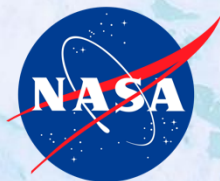


UNBOUND

FOR COASTAL ISSUES

Prepared by Virginia
Tech and Old
Dominion September
2023 NASA # 426757

Recommendation
Report: Understanding
Needs to Broaden
Outside Use of NASA
Data for Coastal Issues
(UNBOUND-CI)



UNBOUND FOR COASTAL ISSUES

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Acronyms & Definitions

AGOL – ArcGIS Online

ARSET – Applied Remote Sensing Training

CSDA – Commercial Smallsat Data Acquisition

DSWX – Dynamic Surface Water eXtent

EPA – Environmental Protection Agency

ESDS – Earth Science Data System

Esri – Environmental Systems Research Institute

GIS – Geographic Information System

GISci – Geographic Information Science

GRDI – Global Gridded Relative Deprivation Index

LP DAAC – Land Processes Distributed Active Archive Center

MODIS – Moderate Resolution Imaging Spectroradiometer

NASA – National Aeronautics and Space Administration

NLP – Natural Language Processing

NOAA – National Oceanic and Atmospheric Administration

OPERA – Observational Products for End-Users from Remote Sensing Analysis

PLACE – Population, Landscape and Climate Estimates

PO DAAC – Physical Oceanography Distributed Active Archive Center

SAR – Synthetic aperture radar

SAV – Submerged Aquatic Vegetation

SEDAC – Socioeconomic Data and Applications Center

SLR – Satellite Laser Ranging

SVI – Social Vulnerability Index

SWOT – Surface Water and Ocean Topography

UNBOUND-CI – NASA's Understanding Needs to Broaden Outside Use of NASA Data Coastal Issues

UNBOUND-AQ – NASA's Understanding Needs to Broaden Outside Use of NASA Data Air Quality

VIIRS – Visible Infrared Imaging Radiometer Suite

Introduction

This workshop series worked with coastal zone end users to understand how NASA's spatiotemporal earth science data can be more easily accessible and usable to them. This workshop focused on broadening the use of NASA datasets by agency planners, resilience officials, emergency management GIS managers, academic and governmental scientists, and non-governmental agencies for coastal zone management, flood risk management, and sea level rise and subsidence. By engaging a representative sample of end users with NASA's innovative datasets, this workshop series endeavored to identify and understand the challenges that users experience accessing and using NASA data to comprehensively address many of the coastal resilience issues related to social, economic, and environmental dimensions.

The workshop series emphasized a geographic approach and sought to understand how participants can effectively use scientific NASA data in the coastal zone with the goal that use of this data will inform local, state, and regional decisions and ultimately provide benefits to society. This workshop series consisted of four themed workshop days, presentations from field experts, break out room activities, homework assignments, and surveys.

Key Recommendations

In following with the five themes that emerged from data analysis, the team makes five key recommendations succeeding participant feedback. For an in-depth look at emerging themes, see page 12 for more.

1. Develop Centralized Landing Page for NASA Resources

The implementation of a centralized landing page serves as a strategic solution to meet user expectations. This would offer an intuitive entry point and serve as an extensive repository for NASA resources and functionalities. Workshop participants relied on external platforms like Google and NASA Worldview for initial inquiries. Users often structured search queries with relevant keywords, occasionally including "NASA" for specificity. However, the omission of "NASA" in searches led to NASA websites appearing below top hits, emphasizing the need for a centralized landing page designed for user-friendly navigation with enhanced search engine optimization.

Prioritizing users' desire for a consolidated list detailing NASA resources and functionalities, the landing page serves as a user-friendly starting point, enhancing awareness and facilitating efficient data discovery. This centralized hub would ensure a more accessible experience for users seeking NASA resources. The landing page achieves this by providing succinct descriptions of each resource and allowing users to conduct keyword searches seamlessly. Acknowledging the difficulties presented by information overload, users suggested the incorporation of aids, such as infographics, to visually represent the structure of site navigation and the diverse range of resources available.

A user-friendly landing informs users about the expansive possibilities within NASA's toolkit, addressing the need for a clear list of datasets. This consolidated resource eliminates the

need to search across various platforms, aligning with the goal of creating a centralized hub for a streamlined and efficient experience in discovering NASA resources.

2. Investing in Artificial Intelligence (AI) for Enhanced User Experience

Recognizing instances where participants encountered challenges in navigating, finding programs, and accessing pertinent data, a strategic investment in Artificial Intelligence (AI) is proposed to improve site navigation. Participants expressed uncertainties about progressing through activities and faced difficulties stemming from unfamiliar terms, abbreviations, and labels used.

The introduction of a Natural Language Processing (NLP) chatbot is suggested to assist users with website navigation. NLP chatbots can engage in real-time conversations with users, providing immediate guidance and support. This approach not only facilitates prompt issue resolution but also enables NASA to build a repository of specific user issues and preferences. The aggregated insights serve as a foundation for informed decisions, shaping future enhancements to the website's user interface and ensuring that NASA resources continually evolve to meet the dynamic needs of users.

3. Increase Accessibility of Data

Participants in every group expressed the desire for more integration with data programs they are familiar with. Largely, these calls were for compatibility with GIS platforms. To answer these calls, this team recommends that NASA expands data on Esri ArcGIS Living Atlas of the World—a platform that 54% of participants ranked as “very easy.” We recommend that NASA become the controller of data that is hosted on Living Atlas to gain access to data metrics, in addition to increasing the number of datasets available on Living Atlas.

4. Enhance Regional and Occupational Relevance

Tailor NASA applications to suit the specific demands of users from diverse regions and occupational requirements. Understanding the array of workshop participants, ranging from local government representatives to professionals in global organizations, reveals their varied needs are closely tied to the scale of their operations. Feedback received spans from a call for “more global data” to a desire for finer granularity at the county line or town boundaries. A common thread observed is the distinct need for themed data filtration, as coastal data practitioners consume many forms of data depending on their background and career. Our suggestion is to incorporate NASA's DEVELOP project themes as filtration possibilities for NASA applications. These themes: Agriculture, Climate, Disasters, Ecological Conservation, Energy, Health & Air Quality, Urban Development, Water Resources, and Wildland Fires, have the capability to reflect the nuanced requirements across different occupational contexts. This also includes understanding the unique challenges faced by users outside the academic sphere and beyond the borders of the United States. Participant responses also reflected the importance of coordination between federal agencies, such as NGS and NASA, to encourage collaboration and effectively address regional challenges, particularly in highly vulnerable and underrepresented areas like American Samoa.

5. Incorporate Training Pedagogy into Workshops

Throughout the workshop, numerous participants expressed their enthusiasm for applying what they had learned within their teams and sharing NASA resources with colleagues. Recognizing this aspiration, our recommendation is multifold in adopting different kinds of pedagogical approaches in endeavoring to expand the use of NASA resources. This can look like shifting a training workshop's goal from "teach practitioners how to use NASA resources" to something like "teach practitioners how to use NASA resources with the intent of training them as ambassadors of NASA applications." To achieve this, we propose the development of a speaking series, workshop, or modular program that incorporates pedagogical components. This can look like using the Gradual Release of Responsibility Model in training sessions to the effect of making independent learners capable of replicating the model to their colleagues, students, peers, etc. (Fisher and Frey 2014). These elements are designed to equip new NASA practitioners with the skills to navigate NASA tools and with the ability to effectively impart their knowledge, thereby expanding the overall utilization of NASA data.

About UNBOUND

NASA's Understanding Needs to Broaden Outside Use of NASA Data (UNBOUND) Program seeks to discover and understand the needs of potential data practitioners by employing domain-specific workshops targeted at specific user communities to identify recommendations for greater accessibility and use of NASA data.

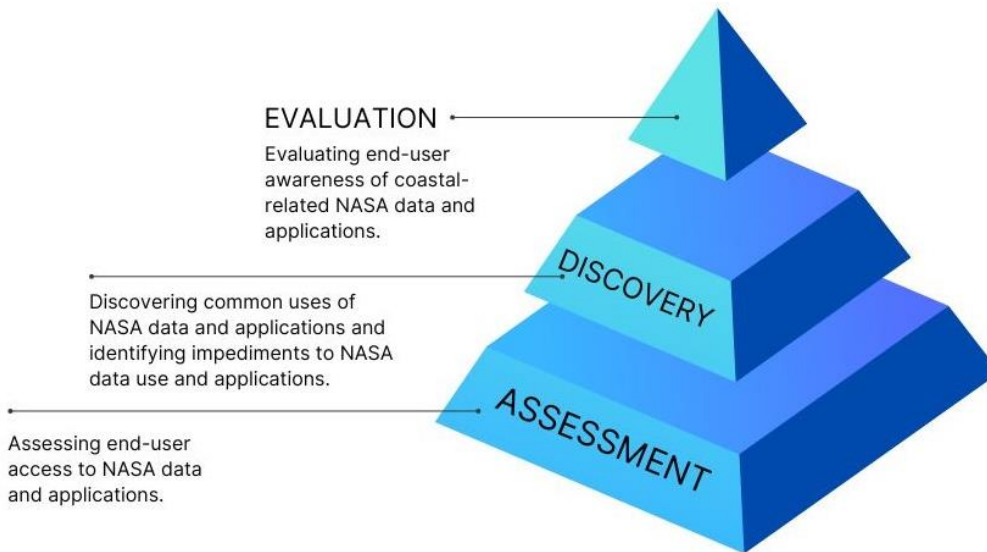
UNBOUND for Coastal Issues (UNBOUND-CI) was a four-session workshop to identify recommendations to make NASA Earth science data products more discoverable and suitable for analyses to address issues in coastal zones, encompassing both coastal and inland areas. The workshop series aimed to engage coastal issues for data practitioners who are not currently using NASA data products or would like to increase their use of NASA data for coastal applications. The workshop series was sponsored by Virginia Tech and Old Dominion University, with support from NASA's Earth Science Data Systems (ESDS) Program. Twelve participants were compensated for their participation and a total of 28 participants attended the workshops.

Workshop Objectives

The goal of the workshop series was to further the use of earth science data to inform decisions and provide benefits to society, which supports NASA's Earth Science Research Program's strategic objectives (ROSES-22). The reality of sea level rise due to climate change for vulnerable coastal communities and efforts to make the coast more resilient presents a unique opportunity to empower these communities with actionable earth science research. Climate-variability and climate change is a global issue that also directly impacts regional and local environments and stakeholders. NASA and Esri signed the Space Act Agreement to address these challenges from a geographic approach. The workshop series emphasized a geographic approach and sought to understand how participants can effectively use scientific NASA data in the coastal zone with the goal that use of this data will inform local, state, and regional decisions and ultimately provide benefits to society.

Each day of the UNBOUND-CI workshop created opportunities for:

1. **DEMONSTRATION** of available NASA technologies by subject matter experts
2. **EXPLORATION** of available NASA technologies by workshop participants. Data collected from surveys, live polling, and detailed note taking were used to measure the primary workshop objectives, which included:



Workshop Methods

Participant Selection

The workshop series consisted of four virtual sessions for 19 workshop participants, 12 of whom were awarded stipends. The call for applications was circulated through the Esri Oceans community via their listserv, coupled with the 33 Sea Grant college and university institutions' listservs, most of which are located near the coasts. The call also ran on the American Planning Association's (APA) listserv, the Geographic Information Systems Professional's (GISP) listserv, and the Association of State Floodplain Managers' (ASFPM) newsletter. The call went out on social media as well, from the Twitter pages of the Virginia Tech Coastal Collaborator, Virginia Tech Center for Coastal Studies, NASA Earth Data, and Old Dominion University's. The call also went out on LinkedIn with the GISCI. These combined platforms lead to over 50,000 unique impressions. Flyers with the call were also distributed at the 2023

What stakeholder category does your organization represent?

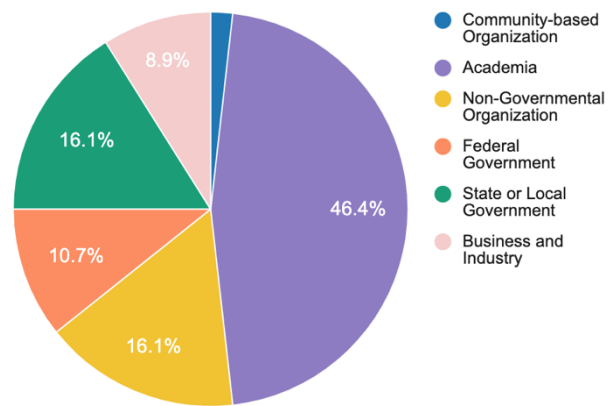


Figure 1 The breakdown of 56 applicant organizational affiliations

Esri User Conference, and the 2023 APA Virginia Conference. See UNBOUND1CI promotion below in Figure 2.

The application was a Google form that received 56 applications. The application collected contact information, demographics, organizational affiliation, familiarity with NASA data, research interests, and more. See the breakdown of the applicant organizational affiliation in Figure 1. The location distribution of applicants varied, with 22 international applicants representing 12 countries, of which all were invited to participate. For the complete application, see Appendix 1.



Figure 2. From the left, Project CO PI Dr. George McLeod, Project PI Dr. Wendy Stout, NASA Program Executive Dr. Yaítza Luna-Cruz, and Esri Ocean Product Engineer Keith VanGraafeiland at the NASA Earth Science booth at the 2024 ESRI Federal GIS Conference. Photo credit Dr. Yaítza Luna-Cruz.

The selection process for awarding stipends used a ranking system that accounted for data experience, NASA data familiarity, potential benefit to participants, proximity to an Environmental Justice (EJ) community, as defined by the [EPA](#), and clarity and descriptiveness of responses. Participants were each ranked independently by three UNBOUND-CI team members and rankings were subsequently averaged. The top 12 were invited to participate with a \$1,200 stipend. Only US citizens were eligible to be selected for a stipend. All other candidates were invited to participate without stipends, but with the offer of Continuing Education (CE) credits through the APA, CFPM, or the GISP.

Methodology

A mixed methods approach contributed to the documentation and evaluation of the UNBOUND-CI workshop. Research faculty used a combination of surveys and participant

observations to collect feedback. Integrating quantitative and qualitative methods is common practice in social science research and enables a fuller understanding of data collected as opposed to using a single method (Bernard & Ryan, 2010; Halcomb & Hickman, 2015, Tracy, 2020). Workshops and subsequent observations in breakout groups were conducted via Cisco's Webex platform. Participants had a centrally located Google Sheet that broke down the workshop day, speakers, group assignments, sign in sheet, directories, group observations, and more. Survey results and analysis of narratives produced through workshop activities captured the rich tapestry of experience from the participants, presenters, and facilitators. The project was reviewed by the Virginia Tech Institutional Review Board (IRB) and all data were anonymized to protect personal identities and information.

Surveys + Padlet Activities


Enrolled participants (n=31) completed a survey at registration to guide the workshop design and to support organizers in meeting the specific needs and interests of participants, including accessibility. Using the Padlet.com platform, participants also completed daily, anonymous surveys about the expert presentations and the breakout session activities. Using Padlet, participants shared their observations, opinions, and questions. Participants completed a longer, post-event survey (n=13) to collect reflections and provide feedback on the workshop series in its entirety.

Participant Observation

Embedded workshop assessments, including observations, can help facilitators to evaluate participant progress and feedback (SERC, 2023; Sufi, et al., 2018). The UNBOUND-CI team video recorded the workshop using Webex, which also provided transcriptions of dialogue for post-event analysis, impact evaluation, and reporting final conclusions. UNBOUND-CI presented participants with tools to contribute live feedback throughout the workshop. Anonymous posts via Padlet.com encouraged open and honest feedback to be collected. UNBOUND-CI also included a capacity-building component for students enrolled in Dr. Hutton's Geography course, Weather, Climate, and Society, at Old Dominion University, who served as qualitative notetakers during the workshop breakout sessions. Students in the class also created poster boards of their observations for their course project. See an anonymized example from Day One below in Figure 3.


Analysis

Data collected from surveys and workshop notes were reviewed and analyzed by the UNBOUND-CI research team. The analysis drew from Tracy's iterative phronetic approach, which involved organizing data into categories and using descriptive codes to explore and interpret emergent themes (Tracy, 2020). Themes were synthesized using participant reflections and recommendations in response to the workshop objectives of evaluating end-user awareness, discovering common uses, identifying impediments, and assessing access.



OLD DOMINION UNIVERSITY


NASA UNBOUND Coastal Issues Workshop Day 1



EARTHDATA
OPEN ACCESS FOR OPEN SCIENCE

Abstract

During the Coastal Issues Workshop, the topics of Equity and Environmental Justice, employing Unbound with the use of NASA datasets, and the Applied Remote Sensing Training Program were presented. Research consisted of explanation, observation, practicing and application. The breakout sessions consistently shared issues of participants struggling to access the datasets.



