no feedback

could not access the data set

n/a

A mock trial with provided data sets for users to have a hands on experience with using the software while the instructors are observing

Appendix E: Workshop 3 Agenda, Assignments, Feedback

Workshop #3: Data Use
Tools: SWOT, ASF SAR/Vertex
Guests: Dr. Tamlin Pavelsky, NASA SWOT and Heidi Kristensen, Alaska Satellite Facility

Time	Activity
9:30 - 10:00	Surface Water and Ocean Topography (SWOT) Demo and discussion with Dr. Tamlin Pavelsky
10:00 - 10:30	Intro to Synthetic Aperture Radar (SAR)/ASF Vertex with Heidi Kristensen
10:30-11:00	Explore SAR as a group
11:00-11:25	Feedback on SAR, introduce assignment #3
11:25-11:30	Wrap up, acknowledgements, updates on what to expect

Homework Assignment #2 with Participant Responses in Italics

NASA UNBOUND Assignment 3 - Data Exploration

1. Open the [Change Detection using OPERA Sentinel-1 RTC tutorial](#).
2. Follow the instructions in the **Find OPERA RTC-S1 Data** and **Download Data** sections of the tutorial to search for OPERA RTC-S1 products for an area and time period of interest to you.
3. Follow the instructions in the [RTC On Demand! tutorial](#) to submit one or two Sentinel-1 products for processing to RTC.
   - You can search for the same time and place as the OPERA RTC-S1 data you downloaded, or find imagery that interests you outside of the time period available in the OPERA products.
   - If you are limited in bandwidth, you do not need to download the completed On Demand RTC products; the analysis exercise can be done with OPERA RTC-S1 products, which are much smaller files.
4. Complete the change detection workflow in the [Change Detection using OPERA Sentinel-1 RTC tutorial](#).
   - There are versions of the workflow for both ArcGIS and QGIS. If you use a different platform for GIS analysis, try to apply the workflow in your usual

environment. If that is not possible, consider installing QGIS, which is free GIS software that is easy to install on Windows, Mac, or Linux operating systems.
   ○ We suggest using the OPERA RTC-S1 products for the analysis, as they are smaller files. This makes it faster to download, and also to perform raster calculations. You can, however, use On-Demand RTC products for the analysis workflow instead. The workflow is the same when using either product.
5. Complete the homework form.

The slides from the workshop presentation are [available for reference](#).
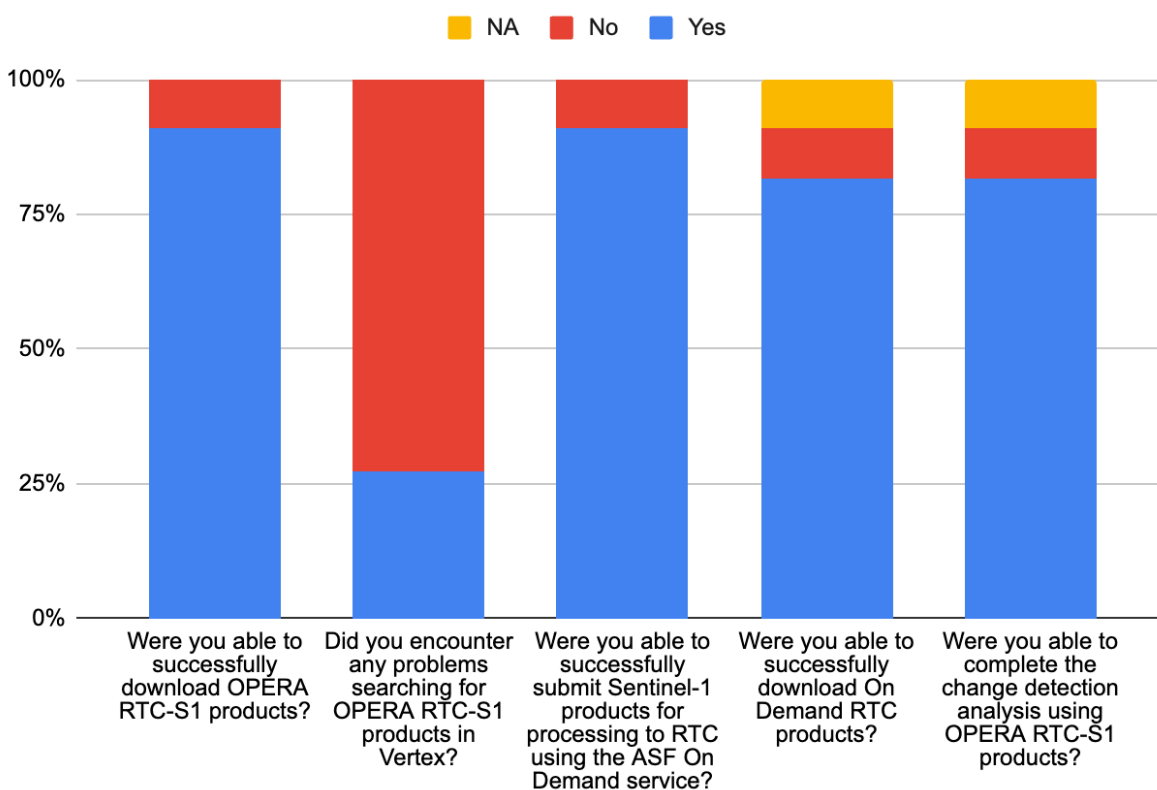

