



NASA's Applied Remote Sensing Training Program

Train. Empower. Advance.

2016 Annual Report



NASA's Applied Remote Sensing Training Program (ARSET)

Vision: Enabling better decisions for a better planet

Mission: Empowering the global community through remote sensing trainings

NASA's Applied Remote Sensing Training Program (ARSET) empowers the global community through remote sensing training. Through online and in-person training, participants learn how to use NASA Earth data and models for environmental management and decision support. Trainings are intended primarily for policymakers, NGOs, and other applied science professionals. To learn more, visit <http://arset.gsfc.nasa.gov>.

Since 2009, more than 8,000 people have participated in ARSET trainings, representing over 2,600 organizations and 160 countries. ARSET provides two types of training:

Online Training

Online training is offered as a series of webinars over two to five weeks, one to two hours per week, and twice a day to accommodate multiple time zones. Online training is available at multiple levels from introductory to advanced. All training materials and recorded webinars are freely available on the ARSET website. Many training materials are available in both English and Spanish.

In-Person Training

In-person training is conducted in partnership with a stakeholder to meet the needs of a specific region or community. The training is held in a computer laboratory for two to six days. Attendees learn how to access, interpret, and apply NASA data with an emphasis on case studies and group projects and presentations.

Focus Areas for ARSET Trainings



Disasters



Health & Air Quality



Land



Water Resources



Wildfires



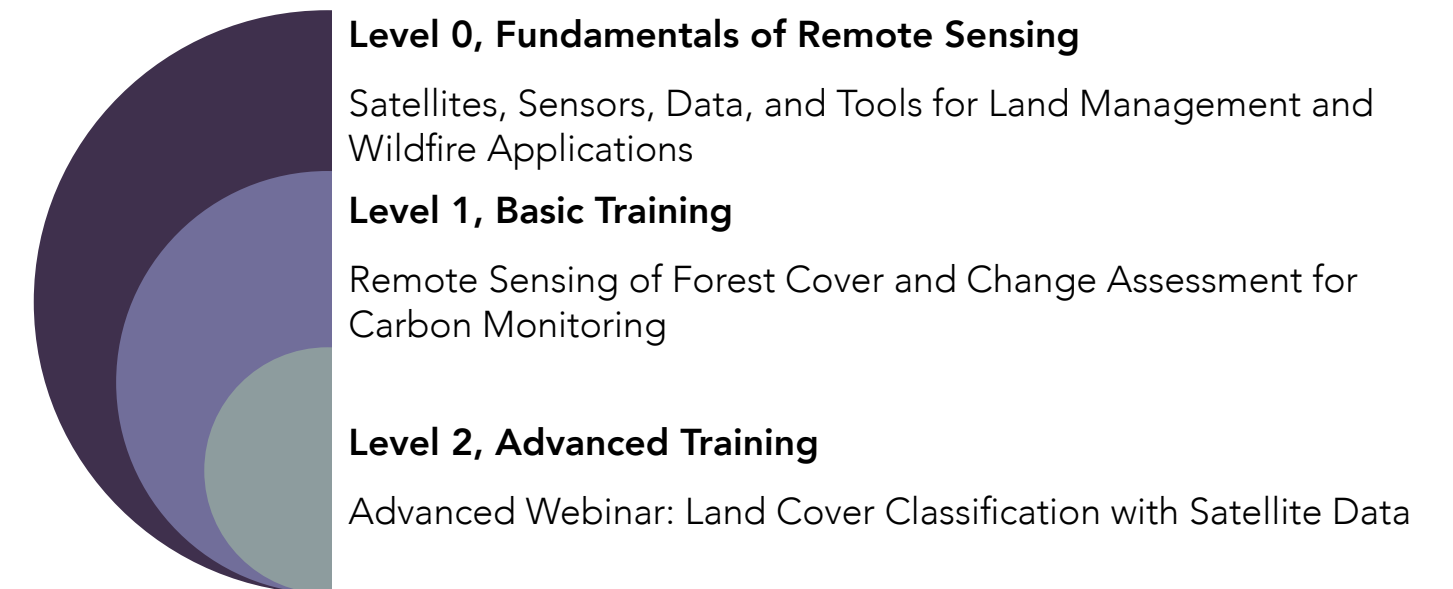
Train the Trainers

The Gradual Learning Process

ARSET offers training at a variety of levels. This allows participants to learn remote sensing based on their level of experience and need. Participants with no remote sensing experience can take a Level 0, or fundamentals of remote sensing, training followed by a Level 1, or basic, training. Level 0 and 1 trainings provide awareness of the principles of remote sensing, available NASA data and tools, and applications of these resources to environmental management.

Level 2, or advanced, training covers more complex data sets, analysis software, and their application to decision support. Attendees apply the knowledge and skills learned to specific case studies, and in some instances participants develop and present their own case study to other training participants.

Starting in 2015, ARSET added online Level 2 remote sensing training; previously, all Level 2 training was done in-person. In 2016, ARSET developed additional Level 2 online trainings: *Advanced Webinar: Using NASA Remote Sensing for Flood Monitoring and Management* and *Advanced Webinar: Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery*. By offering online trainings at all levels, ARSET continues to live up to its mission of empowering the global community.



In 2017, ARSET will develop additional Level 0, or fundamentals of remote sensing, trainings:

- NASA Satellites, Sensors, Data, and Tools for Water Resources Management
- Satellites, Sensors, Data, and Tools for Aquatic Remote Sensing