3 Presenters:

- **Dr. Yaitza Luna-Cruz**
 - Topic: Equity and Environmental Justice
- **Elizabeth Joyner and Leah Schwizer**
 - Topic: Getting Started with NASA Resources
- **Sean McCartney**
 - Topic: Applied Remote Sensing Training (ARSET)


UNBOUND

Vision: Users will employ NASA data in research, tool development, and decision-making.

Goal: Extend the impact of NASA data by making data more accessible and useable in the context of this user community.

Introduction

On Day 1, we first discussed the roles of the UNBOUND workshop and its importance. We then focused on introducing participants to resources, such as data and tools, available from NASA to examine coastal zone management issues. There are also training resources available, to users with different levels of experience to help better understand some of the resources that NASA has to offer.



Research Methods

The workshop consisted of a main session with 3 presenters followed by 5 breakouts of approximately 3 practitioner participants. Student observers took notes and made observations throughout the workshop. Notes and observations were in the format selected by the student. These were later compared to determine takeaways.

Workshop Findings/Recommendations

Question: Find the sea surface temperature for the Gulf of Mexico from August 25th 2005, during Hurricane Katrina.

- **Breakout 1:** Participants in this group encountered a few obstacles when trying to discover which data to use. Overall, they were familiar with using satellite data, which resulted in a successful completion of the exercise.
- **Breakout 2:** Participants in this breakout group faced some difficulty utilizing the data at first. Members said that the data was "a bit confusing". They had several questions that their moderator answered, and they had an easier time understanding the data after their questions were answered.
- **Breakout 3:** Participants had issues figuring out where on the website to access the data. They were also unsure if the map images were loading properly. Once the website was explored, navigation and functionality were increased.
- **Breakout 4:** Participants had some difficulty analyzing the data at first but they were able to help each other break it down and better understand what they were looking at. The participants in this breakout group had a relatively easy time finding and navigating the data to complete the task given.
- **Breakout 5:** Participants struggled as they did not know where to begin. They clicked and searched with many different links and keywords but ultimately was not able to find the correct dataset. Participant recommended a "turn to" video.

Citations and Acknowledgements:

Dr. Yaitza Luna-Cruz (Equity and Environmental Justice): [NASA, Earthdata, Earthdata Portal, NASA, NASA UNBOUND](#)
 Elizabeth Joyner and Leah Schwizer (NASA Resources): [Leah's Presentation, Earthdata Portal, Earthdata, Earthdata, GIS at NASA, NASA, Workshop, Earthdata SEARCH, NASA, Sea-level Projections, NASA, Sea-level Observer](#)
 Sean McCartney (ARSET): [NASA, ARSET](#)

Figure 3 Example from Dr. Hutton's student observations of the Day One Workshop

Breakout Activities

Breakout activities were planned to conduct the exploration of NASA data related to coastal issues for each day of the workshop. A driver-navigator-observer activity, inspired by UNBOUND-AQ ([Air Quality](#)) was used. Exercises developed by the UNBOUND-CI team put participants in the driver's seat, asking participants to collaboratively carry out a search for a particular dataset. Participants in each breakout room chose one person to act as the driver, one person to act as the navigator, and one person to take notes as the observer. The navigator provided directions to the driver, who followed the navigator's instructions using their own computer and sharing their screen with the others. The observer took notes and summarized the insights for the full group once the attendees returned to the main room. The exercise began with participants locating a NASA dataset, article, or web application related to coastal issues. One or two follow-up questions encouraged further exploration of the data.

Homework Assignments

Session workshops introduced participants to resources (data and programs) available from NASA around coastal issues. The homework assignments asked participants to expand on the concepts and resources discussed during presentations and to independently work through specific processes to help identify accessibility of different resources and to provide feedback on ease of use and potential applications in their own work. The first homework assignment, Session 2 - NASA Data for Sea Level Rise Homework focused on the [Flooding Analysis Tool](#) as well as the [EarthData](#) search to explore data related to coastal flooding and sea level rise. The second homework assignment, Session 3 Homework - NASA Data for Coastal Flooding Impacts had participants explore [NASA power user profiles](#) to better

understand existing applications of NASA data and programs. We then asked participants to step into the role of a power user supporting NASA partner organizations in the response and recovery of a flood disaster. Participants were asked to use the [NASA EarthData Floods Data Pathfinder](#) to locate the Flood Dashboard. Participants were then given a scenario of an impending tropical storm event where a NASA partner organization reached out for help using existing data to identify coastal areas along the east coast where soil moisture levels are high. Participants were asked to use what they have learned throughout the UNBOUND-CI workshop to identify data and programs that would help in this scenario. Both assignments asked participants to describe successes and challenges and think about how the resources can be integrated into their existing workflows. The assignments can be found in Appendix 4.

Emergent Themes

Five themes emerged from the analysis of the data collected from surveys, Padlet reflections, and breakout session observations. The themes, along with additional insights from the UNBOUND-CI team, inform the final recommendations.

Recognizing Regional and Occupational Diversity

User applications are largely driven by place and occupation. Users outside of academia and the United States face challenges with access. In addition, participants shared that they would like NASA applications to consider and include local data specific to region. It is also important to obtain input from users working across different organizations, regions, and scales. See Figure 4 to see the distribution of scale of work amongst the participants.

A conversation with users living and working in the Pacific Rim provided especially important place-based and organizational insights. Many were unable to participate in the workshop, due to the US-centered time zone and schedule. Feedback from users in the Pacific islands included:

- Users, specifically American Samoa, feel “invisible” and want to “be heard.”
- Coordination between federal agencies could be better and users mentioned that NGS and NASA seemed to be at odds regarding subsidence in American Samoa after the 2019 Tsunami.
- There is little awareness of NASA data and products, and more targeted communication would be helpful
- A shortage of technical expertise hinders the use of complex data and tools. Limited staff, like many organizations, need to wear many hats. In areas where users do have skill, they often do not have the staff availability and time.

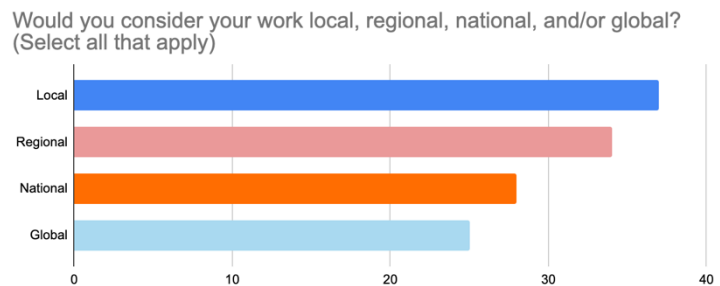


Figure 4 The breakdown of 56 applicant organizational affiliations

Training Users (and Trainers)

Workshop participants were excited to be introduced to NASA products and shared an interest in spending time with trainings and tutorials. Users suggested that it would take time to build their level of comfort and skills with the technologies presented in the workshop and that they were invested in learning. Many commented that tutorials and trainings would be helpful and were enthusiastic about sharing their newfound expertise with their networks.

“Several of the training opportunities may be useful to my community. Can't wait to learn more!”

Developing Intuitive Web Tools + Interfaces

New web interfaces can be challenging to navigate at first and require time to learn. Participants shared a preference for intuitive user design and web site navigation. Users sometimes struggled to find all of the information needed within one NASA site and experienced difficulty working across different platforms to cross reference. Users offered that **clear labels** and interfaces that transition easily across different devices, especially **small and mobile screens**, would increase their use of the technologies. Products such as NASA WorldView that allowed for customization were highlights for users who wanted to view specific events temporally and spatially.

“I appreciated that the [SEDAC] excel sheet had multiple tabs with detailed information but it still did not make it entirely clear on what each attribute was in reference to.”

Below in Figure 5 you can see participants working on how to narrow their results for locating NASA dynamic surface water extant product with 30-meter spatial resolution to Porto Alegre, Brazil before a June 16th, 2023, flooding event. The group tried to search the location in the search bar, tried to zoom in on Brazil, and tried to draw boundaries around the location, of which they had to use Google Maps to locate. “There are so many” was repeated several times as participants became frustrated and appealed to facilitators for help in downloading the correct files. The task was eventually marked as incomplete when the breakout session ended, the group never having reached the second activity.

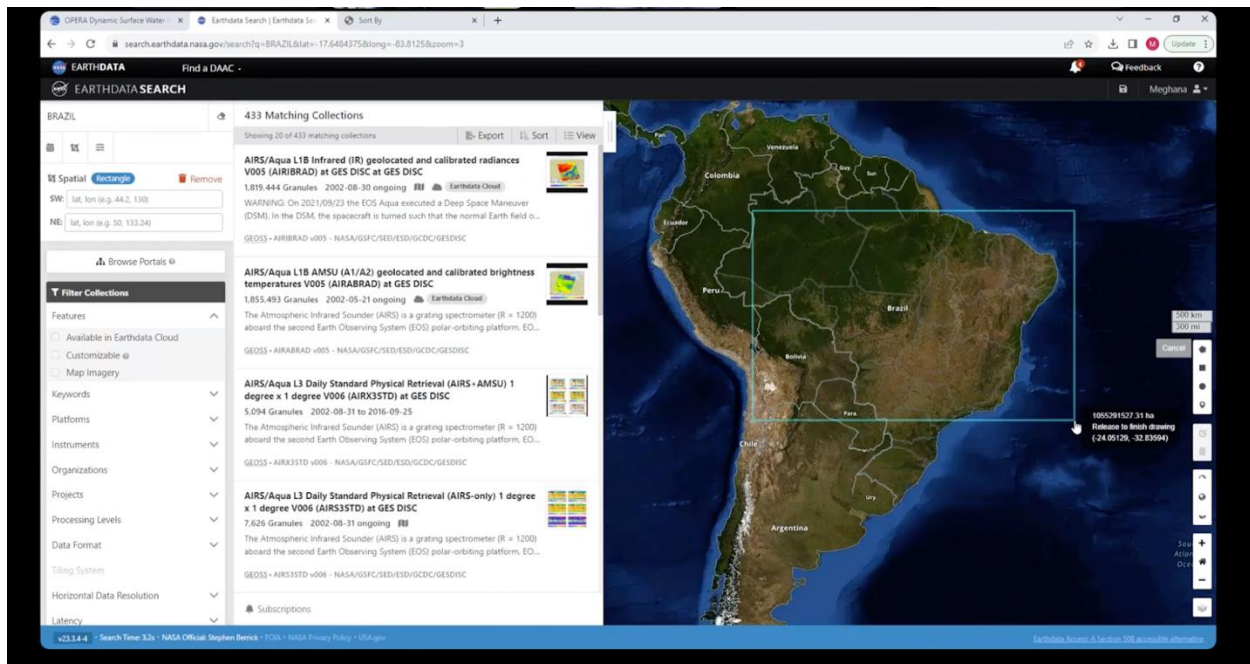


Figure 5 Participants working on narrowing their results for locating NASA dynamic surface water extant product with 30-meter spatial resolution to Porto Alegre, Brazil before a June 16th, 2023, flooding event.

Locating Data + Technologies

A common request from participants was for a central repository of NASA data and technologies related to coastal issues. Through the workshop, participants learned of the vast number of NASA products that could enhance their work and productivity. Similarly, participants want the ability to locate relevant data and technologies from NASA platforms (e.g. NOAA, SEDAC).

“Difficult to figure out where to go in the first place. It would be better to have a centralized place to get data and branch out from there. It's confusing how to get started - in the past I've given up.”

Building Compatibility

Participants came to the workshop with varying degrees of skills and experience with NASA products. Frequent users of different mapping tools (e.g., ArcGIS) shared an appreciation for opportunities that would allow them to transition easily between NASA and non-NASA products.

“It's great to see NASA making resources more GIS ready and available in the Living Atlas.”

Workshop Series

The following section provides a detailed summary of the presentations, breakout exercises, and participant reflections about coastal-related NASA products that were demonstrated and explored on each day of the workshop. Real-time surveys, via Padlet, and observations in breakout sessions were used to gather participant feedback about the following areas of user experience:

Workshop Day One: NASA Data for Coastal Management

Sep 18, 2023

Workshop One covered foundational topics from four field experts that included how to find data on Data Pathfinders, browse imagery on NASA Worldview, access data and GIS services on Earthdata, and explore remote sensing with ARSET. Resources were also shared with participants on where to access training for NASA programs. After giving feedback on the presentations, the participants joined break out rooms with the groupmates and moderator that they would have for the entire workshop. Following introductions, participants chose roles—navigator, driver, observer—and began to try and answer a question asked by the moderator. These questions asked participants to engage with High Resolution Sea Surface Temperature (PO DAAC) and Shuttle Radar Topography Mission Global 1 arc second (LP DAAC). To see breakout room activity questions, see Appendix 4. After breakout rooms rejoined the main room, participants were asked to fill out anonymous guided reflections on the experience. To see the questions asked, see Appendix 3. The final task the participants did was to have the observers of each breakout room report how their group did with the questions they were asked to answer.

Expert Presentation Topics: Earthdata, NASA GIS, ARSET

Guest Speakers and Presentations

Dr. Gerald Guala "Stinger" - Welcome

Dr. Yáitza Luna-Cruz - "Equity and Environmental Justice"

Elizabeth Joyner & Leah Switzer - "EGIST Demo for UNBOUND-Coastal Issues"

Sean McCartney - "Applied Remote Sensing Training Program"

Participant Feedback Summary

Participants appreciated building familiarity with the technologies presented, especially access to various data viewers, the ability to share visualizations, and compatibility with GIS software. Learning about NASA-sponsored training opportunities was helpful for those unfamiliar with the technologies. Feedback from breakout session exercises provided additional insights as well as impediments, such as participant reluctance to download large data exports and the need to download data individually. Participants also found additional datasets through the breakout activity that were unknown, despite being long-term users.

Selected Quotes

- “It’s great to see NASA making resources more GIS ready and available in the Living Atlas.”
- “Relatively small Indigenous communities experience quite enormous climate induced coastal issues and these will go a long way to help my research.”
- “Story maps have grown increasingly popular in my work and the ability to bring NASA data into story maps using AGOL [ArcGIS Online] is awesome!”
- “I am very excited for the trainings for SAR and for ‘MODIS to VIIRS;’ these courses are going to be crucial for coastal zones.”
- “Visualizations of change in coastal areas - important when making decisions for coastal managers.”

Workshop Day Two: NASA Data for Sea level

Sep 19, 2023

Workshop Two covered foundational topics from four field experts that included Esri ArcGIS Living Atlas of the World, Sea Level Rise and Wetlands, NASA Sea Level Science: Supporting Planning and Adaptation, and NASA Sea Level Change Portal. After giving feedback on the presentations, the participants joined break out rooms with their group members and moderator. Following a shorter introduction, participants chose roles—navigator, driver, observer—and began to try and answer a question asked by the moderator. These questions asked participants to engage with the Flooding Analysis tool, Interagency Sea Level Rise Scenario Tool, and two NASA articles that provided the basis of conversation on where to find data. The articles were “[Why Seas are Rising Faster on the Southeast Coast](#)” and “[Going with the Flow: How Rivers Change Sea Level](#).” To see breakout room activity questions, see Appendix 3. After breakout rooms rejoined the main room, participants were asked to fill out anonymous guided reflections on the experience. To see the questions asked, see Appendix 3. The final task the participants did was to have the observers of each breakout room report how their group did with the questions they were asked to answer.

Expert Presentation Topics: NASA Sea Level Change Portal, ArcGIS Living Atlas, Sea Level Science and Application at NASA, Sea Level Rise and Wetlands

Guest Speakers and Presentations

Keith VanGraafeiland - Esri ArcGIS Living Atlas of the World
Dr. Tom Allen - Sea Level Rise and Wetlands
Dr. Ben Hamlington - NASA Sea Level Science: Supporting Planning and Adaptation
Dr. Carmen Blackwood - NASA Sea Level Change Portal

Participant Feedback Summary

In Workshop Two, participants emphasized the importance of sharing Esri maps and other data with collaborators, especially those who do not use GIS. In addition, participants were excited to learn about Esri products that were publicly available. The applicability and accessibility of products presented, including Esri Living Atlas, SAR, and Sea Level Rise Portals. Participants noted the ability to scale, whether globally or locally, as particularly useful. In the breakout sessions, groups were assigned to find data using the Flooding Analysis Tool and the Interagency Sea Level Rise Scenario Tool. Three out of five groups began the activity with a Google search of terms assigned in the exercise, while two groups moved directly to NASA sea level rise websites. Using Google as a starting place was a frequent tactic for users who were new to navigating NASA products. General comments were made about feeling overwhelmed with the amount of information provided on flood analysis tool websites, especially for those new to the products. One participant suggested that NASA add a robot/chat feature to help with navigation, while another requested infographics to make the information overload more manageable.

