



# ARSET

applied remote sensing training program

**2023 Annual Summary**



# 2023 Annual Summary



**In 2023 ARSET trained its 100,000th participant!**

## Join us as we reflect on our year!

Welcome to our 2023 Annual Summary! To recount our major activities and changes for this past year, we delivered a total of 14 trainings (11 online and two in person), and five of these were delivered in Spanish. In July, we officially trained our 100,000th person, a huge milestone for ARSET. In addition, we welcomed some new team members, said goodbye to others, and the team met for an in-person retreat at NASA Goddard Space Flight Center in Greenbelt, MD for the first time since 2019. We capped off the year with the launch of our new learning management system and our first online, self-paced training, [Developing Sustainable Earth Science Applications](#).

In the following pages, you will see a summary breakdown of each training we delivered, along with some feedback and stories from those who participated in our trainings. We would also like to extend a special thank you to the NASA Earth Action Program and leadership for their guidance and support, and all of our generous guest speakers and collaborators who donated their time and effort to expand the scope of topics we were able to train on.



Above: ARSET team members at the ARSET Retreat in September, 2023 at NASA Goddard Space Flight Center (GSFC). Photo courtesy of Sarah Cutshall.

# 2023 Statistics

**19,756**

Total Participants

**5,110**

On-Demand Training Participants

**14,646**

Live Training Participants

**16%**

US Participation

**158**

Countries Reached

**53**

US States & Territories Reached

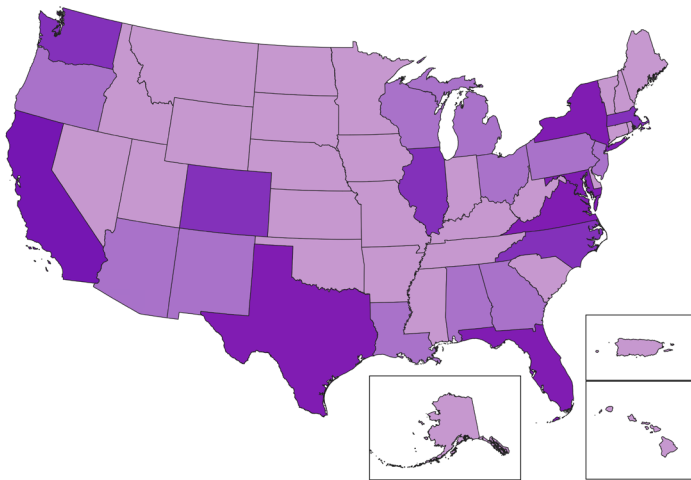
**4,740**

Unique Organizations Reached

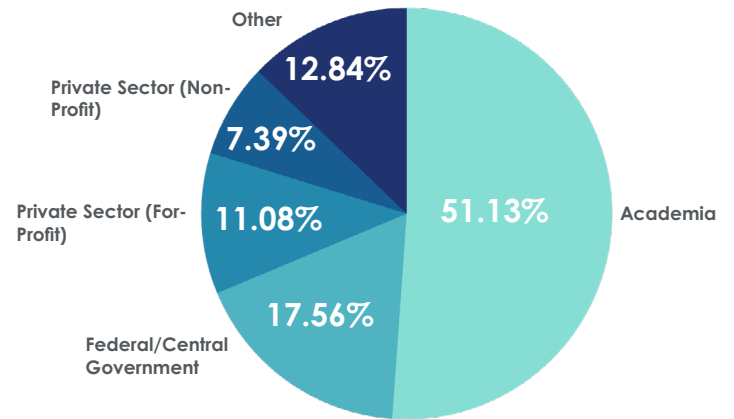
**84%**

International Participation

## 2023 Maps - US and World Participation



## 2023 Participation by Sector



### 2023 Participation

#### Number of Participants

□ No Participation

■ 1-5

■ 6-20

■ 21-50

■ 51-100

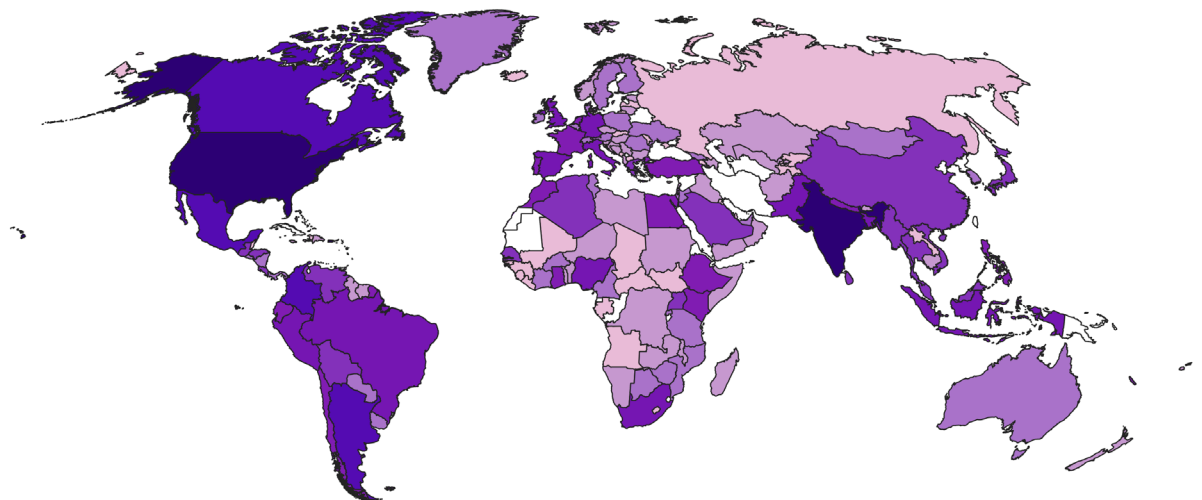
■ 101-200

■ 201-400

■ 400 - 1000

■ 1000-2000

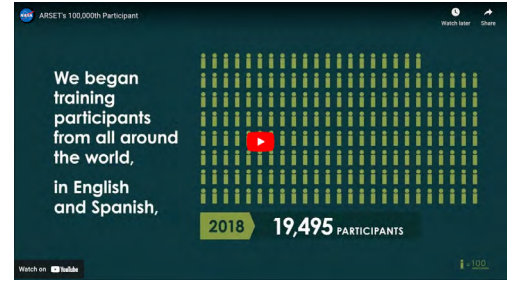
■ 2000+





# Marking a Milestone in Earth Data Training

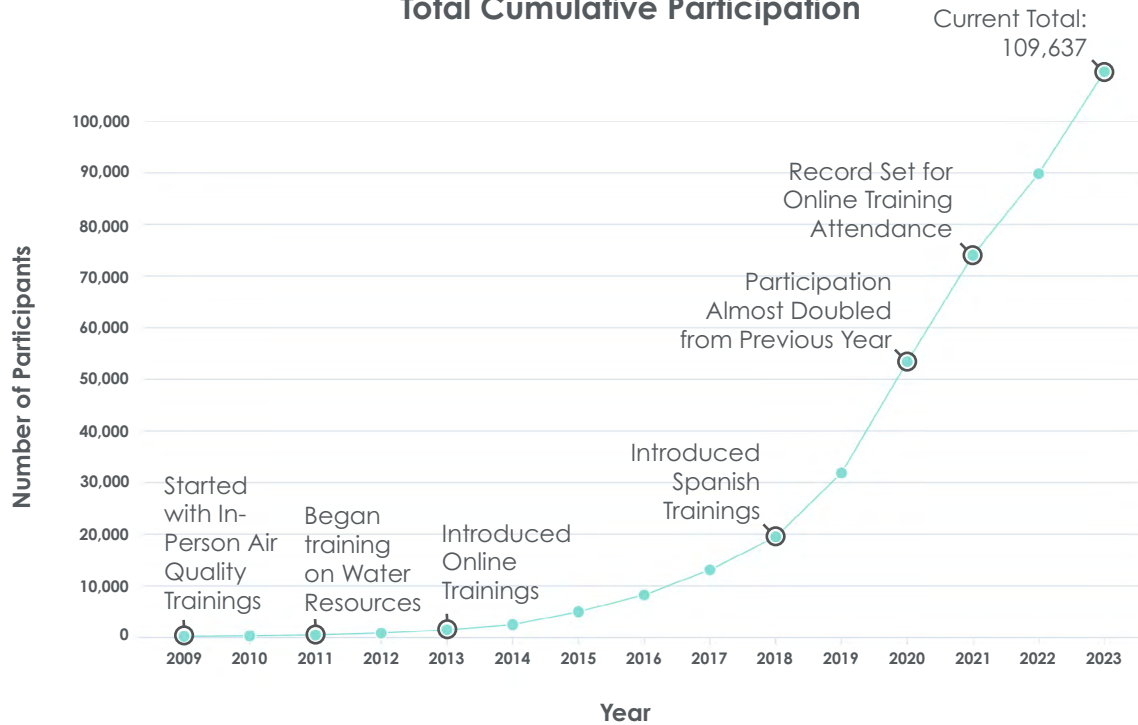
In July 2023, we officially logged our 100,000th person trained during our live in-person and online training sessions. Note that this doesn't include individuals accessing our content asynchronously through YouTube or our website. This has been a major milestone for the ARSET program and was featured in a [news story on the Applied Sciences website](#). ARSET has truly become a trusted source for the international community and we are excited to train the next 100,000 participants!



[Click to Watch the Video](#)



## Total Cumulative Participation





# 2023 ARSET Retreat

In September 2023, the ARSET Team met in-person for a three-day retreat at Goddard Space Flight Center in Greenbelt, MD! For many of the team members, this was their first time ever meeting in person. This gave the team an opportunity to reflect on the past year, assess our current standards and operating procedures, outline goals for the future, and come up with strategies to meet these goals and improve our workflows. The team also took this opportunity to get to know each other, take a tour of Goddard, and take professional headshot photos as a team. Before the end of the three-day retreat, the team ended up with a detailed list of action items to improve our workflow and enhance our trainings.



Top-Left: ARSET team members at the ARSET Retreat in September, 2023 at NASA Goddard Space Flight Center (GSFC). Top-Right: The ARSET Team tours the centrifuge at Goddard Space Flight Center. Bottom-Left: The ARSET Team on a guided tour of Mission Control for the Hubble Space Telescope. Bottom-Right: ARSET team photo at NASA Goddard Space Flight Center.

# 2023 Trainings (Following Pages)

ARSET delivered a total of 14 trainings, both online and in-person in 2023. In the following pages you will find a page with the following information for each training offered:

- Training description with links to the training materials and general info
- A list of ARSET instructors and guest instructors who created and delivered the training
- Some general training statistics including overall attendance and countries reached
- Notable quotes from training participants taken from survey responses

Instructors

Training Statistics

Participant Quotes

ARSET Instructors	
Juan Torres-Pérez NASA Ames Research Center	Amber McCullum NASA Ames Research Center
Ashley Seacord NASA Ames Research Center	

Statistics	
1,170 Participants	400 Organizations
107 Countries	39 US States

100% of participants reported improved understanding of how EO data and tools can be used for citizen science projects, with 56% reporting that their understanding improved greatly.