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2016 Accomplishments

trained
3,277
participants



engaged
1,449
organizations



trained
1,023
in one day



trained
768
in one series



reached
140
countries



hosted
15
trainings



participated in
36
meetings



hosted a
6
day training

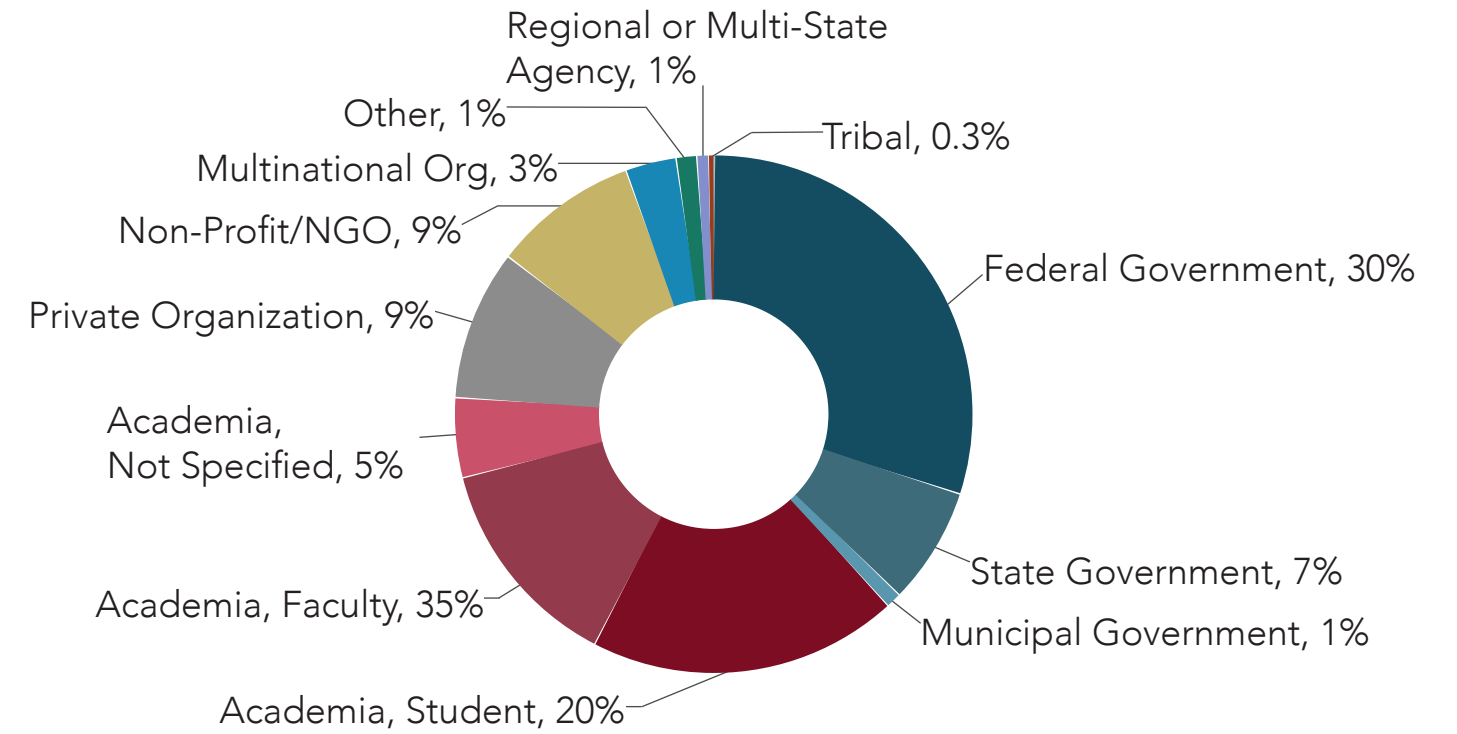


incorporated
6
new topics

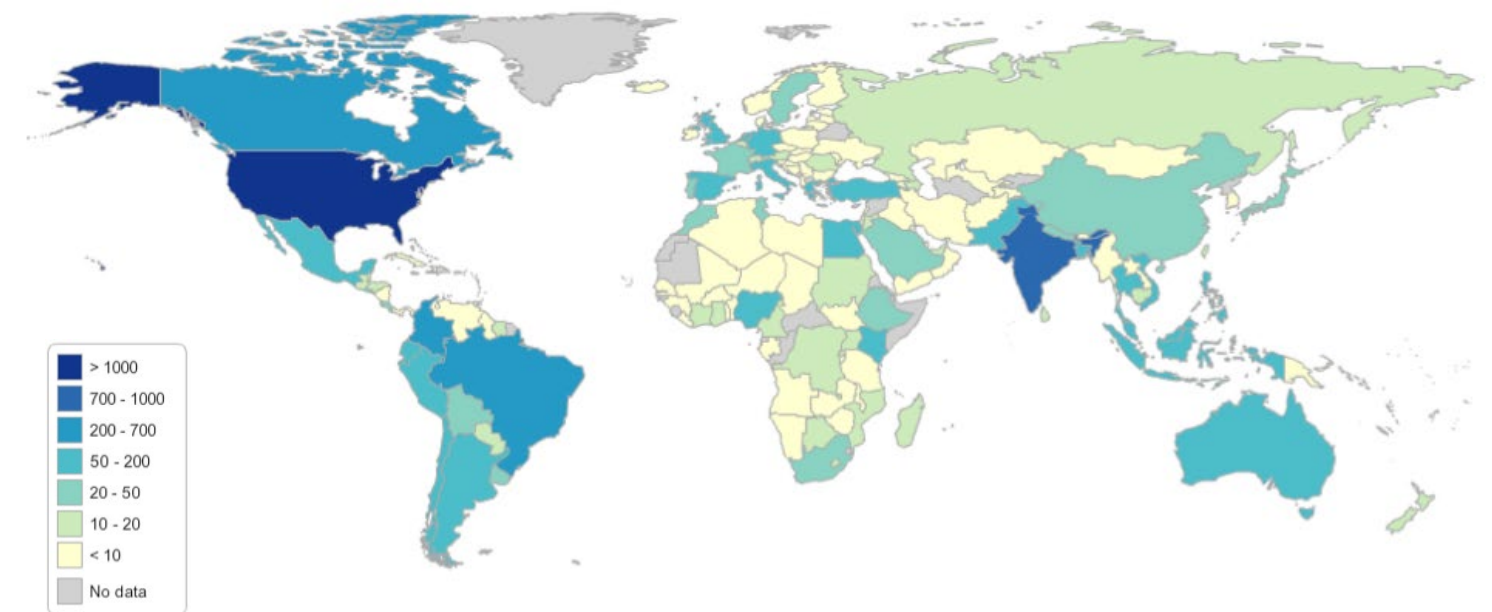


Participant Demographics

Participants by Sector (2009-2016)