Selected Quotes

- “I’m really excited about the availability of the data, and that it is using IPCC data - I will be using these resources in my work.”
- “Great resources and useful tools. Looking forward to the SWOT data being available for public use!”
- “I am looking forward to looking at the coastal wetlands data in northeastern NC in more detail. I know there are a lot of changes occurring in this area.”
- “I was not familiar with most of this data before as I mainly used the NOAA sea level rise viewer. “The high-resolution on some of the satellite data is incredible and allows for in-depth views on data variables within a community. Access to public GIS tools is a game changer as well and will hopefully pave the way for more independent research (such as community-based assessments).

Workshop Day Three: NASA Data for Flood Risk Management

Sep 25, 2023

Workshop Three covered foundational topics from multiple field experts and the NASA OPERA team. This included a case study of planning for regional sea level rise, as well as presentations on assessing submerged aquatic vegetation (SAV) and harmful algal blooms (HABS), and the possibilities of remote sensing analysis.

After giving feedback on the presentations, the participants joined break out rooms with their group members and moderator. Due to lower attendance this day, groups one and two were combined. Additionally, homework was due at the start of the workshop, and participants had the opportunity to discuss how the homework they had received the week prior had gone for them. The assignment asked participants to engage with the Flooding Analysis Tool, and to find specific datasets on

“I look forward to exploring SAR. I [think] it would be useful in the future for marsh migration.”

NASA Earthdata. You can find the homework assignments in Appendix 4. Following a discussion of homework, participants chose roles—navigator, driver, observer—and began to try and answer a question asked by the moderator. These questions asked participants to engage with Dynamic Surface Water Extent, NASA PO. DAAC, NASA Earthdata, NASA Worldview, and the Single Pixel Extraction Tool. To see breakout room activity questions, see Appendix 3. After breakout rooms rejoined the main room, participants were asked to fill out anonymous guided reflections on the experience. To see the questions asked, see Appendix 3. The final task the participants did was to have the observers of each breakout room report how their group did with the questions they were asked to answer.

Expert Presentation Topics: Planning Sea Level Rise in Hampton Roads, OPERA Mission, NASA Commercial Smallsat Data Acquisition (CSDA) Program - Assessing SAV and Harmful Algal Blooms in the Chesapeake Bay

Guest Speakers and Presentations

[Benjamin McFarlane – “Planning for Sea Level Rise In Hampton Roads”](#)

[Dr. Richard Zimmerman – “Assessing SAV and Harmful Algal Blooms”](#)

[Dr. Alexander Handwerger – “Observational Products for End-Users from Remote Sensing Analysis \(OPERA\)”](#)

Participant Feedback Summary

In the homework discussion of finding datasets on NASA Earthdata, multiple participants relayed that they did not know what an NC file was, with one reporting that they went to YouTube to figure out how to use an NC file in Arc Pro, to no avail. Multiple participants struggled with how to filter metadata to find what they needed, one participant saying it took them “20-30 minutes to actually get the numbers associated with the [needed] file.” When reflecting on the Flood Analysis Tool, multiple participants commented on the scale of the tool, wishing that the data could be more granular. One participant commented that the closest point to their locality was in another state, making it not useful to them.

Exposure to the NASA products in Workshop Three encouraged participants to consider innovation in work applications and the usefulness for specific regions where they are working. Participants also were interested in NASA making updates to the products public to build awareness of new technologies. With NASA OPERA, participants commented that Surface Disturbance was useful for identification of landform changes from recurrent flooding. They also identified the need for a "comprehensive guide" of "charts/tables of all possible products...that NASA supports or has reviewed that says: what it is, resolution, data type.

In the Workshop Three breakout exercise, groups used the Flooding Analysis Tool to locate data. Participants commented that "the visual aspects of the data allow data practitioners to observe specific events both temporally and spatially, especially the PODAAC interface." In the NASA WorldView map, users appreciated the "Start Comparison" Tool, which allowed them to slide/swipe between two days of maps. However, members of another group were unable to locate the layers option in OPERA Dynamic Surface Water Extent from Harmonized Landsat Sentinel-2. Several users noted that lack of knowledge/training on how to use the program was an impediment, stating,

Selected Quotes

- "Discovery of data was a bit challenging and understanding the differences between the different OPERA DSWX layers wasn't entirely clear to me."
- "The NASA Flooding Analysis Tool is nearly a one-stop shop. Lots of interactivity and customization."
- After today's workshop, it seems that it takes some learning to find and use the DSWx dataset.
- On the Smallest Data Acquisition Program - It was nice learning about cube satellites and your applications. I just wish I could access the data (I'm not in academia)!
- NASA WorldView Earthdata and the Floods Data Pathfinder provide a "holistic picture of land and sea and the data sets available to analyze each."
- Users unable to locate layers option in OPERA Dynamic Surface Water Extent from Harmonized Landsat Sentinel-2 provisional product. Once the layer files were located, users had difficulty identifying which layer to access.
- Comment on NASA Worldview: "It sort of feels to me that you end up chasing something and you end up losing where you came from and it'd be nice to somehow have a chain."
- "Those of us that are GIS users want that little right click zoom tool."
- On NASA Worldview: "I don't know if there's a swipe tool. I don't know if they'll let us add the data twice either. That would be a really cool feature to have though, wouldn't it?"
- "I did find a bug in a flooding analysis tool...It is that when you enter the threshold, the custom threshold, whether you have it set to feet or meters, it still takes it as feet."

Workshop Day Four: Human Dimensions of Coastal Zones

Sep 26, 2023

Workshop Four covered foundational topics from multiple field experts and members of the NASA Disaster Program. These presentations covered disaster uses of SEDAC and NASA WorldView, like ground level context for remote sensing data, US Social Vulnerability Index Grids with Population, Landscape and Climate Estimates (PLACE), Global Gridded Relative Deprivation Index (GRDI), POPGRID Viewer, SVI, and more. After giving feedback on the presentations, the participants joined break out rooms with their group members and moderator. Due to lower attendance on this day, groups one and two were combined, as well as groups three and five.

Following re-introductions amongst the new groups, participants chose roles—navigator, driver, observer—and began to try and answer a question asked by the moderator. To see breakout room activity questions, see Appendix 3. After breakout rooms rejoined the main room, participants were asked to fill out anonymous guided reflections on the experience. To see the questions asked, see Appendix. The final task the participants did was to have the observers of each breakout room report how their group did with the questions they were asked to answer. Participants were given the final homework assignment, which would be submitted two weeks later with the exit survey. The exit survey can be found in Appendix 6.

Expert Presentation Topics: NASA's Disasters Program, SEDAC

Guest Speakers and Presentations

Dr. Alex De Sherbinin: "NASA SEDAC Presentation"

Dr. Shanna McClain, Garrett Layne: "NASA Disasters Program Presentation"

Participant Feedback Summary

In Workshop Four, participants learned about NASA's Disasters Program and SEDAC. As one participant noted, "Socioeconomic data is important to focus on the human impacts of disasters, climate change and sea level rise. It is also important to use when applying for funding for resiliency or related projects. Socioeconomic data helps determine who will be most impacted by extreme events." The capability of products to operate at small geographical scales was appealing as participants considered application to their work and research.

The breakout exercises asked groups to read the Earthdata article, "Adding the Who to Earth Observations," to learn more about SEDAC data and its potential uses. Socioeconomic datasets that one group listed as useful when studying coastal management, sea level rise, or flood risk included:

- SVI (Social Vulnerability Index)
- Number of households in a flood zone that have flood insurance
- Demographic and economic data indicating who might be most at risk in a flood zone
- Cost of homes, how expensive a house is and whether they will harden their shoreline
- Type, age, etc. of the residential structure
- Land use type
- If a storm surge happens, how long do evacuations take. Is public transportation provided? How do people get out?
- Shelter capacity and location, number of available hotels

After reading the article, groups were asked to find the U.S. Climate Risk Projections by County, v1 (2040-2049) dataset. Next steps included downloading an Excel (.xlsx) zip spreadsheet and exploring the tabs to locate the standardized composite risk for Miami-Dade County, Florida.

Locating data was challenging for groups once they accessed Excel spreadsheets. They commented that the transition between the spreadsheet and SEDAC map page were "not intuitive." On the interactive map, users also encountered confusion when attempting to locate county data via the tab labels. Cross-referencing the spreadsheet with the data dictionary and composite numbers was found to be a cumbersome process, particularly for participants unfamiliar with the terminology.

Selected Quotes

- "It would be better if the [Worldview models] were cloud based and explained, and the data sets were just pulled into it."

- “[SEDAC] looks like it could be a very useful tool when evaluating social vulnerability and hazards. I look forward to seeing how I can use this in the future.”
- “I recently learned about the Social Vulnerability Index (UNBOUND Day 1), so it was great to see a few elements of the SVI [in the SEDAC exercise].”
- “Why does the main [Earthdata] landing page NOT have a quick button to the “Search Earthdata?”
- “The fact that you can create a polygon [in the Popgrid Viewer] and approximate how many people live there is really, really cool.”
- “The SEDAC mapping ability to construct your own impact regions is super cool and very helpful for planners.”
- “Very beneficial to show how social economics data can be merged and utilized for analysis. As a researcher focusing on coastal resilience, being able to select an index of demographics, income etc. would be helpful to identify areas impacted that may also be low-income areas.

Results and Recommendations

Very Difficult to Access/Use, Somewhat Difficult to Access/Use, Neutral, Somewhat Easy to Access/Use and Very Easy to Access/Use

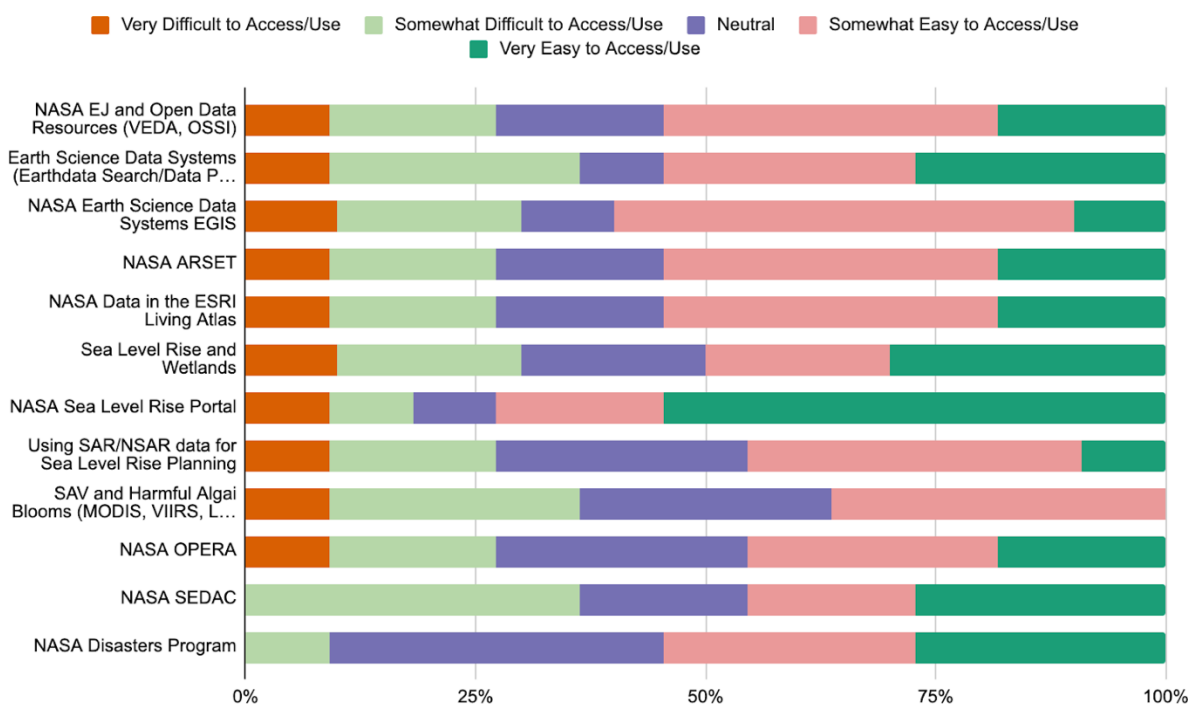


Figure 7 A summary of responses from the exit survey detailing each resource used and the correlating "difficulty" of each resource.

Product-Specific Recommendations from Participants	
Dynamic Surface Water Extent	<ul style="list-style-type: none"> • Improve interface for locating the layers option in OPERA Dynamic Surface Water Extent from Harmonized Landsat Sentinel-2

	<p>provisional product. Users struggled to locate the layer files and found it challenging to identify which layer to access.</p>
<p>Flooding analysis tool</p>	<ul style="list-style-type: none"> • Improve Search Engine Optimization so users can find NASA sites and products more easily. • Participants commented about the data points being a “closed list of locations” and would prefer that the Flooding Analysis Tool's location feature allow the search of areas outside of the data points. • Expand data in rural areas. • Include projections beyond the year 2100. • If you don't know that the website exists, you're not going to know where to look. Not only that but if you type in keywords to any search engines, most of these sites don't come up as the top returns.
<p>High Resolution Sea Surface Temperature (PO DAAC)</p>	<ul style="list-style-type: none"> • Streamline paths for locating data. • In Data Pathfinders, separate the resource types rather than combining reports with data. • Make the State of the Ocean tool more visible on the PODAAC main site. • One participant noted, “the search function led to multiple resource types, rather than just data, and the results did not include the data I needed.”
<p>Interagency Sea Level Rise Scenario Tool</p> <p>Very Difficult to Access/Use: 9.09%</p> <p>Somewhat Difficult to Access/Use: 9.09%</p> <p>Neutral: 9.09%</p> <p>Somewhat Easy to Access/Use: 18.18%</p> <p>Very Easy to Access/Use: 54.55%</p>	<ul style="list-style-type: none"> • Add a bot/chat feature to help with navigation. • From a participant working in community risk assessment, “having these large-scale tools is great, but I need to get to decision making and so I have to get very, very granular and take what I need and nothing else.” • Create a polygon tool that allows users to draw geographical boundaries around specific areas. • Include state boundaries in the base map to help orient users. • Provide data as Web Map Service or WMTS Web Map Tile Service.

<p>NASA Earthdata</p> <p>Very Difficult to Access/Use: 9.09%</p> <p>Somewhat Difficult to Access/Use: 27.27%</p> <p>Neutral: 9.09%</p> <p>Somewhat Easy to Access/Use: 27.27%</p> <p>Very Easy to Access/Use: 27.27%</p>	<ul style="list-style-type: none"> • Clarify labels for data titles. A participant noted: “One of the biggest impediments for data discovery I think is the titles of the data. I know when you look closely you can figure out what the data is, but the numerous different acronyms and numbers can be confusing, and I think that is why I prefer searching for data in ArcGIS online sometimes (when applicable) because it is clearly labelled and there is often a description right away as to what the data is. Wondering if there are elements of that which could be applied to the search tools used today.” • Increase the size of the Earthdata calendar icon. • In Earthdata map, a box appears for some users that blocks the image and cannot be moved. • Develop an Earthdata interface that transitions easily to larger and smaller screens.
<p>NASA Worldview</p>	<ul style="list-style-type: none"> • Reduce amount of redundant data • Include a swipe tool for transitioning between time and scale in maps. • Consider cloud-based storage. As mentioned in a breakout session: "It would be better if the [Worldview models] were cloud based...and the data sets were just pulled into [the map]." • Develop a history or log that users can access for tracking their actions.
<p>Shuttle Radar Topography Mission Global 1 arc second (LP DAAC)</p>	<ul style="list-style-type: none"> • Improve organization of dataset locations. • Limit the use of acronyms. • Create clearer, more comprehensive labels for datasets.
<p>SEDAC</p> <p>Very Difficult to Access/Use 0.00%</p> <p>Somewhat Difficult to Access/USE: 36.36%</p> <p>Neutral: 18.18%</p> <p>Somewhat Easy to Access/Use: 18.18%</p> <p>Very Easy to Access/Use: 27.27%</p>	<ul style="list-style-type: none"> • Create intuitive tools in SEDAC interactive map. • Develop methods for easily cross-referencing data with the data dictionary. • Users would like to access the original data upon which the climate risk data were based. • Attach qualitative information to datasets so that users know how data are being defined. For example, what constitutes a hazard and what components were included for exposure or sensitivity? • Expand the explanations of indices and variables. • Refine geographical scale data and expand available local and rural data. • Provide risk data in an interactive map or ArcGIS layer.
<p>Single Pixel Extraction Tool</p>	<ul style="list-style-type: none"> • Users suggested that tutorials and trainings would help them to learn the tool.