Figure E1. By following the tutorials provided by the Alaska Satellite Facility, over 75% of participants were able to download OPERA RTC-S1 products, submit Sentinel-1 products for processing, download On Demand RTC products, and complete change detection analysis using Opera RTC-S1 products.

If you encountered problems searching for OPERA RTC-S1 products in Vertex, what problems did you encounter? Do you have suggestions for changes that would have made the process easier?

Following the instructions, I think it was easy to look for the data. I liked how wide the results were within our area.
There is no data covering the Shinnecock Reservation (Long Island, NY) for these products except for a short time period in 2014. There is OPERA data in Worldview that covers this area and OPERA products in Vertex that cover this area, however not RTC-S1.
The Vertex portal isn't intuitive. Its strength, i.e., that it offers several data products at different temporal and spatial scales, also makes it challenging to interact with for data exploration like the instructions in the StoryMap suggested. I think the YouTube videos under the Search Help were friendlier than the StoryMap (could this be a pop up when one opens Vertex?).

If you were unable to successfully submit Sentinel-1 products for processing to RTC using the ASF On Demand service, what difficulties did you encounter?

It took awhile to download, but didn't encounter any difficulties.
There was no On Demand button
I was unsuccessful due to my internet connection on my first try. I was able to successfully return to download the Sentinel-1 products for Corongo on a different day and time. I think this analysis will be very difficult to perform while in Corongo.

If you were unable to successfully download On Demand RTC products, what difficulties did you encounter? If Did not try, what kept you from attempting the download?

I downloaded multiple files, so it took awhile to download. But I had no issues.
There was no On Demand button after I searched products
Poor internet connection
I watched the YouTube videos and started poking around separate from the StoryMap.
I did have some difficulties at first, but I was able to get them to download.

Do you have any additional comments on the process of searching for Sentinel-1 products and submitting them for On Demand processing?

It was unclear right away what VV, VH, and the rest of the options meant. I didn't know that I needed to have similar datasets from each and that some may be useful for analysis while others were not. A deeper understanding of the datasets would probably help me.
Not today
The steps were easy to follow. I have no additional comments.
A time estimate would have been extremely helpful. I was requesting mine in the hopes to use them as part of a figure for a proposal I was putting together. I thought the process would take about an hour, but after the data still weren't ready before I went to bed that evening, I needed to move forward without them and come back to this assignment later.
I will look for another area to try the On Demand Processing
None
I had some issues lining up the correct comparison and reference raster for the calculation of the log difference. That probably took the longest before I was able to get that to run.
Details were well explained and easy to follow.
the directions and step by step instructions are simple to understand

If you were unable to complete the change detection analysis using OPERA RTC-S1 products, what were the barriers to completing the analysis?