**From the Participants**

*"I identify myself as part of a community devoid of services, which is why I am very interested in participating in these courses, which are very important, in order to transmit this knowledge to the technicians of the municipalities in my area."* (Survey Comment, February, 2022; Federal Government Employee, Peru)

General Info & Link

## ARSET Instructors

### Juan Torres-Pérez

NASA Ames Research Center

### Amber McCullum

NASA Ames Research Center/Bay Area Env. Research Institute

### Britnay Beaudry

NASA Ames Research Center/Bay Area Env. Research Institute

## Statistics

**1,169**

Participants

**767**

Organizations

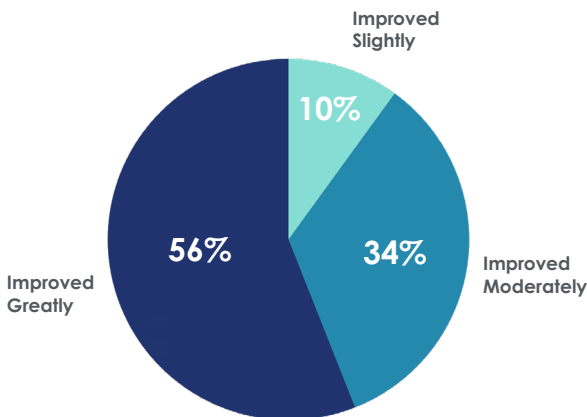
**107**

Countries

**39**

US States

100% of participants reported improved understanding of how EO data and tools can be used for citizen science projects, with 56% reporting that their understanding improved greatly.



## Connecting Citizen Science with Remote Sensing

January 24, 2023 - January 31, 2023 Online Instructor-Led

Introductory Bilingual

This three-part training provides attendees an overview of citizen science efforts that use Earth Observations, and how to engage with community members in a supportive and meaningful manner to achieve project goals. Case-study examples of successful citizen science projects are also provided, with some examples from NASA supported projects and activities.



## From the Participants

*“I identify myself as part of a community devoid of services, which is why I am very interested in participating in these courses, which are very important, in order to transmit this knowledge to the technicians of the municipalities in my area.”* (Survey Comment, February, 2022; Federal Government Employee, Peru)



## ARSET Instructors

### Melanie Follette-Cook

NASA Goddard Space Flight Center

### Carl Malings

NASA Goddard Space Flight Center/Morgan State University

### Pawan Gupta

NASA Goddard Space Flight Center

### Sarah Strode

NASA Goddard Space Flight Center/Morgan State University

## Statistics

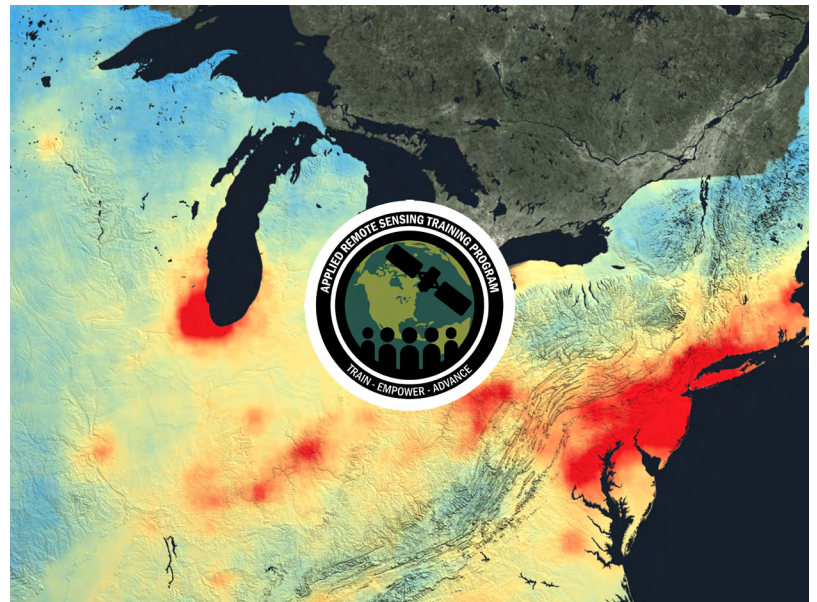
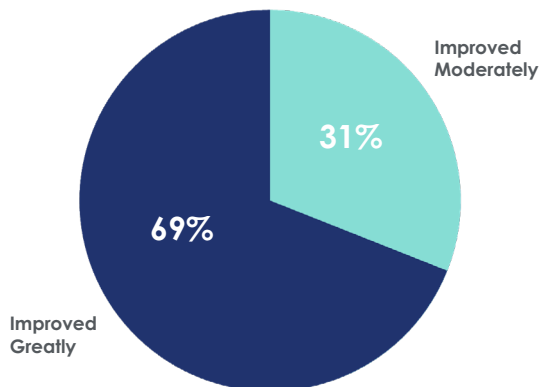
29

Participants

6

Organizations

My understanding of how satellite remote sensing information can complement and integrate with other sources of air quality information (e.g., AirNow surface monitor data)...



## NASA Air Quality-Focused Remote Sensing for EPA Applications

March 21, 2023 - March 23, 2023

In-Person

### Advanced

This three-day, in-person training, developed in partnership with and hosted by EPA, included lectures & exercises highlighting applications related to air quality monitoring, forecasting, smoke, fire, PM2.5 monitoring, image interpretation, and data access for modeling efforts. To conclude the training, participants completed a case study that incorporated all data portals, tools, and relevant data in an effort to properly identify, track, and measure air quality events of their choosing.

Below: ARSET instructors Pawan Gupta, Melanie Follette-Cook, Carl Malings, and Sarah Strode with training participants.





## ARSET Instructors

### Amber McCullum

NASA Ames Research Center/Bay Area Env. Research Institute

### Juan Torres-Pérez

NASA Ames Research Center

### Britnay Beaudry

NASA Ames Research Center/Bay Area Env. Research Institute

## Guest Instructors

### Phil Townsend

University of Wisconsin, Madison

### Atticus Stovall

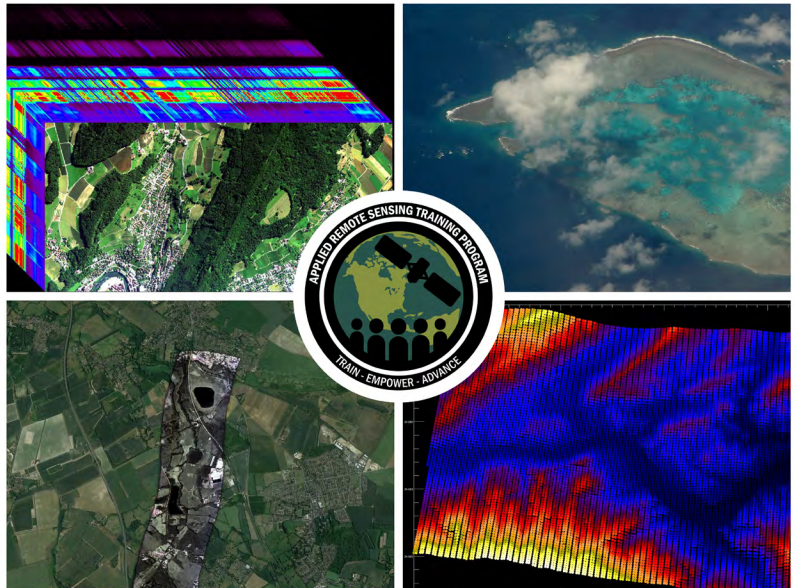
University of MD/NASA Goddard Space Flight Center

### Liane Guild

NASA Ames Research Center

### Natasha Stavros

Cooperative Institute for Research in Environmental Sciences/UC Boulder



## Statistics

**1,341**

Participants

**893**

Organizations

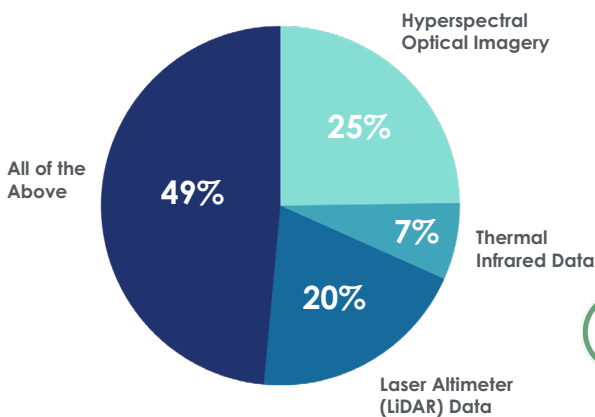
**108**

Countries

**44**

US States

For the work you do, which of these Earth Observations are you most likely to use?



## Biodiversity Applications for Airborne Imaging Systems

March 27, 2023 - April 05, 2023

Online Instructor-Led

Intermediate

This four-part training first highlights the use of hyperspectral Visible to Shortwave Infrared (VSWIR) imaging spectroscopy data for measuring and monitoring terrestrial and aquatic biodiversity (e.g., mapping plant or phytoplankton functional types). Next, the series focuses on using thermal and LiDAR data for characterizing the structure and function of ecosystems using airborne campaigns including the Hyperspectral Thermal Emission Spectrometer (HyTES) and NASA's Land, Vegetation, and Ice Sensor (LVIS).

## From the Participants

*"I am applying for scholarships to further my education and career, this platform is really helping me in deciding my area of specialization."* (Survey Comment, April, 2023; Private Sector Employee, Nigeria)

*"Fantastic series! Really benefitted from having the PI's participate, bringing their enthusiasm about their upcoming campaign in the fall."* (Survey Comment, April, 2023; Retired Academic Staff, United States)



## ARSET Instructors

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech

## Guest Instructors

### Armando Marino

University of Stirling

### Krištof Oštir

University of Ljubljana

### Matej Račič

University of Ljubljana

### Heather McNairn

Agriculture and Agri-Food Canada

### Emily Lindsay

Agriculture and Agri-Food Canada

### Xianfeng Jiao

Agriculture and Agri-Food Canada



## Crop Mapping using Synthetic Aperture Radar (SAR) and Optical Remote Sensing

April 04, 2023 - April 11, 2023

Online Instructor-Led

Advanced Bilingual

## Statistics

1,976

Participants

1,232

Organizations

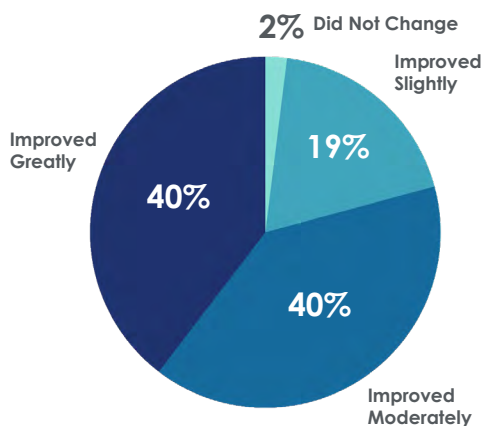
127

Countries

37

US States

My ability to classify crop type using a time series of radar and optical imagery...