Which barriers prevent you from using NASA data in your work? (You may choose multiple options)

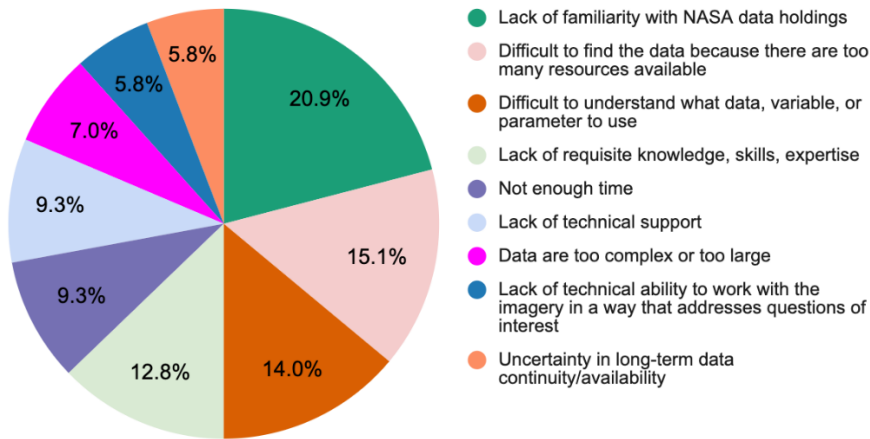


Figure 6 The results of an exit survey question on barriers to NASA data

What NASA technologies would you like to use for your work moving forward? (Select all that apply)

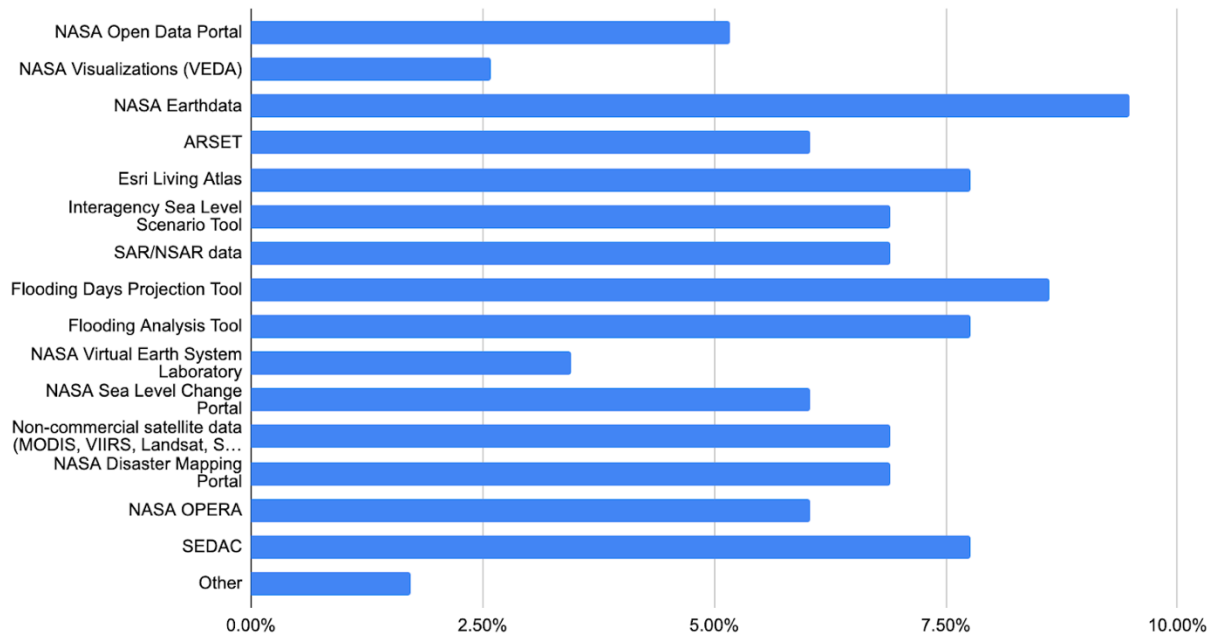


Figure 8 An exit survey result showing the likelihood of participants to use specific NASA technologies going forward.

Pacific Islands User Feedback

Additional feedback was collected from the team's conversation with users from the Pacific Islands.

- Create an INBOUND channel of communication to NASA so that communities are sure to be heard.
- Develop “plug and play” applications and data that are more accessible to users at all levels of expertise.
- Increase availability of “recipes,” pathfinders, and trainings.
- Consideration of PACIFIC TIME for live workshops and meetings.
- Develop more human support, whether in the form of research partnerships, internships, funding for fellowships that support their region.
- Include data specifically on REEF CREST HEIGHTS as this is critical to American Samoa.
- Create high spatial and temporal resolution time series imagery for change detection.

Participant Reflections (Raw Data)

How do you expect to use the NASA data and/or technologies that were presented in the workshop?

- “I have devised a three-fold plan for leveraging the data from the Disasters Mapping Portal: (1) Educational Enhancement: I intend to apply this data in my instruction of the SOCI 6332 GIS for Disaster Management course, a graduate-level offering in the Disaster Studies MA program, which has been a core component since Fall 2016. Some of my former students have progressed into roles demanding the application of GIS knowledge and skills, such as GIS Manager positions in city governments and GIS analysts at the county level. I will incorporate this data into my course materials to enrich the learning experience for current students. (2) Textbook Enrichment: As I work on my forthcoming textbook titled "GIS for Disaster Management," I see an opportunity to introduce these datasets and develop lab exercises centered around them. This inclusion will significantly enhance the educational value of the textbook and provide practical, real-world examples for readers. (3) Research Advancement: My research interests have centered on flood, hurricane, and storm-related disasters, with a particular focus on human dimensions. These datasets will prove invaluable for both my ongoing research projects and future studies, contributing to a deeper understanding of these critical topics. In these three distinct ways, I aim to maximize the utility and impact of the Disasters Mapping Portal data in education, publishing, and research within the field of disaster management and GIS.”
- “I plan to use some of the datasets and tools in my research at National/Regional Scale. Since my expertise is super related to this workshop, I already knew that some of the tools and data will be super useful in my future research. I plan to use them very often in my coastal research endeavors.”
- “SLR/resiliency planning. Environmental Justice/Equity analysis.”
- “Will combine physical observation data like DSWX, soil moisture, precipitation with socioeconomic data from SEDAC to perform various types of risk and resilience analysis. Will also examine the use of commercial satellite data, in concert with UAVs, for detection of ultra-localized environmental conditions and hazard impacts.”

- “I expect to use sea level rise and land cover data to assess how resilient salmonid habitat is to a changing climate.”
- “Could not attend due to the time difference. There were no sessions for Pacific Standard Time zones. Extremely difficult to try to make the 0700 training sessions.”
- “I expect to apply NASA data to the resiliency and coastal change projects that we at the UH Manoa, Climate Resilience Collaborative conduct. Specific data include projection rates (SLR scenarios), tide gauge data, satellite imagery, and SLR/Flooding tools. I'm sure there are many more data resources that I will be utilizing and sharing with my group but those are a few that come to mind.”
- “I will likely use the NASA data to evaluate sea level rise, water quality issues, and disaster response.
- “I have used Esri Living ATLAS once before but will revisit the tool. I loved NASA's Earth Data although it does not contain enough data for my specific line of work. I can see the potential and recommend it to colleagues who work on a global scale.”
- “The main systematized data of the ground hydrometeorological network stations and satellite supervision for the whole of globe can be received by using the server network of the USA National Ocean and Atmosphere Administration (NOAA). There is a separate entity of NOAA Satellites and Information with the body of the National Environmental Satellite, Data and Information Service (NESDIS). Within the framework of the NESDIS is functioning the Office of Satellite Data Processing and Distribution (OSDPD) for processing and distribution of satellite data which provides processing, systematization and supply to users in the USA and other countries data and information from the environmental satellites. The final goal of user`s maintenance is reaching by appropriate information production over the following three institutions: Satellite Service Division (SSD); Information Processing Division (IPD); Direct Services Division (DSD). There are number of other institutions for maintenance of the initial data for monitoring of the environment. For the considered purposes in the paper has been used the data from the IPD divisions of the Satellite Active Archive (SAA) through the Internet network. In the network is presented an opportunity of selection of such information which refers to Advanced Very High-Resolution Radiometer (AVHRR); Pathfinder – specialized software. Information production of the AVHRRPF (sometimes calls as PATMOS) with a free of access represents of the number of USA satellites NOAA- 7-9 – and 14. Within the framework of the PATMOS- A1 statistical characteristics have been calculated using the indicated above satellites for intensive outgoing radiation in all five channels of visible area of the spectrum, two channels as called “atmosphere transparency windows” for 10-12 micrometers and near infrared area for elimination of impact of atmospheric cloudless and cloudy conditions. Cloudy cover statistical characteristics have been calculated where condition describes by a huge of parameters. Based on the PATMOS – A2 version statistical characteristics of the atmospheric aerosol optical thickness above oceans as well as values of the absorbed solar (short wavelength) radiation and thermal (long wavelength) radiation have been calculated which define radiation balance on the top of an atmosphere. In the climate and climate change investigations usually use monthly average values of appropriate characteristics. Below presents some of data analysis results off the PATMOS- A2 information production for the term of 1982-2000 in two allocated areas of Near - Caspian region (from 380 up to 420 north longitude from 440 to 520 east latitude; and from 340 up to 500 north longitude, from 440 up to 560 east latitude) incorporation with data of a ground measuring network based on characteristics, as monthly average values of air temperature, atmospheric pressure and average speed of a wind at the surface level. The first of selected areas approximately

covers the territory of Azerbaijan and second - wider area of territory of Russia, Azerbaijan, Georgia, Iran, Turkmenistan, and Kazakhstan. The specified data of a ground network are accessible through the Internet network and other information center of the USA national climate data center (NCDC)."

- "I will either download and prepare them/model them for my own applications (for our end-users) or I will connect to rest endpoints, which is a really great feature."

Who or what was missing from this workshop (e.g., what technology or data should we include)?

- "I couldn't come up with any ideas at the moment."
- "River Bathometry? Since it is very important aspect of many water related issues including coastal water issue!"
- "It would have been nice to have seen more about the new ocean/water satellite (SWOT). Oil spill response applications could have been helpful. Having some off-the-shelf wetland mapping product would be useful."
- "Is NASA doing anything with UAVs?"
- "Nothing I can think of - overall the workshop was well thought out."
- "The workshop could have been divided into two separate sessions, one for East Coast Time zones and the other for Pacific coast time zones. The time differences made attending the sessions extremely difficult for does with family members that they have to take care of."
- "Having a diversity of speakers that included indigenous perspectives would be an important thing to consider for future workshops. With the rise in diversity and equity in STEM-related fields, the many different lenses and perspectives are indispensable to driving novel research, and I think show-casing this in this workshop, will provide attendees an opportunity to see that, indeed there are diverse people in these fields but also experience the many different approaches to understanding and examining such data. Likewise, with the importance of place-based research, having indigenous researchers, or even community members from these areas, will be instrumental in gaining insight into the lens of someone who is directly affected by this type of research."
- "A resource list that includes the web location and data available would have been helpful."
- "Data within the Great Lakes! This could be leaf on/off imagery, Lidar of coastal bluffs, satellites images pre/post lake level rise, etc."
- "I still find it difficult to answer."
- "I think it would be good to get input from users on the whole setup of data access and tool usage to get some really good thoughts on intuitiveness of layout. Maybe some diagramming. I realize that a lot of information is split up by the different NASA Centers, but that doesn't necessarily make the most sense from users on the outside looking in."

What is your biggest takeaway from the UNBOUND -CI workshop?

- "Gaining insight into the diverse datasets and exploring their potential applications, while also familiarizing oneself with the dedicated experts who have been diligently working on them."

- “I learned about many tools and dataset that was unknown to me. There are many things to explore related to coastal change research.”
- “I'm excited to test out the new ocean sensing satellite data. I appreciate the thoroughness of the SLR/Flooding tool.”
- “NASA has an incredible array of resources that were not widely known to most of the practitioners attending the event. There are also often a variety of "pathways" to the same data or information.”
- “NASA has a ton of resources. Some of which I am excited to incorporate into my work and others that I don't have the data analysis skill set to use.”
- “Could not attend due to the time difference. There were no sessions for Pacific Standard Time zones. Extremely difficult to try to make the 0700 training sessions.”
- “Attending this workshop has opened my eyes to the amount of free and available data that I can use for my work and share with my working group. I got the sense that the UNBOUND-CI team cares about their work and felt encouraged to learn more about the products available so that my coastal community can find ways to be resilient and spread awareness about our ever-changing coastline.”
- “There is a lot of information out there (which can be quite confusing at times). It's difficult to know which data set to use, but usually I can find what I need through a Google search.”
- “NASA offers a lot of publicly accessible tools (this is very beneficial to my work as I highlight community awareness and engagement). The datasets offered by NASA are tools that can help Coastal Management Analysts make innovative and accurate conclusions.”
- “In the work, an analysis was carried out on the basis of the available SST values of the Caspian Sea in order to develop a further methodology for collecting and analyzing satellite data. The data obtained from the NOAA series satellites improve the ability to consider the re-analysis of the average annual values of the characteristics of the water surface temperature intensities. These studies further consider the atmosphere-sea system, which is necessary in solving the problems associated with the environmental problems of the Caspian Sea.”
- “I was glad that NASA realizes that its access to data is confusing. I've been doing GIS and remote sensing for over 10 years so I can't imagine it feels very accessible to non-Geospatial folks.”

What was the most valuable part of the workshop (e.g., introductions, demonstrations, breakout activities, report-outs, homework, data resources)?

- “All parts.”
- “Live demonstration of the tools available. I also liked the homework part very much. I liked the demonstration part because it taught us how to use it for a specific problem.”
- “Breakout activities. It gave us dedicated time to explore the tools as a group and hear from other group members and their unique perspectives.”
- “Pairing of demonstrations and breakouts was very helpful to understand the data and resource pathways.”
- “The presentations and data resources were most valuable as they depicted how various aspects of NASA's data catalogue could be used. The homework was helpful to test out

some resources, but was also a little tedious walking through how I accessed information (although I understand the purpose of these questions). The breakout activities were a great way to play around with the data/tools that had been presented on, and I appreciated my team - I felt like we worked well together and were generally on the same page.”

- “Could not attend due to the time difference. There were no sessions for Pacific Standard Time zones. Extremely difficult to try to make the 0700 training sessions.”
- “All of the components mentioned above were valuable and provided deep insight into the many tools and resources NASA Earth Data has. The speakers' demonstrations were helpful, and I appreciated the step-by-step processes of working through the tools and different topics. Applying what I learned after the demonstrations was useful and allowed me to become more comfortable exploring the many sites/tools/resources. The breakout activities allowed us to network and engage in problem-solving conversations. I also enjoyed being pushed to solve questions/prompts and take on different roles within our breakout groups, allowing me to have different perspectives while looking at NASA Earth Data.”
- “The most valuable part of the workshop was the data resources that were provided. I was unaware of the vast amount of data that is available.”
- “The breakout activities and resources. Thank you for providing a Google Doc during each session with Presenter names and direct resource links. I also found it helpful that the chat was utilized by facilitators to help answer questions on the spot.”
- “I honestly liked the last day when they talked about emergency situations. And I liked the team even more. Your understanding and good attitude remain very important to me.”
- “From a personal perspective, the demonstrations were the most useful as I got an overview of what is available. However, from the host's perspective I imagine the breakout activities were the most useful because they can watch where we struggled.”

Facilitator Reflections

In the team meetings following the workshops and the through the data analysis phase, we found ourselves reflecting to each other on the different things we noticed in the unique roles we had through the project. We decided to document our standpoints through a short reflective exercise to showcase what stood out to us as designers, facilitators, moderators, analyzers, etc. through the UNBOUND-CI project.

Wendy Stout, PhD: PI, Facilitator

In my capacity as the lead Principal Investigator (PI), workshop facilitator, and data analyst for the UNBOUND-CI workshop, several noteworthy observations emerged from my interactions with participants.

Firstly, it was clear that participants have considerable enthusiasm for the wealth of data provided by NASA. Their genuine investment in acquiring comprehensive knowledge was evident, as evidenced by their eagerness to explore every facet of the resources presented. Notably, within the breakout group I led, each introduction of a new resource spurred innovative ideas on how to incorporate that data into their professions. This keen interest underscored a desire for both NASA data and the requisite skills to access and utilize it

Secondly, despite the participants' enthusiasm for engaging with NASA technologies, a discernible challenge surfaced in the form of complexities and occasional navigational hurdles. Users, at times, encountered frustrations while navigating different datasets, experiencing difficulties in locating data or determining a starting point for their data search.