Lack of data availability in the area of interest (Shinnecock Reservation). Which is a real shame because this is exactly the kind of analysis we'd like to be able to do before and after coastal flooding events. There is a need!   *Using the on demand products I was unsure if these were already in the power scale or in db. The values were not right around zero like in the tutorial example and running the power scale conversions on them made the images look very wrong. The log difference was then using the power scale files which, I plausibly don't have if the on-demand RTC products are already in db. If the RTC on-demand products can be used in this tutorial (like it says) it would be helpful to add more information on how they might differ or explicitly say there is non difference between them. Or, what settings to request the RTC products with to have them be compatible with the tutorial (I requested them in gamma because I wasn't sure).*
NA

GPS subscription expired. I have no current access to my online arc software right now.

How likely are you to use Sentinel-1 RTC products in your work in the future?
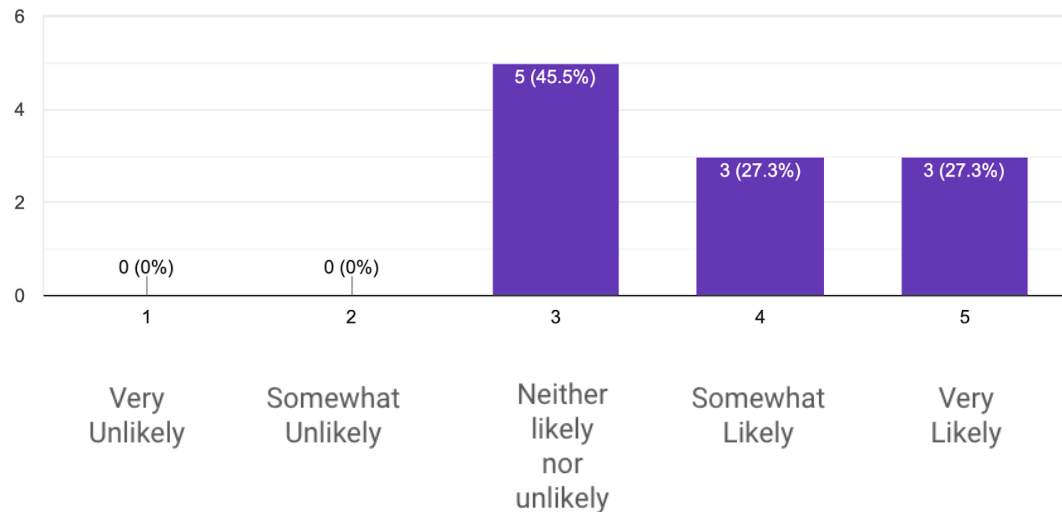11 responses

Figure E2. Over half of participants anticipate using Sentinel-1 RTC products in their future work.

Do you have any additional comments or impressions about SAR in general, the Vertex web portal, or the StoryMap tutorials that you would like to share?

The SAR are useful, but still very technical. I would need to work with people who had a firm understanding of what is possible and the analysis methods. I could follow a set of instructions based on the tutorial, but I do not understand enough about the datasets or analysis methods yet to know what is possible and how to accomplish tasks outside of the tutorial. I thought the Story Map was a very good way to create the tutorial.

Very informative and easy to follow.

I think this is a good tool to use to check for change detection for erosion as well if there are a lot of storms within a year. I know it takes a lot more hands-on experience to get familiar with using these tools.

I'm having trouble understanding the difference between the OPERA RTC and RTC on demand products. Are the OPERA products literally different data or are they simply the ones produced by the OPERA project instead of on-demand? Initially I thought OPERA was an instrument on the Sentinel satellite, I have since realized that's not the case and OPERA is a project to create more usable end products. A quick explainer of the data types, their origins, differences, and why you might want the various ones might be something that is helpful. You may already have this somewhere on the site (I did go back and find a short explainer halfway through the tutorial that the change detection can also be completed with the on demand products after writing this), but linking to it at the beginning of these tutorials to be able to redirect/explain to users about to go through them would be immensely helpful.