This three-part training builds on previous ARSET agricultural trainings. Here we present more advanced radar remote sensing techniques using polarimetry and a canopy structure dynamic model to monitor crop growth. The training also covers how to apply machine learning methods to classify crop type using a time series of Sentinel-1 & Sentinel-2 imagery. This series includes practical exercises using the Sentinel Application Platform (SNAP) and Python code written in Python Jupyter Notebooks.

This webinar series is a collaboration between ARSET, Agriculture and Agri-Food Canada (AAFC), the European Space Agency (ESA), University of Stirling, University of Ljubljana, and the CEOS Working Group on Capacity Building & Data Democracy (WGCapD).

## From the Participants

*"I appreciate the opportunity that ARSET gives us to improve my skills and update myself. I am a remote sensing teacher and it is essential to be updated in order to provide quality training to my students."* (Survey Comment, April, 2023; Faculty, Argentina)

*"I have to say this training hugely exceeds my expectations. The trainers' oral presentations are direct with a good enough speed. The organizers' speaking is very professional. The theory part and hand-on practice are full of knowledge and super valid for me."* (Survey Comment, April, 2022; Student, Italy)





## Hosts

### Brock Blevins

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech

## Guest Instructors

### Jordan A.

#### Caraballo-Vega

NASA Goddard Space Flight Center/AST

### Caleb Spradlin

NASA Goddard Space Flight Center/InuTeq, LLC

### Jian Li

NASA Goddard Space Flight Center/InuTeq, LLC

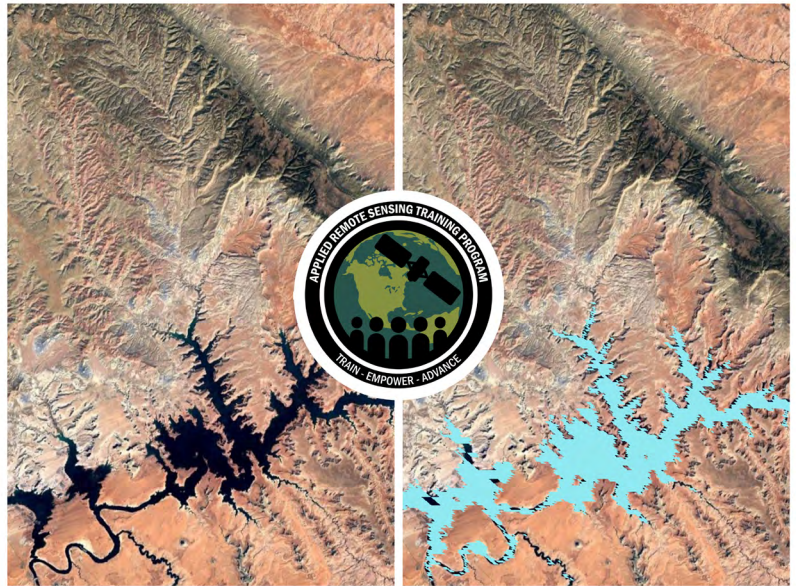
### Jules Kouatchou

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Guest Contributors

### Mark L. Carroll

NASA Goddard Space Flight Center/AST



## Statistics

**3,056**

Participants

**1,744**

Organizations

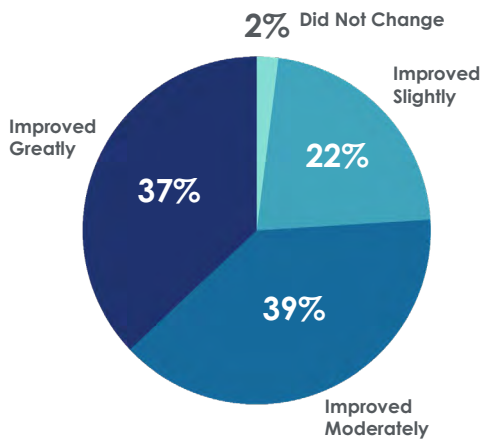
**127**

Countries

**49**

US States

My ability to explain how to apply basic machine learning algorithms and techniques to remote sensing data...



## From the Participants

*“As a young person living in Kenya, where the youth unemployment rate is high, I am optimistic that the skills and knowledge gained from this program will improve my chances of getting employed. I now have a competitive edge in the job market as I can offer a unique blend of skills that are highly sought after in various industries. I believe that this program has opened up many doors of opportunities for me, and I am excited to see where this journey takes me.”* (Survey Comment, May, 2023; Student, Kenya)

*“I liked the fact that hands-on training wasn’t expected from the students during the lectures. That kind of approach often times (when student’s theoretical knowledge and hands-on skills are limited) leads to getting overwhelmed and lost in both theoretical and hands-on training part. Posting recordings online is another great practice, thanks. Best wishes from Croatia, keep up the good work!”* (Survey Comment, May, 2023; Private Sector Employee/Post-Doctoral Student, Croatia)

## Fundamentals of Machine Learning for Earth Science

April 20, 2023 - May 04, 2023

Online Instructor-Led

Introductory

Bilingual

This three-part training provides an overview of machine learning in regards to Earth Science, and shows how to apply these algorithms and techniques to remote sensing data in a meaningful way. End-to-end case study examples for generating a simple random forest model for land cover classification from optical remote sensing are also provided.





## Host

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Guest Instructors

### Lori Schultz

NASA Marshall Space Flight Center/SPoRT

### Christopher Hain

NASA Marshall Space Flight Center/SPoRT

### Jonathan Case

ENSCO, Inc./SPoRT

### Richard Heim

NOAA/NESDIS/National Centers for Environmental Information

### Corey Davis

NC State Climate Office

### Ryan Wade

University of Alabama, Huntsville/SPoRT

### Kevin Fuell

University of Alabama, Huntsville/SPoRT

### Sujay Kumar

NASA Goddard Space Flight Center

### Kris White

NOAA/National Weather Service/SPoRT

### Barrett Smith

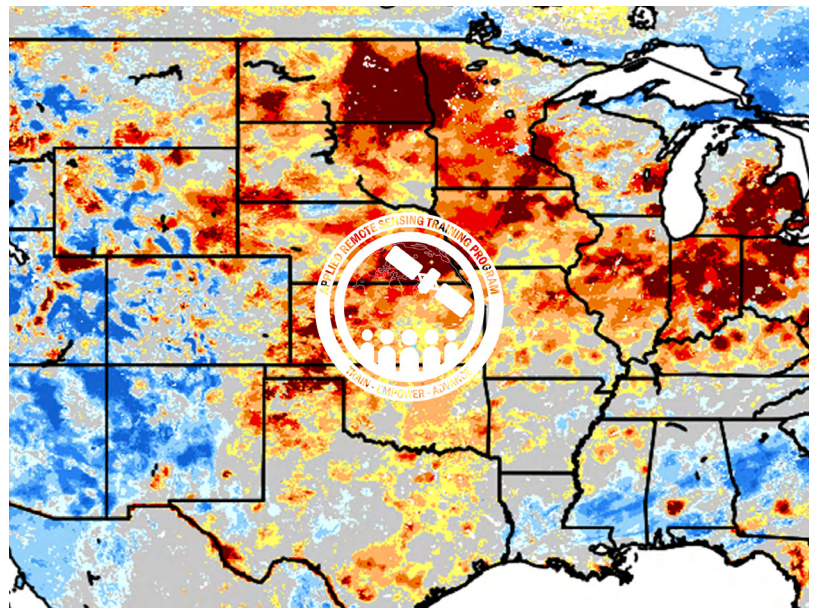
National Weather Service WFO Raleigh, NC

### Matt Smith

University of Alabama, Huntsville/SPoRT

### Rob Junod

University of Alabama, Huntsville/SPoRT



## Application of NASA SPoRT-Land Information System (SPoRT-LIS) Soil Moisture Data for Drought

May 17, 2023 - May 31, 2023

Online Instructor-Led

### Introductory

This three-part training, created in partnership with the NASA Short-term Prediction Research and Transition Center (SPoRT), focuses on the introduction of the NASA Land Information System (LIS) output of soil moisture at various depths for drought analysis and monitoring. Examples from operational applications as well as practice exercises for using LIS output for drought monitoring are included, and self-paced microlessons are available to help users confirm their understanding and improve their skills.

## Statistics

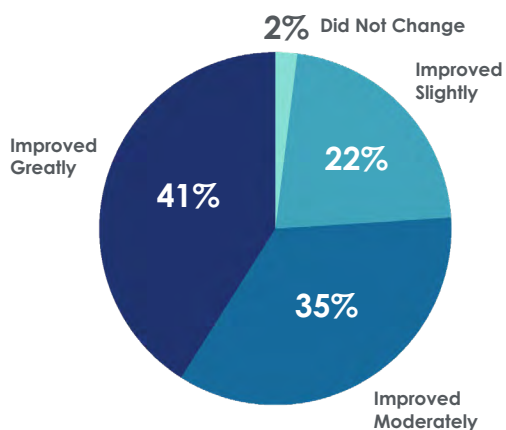
**749**  
Participants

**549**  
Organizations

**110**  
Countries

**40**  
US States

My confidence in my ability to apply SPoRT-LIS outputs to positively impact the products and services my agency/organization provides to people directly impacted by drought...



## From the Participants

*“Perfect idea for using: micro-lessons: self-paced training. Please Add this to all future trainings.”* (Survey Comment, June, 2023; Doctoral Student, El Salvador)

## ARSET Instructors

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech

### Juan L. Torres-Pérez

NASA Ames Research Center

### Sativa Cruz

NASA Ames Research Center/Bay Area Env. Research Institute

### Amita Mehta

NASA Goddard Space Flight Center/University of MD, Baltimore County

### Amber McCullum

NASA Ames Research Center/Bay Area Env. Research Institute

### Brittany Beaudry

NASA Ames Research Center/Bay Area Env. Research Institute

## Guest Instructors

### Mandy Lopez

NASA Jet Propulsion Laboratory

### Ibrahim

Mohammed  
SAIC/NASA



## Assessing the Impacts of Fires on Watershed Health

July 06, 2023 - July 13, 2023

Online Instructor-Led

Advanced

This three-part training focuses on using remote sensing observations for monitoring post-fire impacts on watershed health, building off the ARSET training offered in 2021: Satellite Observations and Tools for Fire Risk, Detection, and Analysis. Specifically, this training highlights uses of NASA Earth Observations (EO) for pre-fire land cover mapping, watershed delineation and stream mapping, calculating anomalies in biophysical and meteorological conditions for a watershed of interest, post-fire burn severity mapping, and pre- and post-fire riverine and freshwater water quality.