George M. McLeod, PhD: Co-PI, Facilitator

My role in UNBOUND-CI was to lead ODU's team and coordinate our activities as we partnered with Virginia Tech to deliver this workshop series. Chief among my personal activities for UNBOUND-CI was the selection and engagement of our incredible cast of guest speakers from NASA, academia, private industry, and local and regional planning agencies.

I came away with two key impressions. (1) There is tremendous demand among the community of professionals dealing with "coastal issues" for NASA data, ancillary derived data products, and data delivery/discovery tools. (2) Awareness of the breadth and depth of the products and services already publicly available from NASA is generally low (or much lower than desired) among the coastal community of practice. Additional public outreach, training, and publicity regarding these rich NASA resources would be well received.

Jessica Rich, PhD: VT Co-PI and Facilitator

I served as the Co-PI from Virginia Tech and, with Wendy Stout and Megan Bronson, led the qualitative research component, including documentation of workshop activities; developing research instruments and collecting data; conducting the final data analysis and writing the final report. As a qualitative researcher and communication expert, I found the breakout sessions to be critical for creating a space for the UNBOUND-CI team to build rapport with participants and learn about user experience and data discovery. Feedback from the breakout groups provided rich insights about the interplay between users and NASA products, as well as assessing data needs.

Nicole Hutton, PhD: ODU Co-PI, Facilitator, Moderator

My takeaway is: don't bury the lede. People are keen to learn about new or alternate data platforms, but if it is difficult to find or use them, they may be deterred by frustration. People are willing to struggle a little to learn new things that complement their work though. It's about finding the threshold between interest and tolerance in new data management systems.

Yin-Hsuen Chen, PhD: Workshop Designer

My primary responsibility was to contribute to the design of workshop breakout sessions. This involved identifying NASA data, articles, and web tools relevant to coastal issues. Additionally, I designed follow-up questions for participants to delve into the explored data.

Biggest takeaway: There is a wealth of NASA data that could enhance the content of this workshop. I would appreciate having more time to adequately prepare, allowing for the inclusion of additional hands-on exercises before the workshop takes place.

Blake Steiner: Technology Facilitator

My biggest takeaway was that it is critical to test and practice with different web communication technology, as approved by NASA, for any wrinkles. We caught a significant issue with Cisco's WebEx ahead of time and resolved it with a backup prepared for the workshop.

Christopher Davis: Breakout Session Designer

Biggest Takeaway: Designing breakout exercises to expose participants to the pertinent NASA data and tools was, at times, challenging. The climate tools for sea level change were easily accessible and were great learning tools for the participants. The challenging aspect was finding relevant datasets through NASA Earthdata searches and then crafting those datasets into exercises that could elicit worthwhile feedback and data insights.

Megan Bronson: Facilitator

My biggest takeaway from being a "no NASA experience" facilitator was that my genuine lack of experience and in/ability to confirm or deny whether the participants were correct led my group even more into the weeds on some activities and initially I had viewed that as a weakness of mine. After working with the post-workshop data, I realized that facilitator experience had a large impact on outcomes as "hints" or affirmations moved the activity forward, but not always the feedback. My second take away was learning that I had actually used SEDAC data before in my own work, but never recognized it was a NASA program. This feels like a slight marketing flaw, because as a graduate student being able to say that I have some experience in NASA datasets can be a credibility and confidence boost in exploring other NASA resources.

Keri Rouse: Communications Support

Reflecting on discoverability feedback and navigation challenges in accessing NASA products got me thinking about the potential counterproductive impact and user frustration from muddled website navigation or using information for the wrong application. Improving accessibility not only streamlines information retrieval but also creates opportunities for users to discover previously unknown products or information, which may inspire a fresh perspective to approach problems or unveil alternative solutions and new opportunities.

References

Bernard, H. R., & Ryan, G. W. (2010). *Analyzing qualitative data: Systematic approaches*. Los Angeles, CA: Sage.

Fisher, D., & Frey, N. (2014). *Checking for understanding: formative assessment techniques for your classroom (Second)*. ASCD.

Halcomb E, Hickman L. Mixed methods research. *Nurs Stand*. 2015 Apr 8;29(32):41-7. doi: 10.7748/ns.29.32.41.e8858. PMID: 25850508.

NASA ROSES 2023. (2023, March 29). *NASA Research Opportunities in Space and Earth*

Sciences ROSES-2022 - deadlines by program | Grant Bulletin. Retrieved February 9, 2023, from <https://grantbulletin.research.uiowa.edu/nasa-research-opportunities-space-and-earthsciences-roses-2022-deadlines-program>

Science Education Resource Center. (2023). Designing your workshop. Retrieved from <https://serc.carleton.edu/NAGTWorkshops/leadership/designing.html>

Sufi S, Nenadic A, Silva R, Duckles B, Simera I, de Beyer JA, et al. (2018) Ten simple rules for measuring the impact of workshops. *PLoS Comput Biol* 14(8): e1006191. <https://doi.org/10.1371/journal.pcbi.1006191>

Tracy, S. J. (2020). *Qualitative research methods: collecting evidence, crafting analysis, communicating impact* (Second). Wiley Blackwell.

Appendices

1. Application for Stipend

NASA UNBOUND Coastal Issues Application

Virginia Tech and Old Dominion University, with support from the NASA Earth Science Data Systems Program, invite data practitioners involved in coastal zone management, flood risk management, or tackling sea level rise and subsidence issues to participate in an exciting opportunity to enhance awareness, accessibility, and utilization of NASA Earth science data for coastal applications.

Introducing UNBOUND-CI: a multi-session workshop to identify recommendations to make NASA data products more discoverable and suitable for analyses to address issues in coastal zones, encompassing both coastal and inland areas. The workshop series aims to engage coastal issues for data practitioners who are not currently using NASA data products or would like to increase the use of NASA data for coastal applications. Participants are expected to test NASA Earth data and develop a series of practical recommendations to improve NASA Earth Science Data Systems. See previous UNBOUND reports [HERE](#).

Dates: September 18, 19, 25, 26, Time: 10:00 AM - 12:30 PM EST Application Deadline: August 31, 2023

Stipends and CEC Available:

Twelve individual participants (only one per organization) selected will receive \$1,200 each. Additional interested participants (not receiving a stipend) will be notified of selection to participate based on selection criteria and number of applications. Continuing education credits are available for APA, GISP, and CFPM certifications for all participants. 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 working in Environmental Justice communities, as defined by the EPA via EJScreen.

Roles and Responsibilities:

Each paid participant is expected to actively contribute to discussions, test assigned NASA Earth Data, and develop individual responses that will go into a final report.

Workshop Themes Include: NASA Data for Coastal Management, NASA Data for Sea Level Rise, NASA Data for Flood Risk Management, Human Dimensions for Coastal Zones.

Contact Dr. Wendy Stout (wstout@vt.edu) or Dr. George McLeod (gmcleod@odu.edu) with any questions.

Email/First Name

List your organization/institution

What is your role or job title in the organization?

Share link(s) to your organization, or if applicable, your organization's work in coastal issues

What stakeholder category does your organization represent?

- Community-based Organization
- Academia
- Non-Governmental Organization
- Federal Government
- Tribal Government
- State or Local Government
- Business and Industry

Would you consider your work local, regional, national, and/or global? (Select all that apply)

- Local
- Regional
- National
- Global

This workshop series aims to engage data practitioners who are not currently using NASA data products or would like to increase their utilization of NASA data for coastal applications. Consequently, we would like to learn more about how you/your organization uses coastal zone data.

Rank the four workshop topics in order of most relevant to least relevant to your work, one being most relevant and four being least relevant

- NASA Data for Coastal Management
- NASA Data for Sea Level Rise
- NASA Data for Flood Risk Management
- Human Dimensions for Coastal Zones

Please provide additional details about your research interests and data experience related to coastal issues?

What datasets do you use in your work?

What type of data would be helpful in your work but you have had a hard time finding or accessing?

What is your familiarity with using 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'm not sure if I have used NASA data

Please select the description that best describes your data skillset (Check all that apply)

- I regularly download and use data including geospatial data and am comfortable with GIS programs
- I have some experience manipulating data and have some GIS experience
- I have limited experience manipulating data and prefer to use data viewers
- I have strong statistical analysis skills and work often with non-geospatial data
- I have some statistical analysis skills and am comfortable with advanced functions
- I use data in analysis and decision making

What is your experience with computer programming or scripting? (Note: programming knowledge is not required for participation)

- Very experienced with multiple programming languages and scripting environments

- Experience with application-specific scientific scripting using Python, R, or similar
- Familiarity with programming and scripting, but limited use
- Minimal use or programming and scripting in my role
- Other:

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

2. Registration Survey

Congratulations and Welcome! We would like to invite you to participate in the Understanding Needs to Broaden Outside Use of NASA Data (UNBOUND) for Coastal Issues (CI). Please fill out this form by September 12th to confirm your participation and make sure that you are available for the proposed workshop dates in September. Workshops UNBOUND-CI will be four workshops, running 150 minutes each. All workshops will run from 10am-12:30pm EST/7am-9:30am PST. Double check times for your time zone. Workshop platform will be Webex. Participants will receive login information in a separate email. Participation Guidelines

- Work together to create a welcoming, inclusive, and safe(r) environment for everyone.
- Sexual and verbal harassment are unacceptable. This includes derogatory comments, jokes, explicit language, or unwelcome contact outside of the conference environment. Treat people fairly and equally based on identity (e.g., race, gender, sexuality, age, class background, ability, religion, and more).
- Ask for consent (i.e., permission) and respect people’s boundaries.
- Demonstrate civility and respect for others through behavior, attitude, and language.
- Be mindful of how much time and space you are taking up. Be aware of the dynamics of power and privilege, and whether you are taking advantage of it.
- Accept personal responsibility and accountability – they are the foundation of successful outcomes for individuals, teams, and the event.
- Do not share materials that belong to someone else until you obtain permission.

Name/Organization/Mailing Address/Email Address

Are you available for all four workshops? (September 18th, 19th, 25th, 26th) Yes No

If you require certification for Continuing Education Credits, please select your organization below (Select all that apply): APA GISP CFPM

Will you be needing any form of accommodations? If yes, please list below. Note: Closed captioning is already available in Webex Yes No

You will need to have an Earthdata account to access the datasets throughout the workshop. Do you have an Earthdata Login and is the username/password accessible?

- Yes, and I have it!
- I have one but don’t recall what the username/password is.
- I will sign up now.

Instructions to Register for a NASA Earthdata Login Navigate to the Earthdata Login page at <https://urs.earthdata.nasa.gov> Register for an Earthdata Login with an email address. Upon registering, you will receive instructions by email to confirm your registration. Please complete confirmation as soon as possible. -It can take up to 48 hours to create an account so don't wait!

What is your familiarity with the following data formats?

I use this format regularly. I use this format occasionally. I have never used this format.

- ASCII/CSV
- .xml
- KMZ/KML
- Access via API
- HDF/HDF5
- GeoTIFF
- AutoCAD Drawings (.dwg) ...

- Digital Elevation Models (.dem, .flt, .csv, .tif, .txt, .hgt) ...
- Esri File Geodatabase (.gdb) ...
- Esri Layer File (.lyr) ...
- Shapefile (.shp) ...
- Geography Markup Language (.gml) ...
- KML - Keyhole Markup Language (.kml) ...
- GeoJSON (.json, .geojson)
- Binary
- Cloud Optimized GeoTIFF (COG)
- NetCDF
- Other (describe below)

How would you describe your level of expertise using NASA Earth observation data?

- I am a seasoned data user of NASA Earth data
- I am a new data user of NASA Earth data
- I am not a current user of NASA Earth data but have been in the past
- I have never used NASA Earth data

Which barriers prevent you from using NASA data in your work? (You may choose multiple options)

- Not enough time
- Data are too complex or too large
- Difficult to understand what data, variable, or parameter to use
- Lack of technical support
- Lack of technical ability to work with the imagery in a way that addresses questions of interest
- Difficult to find the data because there are too many resources available
- Uncertainty in long-term data continuity/availability
- Lack of requisite knowledge, skills, expertise
- Lack of familiarity with NASA data holdings

If you are currently a user of NASA Earth data, where do you obtain your data? (Select all that apply, If you are not currently a user of NASA Earth data choose never for each of these)

Never Sometimes Always

- Access through Interactive Web Apps, like NASA Worldview
- Access through Giovanni or other Data Portal
- Download through Earthdata Search
- Download through a Distributed Active Archive Centers (DAAC)
- Subset through DAACs' tools (AppEEARS, TESViS, SDAT, etc.)
- Subset through OPeNDAP
- Access through NASA Earthdata Cloud direct S3
- Access Earth data via API
- Access through Esri Living Atlas

At what scale have you applied NASA technologies and data to coastal issues? Select all that apply

- Global
- National
- State
- Regional
- Local
- I have not applied NASA technologies or data at any scale

Please indicate your level of experience with these NASA technologies:

I do not know about this technology, I know of this technology but I have no experience, I have some experience with this technology, I am competent with this technology, I consider myself an expert of this technology

- NASA Earthdata
- NASA Open Data Portal
- Esri Living Atlas
- Interagency Sea Level Scenario Tool
- Flooding Days Projection Tool
- Flooding Analysis Tool
- NASA Virtual Earth System Laboratory
- NASA Sea Level Change Portal
- NASA Disaster Mapping Portal
- NASA OPERA
- SEDAC

Participant Location: Please click on the link to add your location to the Participant Locations

Map.<https://padlet.com/wstout3/participant-locations-pypx0a4kj5y4b417>Please add a photo, your name, Employer, and other fun facts about you and your location (can generalize if desired). Feel free to zoom to Hampton VA to see my location as an example.

Is there anything else you feel we should know?

3. Daily Schedule

Workshop One Breakout Activities

Exercise #1

Let's start with sea surface temperature. We use this information to keep an eye on tropical cyclones, which can have a big impact on coastal areas.

Moderator Question to post to chat: Please locate daily sea surface temperature data for the Gulf of Mexico from Aug 23 to 28 during Hurricane Katrina in 2005.

[Group is looking for daily sea surface temperature data for Gulf of Mexico from Aug 23 to 28 during Hurricane Katrina in 2005. In can be found as this dataset: Group for High Resolution Sea Surface Temperature (GHRSSST) Level 4 MUR Global Foundation Sea Surface Temperature Analysis (v4.1) (<https://podaac.jpl.nasa.gov/dataset/MUR-JPL-L4-GLOB-v4.1#>)]

Once the group located the data, they need to answer following questions:

Provide an interactive data visualization if needed : [https://soto.podaac.earthdatacloud.nasa.gov/?v=-188.30923987610498,-49.13790687111017,64.46458426877622,73.43106723247544&l=Reference_Labels_15m\(hidden\),Reference_Features_15m\(hidden\),Coastlines_15m\(hidden\),GHRSSST_L4_MUR_Sea_Surface_Temperature,VIIRS_NOAA20_CorrectedReflectance_TrueColor\(hidden\),BlueMarble_ShadedRelief&lg=true&t=2023-07-17-T17%3A20%3A13Z](https://soto.podaac.earthdatacloud.nasa.gov/?v=-188.30923987610498,-49.13790687111017,64.46458426877622,73.43106723247544&l=Reference_Labels_15m(hidden),Reference_Features_15m(hidden),Coastlines_15m(hidden),GHRSSST_L4_MUR_Sea_Surface_Temperature,VIIRS_NOAA20_CorrectedReflectance_TrueColor(hidden),BlueMarble_ShadedRelief&lg=true&t=2023-07-17-T17%3A20%3A13Z)

Moderator Question to post in chat: Was the sea surface temperature higher or lower after Hurricane Katrina moves over the Gulf of Mexico? [Question Intent: What happens to the sea surface temperature as the hurricane passes over] Lower. As the storm moves over warm ocean waters, it evaporates large quantities of seawater, which cools the ocean surface.

- Moderator Question to post to chat: Other than observing tropical cyclone activities, what are other coastal issues that can apply sea surface temperature data? Possible applications include: Fisheries Management: Sea surface temperature data is used by fisheries managers to locate areas with optimal water temperatures for different fish species. This information is vital for sustainable fisheries management and can help prevent overfishing.

- Shipping and Navigation: Sea surface temperature data is used by ship operators for route planning and optimizing fuel consumption. It helps avoid areas of extreme temperatures that can affect ship engines and cargo.
- Tourism and Recreation: Sea surface temperature data is of interest to the tourism industry, particularly in coastal and island destinations. It helps tourists plan activities such as swimming, diving, and boating based on water temperature.