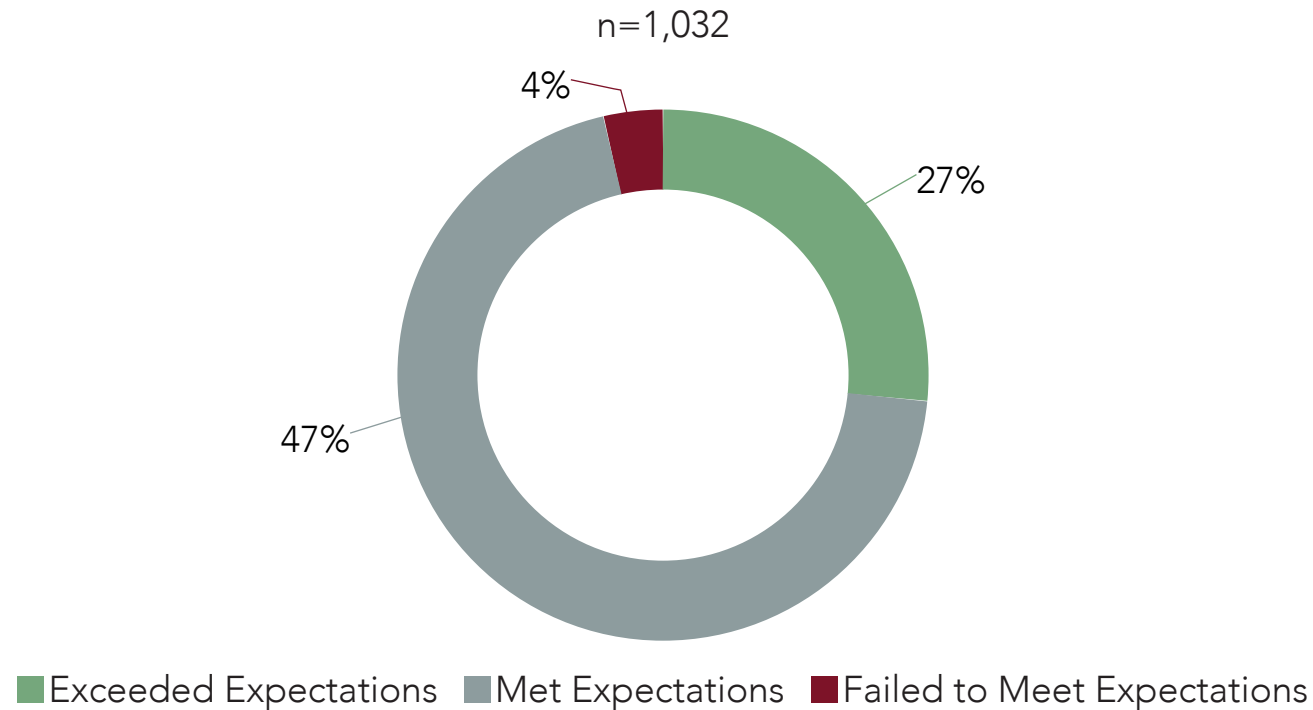


Participants by Country (2009-2016)