## Statistics

804

Participants

592

Organizations

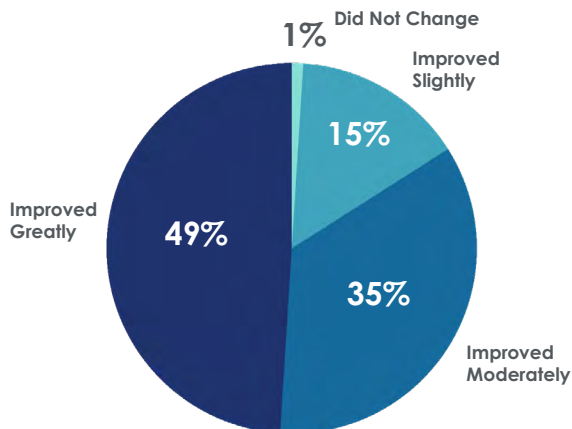
102

Countries

39

US States

My ability to analyze the key fire science criteria to select the appropriate data from satellites/instruments for a given watershed...



*"The exercises were practical and helped to improve the choice of choosing basin limits and river sub-basins. The SWAT model was useful for the study of channels, rivers and hydrographic basins, which was developed to assess the impact of management practices. management of soil, water, vegetation and crops and their inputs on the production of water, sediments in a hydrological basin."* (Survey Comment, July 2023; Student, Mexico)

## From the Participants

*"It was great to be part of the all the ARSET webinar session. I am learning more from the ARSET than my university."* (Survey Comment, July 2023; Faculty, India)

*"In my opinion, the codes were inscribed in a lucid and comprehensible fashion, hence it is remarkably effortless to alter and implement them. I would like that you continue with this modifiable code methodology to fortify understanding in forthcoming instructional meetings."* (Survey Comment, July 2023; Faculty, Venezuela)



## ARSET Instructors

### Amita Mehta

NASA Goddard Space Flight Center/University of MD, Baltimore County

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Guest Instructors

### Bridget Seegers

NASA Goddard Space Flight Center/Morgan State University

### Blake Schaeffer

Environmental Protection Agency

### Daniel Sobota

Oregon Department of Environmental Quality

## Statistics

**1,054**

Participants

**719**

Organizations

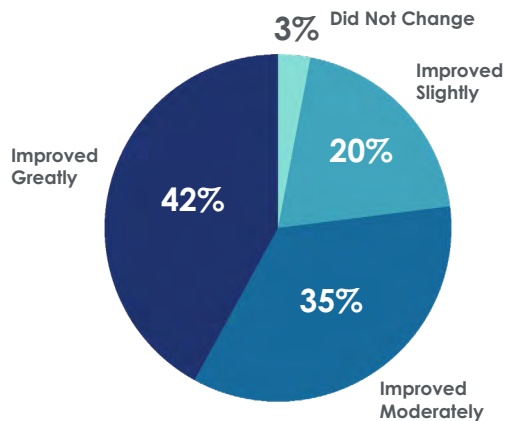
**108**

Countries

**32**

US States

My ability to utilize GEE to access satellite images and develop methodology to derive water quality parameters from remote sensing and in situ measurements...



## Monitoring Water Quality of Inland Lakes using Remote Sensing

July 18, 2023 - July 25, 2023

Online Instructor-Led

Advanced

This three-part training focuses on demonstrating the use of remote sensing observations from Landsat 8 and 9, Sentinel-2, and Sentinel-3 for assessing water quality parameters, including chlorophyll-a concentration and Total Suspended Solids (TSS) in inland lakes. This training also highlights the importance of *in situ* measurements of these parameters, coincident with satellite observations, in developing methodologies for operational water quality monitoring.

## From the Participants

*"GREAT course, lectures were excellent, Exercises were engaging, Homework was understandable and questions were well designed."* (Survey Comment, August, 2023; State Government Employee, United States)

*"Thank you very much, the training was great! I was particularly impressed with the lengths you went to during the Q&A to answer the questions thoroughly and thoughtfully."* (Survey Comment, August, 2023; Federal Government Employee, Canada)

*"Thank you so much for providing this opportunity. It's the second ARSET course I take and I'm always very happy and motivated with the potential applications provided. The length of the course and the effort required is perfect to follow it and keep motivated and interested. All the materials are very helpful and for free which is great!! Congratulations for such a good initiative :)"* (Survey Comment, August, 2023; Student, Spain)



## ARSET Instructors

### Melanie Follette-Cook

NASA Goddard Space Flight Center

### Sarah Strode

NASA Goddard Space Flight Center/Morgan State University

### Carl Malings

NASA Goddard Space Flight Center/Morgan State University

## Guest Instructors

### Susan Anenberg

The George Washington University

### Qian Xiao

University of Texas

### Danielle Wood

Massachusetts Institute of Technology

### Tanya Kreutzer Sayyed

University of MD, Baltimore County

### Shobhana Gupta

NASA Equity and Environmental Justice

### Gaige Kerr

The George Washington University

### Ufuoma

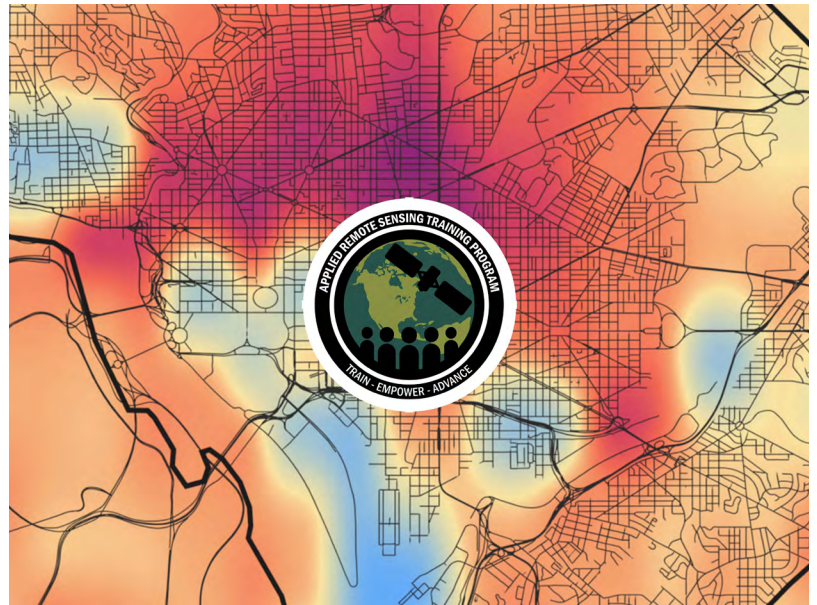
Ovienmhada  
Massachusetts Institute of Technology

### Mitra Kashani

Centers for Disease Control and Prevention

### Daniel Carrion

Yale University



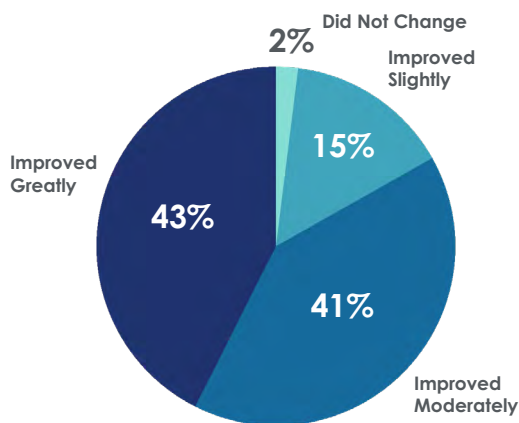
## Satellite Data for Air Quality Environmental Justice and Equity Applications

August 23, 2023 - September 06, 2023 Online Instructor-Led Intermediate

This three-part training, in collaboration with the Health and Air Quality Applied Sciences Team (HAQAST) Tiger Team on Satellite Data for Environmental Justice (SD4EJ), demonstrates how remotely-sensed environmental indicators, specifically for air pollution, can be paired with demographic data to understand disproportionate exposures among minoritized and marginalized population subgroups.

## Statistics

As a result of this ARSET training, my ability to describe how satellite data have been combined with socioeconomic information to investigate EJ issues such as heat exposure or access to green space...



1,065  
Participants

97  
Countries

659  
Organizations

46  
US States

## From the Participants

*"I found the HAQAST forum to be an informative and engaging platform. It provided valuable insights and fostered meaningful discussions about health and air quality applied sciences. I look forward to participating in future discussions and learning more from this community."* (Survey Comment, September, 2023; Unemployed, India)

*"I work on EJ analysis for the EPA. Data obtention for the most underserved communities is always difficult, and ensuring that we're working 'with' rather than doing 'to' communities always demands active recognition of the historical role governments may have played in creating the current state in which these communities function. In this case, remote sensing products that are easily accessible and speak to issues (e.g., air quality) that people really care about to empower them to take action are vital."* (Survey Comment, September, 2023; Federal Government Employee, United States)

## Host

**Sean McCartney**

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Guest Instructors

**Alex Ruane**

NASA Goddard Institute for Space Studies

**Sanketa Kadam**

NASA Goddard Institute for Space Studies/Columbia University

## Guest Contributors

**Nick Pelaccio**

NASA Goddard Institute for Space Studies/Columbia University

## Statistics

**790**

Participants

**586**

Organizations

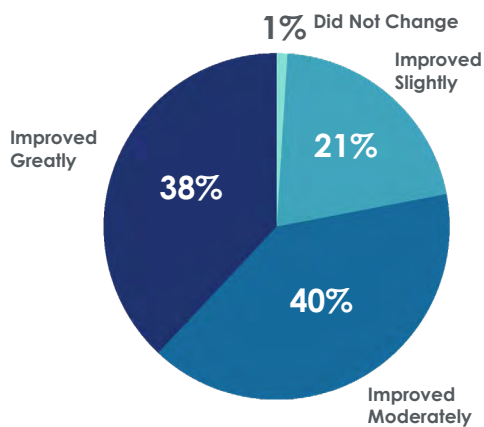
**103**

Countries

**37**

US States

My ability to identify components of my own system that are vulnerable or exposed to climate risks...



## Building Climate Risk Assessments from Local Vulnerability and Exposure

September 19, 2023 - September 21, 2023

Online Instructor-Led    Introductory

This two-part training describes climate risk assessment approaches that originate with stakeholder expertise in the fundamental climate vulnerability and exposure of their system. This training also provides an assessment and engagement framework and uses examples from the NASA Climate Adaptation Science Investigators (CASI) Program that is preparing NASA facilities for future climate resilience.