I was able to download on-demand products, so if it's the case that these two datasets (on-demand RTC and OPERA RTC) are the same and simply need to be processed by request first then the above comments regarding data availability are not as salient. However, I'm still unclear if that's the case or not.

Overall, these were some of the most clearly laid out tutorials of all the portals and datasets we've worked with as part of UNBOUND (and frankly in my day to day use of NASA datasets) and I'd like to commend you for that. I did however, share these tutorials with my team and at least one member had trouble with the story maps not loading properly. I think having a static option (just shows the maps as embedded images and is in a long form web page document) for those that have computer rendering issues would be helpful.

I believe that NASA's data is going to get better and better in the long run.

I have experience working on an HPC so I understood what "submitting a job" meant, however, this language (along with all the acronyms and classifications - i.e., single look complex, detected high-res dual-pol) feels like a barrier to making this truly accessible and showing how cool it is to have an on demand processing platform.

I think I would have to explain this vocabulary to my cousin and uncles, and while intermediaries of GIS/remote sensing are necessary for capacity building, I am not sure people without a GIS/remote sensing background could interact enough with it to see the need. That's only my opinion though.

The StoryMap tutorial made this assignment really clear and fun. It made gathering the data on the ASF Vertex web portal relatively easy with what data and files to choose from. Having the two options for either ESRI ArcGIS or QGIS to do your work makes that accessible especially for those that don't have ArcGIS. I haven't used QGIS, but when I find some more time, I will come back to this and give it a try to get myself familiar with QGIS as well.
Miigwech.

Only thing I don't like about it is the title. I feel like it should start with the word "Tutorial" then the rest behind it. I know that may sound weird but the title is so long the tutorial in front might improve more activity to the page.

Appendix F: Post-Workshop Survey and Feedback

NASA UNBOUND Post-Workshop Survey

Thank you for participating in the NASA UNBOUND for Food Energy and Water in Tribal Communities workshop series. We appreciate the discussion, feedback and time you've put in! To help NASA better serve Tribal Communities with tools and data, we would appreciate you completing this final workshop survey.

Please have these completed by **April 2nd.**

Please email Emily Sousa at eesousa@alaska.edu with any questions. Thank you!

Email*   Your email

NASA Tools and Data

During this workshop, we covered different NASA tools and datasets (Worldview, POWER, SWOT, and SAR). Please answer the questions for each tool or dataset we discussed.

Table E1. % responses to the likert question *"How easy were the following NASA tools to work with?"* for each NASA tool.

	Very easy	Somewhat easy	Neither easy nor difficult	Somewhat difficult	Very difficult
Worldview	0	37.5	12.5	50	0
POWER	0	37.5	25	37.5	0
SWOT	0	12.5	62.5	25	0
SAR	0	25	25	50	0

Table E2. % responses to the likert question *"How likely are you to use the following NASA tools in your work?"* for each NASA tool.

	Very likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Very unlikely
Worldview	37.5	25	37.5	0	0
POWER	25	0	62.5	12.5	0
SWOT	25	37.5	25	12.5	0
SAR	12.5	50	25	12.5	0

Overall Feedback

The next set of questions refer to the workshop series and datasets/tools as a whole.