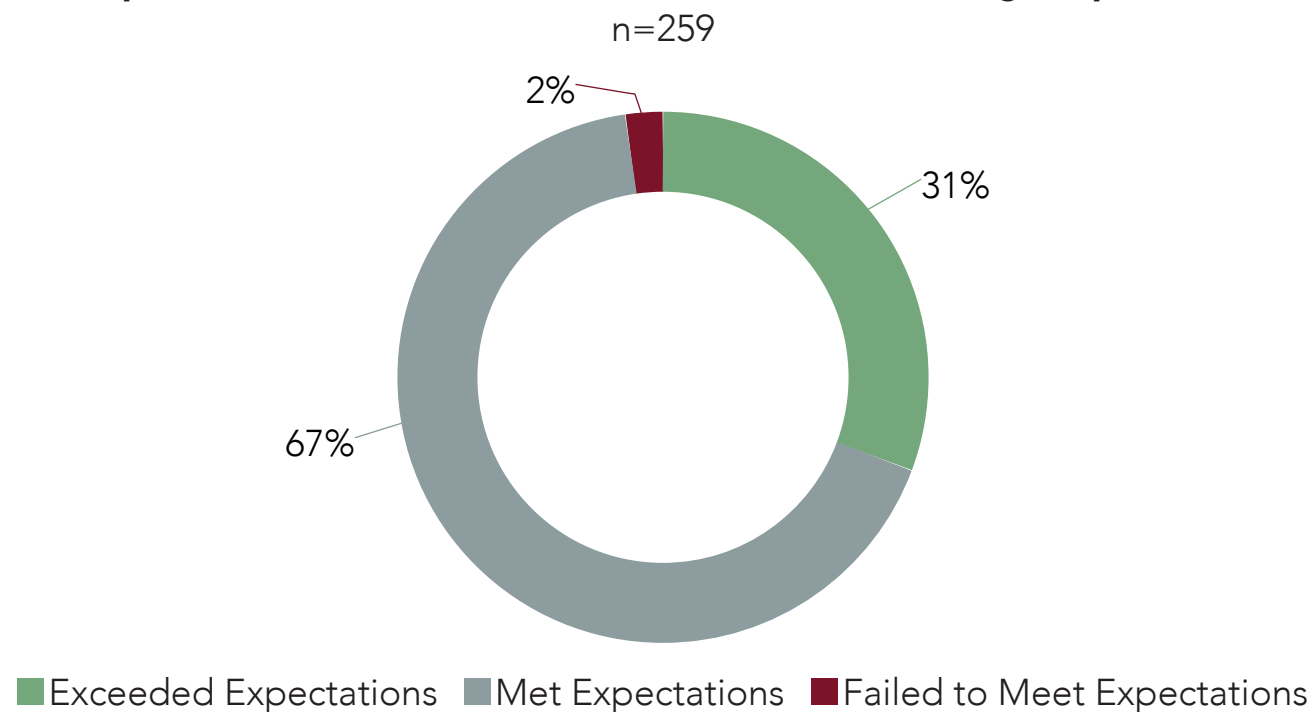


2016 Post-Training Survey Responses

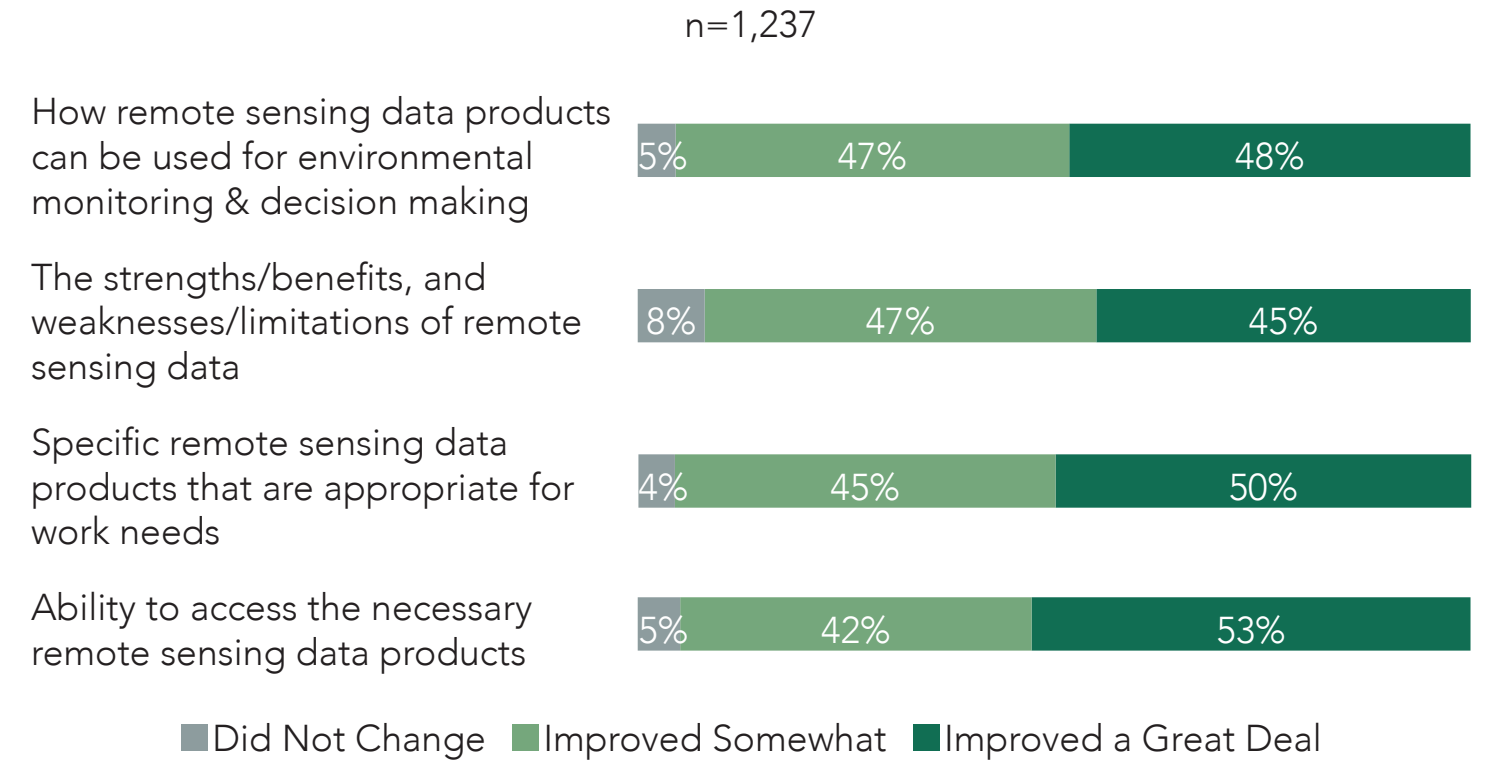
Satisfaction with ARSET Training (All Respondents)



Satisfaction with ARSET Training (Respondents with Little to no Remote Sensing Experience)



Participant's Perceptions of Change in Understanding as a Result of ARSET Training



About ARSET Program Evaluation

ARSET uses anonymous surveys and interviews for program evaluation. The surveys:

1. Assess attendees' progress towards meeting learning objectives
2. Assess the impact of NASA resources presented during the ARSET training on participants' decision-support activities
3. Collect information on the utility of specific NASA data and analysis tools
4. Gauge interest in future training topics

Two surveys are disseminated to program participants: one immediately after training, and one six months after training. The first survey provides detailed feedback on logistics of the training and immediate impressions from participants. The second survey is designed to assess the long-term impact of the training on participant decision-support activities, as well as the usefulness of specific satellite instruments and data access portals.

Interacting with the Global Community

International Conferences

- May 9-13: 8th Virtual Laboratory Management Group Meeting (Barbados)
- May 17-26: Combating Air Pollution in Northern India (India)
- Sep. 1: World Congress on Air Pollution and Better Air Quality Conference (Busan, South Korea)
- Oct. 25: African Association of Remote Sensing of the Environment (Uganda)

U.S. Conferences

- Jan. 13: EPA National Water Quality Monitoring Conference Planning Call, Virtual
- April 18-20: InterAction Forum (Washington D.C.)
- May 11: From Global to the Individual: the Health Impact of Air Pollution (Washington D.C.)
- June 6-9: National Center for Ecological Analysis and Synthesis Working Group Meeting (Santa Barbara, CA)
- June 20: Air Quality Monitoring and Health Impacts (Washington D.C.)
- Sep. 13-14: NOAA Satellite Aerosol Product Workshop for Science & Operational Users (College Park, MD)
- Sep. 28-29: LINGOS Learning Forum (Seattle, WA)
- Oct. 1-6: IUCN World Conservation Congress (Honolulu, HI)
- Nov. 14-17: 2nd International Smoke Symposium (Long Beach, CA)

Other Meetings

- March 14-16: Meeting with U.S. Forest Service Remote Sensing Applications Center, (Salt Lake City, UT)
- May 19: Indian Space Research Organization Center Visit (India)
- June 29: Environment, Science, Technology, and Health (ESTH) Foreign Service Presentation (Washington D.C.)
- Oct 5: North American Carbon Program Steering Committee Group Meeting (Washington D.C.)

NASA Meetings Attended by ARSET

ARSET is a member of five DAAC user working groups. The program also attends other NASA meetings to provide end-user feedback and stay up-to-date on new resources.