## From the Participants

*“Wow, what an invaluable course to offer participants around the world and it was free! I learned a great deal and Alex’s perspective as a scientist who contributed to the latest AR6 report was extremely helpful. I reference the IPCC reports frequently in my line of work and it was helpful to learn in greater detail about the components that contribute towards improved decision making on such a complex issue. As a US Citizen, I feel my tax dollars have been well spent on the science NASA has put forth as this organization is leading the world on tackling the climate crisis with the best possible science. Keep up all the great work ARSET and NASA!”* (Survey Comment, October, 2023; Federal Government Employee, United States)

*“Thank you for organizing this. Much appreciated. For a person living in Nepal and having access to resources of NASA, this is profoundly generous of you people.”* (Survey Comment, October, 2023; Private Sector Employee, Nepal)



## Host

### Brock Blevins

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Guest Instructors

### Charles Huyck

ImageCat

### Georgiana Esquivias

ImageCat

### Michael Eguchi

ImageCat

### Greg Yetman

CIESIN/Columbia University

### Juan Martinez

Center for International Earth Science Information Network/Columbia University

### Taylor Hauser

Oak Ridge National Laboratory (ORNL)

### Paul Amyx

ImageCat

### Marina T. Mendoza

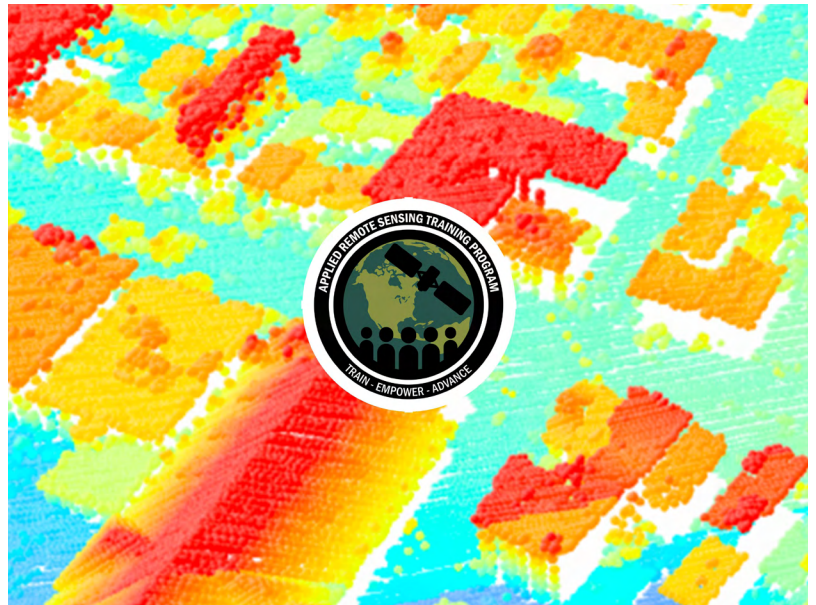
ImageCat

### Amy Rose

Oak Ridge National Laboratory (ORNL)

### Philippe Ambrozio Dias

Oak Ridge National Laboratory (ORNL)



## Transforming EO Data into Building Infrastructure Data Sets for Disaster Risk Modeling

October 03, 2023 - October 10, 2023 Online Instructor-Led

Intermediate

This three-part training covers the basics of natural hazard risk modeling and exposure development with a focus on fusing data from multiple datasets expressly for the purposes of risk assessment. It also presents examples that apply the techniques to applications related to flood risk assessment, climate adaptation, and earthquake modeling. Part of the work highlighted in this training was funded by the NASA Disasters program.

## Statistics

808

Participants

628

Organizations

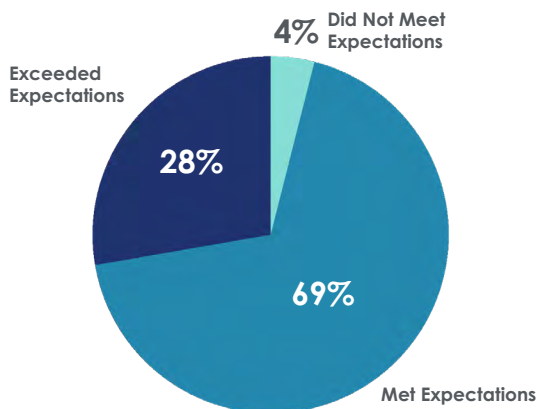
101

Countries

29

US States

How did this ARSET training meet your expectations?



## From the Participants

"I have taken ARSET courses numerous times to get briefing on current operational practices. I know what to expect from the courses. I find them to be quite worthwhile and will continue to take them when the time and subject area align with my needs. Great work!" (Survey Comment, October, 2023; NGO Employee, United States)

"We work with local fishermen and one of the greatest challenges we face is identifying potential areas for fishing while at the same time ensuring that we do not compromise on the conservation effort. Others include issues of coral bleaching which we monitor at a small scale. [It] Would be useful to develop local algorithms (or products) that can monitor larger areas with precise accuracy. At the moment, current products seems to over estimate coral bleaching alerts." (Survey Comment, October, 2023; Student, Kenya)



## Host

### Erika Podest

NASA Jet Propulsion  
Laboratory/Caltech

## Guest Instructors

### Eric Fielding

NASA Jet Propulsion  
Laboratory/Caltech

### Malin Johansson

UiT The Arctic University of  
Norway

### Franz Meyer

Alaska Satellite Facility/  
University of Alaska,  
Fairbanks

## Statistics

**918**

Participants

**662**

Organizations

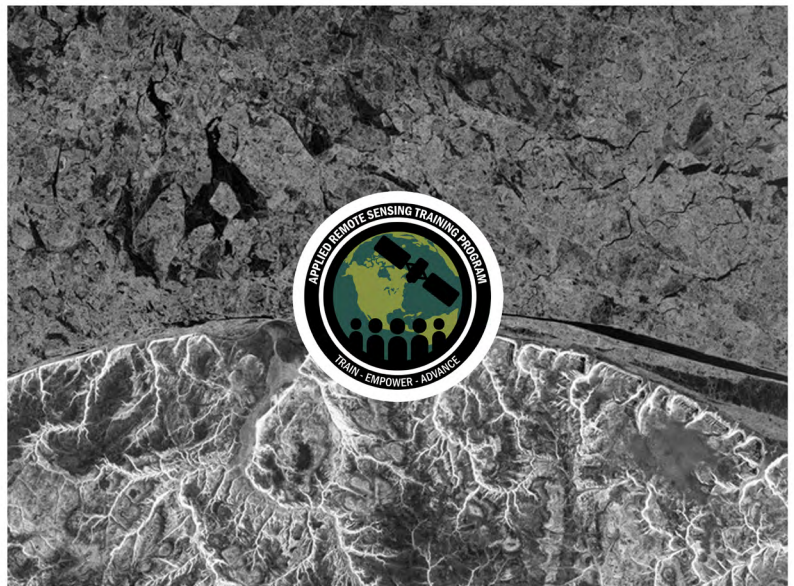
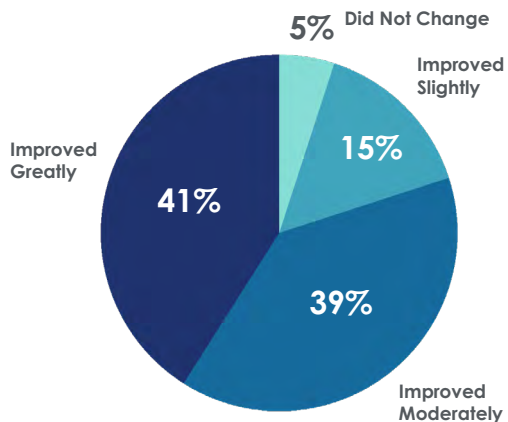
**105**

Countries

**31**

US States

My ability to detect and monitor sea ice to identify potential risks to shipping and coastal erosion...



## SAR for Detecting and Monitoring Floods, Sea Ice, and Subsidence from Groundwater Extraction

October 24, 2023 - November 1, 2023 Online Instructor-Led

Advanced Bilingual

This three-part training is a follow-on to the SAR training held in October 2022, which covered detection and monitoring of oil spills, landslides, and floods. This training expands on the theory and applications of SAR data to detect and monitor floods through the use of SAR time-series in order to more closely monitor the increase/recession of flood waters. This training also covers two new application areas: the use of InSAR to measure subsidence due to groundwater extraction, and the use of SAR to detect and monitor sea ice.



## From the Participants

*"I am lucky to follow ARSET some years now. This was another well designed Webinar with new knowledge for SAR tools and methodologies that are available and new data and missions to come. All three sections (Ice, Floods, Subsidence) were covered thoroughly giving the feeling of the researchers doing the actual work, but each of these subjects deserve a separate Webinar in the future. Thank you all NASA ARSET and guest instructors / researchers!"* (Survey Comment, November, 2023; Water Utility Employee, Greece)

## ARSET Instructors

### Britnay Beaudry

NASA Ames Research Center/Bay Area Env. Research Institute

### Amber McCullum

NASA Ames Research Center/Bay Area Env. Research Institute

### Sativa Cruz

NASA Ames Research Center/Bay Area Env. Research Institute

### Juan L. Torres-Pérez

NASA Ames Research Center

## Statistics

**854**

Participants

**613**

Organizations

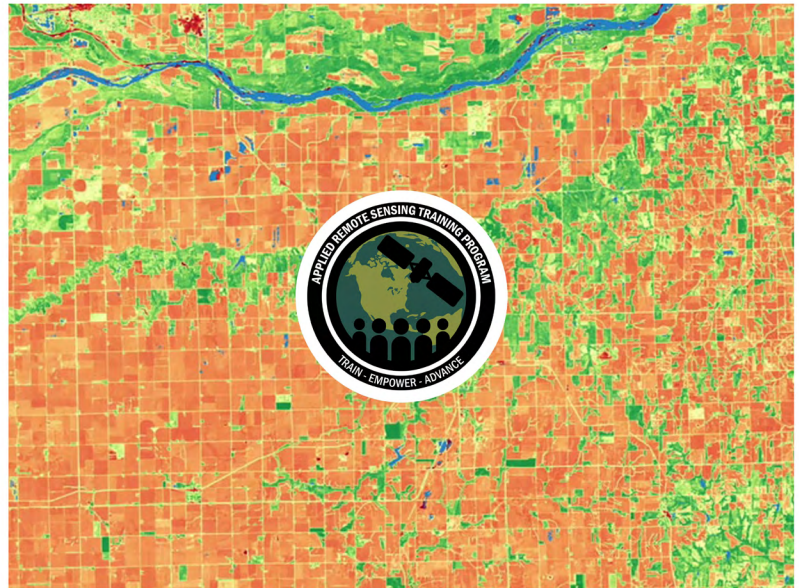
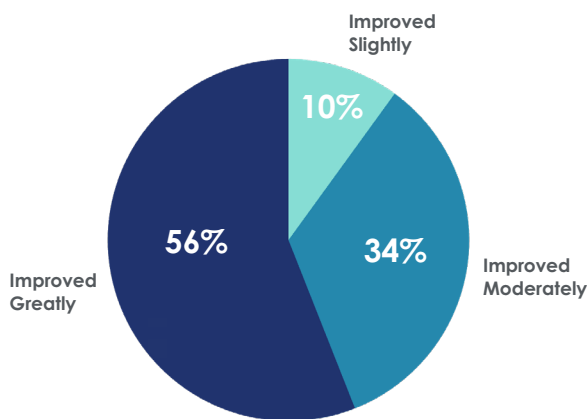
**96**

Countries

**43**

US States

100% of participants reported improved understanding of how EO data and tools can be used for citizen science projects, with 56% reporting that their understanding improved greatly.