*****Exercise #2*****

Great work! Now, onto our next task. We're talking about digital elevation data, which helps us find those low-lying spots along the coast that are prone to natural disasters. In this exercise, your mission is to find this data for Kolkata, India. Why Kolkata? Well, it's been tagged as the city most at risk from rising sea levels in 2070.

Moderator Question to post in chat: Please locate a Digital Elevation Model (DEM) of 30m resolution for Kolkata, India. [Group is looking for a digital elevation model in about 30m resolution for Kolkata, India. In can be found as this dataset: NASA Shuttle Radar Topography Mission (SRTM) Global 1 arc second (<https://lpdaac.usgs.gov/products/srtmg11v003/>)]

Once the group located the data, they need to answer following questions:

Moderator Question to Post: What is the name of the NASA mission that created this dataset? Answer: NASA Shuttle Radar Topography Mission (SRTM) datasets

Moderator Question to Post: Please download the DTM data and inspect the file name, can you tell the logic behind its naming? Answer: If the participant access through NASA platform, the file name should be: N22E088.SRTMGL1.hgt, It gives the latitude, longitude, mission name, and height

*****Exercise 3*****

Excellent job! Now that you have some experience finding NASA data that are good for geospatial analyses on coastal studies, let's move on to find a NASA article.

Moderator prompt to post: Please locate a map showing how much sea level rise does NASA expect to impact its five coastal facilities by 2050.

[Group is looking for a map showing how much sea level rise does NASA expect to impact its five coastal facilities by 2050? In can be found here: Sea Level Rise Hits Home at NASA (<https://earthobservatory.nasa.gov/features/NASASeaLevel/page1.php>)]

Once the group located the article, they need to answer following questions:

Moderator Question to Post: What are the three NASA facilities on the east coast of US? Wallops Flight Facility, Langley Research Center, and Kennedy Space Center.

Moderator Question to Post: Of the three NASA facilities in the US east coast, which one has the highest expected sea level in 2050s based on the global climate models (GCMs)? Langley Research Center, the estimation is 7 to 11 inches.

*****Exercise 4*** (Backup Content, if Group breezes through the earlier exercises*****

Excellent work! Let's move on to our next exercise with a NASA program. Has everyone heard about the erosion problem of the Mississippi Delta?

Moderator Question to post: Please locate a NASA web page for a mission investigating the Mississippi River Delta

[Group is looking for a web page explaining a mission to investigate the Mississippi River Delta. participants might land to several web pages or article, such as: Delta X (<https://deltax.jpl.nasa.gov/about/>)]

Once the group located the mission web page, they need to answer following questions:

Moderator Question to Post: Within all the products that Delta-X mission is going to deliver, describe the definition of level 2, 3, and 4. Level 2 indicates georeferenced remote sensing data. Level 3 indicates remote sensing measurements. Level 4 indicates science products.

Moderator Question to Post: What airborne platform that NASA uses to collect data associated with vegetation in this mission? AVIRIS-NG (Airborne Visible / Infrared Imaging Spectrometer)

*****Exercise 5*** (Backup Content, if Group breezes through the earlier exercises*****

You are doing such a good job! We are now in the last exercise. In the last exercise, we are going to stay in the Gulf of Mexico to find NASA data for harmful algal blooms.

Moderator prompt to post: Please locate Chlorophyll data in 1km grid for the west coast of Florida during the red tide bloom in 2019 Jan to May

[Group is looking for Chlorophyll data in 1km grid for the west coast of Florida during the red tide bloom in 2019 Jan to May. In can be found here : MODIS Chlorophyll a layer ([https://soto.podaac.earthdatacloud.nasa.gov/?v=-57.03014652876405,-117.16567081533324,320.06447498518,77.7282534874555&l=Reference_Labels_15m\(hidden\),Reference_Features_15m\(hidden\),Coastlines_15m\(hidden\),MODIS_Aqua_L2_Chlorophyll_A,VIIRS_NOAA20_CorrectedReflectance_TrueColor\(hidden\),BlueMarble_ShadedRelief&lg=true&t=2023-07-17-T17%3A20%3A13Z](https://soto.podaac.earthdatacloud.nasa.gov/?v=-57.03014652876405,-117.16567081533324,320.06447498518,77.7282534874555&l=Reference_Labels_15m(hidden),Reference_Features_15m(hidden),Coastlines_15m(hidden),MODIS_Aqua_L2_Chlorophyll_A,VIIRS_NOAA20_CorrectedReflectance_TrueColor(hidden),BlueMarble_ShadedRelief&lg=true&t=2023-07-17-T17%3A20%3A13Z))]

Moderator Question to Post: What satellite platform that NASA uses to collect Chlorophyll a data? What is the start and end date of this collection? MODIS is the platform. The start date is 2002 July 4th to Present

Moderator Question to Post: Other than monitoring harmful algae bloom, that is other applications for Chlorophyll data?

Fisheries Management: Monitoring chlorophyll levels helps fisheries management by providing information on primary production and the availability of food for fish and other aquatic organisms. It can be used to identify areas with high biological productivity, which are often associated with rich fisheries.

Climate Change Research: Monitoring long-term changes in chlorophyll-a concentrations provides insights into the impacts of climate change on marine and freshwater ecosystems. It can help researchers understand how warming waters affect phytoplankton populations and food webs.

Flood and Sedimentation Monitoring: In freshwater environments, changes in chlorophyll concentrations can indicate changes in water clarity due to sedimentation and runoff. Monitoring chlorophyll levels can help assess the impacts of land use changes and flooding events.

Environmental Impact Assessment: Chlorophyll data can be used in environmental impact assessments for construction projects near water bodies. Changes in chlorophyll levels can help evaluate the effects of construction activities on water quality and ecosystems.

Workshop Two Breakout Activities

*****Exercise #1*****

You've heard a lot about sea level rise in the Main Room presentations today! We're going to continue to explore those topics here in the Breakout Session. To start off, we're going to take a look at some projections for how the

number of flooding days could increase in the future due to high-tide flooding. For this exercise, I'd like the group to determine how many more flooding days per month, on a 5-year average, Sandy Hook, NJ, can expect by 2050, assuming a flooding threshold at the NOAA Moderate Level and an Intermediate High U.S. Interagency Scenario.

[Group is looking for the Flooding Analysis Tool, which can be found here: <https://sealevel.nasa.gov/flooding-analysis-tool/projected-flooding>. Once they find the tool, they should be on the Projected Flooding tab. They'll enter Sandy Hook, NJ, in the blank or navigate to it on the map. They'll then need to change the flooding threshold to NOAA Moderate and the U.S. Interagency Scenario to Intermediate High. The group should navigate to the Extreme Flooding Chart. Using the chart, the group should be able to determine that Sandy Hook, NJ, will experience, on a 5-year average, around 16 flooding days per month by 2050.]

[As the group navigates through the tool, they should be thinking about these questions:

How was it to find the tool based on what was being asked of you to find?
Once you found the tool, how was it to find the part of the tool that helped you answer the question?
How would the information in the Flood Days Projection Tool be useful in your job or profession?]

Exercise 2

For the next exercise, we're going to explore some sea level rise projections for near-future. In Norfolk, Virginia, sea level rise is increasing faster than anywhere on the East Coast. The group needs to find the predicted sea levels for Sewells Point, Virginia, in 2080, 2100, and 2140 using an Intermediate Scenario.

[Group is looking for the Interagency Sea Level Rise Scenario Tool, which can be found here: <https://sealevel.nasa.gov/task-force-scenario-tool/>. Once they find the tool, they can either change the year and scenario level on the left and update the map. Zooming into Sewells Point, Virginia, will show the updated value for sea level rise for that year. They can also click on the point for Sewells Point, click the "full projection" link in the pop-up, and change the year within the newly opened page. A: 2080: 2.92 ft, 2100, 4.30 ft, 2140: 7.09 ft]

[As the group navigates through the tool, they should be thinking about these questions: How was it to find the tool based on what was being asked of you to find? Once you found the tool, how was it to find the part of the tool that helped you answer the question? How would the information in the Flood Days Projection Tool be useful in your job or profession?]

Exercise #3

Now that we've explored some NASA sea level rise tools and how they might be used, we're going to go under the hood to figure out why sea level rise is happening. We'll start with an exercise that uncovers why sea level rise is increasing at a greater rate along the Southeast U.S. coast and Gulf of Mexico. To do this, the group needs to find a NASA news article that answers this question, Why is sea level increasing at a greater rate in the southeastern United States and Gulf of Mexico?.

[Group is looking for a NASA Sea Level Change Team news article entitled "Why Seas are Rising Faster on the Southeast Coast" by Ethan Huang. It can be found at this link: <https://sealevel.nasa.gov/news/264/why-seas-are-rising-faster-on-the-southeast-coast/>]

Once the group has found the news article, we need to answer these questions:

What is stereodynamic sea level rise? [A: Stereodynamic Sea Level Rise is the combination of ocean-water expansion in response to warming, saltiness, and ocean circulation.]

What components of stereodynamic sea level rise are contributing to the high acceleration in rates of sea level rise in the Southeast U.S. Coast? [A: Approximately 40% of the acceleration that we have seen since 2010 can be attributed to man-made climate change. The rest can be attributed to wind-driven ocean circulation unique to the Southeast and Gulf Coast.]

After learning about Stereodynamic Sea Level Rise, what NASA datasets or applications would you think about using to investigate the phenomenon further? Where would you go to look for these datasets and applications? [A. Open ended question. We want to see the group brainstorm about what datasets they would search for and how they would get them.]

*****Exercise 4*** (Backup Content, if Group breezes through the earlier exercises*****

When we think of sea level rise, we tend to only think of sea level rise increasing due to ice melt, but recent research from NASA sheds some light on how river discharges are affecting sea level rise. The group needs to find a NASA news article that discusses this new research on how riverine discharge impacts sea level.

[Group is looking for a NASA Sea Level Change Team news article entitled “Going With the Flow: How Rivers Change Sea Level” by Ethan Huang, NASA’s Sea Level Change Team. It can be found at this link:
<https://sealevel.nasa.gov/news/245/going-with-the-flow-how-rivers-change-sea-level/>]

Once the group has found the article, we need to answer these questions:

What is halosteric height? [A: Halosteric height is the change in the salinity, or “saltiness,” of seawater which can cause corresponding changes in sea level.]

How do seasonal or nonseasonal river discharge affect the halosteric height and sea level rise? [A: River discharge brings in freshwater that dilutes the seawater, and fresher seawater occupies more volume locally. This effect increases the so-called halosteric height.]

After learning about how river discharge can affect sea level rise, what NASA datasets or applications would you think about using to investigate the river discharge further? Where would you go to look for these datasets and applications? [A. Open ended question. We want to see the group brainstorm about what datasets they would search for and how they would get them.]

Workshop Three Breakout Activities

In today’s workshop, we have a case study from Hampton Roads and introductions about the NASA commercial data and OPERA mission. Now, let’s dive into data that you can apply to study coastal flooding.

*****Exercise #1*****

In exercise 1, I would like to start with something related to today’s presentation, the flood water extent. This near real time flood water extent data can provide rapid response to flooding zones in the coast.

Moderator Question to post in chat: Please locate NASA dynamic surface water extent product with 30m spatial resolution for Porto Alegre, Brazil before and after June 16, 2023, flooding event.

[Group is looking for NASA dynamic surface water extent product with 30m spatial resolution for Porto Alegre, Brazil before and after June 16, 2023 flooding event. It can be accessed here:

NASA podaac https://podaac.jpl.nasa.gov/cloud-datasets?search=OPERA_DSWX-HLS_PROVISIONAL_V1

NASA EarthData [https://search.earthdata.nasa.gov/search/granules?portal=podaac-cloud&p=C2617126679-POCLOUD&pg\[0\]\[v\]=f&pg\[0\]\[qt\]=2023-06-14T00%3A00%3A00.000Z%2C2023-06-18T23%3A59%3A59.999Z&pg\[0\]\[gsk\]=-start_date&g=G2714843896-POCLOUD&q=dswx&sb\[0\]=-51.44238%2C-30.32348%2C-50.8623%2C-29.72596&tl=1694788625!3!!&lat=-30.318638311556825&long=-51.32812500000001&zoom=7](https://search.earthdata.nasa.gov/search/granules?portal=podaac-cloud&p=C2617126679-POCLOUD&pg[0][v]=f&pg[0][qt]=2023-06-14T00%3A00%3A00.000Z%2C2023-06-18T23%3A59%3A59.999Z&pg[0][gsk]=-start_date&g=G2714843896-POCLOUD&q=dswx&sb[0]=-51.44238%2C-30.32348%2C-50.8623%2C-29.72596&tl=1694788625!3!!&lat=-30.318638311556825&long=-51.32812500000001&zoom=7)

NASA WorldView <https://soto.podaac.earthdatacloud.nasa.gov/?v=-51.95553210763907,-30.63975817752967,-49.86735003860103,->

29.627207393011744&l=Reference_Labels_15m,Reference_Features_15m(hidden),Coastlines_15m,OPERA_L3_Dynamic_Surface_Water_Extent-HLS_Provisional,HLS_S30_Nadir_BRDF_Adjusted_Reflectance(hidden),HLS_L30_Nadir_BRDF_Adjusted_Reflectance(hidden),MODIS_Aqua_CorrectedReflectance_TrueColor(hidden)&lg=false&tr=hls_intro&t=2023-06-18-T13%3A53%3A10Z]

Moderator Question to post to chat: How many layers does this NASA product provide? Please look into Layers 1 and 2. What is the difference between them and how can these two layers be applied to different flooding issues?
Answer: 10 layers.

Layer 1 is Water classification (WTR). Masked interpreted water classification layer. This represents pixel-wise classification into one of three water classes (not water, open water, and partial surface water), snow/ice, cloud/cloud shadow and adjacent to cloud/cloud shadow, ocean masked, or no data classes.

Layer 2 is a binary water layer (BWTR). The binary water map is derived from the water classification layer as a union of water classes (open water and partial surface water) into a binary map indicating areas with and without water.

Product information can be found here:

https://d2pn8kiwq2w21t.cloudfront.net/documents/ProductSpec_DSWX_URS309746.pdf

Moderator Question to post to chat: What is the temporal resolution of this product? Between daily to weekly

Exercise #2

You're doing great! Now, let's shift our focus to finding precipitation data. When we're dealing with coastal flooding, precipitation is one of the key factors.

Moderator Question to post in chat: Please locate a web-based tool to extract and visualize daily precipitation for St. Croix (Virgin Islands) from the beginning of 2005 to the end of 2015, developed by NASA's DAYMET program.

[Group is looking for a web-based tool to extract daily precipitation for St. Croix (Virgin Islands) from the beginning of 2005 to the end of 2015. This tool can be access from Single Pixel Extraction Tool (<https://daymet.ornl.gov/single-pixel/>)]

Moderator Question to post to chat: What is the highest precipitation during this period, and what is the date?

Answer: Around 150 mm/day (values might vary depending on the pixel location). If the participants visualize data from January 1, 2005, the highest day would be around day 2537 (December 13, 2011).

Moderator Question to post to chat: Other than precipitation data, what are other variables you can extract? Answer: Other parameters include: minimum temperature (tmin), maximum temperature (tmax), shortwave radiation (srad), vapor pressure (vp), snow water equivalent (swe), and day length

Moderator Question to post to chat: Other than NASA DAYMAT, have you used other precipitation data from NASA for your work??

Exercise #3

Great work! Now, onto our next task. We're talking about digital elevation data, which helps us find those low-lying spots along the coast that are prone to coastal flooding. In this exercise, your mission is to find digital elevation data for Manila, Philippines.

Moderator Question to post in chat: Please locate a 30m grid resolution Digital Elevation Model (DEM) for Manila, Philippines.

[Group is looking for a digital elevation model in about 30m resolution for Manila, Philippines. It can be found as this dataset: NASA Shuttle Radar Topography Mission (SRTM) Global 1 arc second (<https://lpdaac.usgs.gov/products/srtmg11v003/>)]

Once the group has located the data, they need to answer following questions:

Moderator Question to Post: What is the name of the NASA mission that created this dataset? Answer: NASA Shuttle Radar Topography Mission (SRTM) datasets

Moderator Question to Post: Please download the DTM data and inspect the file name, can you tell the logic behind its naming? Answer: If the participant access through NASA platform, the file name should be: N22E088.SRTMGL1.hgt, It gives the latitude, longitude, mission name, and height

*****Exercise #4*** (Backup Content, if Group breezes through the earlier exercises*****

Excellent job! We have found water extents, rainfall, and elevation data, what would be other data you think might be related to coastal flooding? Let's move onto soil moisture data. This is crucial because when the soil is already saturated with moisture, even a little rain can lead to flooding.