DAAC User Working Groups

- Atmospheric Science Data Center (ASDC)
 - Sep. 22-23: User Working Group Meeting
- Goddard Earth Sciences Data and Information Services Center (GES DISC)
 - Ongoing Interactions
- Land, Atmosphere, Near Real-Time Capability for EOS (LANCE)
 - Sep. 27: User Working Group Meeting
- Land Processes (LP DAAC)
 - June 21-22: Working Group Meeting
- Level 1 and Atmosphere Archive and Distribution System (LAADS)
 - Oct. 1: LAADSWeb Usability Group
- Oak Ridge National Laboratory DAAC (ORNL DAAC)
 - May 23-25: Working Group Meeting

NASA Meetings (PI, Missions, Working Group, Other)

- Jan. 5-7: NASA Air Quality Applied Sciences Team (Durham, NC)
- Feb. 29-Mar1: Wildfire PI Meeting (Boise, ID)
- March 29: Capacity Building Summit (LARC)
- April 18-19: LCLUC Spring Science Team Meeting (Bethesda, MD)
- April 26-28: Water PI Meeting (Tuscaloosa, AL)
- May 4-6: Ecoforecasting PI Meeting (Silver Spring, MD)
- May 19-20: SERVIR Applied Sciences Team Meeting (Washington D.C.)
- Jun 7-9: MODIS-VIIRS Science Team Meeting (Silver Spring, MD)
- Jul 13: TEMPO Meeting (Huntsville, AL)
- Sep 13: OCO-2 Science Data Applications and Technical Interchange Meeting (Washington D.C.)
- Sep 27-29: Workshop to Develop a Portfolio of Low-Latency Data Sets for Time-Sensitive Applications (LARC)

In 2016, ARSET continued to translate the majority of its training materials into Spanish. They are freely available on the ARSET webpage.

In July 2016, The program also delivered presentations in Spanish during an in-person training in Brazil. This effort, led by David Barbato (UMBC/JCET), has helped to engage stakeholders across Latin America.

ARSET Focus Areas: 2016 Trainings





Accomplishments

- Hosted first advanced webinar for disasters focus area
- During the advanced webinar, participants had the opportunity to conduct hands-on exercises similar to those used during in-person trainings
- The advanced webinar was the first online ARSET training that required a prerequisite homework assignment
- Hosted first disaster training not focused on flooding or precipitation
- The disaster overview training featured 24 tools and portals
- Trainings engaged more guest speakers and experts
- Added one new trainer with expertise in Synthetic Aperture Radar (SAR) data, who also assists with water resources trainings

Participant Feedback

Advanced Webinar: Using NASA Remote Sensing for Flood Monitoring and Management

The greatest benefit of the training the “Flooding Municipal Emergency Plans, the hydrometeorological part where you keep track of the event and allows you to set the different risk levels, counting on hydrological and meteorological thresholds.” - Attendee from State/Provincial Government, Spain

“Already we are deploying [the Global Flood Monitoring System] for a flood prone area (Bogra, Bangladesh), just observing to [what] extent we can use it, and [its] accuracy level.” - Attendee, Multi-National Organization, Bangladesh

“These tools have resolved [a] big problem of data availability from National Meteorological Departments and we can use it for our research and [to find] out patterns and identify flood prone areas in near future.” - Attendee from Federal/Central Government, Pakistan

Using NASA Remote Sensing for Disaster Management

“As a project manager, these webinars give me a sense of what is available in terms of remote sensing data and viable applications.” - Attendee from Federal Government, U.S.

“It provides the know-how for my continued professional development in the areas of environmental monitoring, modeling and research using GIS and Remote Sensing; as well as for educating university students and carrying out other outreach programs.” - Faculty Attendee, Nigeria

This training “will help me assess the damage of a disaster to propose remediation” - Attendee from Private Business, Colombia

Disasters Trainings

hosted
2
online trainings



trained
845
participants



engaged
545
organizations



reached
102
countries



reached
46
U.S. states





Training Summaries

Advanced Webinar: Using NASA Remote Sensing for Flood Monitoring and Management

March 16 - April 6

NASA has remote sensing resources available to help professionals with flood management. On Wednesdays from March 16 - April 6, 2016, ARSET hosted its first advanced disaster webinar series: *Using NASA Remote Sensing for Flood Monitoring & Management*. The goal of the training was to provide attendees the necessary skills to use NASA remote sensing data for flood management, from pre-flood monitoring to post-flood relief efforts.

This was ARSET's third and largest advanced webinar ever with 344 attendees from 238 organizations, 75 countries, and 35 U.S. states. It was also the first disasters webinar incorporating a significant use of hands-on activities. Throughout the training, NASA data access and tools were demonstrated using case studies. In the last week, participants applied the data and tools presented to two specific case studies: flooding in India, Nov. - Dec. 2015, and Mississippi River flooding, Dec. 2015 - Jan. 2016.

A majority of respondents to a post-training survey said their understanding of remote sensing improved a great deal, with 95 percent seeing some kind of improvement. About 90 percent of respondents found all elements of the training useful. Two thirds found the following extremely useful: instruction on available web tools to visualize, access, and analyze data; examples and case studies of data applications; and hands-on exercises.

Using NASA Remote Sensing for Disaster Management

June 9 - 30

Many of NASA's Earth observations can help with monitoring and managing natural disasters. On Thursdays in June, ARSET offered its first training to outline the variety of applications of remote sensing data for earthquakes, tsunamis, volcanoes, wildfires, oil spills, storms, flooding, and landslides.

In an effort to expose participants to as many tools as possible, the training covered 24 tools and web portals. In a post-training survey, a majority of respondents indicated that all listed elements of the training were extremely useful. The training met or exceeded expectations of 95 percent of respondents.

Practical Experience



Image Credit: NASA Earth Observatory Images, using Landsat data from USGS. Left: acquired Jan 10, 2015, Right: acquired Jan 3, 2016.

In the last week of the training *Advanced Webinar: Using NASA Remote Sensing for Flood Monitoring and Management*, participants applied the skills they learned to two specific case studies.

The first was the flooding of the Mississippi River in late December 2015. Participants looked at rainfall and flood intensity using the University of Maryland's Global Flood Mapping System, created a rainfall time series, and examined surface inundation with the MODIS Near Real-Time Global Flood Mapping Portal.



Image Credit: NASA Earth Observatory Images, using Landsat data from USGS. Left: acquired Oct. 21, 2015, Right: acquired Dec. 8, 2016.

The second case study was the flooding in Southern India in November and December 2015. Participants used the same tools as in the Mississippi River case study. This allows participants from different parts of the world to apply data more relevant to their daily lives.