## Spectral Indices for Land and Aquatic Applications

October 26, 2023 - November 09, 2023 Online Instructor-Led Introductory

This training provides an overview of spectral indices for land and aquatic applications. Specifically, this training begins with an introduction to the Normalized Difference Vegetation Index (NDVI), along with its calculation, uses, and prominence in Earth science. Session two expands to other spectral indices primarily used in aquatic ecosystems, such as the Normalized Difference Chlorophyll Index (NDCI), Normalized Difference Aquatic Vegetation Index (NDAVI), Floating Algal Index (FAI), and Normalized Difference Turbidity Index (NDTI) for aquatic applications. The final session includes additional land-based indices such as the Enhanced Vegetation Index (EVI), Soil-Adjusted Vegetation Index (SAVI), and Normalized Burn Ratio (NBR).



## From the Participants

*“To enhance the utilization of remote sensing data for land and aquatic applications, gaining expertise in advanced image processing techniques, such as machine learning algorithms for classification and feature extraction, would be valuable. Additionally, acquiring knowledge in specific sensors like SAR (Synthetic Aperture Radar) for water-related studies and hyperspectral imaging for detailed land characterization could be beneficial. For improved ARSET trainings, consider incorporating hands-on exercises with real-world datasets, fostering collaboration through discussion forums, and providing case studies relevant to diverse geographical regions. Integration of emerging technologies like augmented reality for virtual fieldwork simulations may also enhance the learning experience. Regular updates to encompass the latest advancements in remote sensing technology.”* (Survey Comment, November, 2023; State Government Employee, Pakistan)



# ARSET en Español

Desde el inicio del programa en el año 2009, nos esmeramos en hacer nuestras capacitaciones accesibles al mayor número de personas posible. Una de las formas en las que hacemos esto es traduciendo todo el material didáctico de cada capacitación al español. Con la ayuda de algunos de nuestros instructores de habla hispana y nuestro traductor, también ofrecemos ciertas capacitaciones completamente en español. En los últimos 10 años, hemos ofrecido un total de 152 capacitaciones en las Américas en español. Como resultado de estas capacitaciones, hemos podido capacitar a 47,320 hispanohablantes. Este impacto es gracias a nuestro traductor y nuestros instructores de habla hispana.

## Nuestro Traductor, David Barbato



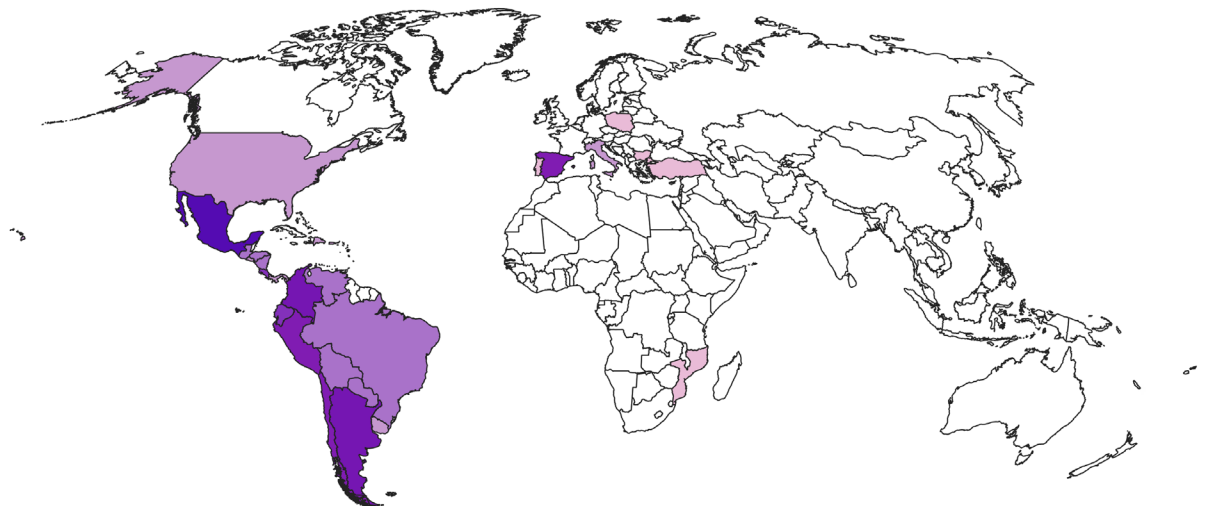
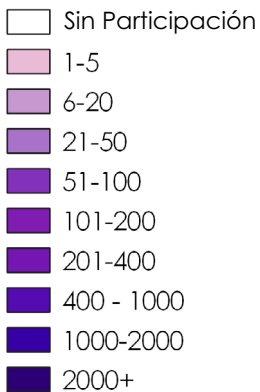
Después de obtener mi licenciatura en español, empecé a trabajar en el sector privado donde pasé varios años en diferentes empleos corporativos. Eventualmente, me di cuenta que pasar todos los días en una oficina comercial con todo girando alrededor de las ganancias no me llenaba y que algo tenía que cambiar. ¿Qué, exactamente? No lo sabía, pero después de un periodo de introspección, entendí que valoro mucho la búsqueda del conocimiento y quería utilizar mis capacidades para algo relacionado con ello. Vi un aviso para un traductor de material de STEM (ciencia, tecnología, ingeniería y matemáticas, por sus siglas en inglés) y decidí postularme a pesar de no tener experiencia relacionada con la ciencia (¡o la capacitación!). El programa de ARSET estaba buscando ampliar su alcance y tuve la oportunidad de formar parte de ese crecimiento traduciendo materiales

de capacitaciones en línea del inglés al español. Esto sigue siendo la mayoría de lo que hago aquí en ARSET, pero con el tiempo, ha llegado a incluir otros tipos de contenido como tuits en las redes sociales, difusión pública e incluso he llegado a ser coautor de un par de artículos que aparecen en publicaciones científicas. Es verdaderamente gratificante trabajar con información que ofrece la posibilidad de mejorar y hasta salvar vidas y me complace saber que estoy ayudando a otras personas a adquirir estos conocimientos con la esperanza que los utilicen justamente para los fines mencionados.

## Mapa de Participación de Hispanohablantes

Participación 2023

Número de Participantes



## Instructores de ARSET

### Juan Torres-Pérez

NASA Ames Research Center

### Amber McCullum

NASA Ames Research Center/Bay Area Env. Research Institute

### Britnay Beaudry

NASA Ames Research Center/Bay Area Env. Research Institute

## Estadísticas

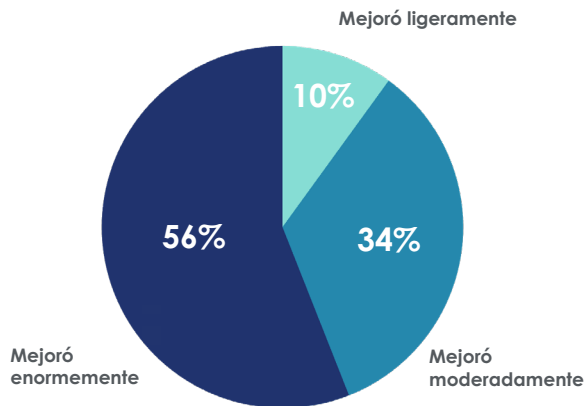
**1,169**  
participantes

**767**  
organizaciones

**107**  
países

**39**  
estados de EE. UU.

El 100 % de los participantes reportó una mejor comprensión de cómo se pueden utilizar los datos y las herramientas de observación de la tierra para proyectos de ciencia ciudadana, y el 56 % reportó que su comprensión mejoró enormemente.



## De los Participantes



*“Me identifico como parte de de una comunidad carente de servicios, es por ello que tengo mucho interes en participar de estos cursos, muy importantes, para pode transmitir este conocimiento a los tecnicos de los municipios de mi localidad. [I identify myself as part of a community devoid of services, which is why I am very interested in participating in these courses, which are very important, in order to transmit this knowledge to the technicians of the municipalities in my area.]” (Survey Comment, February, 2022; Federal Government Employee, Self-Identified as Member of Underserved Community, Peru)*



## Conectando la Ciencia Ciudadana con la Teledetección

24 al 31 de enero de 2023

Virtual

Introdutorio Bilingüe

Esta capacitación presentará una introducción a los esfuerzos de ciencia ciudadana que utilizan observaciones de la Tierra y cómo relacionarse con los miembros de las comunidades de manera significativa y alentadora para lograr las metas de sus proyectos. A las/ los participantes también se les presentarán ejemplos de estudios de caso de proyectos de ciencia ciudadana exitosos, en particular, aquellos financiados bajo el Programa de Ciencias Aplicadas de la NASA.



## Instructores de ARSET

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech and Applications Inc.

## Instructores Invitados

### Armando Marino

University of Stirling

### Krištof Oštir

University of Ljubljana

### Matej Račič

University of Ljubljana

### Heather McNairn

Agriculture and Agri-Food Canada

### Emily Lindsay

Agriculture and Agri-Food Canada

### Xianfeng Jiao

Agriculture and Agri-Food Canada



## Estadísticas

1,977

participantes

900

organizaciones

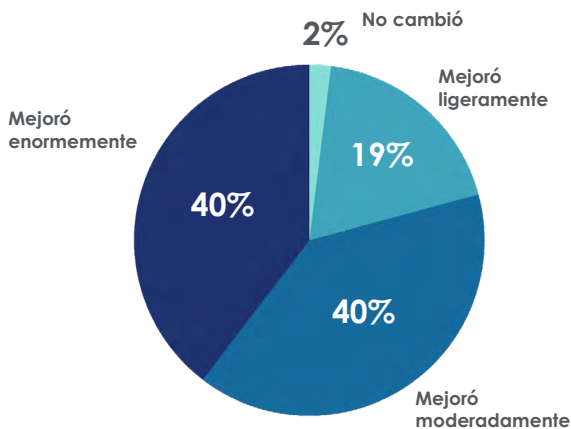
127

países

37

estados de EE. UU.