Moderator Question to post in chat: Please locate daily surface soil moisture data with 9 km resolution for South India before and after 2021 Tropical Depression Wilma landing in India (November 16, 2021)

[Group is looking for daily surface soil moisture data with 9 km resolution for South India before and after 2021 Tropical Depression Wilma landing in India (November 16, 2021). It can be found as this dataset:

Product definition: SMAP L4 Global 3-hourly 9 km EASE-Grid Surface and Root Zone Soil Moisture Analysis Update, Version 7 <https://nsidc.org/data/spl4smau/versions/7>

NASA Worldview

[https://worldview.earthdata.nasa.gov/?v=67.55179663250522,5.618706247836162,93.57853041058664,18.238961012103772&l=Reference_Labels_15m\(hidden\),Reference_Features_15m\(hidden\),Coastlines_15m,SMAP_L4_Analyzed_Surface_Soil_Moisture,VIIRS_NOAA20_CorrectedReflectance_TrueColor\(hidden\),VIIRS_SNPP_CorrectedReflectance_TrueColor\(hidden\),MODIS_Aqua_CorrectedReflectance_TrueColor\(hidden\),MODIS_Terra_CorrectedReflectance_TrueColor\(hidden\)&lg=true&t=2021-10-28-T00%3A00%3A00Z](https://worldview.earthdata.nasa.gov/?v=67.55179663250522,5.618706247836162,93.57853041058664,18.238961012103772&l=Reference_Labels_15m(hidden),Reference_Features_15m(hidden),Coastlines_15m,SMAP_L4_Analyzed_Surface_Soil_Moisture,VIIRS_NOAA20_CorrectedReflectance_TrueColor(hidden),VIIRS_SNPP_CorrectedReflectance_TrueColor(hidden),MODIS_Aqua_CorrectedReflectance_TrueColor(hidden),MODIS_Terra_CorrectedReflectance_TrueColor(hidden)&lg=true&t=2021-10-28-T00%3A00%3A00Z)]

Moderator Question to post in chat: What is the NASA program responsible for this dataset? Answer: SMAP, or Soil Moisture Active Passive program

Moderator Question to post in chat: What is the “level” of the dataset you found? What does that mean? Answer for level: Level 4 products. Answer for definition: Geophysical parameters derived by assimilating level 1, 2, or 3 data into a land surface model.

*Participants might be confused by other soil moisture data, which could be in other levels since there is a lot of soil moisture data with 9 km resolution. But only the level 4 data is named as surface soil moisture data.

Workshop Four Breakout Activities

*****Exercise #1*****

We're going to start off today's Breakout Session with an exercise that explores the value that socioeconomic data can provide alongside physical science data, like sea level rise or coastal inundation.

Moderator prompt: You are looking for a recent NASA article that describes how socioeconomic data helps reveal what Earth observations mean for the lives of people and communities.

[Group is looking for a NASA Earthdata article entitled “Adding the Who to Earth Observations” by Charlie Plain. It can be found at this link: <https://www.earthdata.nasa.gov/learn/articles/the-who-in-socioeconomic-data>]

Once the group has found the news article, we need to answer these questions:

What is the importance of socioeconomic data? Why should we care about it as it relates to sea level rise or other disasters? [A: Socioeconomic data adds the “who” to the scientific question of what, when, where, why, and how. Who is most impacted by extreme events? Who needs to plan for changing agricultural conditions? Who needs to strengthen buildings and building codes?]

Where can you find NASA socioeconomic data? [A: NASA offers socioeconomic data freely and openly through the Socioeconomic Data and Applications Center (SEDAC), one of NASA's Distributed Active Archive Centers (DAACs). SEDAC is managed by the Center for International Earth Science Information Network (CIESIN) at Columbia University in Palisades, New York, and offers an array of data, interactive maps, and tools across a range of themes including agriculture, governance, health, and poverty.]

Based on the article, can you think of important socioeconomic datasets that would be useful when studying coastal management, sea level rise, or flood risk? [A: Open ended....]

Exercise #2

Now that we've explored how socioeconomic data can be used with NASA datasets, we're going to look at a dataset that combines them both!

Moderator Prompt: Find the U.S. Climate Risk Projections by County, v1 (2040–2049) dataset. Once you've located it, please download the Excel .xlsx zip file. Explore the tabs and then please find the standardized composite risk for Miami-Dade County, Florida. Once you've found the risk for Miami-Dade County, use the associated Map Images included on the dataset page to compare.

[Group is looking for the U.S. Climate Risk Projections by County, v1 (2040–2049) dataset, which can be found here: <https://sedac.ciesin.columbia.edu/data/collection/crv>. Once they find the dataset, they will need to click on the Data Download tab and log into Earthdata to download the Excel .xlsx zip file. After they download the crv-us-climate-risk-proj-county-2040-2049-xlsx.zip file, they'll need to unzip it and then open the crv-us-climate-risk-proj-county-2040-2049-xlsx file. They should explore the tabs in the Excel file and get familiar with the data dictionary. The first column in the Climate Risk sheet is the GEOID variable, which is the 5-digit FIPS County Code. In order to find the FIPS County Code that corresponds with Miami-Dade County, Florida, they'll have to search for it on Google. The 5-digit FIPS County Code for Miami-Dade County, Florida is 12086. The easiest way for them to find the entry is to use the Find and Select search in Excel (in the top right, magnifying glass) and search for Miami-Dade County's FIPS County Code. That will highlight the correct cell. They're looking for the Standardized Composite Risk (HEV*100) value for Miami-Dade County all the way to the right of table. The answer is: 16.2499142.]

After finding the information in the Flooding Analysis Tool, I need the group to provide me with their thoughts on these questions:

Comparing the Standardized Composite Risk value for Miami-Dade County, Florida, with the Map on the dataset homepage, does the value on the Excel make sense? Why or why not?

What was your experience downloading and accessing the dataset?

What were some of the socioeconomic variables that were used in the dataset?

Exercise 3

For the next exercise, we're going to explore NASA Worldview and how it can be used to view different kinds of data at once.

Moderator Prompt: Please find the NASA Worldview Tour Story called "Assessing Floodwaters."

[Group is looking for the "Assessing Floodwaters" NASA Worldview Tour Story which can be found here: <https://go.nasa.gov/3kgIhIJ>. Once they find the Tour Story, they need to step through the guided tour. As they step through the Tour Story, they'll need to answer questions about NASA Worldview and the layers they are introduced to.]

As you work through the "Assessing Floodwaters" NASA Worldview Tour Story, I need the group to provide me with their thoughts on these questions:

What is NASA Worldview? What was it designed to be used for? [A. NASA Worldview is an application with over 600 global, full-resolution satellite imagery layers and then download the underlying data. Many of the available imagery layers are updated within three hours of observation, essentially showing the entire Earth as it looks "right now". This supports time-critical application areas such as wildfire management, air quality measurements, and flood monitoring.]

What is the MODIS NRT Global Flood Product? How can it be used, and what are some of its limitations? [A. The MODIS Near Real-Time (NRT) Global Flood Product (MCDWD) provides a daily global map of optically observed flooding. It is derived from the NRT MODIS Surface Reflectance (MOD09) datasets from both the Terra and Aqua satellites. Note that this product cannot detect water under persistent cloud cover. It has a 1, 2, and 3 Day window.]

In the NASA Worldview Tour Story, a population density layer was added for comparison against the flooded areas. What are some other layers you can add from NASA Worldview that would provide a human dimension comparison to flooded areas? [A. Open ended...]

4. Homework Assignments

Session 2 - NASA Data for Sea Level Rise Homework

Please email completed homework to Dr. Wendy Stout at wstout@vt.edu

Our Session 2 Workshop introduced you to resources (data and tools) available from NASA to examine sea level rise and other flooding issues within your communities. Please work through the following steps to help us identify how you can access different resources and let us know your thoughts on the process.

Please complete these exercises on the same computer you will be using for the workshops. For Exercise 2, please use whatever tools/coding environment you are comfortable using (e.g., R, Python, ArcGIS).

Exercise 1. *NASA Sea Level Change Team's Flooding Analysis Tool* (2 questions)

1. Please go to the [Flooding Analysis Tool website](#).
2. Navigate through the pages to get to the tool's main map with individual point locations available across the U.S. and within U.S. Territories.
3. Find and select the location for **Charleston, South Carolina** and then use the tabs below the map to answer the following questions:
 - a. What is the NWS Major default threshold elevation for Charleston?
 - b. What is the U.S. Interagency scenario for Intermediate High Sea level rise by 2100?
 - c. Yes or No. Can you download data directly from the tool to use in other mapping applications?
4. While the process is still fresh in your mind, please let us know how you found the overall process by answering the two questions below.

Question 1. Did you find the information easy to access? If not, please explain the obstacles or issues you encountered.

Question 2. How might you use a tool like this to help with your own work?

Exercise 2. NASA Earthdata (3 questions)

Your goal for this next exercise is to find a NASA dataset you can use as part of your work investigating coastal flooding or sea level rise. We have selected several for you to choose from. Please indicate which dataset you chose when answering the questions,

Work through the process to get to a place where you can download the data and open it in your preferred platform. Explore what information the dataset provides (e.g., spatial resolution, any data use limitations, citations, etc.). Let us know how you found the overall process by answering the questions below. If you are unable to download the specified data (or it takes more than 30 minutes of active effort), please indicate that in the questions below.

Dataset	Short Name
Reconstructed Global Mean Sea Level 1900-2018	JPL_RECON_GMSL
Resilience of Coastal Wetlands to Sea Level Rise, CONUS, 1996-2100	
JPL GRACE and GRACE-FO Mascon Ocean, Ice, and Hydrology Equivalent Water Height Coastal Resolution Improvement (CRI) Filtered Release 06.1 Version 03	TELLUS_GRAC-GRFO_MASCON_CRI_GRID_RL06.1_V3
MERRA-2 statM_2d_pct_Nx: 2d, Single-Level, Monthly Percentiles V1 (M2SMNXPCT) at GES DISC	M2SMNXPCT
SMAP/Sentinel-1 L2 Radiometer/Radar 30-Second Scene 3 km EASE-Grid Soil Moisture V003	C1931663473-NSIDC_ECS

Question 3. Did you find the information easy to access? If not, please explain the obstacles or issues you encountered.

Question 4. How did you find the overall process of bringing the data into your preferred workspace for further analysis?

Question 5. How might you use this data to help with your own work?

Optional Challenge Activity: For this exercise, you'll need to find the **GRACE/G-FO Level-4 Monthly Global Ocean Mass Anomaly version 01** from NASA MEaSUREs HOMaGE project and download the 2nd granule titled "goma_GGFO_MM_SHC_200204-202305_v01". Open the resulting netCDF file and create a plot of the JPL time series.

The Question you are seeking to answer is the following: What is the approximate Global Ocean Mass Anomaly in (mm) on November 10th, 2019?

Please answer the additional questions below to help describe how you found the overall process:

- How was it to find and locate the required dataset? Which method worked best?
- What is Global Ocean Mass and why would there be an anomaly? What is the anomaly telling us?
- How did you find the process of opening the netCDF file?
- Did the overall process make you eager to find the answer or did you find it to be a frustrating experience?

Session 3 & 4 Homework - NASA Data for Coastal Flooding Impacts
Please email completed homework to Dr. Wendy Stout at wstout@vt.edu

Sessions 3 & 4 of the Workshop introduced you to resources (data and tools) available from NASA to examine coastal flooding impacts and risk management issues within your communities. Please work through the following case study to help us identify how you can access different resources and let us know your thoughts on the process. Please complete these exercises on the same computer you will be using for the workshops. Please use whatever tools/coding environment you are comfortable using (e.g., R, Python, ArcGIS).

NASA User Profiles

NASA has put together user profiles of power users of their data and tools. One such profile showcases Lori Schultz, a Research Physical Scientist and NASA Disaster Program Center Coordinator at NASA's Marshall Space Flight Center. [Please use the following link to find out more about Lori Schultz and how she uses NASA data to meet the needs of users and applies satellite data to disaster monitoring and mitigation.](#)

Question 1. Look at the profiles of other users on the site. Who else might you reach out to as an expert resource with coastal issues?

Your Turn

Now, we are asking you to step into the role of a power user supporting NASA partner organizations in the response and recovery of a flood disaster. Using the [NASA EarthData Floods Data Pathfinder](#), please locate the Flood Dashboard titled the "Disasters Mapping Portal". The flood dashboard brings together multiple soil moisture and flood products to give a more complete picture of potential flooding in the United States.

Question 2. How might you use the Flood Dashboard to identify specific areas where flood waters have been detected?

Use the original Pathfinder link to find the *Global Flood Mortality Risks and Distribution, v1 (2000)* dataset.

Question 3. Please describe how you navigated to find the data? If you did not find the data, please indicate that as well.

Next, find out the specifics about the Mortality Risk dataset by accessing more information about it.

Question 4. In what applied use cases would this data be relevant for?

Question 5. In what use cases may this data not be relevant?

Question 6. What other data would you want to see to help with your analysis of flood impacts?

Choose Your Own Adventure

A tropical system is forming in the Atlantic Ocean. The system has nothing stopping it from becoming a major storm before it approaches the east coast of the United States. A NASA partner organization has reached out to you for help to use existing data to identify coastal areas along the east coast where soil moisture levels are high.

Please use what you have learned throughout the UNBOUND-CI workshop to identify data and tools that would help in this scenario.

Question 7. Please provide a description of how you would make decisions on where to go and which data to select.

Question 8. How would you resolve any challenges encountered (e.g., power users, colleagues, NASA information)?

Question 9. Are there other tools or datasets you would use to help with these questions?

Cloud Computing

Question 10. Please describe what, if any, cloud computing resources and tools you use to access and analyze NASA data and resources.

5. Padlet Surveys and Raw Results

Each workshop day there were two Padlet surveys circulated, and they were the same format every time. The first always asked about presentations, and the second always asked the questions below following breakout sessions. Following the reflection questions find the raw participant breakout room reflections.

September 18: NASA UNBOUND Participant Reflection

Participants are invited to share their thoughts on each presentation. We want to capture all of your thoughts about the data and its applications.

Presenter: Elizabeth Joyner, Topic: Accessing NASA Data for Coastal Issues – General Overview

Presenter: Leah Switzer, Topic: NASA GIS Applications and Content for Coastal Issues

Presenter: Sean McCartney, Topic: ARSET Program Overview – with nod to “coastal” intersections

Breakout Reflection- September 19

Were you familiar with the data prior to today?

What did you find useful about the data?

What impediments do you think may affect your application of the data?

How comfortable would you feel applying the data on your own?

Break Out Reflection - September 18 (High Resolution Sea Surface Temperature (PO DAAC) and Shuttle Radar Topography Mission Global 1 arc second (LP DAAC))

Were you familiar with the data prior to today?

- I didn't know specifically about this dataset, but I knew that there are multiple datasets available on sea surface temperature.
- Only played with maybe once before.
- Familiar with terms but not data availability
- I was familiar with the context of the questions (find Sea surface temperature, find DEM) but I did not know the extent of data available in terms of worldview
- Familiar with sea surface data - but not in the worldview. Other folks in my room also explained additional features which helped the group better understand/assess the data
- Not enough time
- We got off to a slow start and never found the data. We were on our way but ran out of time.
- No, wasn't familiar with the data
- Not really. I had very briefly looked at Earthdata previously.
- More comfortable with the GIS
- I was aware of the land surface topography data more so than for the worldview coastlines layer
- Some of it - but it's been a while since I looked for data on this platform

What did you find useful about the data?

- I think the temporal resolution is good. Its daily dataset!!! Global coverage is another important aspect of this dataset!!
- Excited that we can leverage the data within ArcPro
- Filtering I feel like once you figure out how to filter the data you are looking at, it can be very useful. Initially, the data we looked at had multiple layers active, but we we narrowed it, it was a lot easier to interpret.
- WorldView Draws fast, nice customization (color ranges, transparency)
- There is enormous amount of data which would very helpful
- Accessibility: using layers and transitioning data in the world viewer was immediate
- May take a little bit of time to find useful data, but there is a wealth of it.
- So much data available which is great!
- The volume of data available is very impressive.
- Re-symbolization options (can make the data much clearer)
- There is a wealth of data- the trick is finding it

What impediments do you think may affect your application of the data?