Accomplishments

- Hosted the first ARSET training focused on health applications
- Developed a partnership with Clean Air Asia
- Initiated collaboration with the Indian Space Agency and the Indian Institute of Remote Sensing
- ARSET trainer Pawan Gupta participated in a four-city series of panels and discussions on air quality in Northern India, organized by the U.S. State Department
- An advanced webinar participant later attended in an in-person air quality training to share with attendees the skills he learned during the 2015 ARSET advanced webinar. He discussed his work using those skills to study the relationship between public health and regional air quality.
- Added two ARSET trainers: one with expertise in health applications of remote sensing, and the other with expertise in air quality applications of remote sensing

Health & Air Quality Trainings

hosted
2
online trainings



hosted
2
in-person trainings



trained
588
participants



engaged
399
organizations



reached
61
countries



reached
43
U.S. states



Participant Feedback

Fundamentals of Remote Sensing for Health Monitoring

"As a novice regarding remote sensing and its application for global health issues and patterns, I found the webinar series to be highly useful. The presenters taught the material in a manner [that] was easy to understand while touching on several technical aspects of remote sensing." - Attendee, State Government, U.S.

"The greatest benefit [of the training] is knowing where to find and access remote sensing data concerning vegetation cover and basic tools for analyzing habitat trends and characterizing rate of change." Attendee, Federal Government, U.S.

"[It's good to hear] about mosquito tracking - we are working on our Zika response. It's helpful to know the resources that remote sensing provides in this domain." - Attendee, Federal Government, U.S.

Introduction to Satellite Remote Sensing for Air Quality Applications

"The large number of use cases was useful. I loved to see how local context (environment, politics) could have an influence on the evolution of air quality. The list of trace [gases] by mission was great." - Attendee, Private Business, France

"I believe this opens new opportunities to tie up [the] nose level PM2.5 data our city is getting with NASA data, and I [was able] to think of a couple of ideas to make use of NASA's data." - Attendee, Private Business, Philippines



Training Summaries



Fundamentals of Remote Sensing for Health Monitoring

June 2 - 30

NASA Earth observations are a useful tool for monitoring and modeling public health. Remote sensing observations can be used for infectious disease tracking, monitoring toxic and pathogenic exposure, and risk characterization and mitigation. *Fundamentals of Remote Sensing for Health Monitoring* was ARSET's first training focused on health applications.

Over five weeks in June, 368 attendees learned how NASA funded principal investigators and stakeholders, like the Centers for Disease Control, use NASA data for health applications, as well as ways to detect harmful algal blooms and how to calculate mosquito-borne disease risk.

In a post-training survey, 91 percent of respondents indicated their ability to access remote sensing data products improved as a direct result of the training. One participant wrote that the greatest benefit of the training was "knowing that there is an open database with remote sensing [data] that could be used in practical epidemiological problems and solutions. The more technology and information we have, the more we can study certain problems and think of more solutions or alternative solutions."

Introduction to Satellite Remote Sensing for Air Quality Applications

July 6 - August 3

Healthy air is important globally, and NASA satellite observations provide data and images for monitoring and managing air quality all over the world. This introductory webinar series served as a prerequisite to prepare participants for two later in-person trainings. Attendees learned about the fundamentals of remote sensing, NASA particulate matter and trace gas products, and future satellite capabilities.

"The large number of [case studies] were helpful," one participant wrote. "I loved to see how local context (environment, politics) could have an influence on the evolution of air quality. [And] the list of trace gases by mission was great." Overall, participants were very pleased with the training. In a later survey, 96 percent of respondents said that the training met or exceeded their expectations. The majority of respondents also indicated all the tools presented during the training were useful. One participant

wrote, "I believe this opens new opportunities to tie up [the] nose level PM2.5 data our city is getting with NASA data, and I [was able] to think of a couple of ideas to make use of NASA's data."

NASA Earth Observations, Data, and Tools for Air Quality Applications

August 28 - 29

This two-day, in-person training was held in advance of the 17th IUAPPA World Clean Air Congress and 9th CAA Better Air Quality Conferences in Busan, South Korea. The 22 attendees learned about NASA remote sensing data through hands-on exercises and demonstrations on NASA data access.



ARSET trainer Pawan Gupta (USRA/NASA GSFC) giving a presentation at NASA Earth Observations, Data, and Tools for Air Quality Applications. Image Credit: Pawan Gupta

In a post-training survey, a majority of respondents indicated that the tools covered in the training would be useful for their work responsibilities. The training also met or exceeded the expectations of every survey respondent. One respondent wrote, "This training [will] provide a great benefit for my work, as [these] can be good tools to analyze pollution data in many different ways."

The Practical Use of Satellite Observations for Visibility and Air Quality Analysis

September 26

This in-person training was held as a full-day event at the Atmospheric Optics: Aerosols, Visibility, and the Radiative Balance Conference in Jackson Hole, WY. Attendees learned about satellite data and terminology and explored common and achievable uses for satellite data in air quality analysis. The training also outlined current methods for discovering, acquiring, and processing satellite data.



Accomplishments

- Hosted the first ARSET advanced land webinar
- Incorporated open source Geographic Information System program into training
- Developed trainings on carbon monitoring and ocean applications
- Cultivated relationships with SilvaCarbon and Jane Goodall Institute
- Strengthened existing partnerships with Conservation International and Google Earth Engine
- Provided the first ARSET training at the IUCN World Conservation Congress
- Added a new trainer to land team with expertise in coastal and marine applications of remote sensing

Participant Feedback

Advanced Webinar: Creating and Using NDVI from Satellite Imagery

"I really liked the exercises. Since you had them every week, I don't think I can ask for more, but training experiences like that for remote sensing are hard to find, and are, therefore, very valuable." - Attendee, State Government, U.S.