Mi capacidad para clasificar tipos de cultivos utilizando series temporales de radar e imágenes ópticas...



## Mapeo de Cultivos Usando Radar de Apertura Sintética (SAR) y Teledetección Óptica

4 al 11 de abril de 2023

Virtual

Avanzado Bilingüe

Esta capacitación avanzada de tres partes está basada en capacitaciones agrícolas de ARSET anteriores. Aquí presentamos técnicas de teledetección de radar más avanzadas usando polarimetría y un modelo dinámico de la estructura del dosel para monitorear el crecimiento de los cultivos. Esta capacitación también cubrirá cómo aplicar métodos de aprendizaje automático para clasificar tipos de cultivos usando una serie temporal de imágenes de Sentinel-1 y Sentinel-2.

## De los Participantes

*“En general muy buenos los talleres y muy interesantes los temas. Agradezco mucho que los instructores proporcionaran sus códigos para poder adaptarlos a nuestros propios casos de estudio. [In general, the workshops are very good and the topics are very interesting. I really appreciate that the instructors provided their codes so we could adapt them to our own case studies.]”* (Survey Comment, April, 2023; Faculty, Colombia)



## Anfitriones

### Brock Blevins

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech

## Instructores Invitados

### Jordan A.

#### Caraballo-Vega

NASA Goddard Space Flight Center/AST

### Caleb Spradlin

NASA Goddard Space Flight Center/ InuTeq, LLC

### Jian Li

NASA Goddard Space Flight Center/ InuTeq, LLC

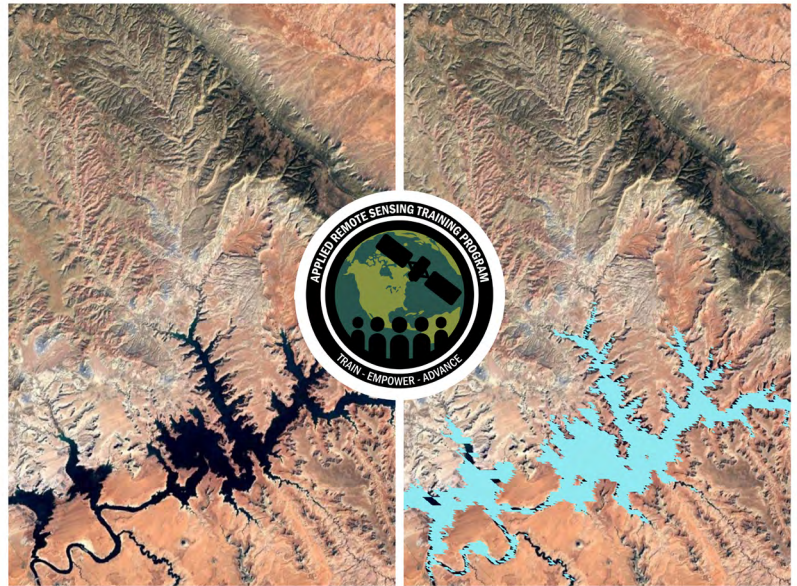
### Jules Kouatchou

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Contribuyentes Invitados

### Mark L. Carroll

NASA Goddard Space Flight Center/AST



## Fundamentos del Aprendizaje Automático para las Ciencias de la Tierra

20 de abril al 4 de mayo de 2023

Virtual

Introductorio

Bilingüe

## Estadísticas

3,056

participantes

1,744

organizaciones

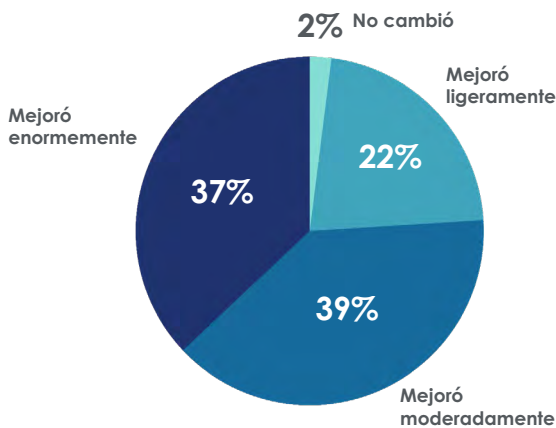
127

países

49

estados de EE. UU.

Mi capacidad para explicar cómo aplicar algoritmos básicos de aprendizaje automático y técnicas para datos de teledetección...



Esta capacitación presentará una visión general del aprendizaje automático orientado hacia las Ciencias de la Tierra y también, cómo aplicar estos algoritmos y técnicas de manera significativa a datos de teledetección. A los participantes también se les proporcionará ejemplos de estudios de caso de principio a fin para generar un modelo "random forest" para la clasificación de la cobertura terrestre a partir de la teledetección óptica. Además presentaremos estudios de caso adicionales para aplicar los flujos de trabajo presentados usando datos adicionales de la NASA.



## De los Participantes

*"Les agradezco el esfuerzo y el esmero en estructurar e impartir este curso. Son un muy valioso recurso de aprendizaje y los insto a seguir proveyendo estas experiencias, muy en especial a las poblaciones que hablan español. [I thank you for the effort and dedication in structuring and teaching this course. They are a very valuable learning resource and I urge you to continue providing these experiences, especially to Spanish-speaking populations.]"* (Survey Comment, May 2023; Private Sector Employee, Costa Rica)



## Instructores de ARSET

### Sean McCartney

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

### Erika Podest

NASA Jet Propulsion Laboratory/Caltech

### Amita Mehta

NASA Goddard Space Flight Center/University of MD, Baltimore County

## Estadísticas

33

participantes

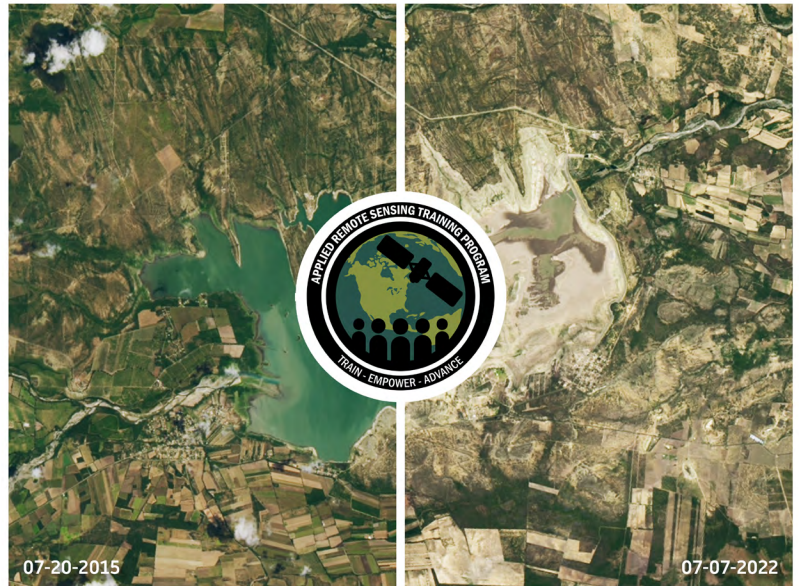
24

organizaciones



## De los Participantes

*“Estoy muy agradecido con el programa ARSET, me encantará seguir colaborando. Tal fue mi gusto por esto, que he decidido realizar una maestría que aborde estos temas. [I am very grateful to the ARSET program, I will love to continue collaborating. My pleasure in this was such that I have decided to pursue a master’s degree that addresses these topics.]”* (Survey Comment, May 2023; Local Government Employee, Mexico)



## La Teledetección para la Gestión del Riesgo de Desastres por Sequías, Incendios Forestales e Inundaciones en México

8 al 11 de mayo de 2023

En Persona

Avanzado

Español

Esta capacitación presencial es en colaboración con la Agencia Mexicana de Protección Civil del Municipio de García Nuevo León, México. La capacitación cubrirá metodologías sobre cómo generar productos relacionados con los desastres a partir de datos satelitales, así como el acceso a productos existentes pertinentes para la evaluación de las sequías, incendios e inundaciones. La capacitación se adaptará a zonas de estudio de México que han sufrido estas tres catástrofes en los últimos años. Esta capacitación proporcionará la capacidad para identificar áreas en riesgo de desastres en México para mejor preparar a las Agencias de Protección Civil de todo el país en la planificación, mitigación y estrategias de recuperación.



## Anfitrión

### Brock Blevins

NASA Goddard Space Flight Center/Science Systems and Applications Inc.

## Instructores Invitados

### Charles Huyck

ImageCat

### Georgiana

#### Esquivias

ImageCat

### Michael Eguchi

ImageCat

### Greg Yetman

CIESIN/Columbia University

### Juan Martinez

Center for International Earth Science Information Network/Columbia University

### Taylor Hauser

Oak Ridge National Laboratory (ORNL)

### Paul Amyx

ImageCat

### Marina T. Mendoza

ImageCat

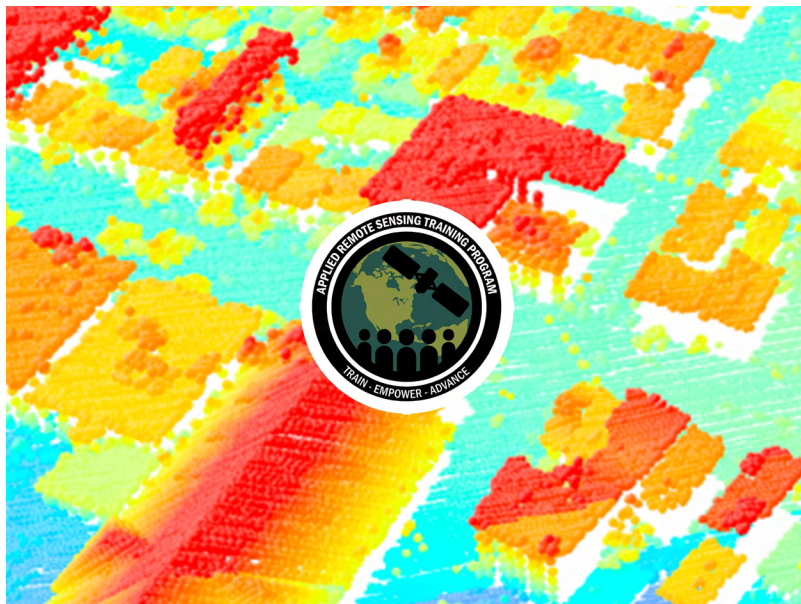
### Amy Rose

Oak Ridge National Laboratory (ORNL)

### Philippe Ambrozio

#### Dias

Oak Ridge National Laboratory (ORNL)



## ARSET- Transformar Datos de Observación de la Tierra en Conjuntos de Datos de Infraestructura Construida para la Modelación del Riesgo de Desastres

3 al 10 de Octubre de 2023

Virtual

Intermedio

Esta capacitación de tres partes cubre los conceptos básicos del modelación de riesgos de peligros naturales y el desarrollo de la exposición con un enfoque en la fusión de datos de múltiples conjuntos de datos expresamente para los fines de la evaluación de riesgos. También presenta ejemplos que aplican las técnicas a aplicaciones relacionadas con la evaluación del riesgo de inundaciones, la adaptación al clima y el modelación de terremotos. Parte del trabajo destacado en esta capacitación fue financiado por el programa de Desastres de la NASA.