- One of the things is that I didn't check the resolution of the dataset! I might go for higher resolution data if there is any!!
- Lots of datasets that seem like they are the same thing.
- From the data pathfinders page, the search function led to multiple resource types, rather than just data, and the results did not include the data I needed. Resource types should be kept separate (don't mix reports with data)
- There were many files with the same name, couldn't immediately locate the description.
- Need for better registry: dataset locations are in need of further organization
- A lack of familiarity with some of the data names and acronyms in the titles of the files and lack of familiarity with some of the file types
- Definitely navigating and finding which tools work for what you are trying to accomplish.
- Just getting to it! Too many paths to get to the data.
- Knowledge of how to navigate the various data sets

How comfortable would you feel applying the data on your own? Why or why not?

- I think it's a good dataset that I might be able to use in my research. One thing I like is that it's a daily dataset!
- I'd feel comfortable.
- I am glad to be learning new ways of getting data! I think my preference and often go to is data I can either find in AGOL or that I can easily plug into gis. But I think the ability to specify time and location parameters before downloading is great and I can see that being really useful and worth the steps to get it into ArcPro.
- I feel more comfortable now to find data.
- There are a lot of valuable layers in the Pathfinders, but in terms of downloading relevant data- I am still a bit unsure of that.
- More comfortable than before, however I am less familiar with converting different file types to be able to use them in gis platforms.
- I think I'd be able to do it - it just takes a while to locate what you need. Sometimes the thematic categories overlap or don't make sense. 'Use case' categories might be useful to those who don't know what data they actually need.
- Relatively comfortable
- It was an intuitive experience
- I think I need a lot more practice, so not super comfortable right now.
- Not very as of now- there were a couple of nuances within the search parameters and filtering, such as trying to enter a date filter that could be improved on the user end.

Breakout Reflection- September 19 (Flooding Analysis tool, Interagency Sea Level Rise Scenario Tool)

Were you familiar with the data prior to today?

- Yes, i had used the NASA Sea Level Rise tools in the past, yes. I'm curious to access them with code, now
- All the tools are new to me! Some of the datasets seemed familiar!
- I'm very familiar with SLR data, but not the NASA resources.
- I was familiar with some of the date, but not all.
- I was not familiar with most of this data before as I mainly used the NOAA sea level rise viewer.
- I knew about some of the data, but not these applications.
- No but I found the homepage and tools very helpful and user friendly.
- Not the tool but I knew the data was publicly accessible, I would've assumed NOAA
- No these were new web apps and pages for me
- Not the data itself, but the data types and some of the instruments used to capture them.
- Yes, I have used this data source before, but not on the website. I have downloaded data to use in ArcPro.

What did you find useful about the data?

- Great datasets! Might be useful for future use!
- The NASA Flooding Analysis Tool is nearly a one stop shop. Lots of interactivity and customization.
- It was simple to understand for the most part. I appreciated the language targeting the general public and not heavy on the jargon.
- I like how easy it is to just pull up the graph by location and download that data is so desired I could see that being easy to use to share this information. The tools overall seemed easy to navigate.

- Relatively intuitive and easy to use if you know what webpage to use.
- It seemed very user friendly and the tools were easier to use.
- Standardized/Solid sources: In my work it's hard to find standardized global data, so I'm feeling really good about coming to NASA as a centralized portal of the best resources.
- The high-resolution on some of the satellite data is incredible and allows for in depth views on data variables within a community.
- Access to public GIS tools is a game changer as well, and will hopefully pave the way for more independent research (such as community-based assessments).
- Web Page: There was great thought put into the layout. The data was displayed in an easy-to-interpret way and was highly adjustable without having to pull data manually.

What impediments do you think may affect your application of the data?

- Global dataset...: I work globally, and look for datasets and tools that provide global perspective.
- the Flooding Analysis Tool didn't show beyond 2100 (even though the projections go beyond that). The Sea Level Evaluation & Assessment Tool doesn't let you zoom in very far. The basemap could use state boundaries to help orient us.
- Is there a single webpage that has all apps/tools and a description of what each does?
- I wish it had data for more rural areas
- If you don't know that the website exists, you're not going to know where to look. Not only that but if you type in keywords to any search engines, most of these sites don't come up as the top returns.
- Because most data seemed to be connected to a specific location it might be difficult to use this data for locations not immediately next to the points.
- I would use the data rather than the applications as I work at a very granular level. What would be easiest for me is if they were provided as WMS or WMTS (or feature services)
- Time Frame: For my area, no data is showing past 2050. It would be great to see more into the future for all sites.

How comfortable would you feel applying the data on your own?

- Comfortable for fast citable facts.
- Definitely
- The more I get familiar with the many tools I think I will be more inclined to use the data, projections, and webpage.
- doing hands-on exercise was very helpful for becoming comfortable
- I feel pretty comfortable using this data on my own and can think of a number of ways this could be helpful.
- Very! Again, for me it's about using the best standards.
- Very comfortable, the streamlined access to the data makes it easy to 'grab-and-go' so to speak.
- Already in use
- We use the raw NOAA data in our own coastal resilience tool.
- Somewhat comfortable with the Flood analysis tool, more comfortable with the Interagency Sea Level Rise

Breakout Reflection- September 25 (Dynamic Surface Water Extent, NASA PO. DAAC, NASA Earthdata, NASA Worldview, and the Single Pixel Extraction Tool)

Were you familiar with the data prior to today?

- No
- Not familiar with the data in prompt 1 at all.
- Familiar with the tools we had learned from the workshops, available for use, but not familiar with it in specifics to the question
- Previously unaware of the existence of the datasets.
- No
- The only familiarity was from the other work we have done in the workshop
- I wasn't
- I had no idea this existed, but it is a very powerful tool!
- Nope!
- No, I wasn't familiar.

- not familiar
- Not at all.
- I was not familiar with the data
- No
- not at all

What did you find useful about the data?

- DSWx
- I'm very interested in using DSWx dataset.
- The procedure of locating and downloading the data.
- The different calculations with AI to extract variety of data from satellite imagery
- The visual aspects of the data allow data practitioners to observe specific events both temporally and spatially. Especially the PODAAC interface
- Once you get to the right data page, it seems easy enough to select the correct data sets in terms of temporal events
- Great resources but it goes back until April 2023! Historical datasets might be useful! seems helpful but unsure how to use the data
- I liked the resolution (both spatial and temporal) of the data, and flood data is very useful to my work.
- I would need to know how to utilize the program before I could use the data.

What impediments do you think may affect your application of the data?

- Can all the prompts maybe be of one town for example, pick Charleston, SC and focus all prompts on Charleston only for the entire 4-day workshop. That way we can stop spending so much time searching for locations and it provides us consistent context on how to apply data to a single location. I don't know about the other participants but for those of us who work in single towns/cities or regions, it would be helpful. Then we could see how all these layers and data we are working to find can be applied. Wouldn't it be much more consistent if we were able to see how sea temp, water quality, SLR, flooding, etc. impact a singular location so at the end we can synthesize how to apply it to our own spaces?
- One of the biggest impediments for data discovery I think is the titles of the data. I know when you look closely you can figure out what the data is, but the numerous different acronyms and numbers can be confusing and I think that is why I prefer searching for data in Arcgis online sometimes (when applicable) because it is clearly labelled and there is often a description right away as to what the data is. Wondering if there are elements of that which could be applied to the search tools used today.
- The Earthdata interface is pretty overwhelming. I struggle with: Knowing what sort of data exists out there because there are so many products and names. Knowing how to use the interfaces--it's all deductive reasoning from knowing how to use ArcGIS but some of the buttons and reasons stuff is presented the way it is makes no sense to me as to why data is presented the way it is. The Earthdata interface looks cluttered depending on how big your screen is. The questions prompts are high order/high level/remote sensing researcher type questions and lack practical application for how to use this at a local level. Like how would apply this to a single town.
- PODAAC should have the SOTO tool more visible on their main site
- I think I wasn't totally clear as to what the data was for so I think that would make it difficult to apply. I think my personal lack of knowledge is the primary impediment, but I think the searching of the data was a little bit of an impediment as well as it was not the most easy to use.
- Getting the data was little challenging!
- -being a new user-unsure what data to search for-how to use it entirely-need an overview or tutorial
- It could be hard to find the surface water data as the spatial and temporal extent varied a lot. Clouds were an issue.
- Navigating the websites to find the correct section to filter and then download the data
- Difficult to figure out where to go in the first place. It would be better to have a centralized place to get data and branch out from there. It's confusing how to get started - in the past I've given up.
- My lack of knowledge on how to use the program was definitely an impediment.
- starting to feel like a guinea pig testing how well questions are written...
- discovery of data was a bit challenging and understanding the differences between the different opera dswx layers wasn't entirely clear to me

How comfortable would you feel applying the data on your own?

- With a small learning curve, yes.

- Even if we could download the data from prompt one, I have no idea what format it was going to be downloaded as or how I'd apply it because of that. The download doesn't even give you an idea of how large what your downloading is going to be.
- Very comfortable, however accessing the data is still a bit difficult as one has to navigate through the metadata before being able to manipulate the numerical data.
- I don't think I feel comfortable yet but maybe with some practice/time spent exploring I could become more comfortable?
- Not comfortable at all. Seems helpful but very confused of the tool and data.
- I would feel super comfortable to get the data and use it in my research!
- I look forward to that, would need to navigate to the data
- I'd be very comfortable applying the data but would need to makes sure that I understand exactly what the data are showing (Opera dswx)
- I would need more practice- currently, it is still difficult to navigate to the correct section to find the data
- I would feel comfortable - once I'd managed to get to the data!
- Not comfortable at all. I would need more training on how to use the program to access the data.
- so so
- after today's workshop, it seems that it takes some learning to find and use the DSWx dataset.
- I also have in mind that it's a WIP, that other dataset / feature will be added in 2024
- Somewhat comfortable...I would need a training/walk through to feel more comfortable

Breakout Reflection-September 26 (SEDAC, NASA Worldview)

Were you familiar with the data prior to today?

- no
- I knew there were maps publicly available containing socioeconomic data but not to this extent
- No
- I was with the CEISEN data and some others with the topic yes, with the data and tools no
- No
- No
- No
- zero prior knowledge
- No
- no
- no
- No

What did you find useful about the data?

- I appreciated that the excel sheet had multiple tabs with detailed information but it still did not make it entirely clear on what each attribute was in reference to.
- I was really interested in: Social Vulnerability Index (SVI), Emergency Management tools and datasets
- Being able to combine EO data with demographic data is extremely powerful
- The information was useful
- Finding and downloading the data was easy. I appreciated that the data, documentation, and maps were together in SEDAC
- The article was useful because it covered a range of data sources and their importance for socioeconomic data
- descriptions of the data within the excel tabs were helpful to better understand what I was looking at
- Everything today - especially social economic data. Just wish there was more data in other countries
- The world viewer gave the most information and allowed customization by adding layers.
- The information provided would be very useful.
- The navigation to finding the data and the data itself (excel) were easy to find and somewhat easy to interpret
- Yes. Data with meta data information including data dictionary and other related information provide more understanding.

What impediments do you think may affect your application of the data?

- The components of the climate risk data were scaled for easy comparison, but it would be nice to know what the original data was.
- Glad there is socioeconomic data along Midwest coastal communities! But the local data seems to be a bit limited
- Interpretation of the data took a little bit of digging (nothing too difficult), but it would be nice to have qualitative information attached to the dataset (what constitutes as a hazard? What components were included for exposure or sensitivity?)
- The indices and variables were not explained. We looked for metadata and explanations, but none sufficed.
- I use global data only. as usual for satellite data: resolution. And perhaps recurrence, when we speak about emergency management
- More finer geographical scale data are needed.
- not as intuitive and a bit busy so that was overwhelming when looking initially at the data
- It is easy to find the data if you know exactly the name of the data to search like we did today, but I am not sure how I would know to find the data if I was just searching on my own without prompting.
- Uncertain. So far it's been great
- Local data is somewhat lacking.
- County level risk data will probably be too coarse for me.
- The Risk data should be provided in an interactive map or ArcGIS layer
- Lack of familiarity with some of the terminology was definitely an impediment.
- Fully understanding the indexes and how they explain the phenomena being measured

How comfortable would you feel applying the data on your own?

- 4.5/5 Comfortable. I need to spend some time to better understanding the data, but feel confident that I would be able to use the data in my work.
- Comfortable, however, I would need more data to supplement this to be able to work on other geographical area
- Very - but would need to understand indices much better
- once I get more familiar, I will get comfortable applying it to my own work and understand how to use it
- Very Comfortable
- Very comfortable.
- I feel fairly comfortable applying the data and am excited to do so.
- it will take some time to digest, but I definitely plan to use some of what was share with us today - especially if the datasets are global
- Comfortable
- I would need to use it more before being able to answer this question.
- I would be somewhat comfortable in terms of finding and applying, but may require more research to appropriately explain the data to others
- I would feel fairly comfortable applying this data on my own.

6. Exit Survey

Thank you for attending the UNBOUND-CI workshop! We would like to gather feedback about your experience. Your insights will help us attune NASA technologies and future workshops to end-user needs. We are not collecting your personal information so please be as open and honest as possible. Please know that your responses will only be reviewed by the workshop organizers. Again, thank you for your time and we look forward to hearing from you!

On which workshop day(s) did you participate? (Select all that apply)

- Monday, September 18
- Tuesday, September 19
- Monday, September 25
- Tuesday, September 26

Which of the following describes your organization? (Select all that apply)

- Academia
- Research

- Local Government
- State Government
- Federal Government
- Nonprofit Organization
- Community Organization
- Other

What NASA technologies would you like to use for your work moving forward? (Select all that apply)

- NASA Open Data Portal
- NASA Visualizations (VEDA)
- NASA Earthdata
- ARSET
- Esri Living Atlas
- Interagency Sea Level Scenario Tool
- SAR/NSAR data
- Flooding Days Projection Tool
- Flooding Analysis Tool
- NASA Virtual Earth System Laboratory
- NASA Sea Level Change Portal
- Non-commercial satellite data (MODIS, VIIRS, Landsat, Sentinel)
- NASA Disaster Mapping Portal
- NASA OPERA
- SEDAC
- Other

Please rate the accessibility and usability of the NASA data highlighted in each of these NASA presentations. (Note: You are not rating the quality of the presentation, but the accessibility and usability of the NASA data demonstrated in the presentation.) Very Difficult to Access/Use, Somewhat Difficult to Access/Use, Neutral, Somewhat Easy to Access/Use, Very Easy to Access/Use

- NASA EJ and Open Data Resources (VEDA, OSSI)
- Earth Science Data Systems (ESDS) (Earthdata Search/Data Pathfinders)
- NASA Earth Science Data Systems EGIS (Enterprise Earthdata GIS)
- NASA ARSET
- NASA Data in the Esri Living Atlas
- Sea Level Rise and Wetlands
- NASA Sea Level Rise Portal
- Using SAR/NSAR data for Sea Level Rise Planning in Hampton Roads, VA
- Assessing SAV and Harmful Algal Blooms in Ches. Bay using noncommercial satellite data (MODIS, VIIRS, Landsat, Sentinel)
- NASA OPERA Program
- NASA SEDAC Program
- NASA Disasters Program

After attending UNBOUND-CI, at what scale do you feel you can apply NASA technologies and data to coastal issues? (Select all that apply)

- Global
- National
- Regional
- Local
- Other

After attending UNBOUND-CI, what do you feel may limit your use of NASA technologies? (Select all that apply)

- Internet Access

- Software Access
- Hardware Access
- Skill
- Duplication with other technologies
- Cost
- Time
- Other

If you currently use NASA data, do you use the cloud for processing?

Yes No I do not currently use NASA data

How do you expect to use the NASA data and/or technologies that were presented in the workshop?

What is your biggest takeaway from the UNBOUND-CI workshop?

In your opinion, the workshop as a whole...

Strongly Agree, Agree, Neither, Agree nor Disagree, Disagree, Strongly Disagree

Had a clear purpose

- Provided meaningful opportunities for contribute.
- Was relevant to the specific needs of my organization.
- Was relevant to the specific needs of my organizational role or position.
- Provided useful feedback to me.
- Made good use of technology.
- Was well-paced.
- Was of high quality overall.

What was the most valuable part of the workshop (e.g., introductions, demonstrations, breakout activities, report-outs, homework, data resources)? Please share reasons this part was valuable to you.

What lessons, if any, did the homework contribute to your learning?

Who or what was missing from this workshop (e.g., what technology or data should we include)?

Would you attend another UNBOUND workshop?

Other comments or suggestions that you would like to add?

“The most important part is to take on the challenge of protecting the ocean as if your life depends on it—because it does.”
— Sylvia A. Earle

Prepared by Virginia
Tech and Old
Dominion September
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Recommendation
Report: Understanding
Needs to Broaden
Outside Use of NASA
Data for Coastal Issues
(UNBOUND-CI)