Remote Sensing of Forest Cover and Change Assessment for Carbon Monitoring

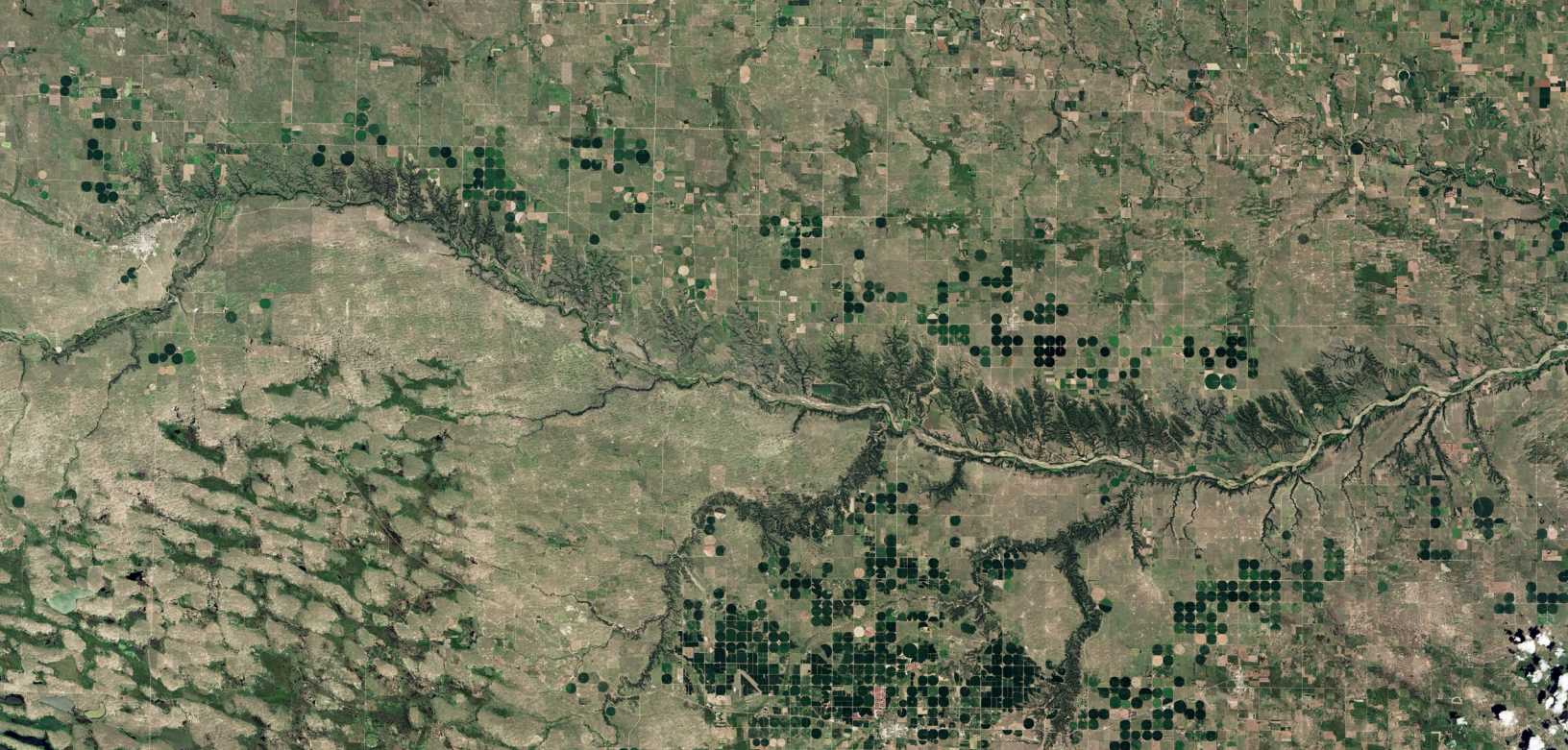
"First and foremost, this was one of the best, clearest, and most helpful webinar series that I have ever attended! What I personally found most beneficial was the clear presentation of REDD+ policies and guidelines, the role of IPCC, the relationship to UNFCCC, and finally how remote sensing can be used to satisfy the requirements. I also really appreciated the overview of the GFOI Methods and Guidance Document and other sources of information to guide people through the process of understanding policies and requirements and how to use remote sensing." - Attendee, Federal/Central Government, Costa Rica

Introduction to Remote Sensing for Coastal and Ocean Applications

"Sherry's ARSET was my favorite one so far!! She was very organized, easy to understand, and engaging! She even answered our questions at the end. That was very impressive. The content was also very interesting." - Attendee, Federal Government, U.S.

From Earth Observations to Earth Applications: Satellite Applications for Biodiversity Conservation

"The greatest benefit was learning how to access the remote sensing data I could use to improve my models of current and future distributions of animals and plants." - Attendee, Postdoc, U.S.



Land Trainings

hosted
3
online trainings



hosted
1
in-person training



trained
826
participants



engaged
488
organizations



reached
101
countries



reached
42
U.S. states





Training Summaries

Advanced Webinar: Creating and Using Normalized Different Vegetation Index (NDVI) from Satellite Imagery

February 10 - March 2

The Normalized Difference Vegetation Index (NDVI) can be used to monitor vegetation and crop health, phenology, track drought conditions, and monitor carbon. This advanced webinar trained attendees on how to acquire, use, and create NDVI imagery from NASA satellite data.

The four-week advanced webinar series provided training at a comparable level to ARSET in-person trainings with more opportunities for interactions between participants and trainers. The demonstrations, exercises, and homework for the training were specifically designed to cover the material with more depth. One advantage of the online format for advanced trainings is that it can accommodate many more participants than in-person. *Creating and Using NDVI from Satellite Imagery* had 121 attendees from 35 countries, compared to in-person trainings, which are typically limited to 30-50 attendees.

In a post-training survey, 92 percent of respondents indicated they saw improvement in their understanding of how to use remote sensing data products for environmental monitoring and decision-making as a direct result of the training. Participants were also able to connect their newly acquired skills to applications in their every-day work. One attendee from Morocco wrote, "As a forest fire manager, the use of the [Normalized Burn Ratio] will be of the greatest benefit for my work in the central level to assess the regeneration dynamics and the severity in the area burned."

Remote Sensing of Forest Cover and Change Assessment for Carbon Monitoring

June 9 - July 7

As levels of carbon dioxide in the atmosphere rise, so does the amount absorbed by forests. A 2014 NASA study found that tropical forests alone absorb 1.4 billion tons of carbon dioxide annually¹. In ARSET's first training focused on carbon monitoring, 427 participants learned how satellite data can be applied to carbon estimation, accuracy assessments, and verification.