## Estadísticas

808

participantes

628

organizaciones

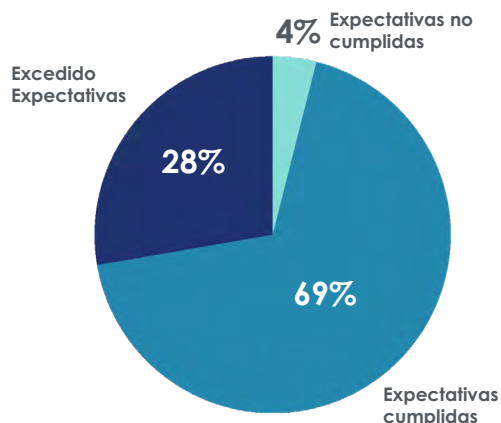
101

países

29

estados de EE. UU.

¿Cómo esta capacitación ARSET se adaptó a sus expectativas?



## De los Participantes

*“Trabajo con comunidades campesinas e indígenas que se ven afectados directamente por el cambio climático por medio de la sequía extrema o de inundaciones muy grandes. Por ello es muy importante el monitoreo y la generación de información para poder responder a estos eventos. [I work with farming and indigenous communities that are directly affected by climate change through extreme drought or very large floods. Therefore, monitoring and generating information is very important to respond to these events.]” (Survey Comment, October, 2023; Federal Government Employee, Argentina)*



## Instructores de ARSET

### Erika Podest

NASA Jet Propulsion  
Laboratory/Caltech

## Instructores Invitados

### Eric Fielding

NASA Jet Propulsion  
Laboratory/Caltech

### Malin Johansson

UiT The Arctic University of  
Norway

### Franz Meyer

Alaska Satellite Facility/  
University of Alaska,  
Fairbanks

## Estadísticas

**918**

participantes

**662**

organizaciones

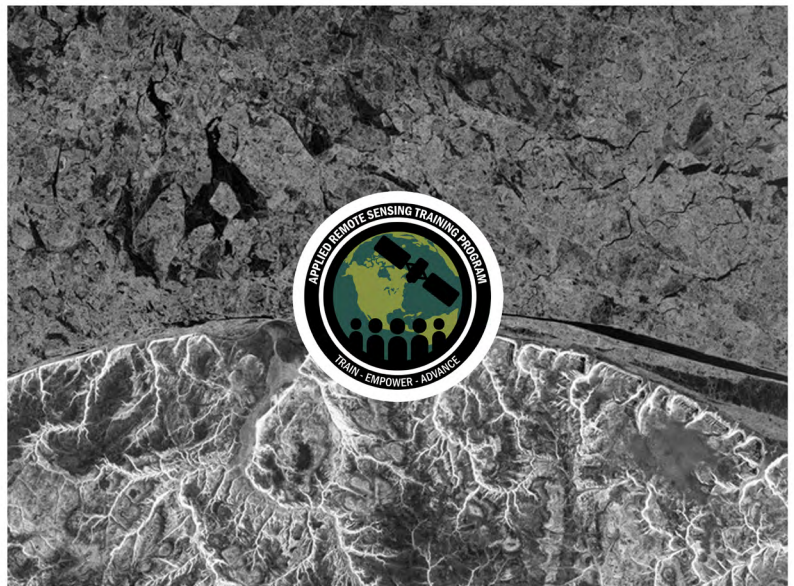
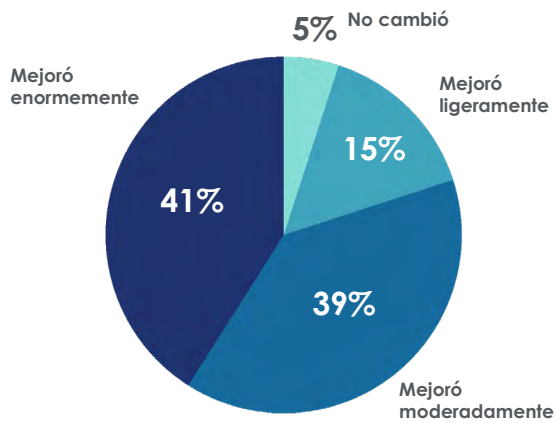
**105**

países

**31**

estados de EE. UU.

'Mi capacidad para detectar y monitorear el hielo marino, inundaciones y la subsidencia del suelo por extracción de agua...



## SAR para la Detección y el Monitoreo de Inundaciones, el Hielo Marino y la Subsidencia del Suelo por Extracción de Agua

24 de octubre al 1 de noviembre de 2023

Virtual

Avanzado Bilingüe

Esta capacitación profundizará la teoría y aplicaciones de datos de SAR para detectar y monitorear inundaciones mediante el uso de imágenes temporales de radar con la finalidad de monitorear más de cerca el incremento/disminución de las inundaciones. Esta capacitación también cubrirá dos nuevas aplicaciones: el uso de interferometría por radar de apertura sintética (InSAR) para medir la subsidencia del suelo por la extracción de aguas subterráneas y el uso de SAR para detectar y monitorear hielo marino.

## De los Participantes

"Los jóvenes de Nuevo León, sobre todo del municipio de Monterelos se encuentran muy desatendidos en cuanto a el desarrollo de habilidades científicas y tecnológicas, los cursos de NASA ARSET han cambiado el pensar de los jóvenes y los ha impulsado a seguir desarrollando proyectos e investigaciones que les permitan participar en diferentes Expo Ciencias. Agradecemos sobre todo que sean de forma gratuita, ya que la mayoría de este tipo de cursos tiene costo y los jóvenes en su mayoría no pueden costearlo. [The young people of Nuevo León, especially the municipality of Monterelos, are very neglected in terms of the development of scientific and technological skills. The NASA ARSET courses have changed the thinking of young people and have encouraged them to continue developing projects and research that allow them to participate in different Science Expos. We especially appreciate that they are free, since most of these types of courses have a cost and most young people cannot afford them.]" (Survey Comment, November, 2023; Faculty, Mexico)

# Participant Highlights

**Isaac Mureithi**, Kenya, Academia (Student)



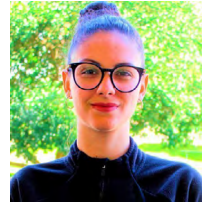
Isaac Mureithi is a student at the KCA University in Kenya interested in risk assessment and climate impacts, especially floods, drought, and food price fluctuations that impact Kenya. After attending the April machine learning training, he noted: "The class has given me a great insight into how Machine Learning can be blended into Actuarial Science. I never imagined that these two fields could work hand in hand. I am now better equipped to understand how data analytics can be applied in Actuarial Science to solve complex problems." He aspires to work in the field of parametric insurance on topics that relate to social issues.

**Liz Silva**, Philippines, Federal/Central Government



Liz Silva is involved with climate change and solid waste management through the Climate Change Service at The Philippines Department of Environment and Natural Resources. She is a member of the National Greenhouse Gas Inventory team for the Waste Sector and the focal person for the UN Environment and Climate and Clean Air Coalition on Short-lived Climate Pollutants (SLCPs) in the Philippines. She handles SLCP related matters including capacity building, providing technical assistance to stakeholders, and supporting policy and regulatory development. Liz attended nine ARSET trainings in 2022, often staying up late in the evening to attend the live sessions, and frequently sharing resources from the sessions with her colleagues. As The Philippines seek to increase their use of geospatial data, ARSET trainings helped Liz strengthen her understanding of the different applications of remote sensing data related to climate impact modeling and tracking Nationally Determined Contributions, or NDCs.

**Rafaela Tiengo**, Portugal, Academia



Rafaela Tiengo is a remote sensing scientist at the MaCoBioS Project and a PhD student at the Polytechnic University of Madrid in Spain. She is currently studying land use and land cover change on small islands and has referenced ARSET trainings for information on using Google Earth Engine, SAR, and optical data in her research, and to increase her understanding of related topics. In addition to using ARSET as a resource to further her own knowledge, Rafaela shares a variety of news and resources related to Remote Sensing science via her newsletter, Twitter, LinkedIn, and on The Scene From Above Podcast - with a new upcoming season - in which she is the news correspondent."

**Lucas Gobatti**, Switzerland, Academia (Student)



Lucas Gobatti, a current PhD candidate at the ETH Zürich and Eawag (Swiss Federal Institute of Aquatic Science and Technology), attended the August 2022 ARSET webinar "Satellite Remote Sensing for Measuring Urban Heat Islands and Constructing Heat Vulnerability Indices." After the training, he reached out to ARSET trainer Sean McCartney for assistance with technical aspects of the data and was provided with additional resources. In June 2023, Lucas and his colleagues Peter Marcus Bach, Andreas Scheidegger, and João Paulo Leitão published a scientific paper where they devised a method to estimate how long it takes for newly built urban vegetated areas to reach their full cooling capacity. The resulting paper, "Using satellite imagery to investigate Blue-Green Infrastructure establishment time for urban cooling," was based on the code provided in the heat islands training.



# The ARSET Team



**Melanie Follette-Cook**  
Project Scientist  
Instructor - Health & Air Quality



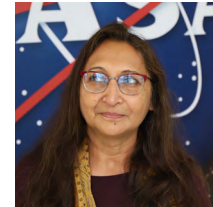
**Pawan Gupta**  
Instructor - Health & Air Quality



**Carl Malings**  
Instructor - Health & Air Quality



**Sarah Strobe**  
Instructor - Health & Air Quality



**Amita Mehta**  
Instructor - Water Resources/Disasters



**Erika Podest**  
Instructor - Water Resources/Disasters



**Sean McCartney**  
Instructor - Water Resources/Disasters



**Amber McCullum**  
Instructor - Ecological Conservation



**Britnay Beaudry**  
Instructor - Ecological Conservation



**Juan Torres-Pérez**  
Instructor - Ecological Conservation



**Sativa Cruz**  
Instructor - Ecological Conservation



**Brock Blevins**  
Training Coordinator



**Selwyn Hudson-Odoi**  
Training Coordinator



**Natasha Johnson-Griffin**  
Training Coordinator



**David Barbato**  
Translator



**Sarah Cutshall**  
Editor/  
Communications



**Jonathan O'Brien**  
Editor/  
Communications



**Suzanne Monthie**  
Instructional Designer



**Kevin Fuell**  
Instructional Designer



**Annelise Carleton-Hug**  
Training Evaluation



**Marines Martins**  
Training Certification



**Thank You!**