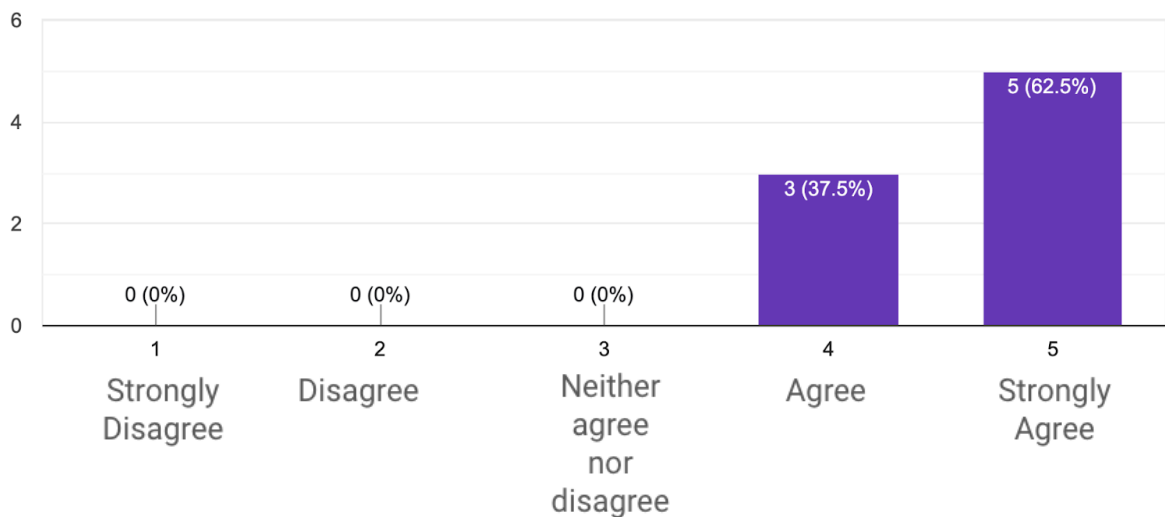I found this workshop series to be relevant to my community's needs
8 responses

Figure E1. Likert scale agreement level with the statement "I found this workshop series to be relevant to my community needs." Participants were in agreement.

Of the NASA data/tools demonstrated in this workshop (Worldview, POWER, SWOT, and SAR), which ones were the most user friendly. Why?

SAR because of the detailed step by step tutorials that went over both working with the data itself as well as how your GIS software should be set up to use it. The SAR data also had images with each of the steps that made it really clear and easy to check lots of the extra things like "hmm my units don't look like they're the same as those in the tutorial, I may have requested these products with the wrong units for this"
I find World view and POWER the most user friendly especially while using with High school students for their research projects. I found the single point tool in POWER |DaVE very helpful to access data products to a single point location.
In my opinion, SAR is the most user friendly for me. When I put more time into the other data/tools, I'm very sure I'll get more comfortable with them.
NASA Worldview was incredible and an untapped resource I did not know about for data exploration.
I liked Worldview the most. I like the power second.
Worldview. I found it simple to get the target dates, and download the data for our needs.
Worldview

Of the NASA data/tools demonstrated in this workshop (Worldview, POWER, SWOT, and SAR), which ones were the most difficult to work with. Why?

SWOT. What we did gave us existing GIS files rather than working start to finish on how to use the data. We also only worked with river/lakes data. When I went back to look at ocean coastline data for my community I had a lot of issues and didn't feel that the data we worked with was representative of a true experience finding the data for our own purposes.
SAR seems to be a little bit difficult .
At this point, I am still trying to figure out how to use SWOT. I am finding it difficult at this time.
All of the data was not transferring into my ArcGis online program. I couldn't get any data downloaded to upload into the program. It could only view it on each individual origination site.
I haven't found either one too difficult to use. The only thing I can comment on is improving options for downloading purposes.
SAR and POWER were difficult to use due to my access rights and passwords and work internet connection interfering with the sites.

Of the NASA data/tools demonstrated in this workshop series (Worldview, POWER, SWOT, and SAR), which ones are the most useful for your community's needs? Why?

I would like to say SWOT because facially it promises exactly what I need with regard to surface water changes over short periods of time. However, I have to go with SAR here because of the accessibility of the data (on-demand products especially) and the usability. The POWER data was just way too low of resolution (there is either one or two data points across the whole reservation) and there were issues with my accessing it (though the POWER staff in the call were able to for the same area so I'm not sure what was up with that). Worldview is firmly in the middle of usefulness, I'm definitely going to keep using it to identify other datasets that maybe useful but I'll probably keep going through Earthdata and taking it off Worldview itself since it gets pretty slow and keeps switching back to fully zoomed out instead of staying on my area of interest while working with it.

Worldview, POWER and SWOT seem very useful to our community and student needs. For example, living in a drought-prone or arid region in tribal Arizona, it helped my students to access the precipitation rates for a certain period of time and compare with other locations to calculate the need for rain water harvesting in our community.

SAR is currently the most useful for my community's needs.

Data from SWOT is what I am most excited about, particularly its possibility to help map and understand wetlands and marsh habitats in the Andes.

Worldview has the most overall usable features I could see using the most. My favorite features for the program were the air quality and air measurements of particles. This feature made me realize the importance of air quality and having the capability to look things up.

Worldview to get the vegetation data to see how our increased rainfall has affected the vegetation in our area.

worldview. it was easier to use and showed easier to use data for what goes on within the Lummi Nation

I liked the SWOT data and I was hoping to see more data in the past years but I understand that it had recently started.

What, if anything, would prevent you from using NASA data/tools in the future?

Accessibility; lack of data over my ROI or within my date range of interest.

As such I am very excited in using NASA data tools which are fairly new to my students and myself. If anything that would prevent me from using NASA data tools would be complexity in accessing data.

If our tribe lost Starlink internet, that would be the main reason for preventing the use of NASA data/tools.

If I did not have access to the saved link on my bookmark. I wonder if looking it up might be difficult if I forgot the names of the website and programs that I found most useful. Losing this information would be difficult if I didn't have access to my current work computer, bookmarks, and information.

I haven't gotten to a point yet on using the data so I haven't gotten to experience this at this point.

Nothing

The only reason that I can think about, is that there is no data within the study area in the future for me to use. I would want more data around the southwest part of Alaska

If you could give NASA any feedback about how they could improve the usefulness and accessibility of their data and tools, what would it be?

There needs to be more links between data and their descriptions; especially example use cases and/or tutorials for using the data. Especially within Earthdata, once I'm already at the download I can't easily go back and try to figure out why this isn't meeting my needs. For example, it took me an exceedingly long time to figure out that the reason I couldn't find any SWOT data in the date range when I _knew_ it was collecting data then was because I was looking at the wrong release. I didn't need data _specific to release 1_ I needed SWOT data in my date range. How is one supposed to _just know_ which one to click on? Especially when most of the dates just show date ranges of instrument collection not date ranges for my specific ROI, or date ranges of the actual release data, etc.

An issue that I encountered was that some data are not available during certain periods of time for our location. Also I would like to know if there is a possibility of including sources like NASA's AERONET (Aerosol Robotic Network) as a source on World view. The reason for this suggestion is because we recently installed equipment at our school and have started collecting aerosol data and it would be interesting and useful for our community and students as well.

I think NASA's data and tools are going to get better and better through time.

One thing I suggested to one of the scientists who were gathering data from the satellites was to potentially do a data summary to the individual reservations they were gathering data on and notifying the reservation and sharing the report of the results. The report including potential damaging materials, potential mineral resources, and general report with information. They gave the tribes the standard 30 day notice to respond no with a lawyer and stuff. I told him tribes are slow and not all emails on the websites are up-to-date or accessible. Some may have even went to the spam folder. Their thinking was they notified them and didn't need to contact them any further. I found this disrespectful for not following through contacting them in-person attempts were not attempted, maybe not affordable. Tribes are very concerned with this access being shared on the website without their consent. It seems very contradictory to share this data about tribal lands with the world.

Downloading the data to be more simplified and could save time.

continuously working on making it easier to use for the average person.

all the data was accessible and useful, so I do not have any further questions or feedback

If you have any additional feedback about the workshop series including thoughts on the format, length, data and products demonstrated, facilitation, or anything else, please let us know here.

It felt squished for time on the days where we had multiple presenters at once. I also vastly preferred the presentations prior to the homeworks than when we did them flipped.

The workshop was very useful and informative. For a high school science teacher like myself, it was a wealth of information and extremely useful for the future.

The workshop series was wonderful, lots of great information. I think if we had more hands on homework, we could have learned a lot more.

I enjoyed the training very much. I enjoyed learning about how to access and use this data. I can see myself using this information in the future to look things up. I am eager to share some of the knowledge I have learned with others when there is need. Thanks for sharing this information.

I thought the work session was great as is. I liked how each of us from different regions were working together and shared what our area has seen with changes in our climate.

nothing

I enjoyed the whole workshop and am grateful to have had the opportunity to learn.