Held in collaboration with SilvaCarbon, the training also featured several guest speakers. They shared their expertise on topics including the United Nations Framework Convention for Climate Change (UNFCCC), the Intergovernmental

Panel on Climate Change (IPCC), Reducing Emissions from Deforestation and Degradation (REDD), national forest monitoring systems, the National Forest Inventory, forest carbon stock estimation, statistical interference, Boston Education in Earth Observational Data Analysis (BEEODA) tools, and reporting requirements and verification.

In a post-training survey, 92 percent of respondents said that the training resulted in a greater understanding of how to use remote sensing data products for environmental monitoring and decision-making. One respondent wrote that the training was "a nice and comprehensive overview of state of the art methods for carbon monitoring and the broader context of REDD+." Another wrote that the training "definitely helped with my own understanding of REDD+ processes and requirements. [...] I will refer to all the course info when considering [and] developing training modules for capacity building (Central Africa / OSFAC) and will refer my colleagues to the material."

¹"NASA Finds Good News on Forests and Carbon Dioxide," 29 Dec 2014, <http://go.nasa.gov/2hyZlkz>

Introduction to Remote Sensing for Coastal and Ocean Applications

July 6 - 27

In its first training focused solely on coastal and ocean applications, ARSET engaged 247 attendees over the course of four weekly sessions. Attendees gained a basic understanding of remote sensing in aquatic environments, how to access and visualize relevant NASA Earth science data, and techniques for using remote sensing data for marine animal migrations and coral reef health.

In a post-training survey, 96 percent of respondents said the training met or exceeded their expectations. A majority of respondents indicated they were capable of using all the tools covered in the training. One respondent wrote, "[The greatest benefit of the training was] general awareness of what data products are available, and where to find those products. [...] It was helpful to have someone explain what the various data levels are, and to go through what many of the acronyms are for - i.e. which are platforms and which are sensors (I find the library soup of NASA acronyms to be very difficult to wrap my head around)."

From Earth Observations to Earth Applications: Satellite Applications for Biodiversity Conservation

September 4

The International Union for Conservation of Nature (IUCN) World Conservation Congress is the world's largest environmental conference. On September 4, ARSET



hosted a one day, in-person training at the meeting as part of a larger conversation on the United Nation's Convention to Combat Desertification with the UN Sustainable Development Goals. Attendees learned about the fundamentals of satellites and remote sensing, discussed specific applications, and completed hands-on demonstrations of how to use remote sensing observations to inform conservation policy and



Trainer Cynthia Schmidt (BAERI/NASA ARC) discussing spatial coverage and temporal resolution. Image Credit: Brock Blevins

management.

ARSET co-hosted this training with Conservation International, Google Earth Engine, and the Jane Goodall Institute, enabling participants to gain a wide variety of perspectives. All responses to a post-training survey indicated that attendees were satisfied with all areas of the training. "The greatest benefit [of the training] was learning how to access the remote sensing data I could use to improve my models of current and future distributions of animals and plants," one attendee wrote. Another attendee also highlighted the importance of the ARSET program, "Thanks for offering the course, and for running your online courses and webinars - access to this type of training is critical for us - most of our people are located in remote areas."



Accomplishments

- Provided the largest and longest in-person training in ARSET history
- Hosted the most-attended online webinar in ARSET history
- Incorporated Synthetic Aperture Radar (SAR) and the Soil Moisture Active Passive (SMAP) mission into trainings
- Cultivated a partnership with the United Nations Educational, Scientific, and Cultural Organization (UNESCO)
- Delivered an in-person training primarily in Spanish
- Added one ARSET trainer who also works with disaster trainings

Participant Feedback

Short Course on Water Quality Monitoring Using NASA Remote Sensing Observations

"Very interesting and useful, especially given the limited time available for it. I feared it would be mind-numbingly boring but rather found it to be quite interesting. Good job and thank you!" - Attendee, Federal Government, U.S.

Application of Satellite Remote Sensing to Support Water Resources Management in Latin America and the Caribbean

"El entrenamiento me ayudo a comprender las multiples herramientas que puedo aplicar en terminos de calidad del dato y del producto que necesito obtener, los analisis por GFMS Y ERDS para el monitoreo de inundaciones." - Attendee, Faculty, Argentina

Applications of Remote Sensing to Soil Moisture and Evapotranspiration

"Though I had a fair idea about the requirements of remote sensing data which would help me greatly with my work, the training helped me understand the basic principles of such remote sensing data and how to access them, which has been immensely helpful." - Attendee, Federal/Central Government, India

"I think this was a good introduction to the topic. The instructors did a great job and I enjoyed a quick refresher on the topic. I also picked up a few ideas on how to better communicate this complicated subject." - Attendee, Student, U.S.

Water Resources Trainings

hosted

1

online training



hosted

2

in-person trainings



trained

847

participants



engaged

526

organizations



reached

84

countries



reached

47

U.S. states





Training Summaries

Short Course on Water Quality Monitoring Using NASA Remote Sensing Observations

May 5

As part of the National Water Quality Monitoring Conference in Tampa, FL, ARSET provided a half-day training on NASA remote sensing observations relevant for water quality monitoring in coastal oceans, estuaries, and lakes. The training also included three hands-on exercises and case studies on the application of remote sensing to the Great Lakes and the Gulf of Mexico.

Application of Satellite Remote Sensing to Support Water Resources Management in Latin America and the Caribbean

July 11 - 20

Developed in collaboration with the United Nations Educational, Scientific, and Cultural Organization (UNESCO), ARSET and several other organizations provided a week long training at the Parque Tecnológico Itaipu (PTI), near Iguazu Falls, Brazil. ARSET delivered 80 percent of the instruction over seven days. There were 49 attendees representing 16 countries across Latin America and the Caribbean.

The training covered remote sensing applications for each component of the water cycle: rainfall, flood monitoring, vegetation, evapotranspiration, groundwater, and soil moisture. Attendees also received training in using Panoply and QGIS to display and analyze data. ARSET created 12 presentations and 8 hands-on exercises, in both English and Spanish.

Every attendee indicated the training met or exceeded their expectations. A



Above: Attendees listening to a presenter at Application of Satellite Remote Sensing to Support Water Resources Management in Latin America and the Caribbean. Below: Participants and trainers at the Itaipu Reservoir and Hydroelectric Plant. Image Credits: Koen Verbist



majority of attendees also indicated in a post-training survey that they had improved a great deal in all four construct areas: their understanding of how remote sensing data can be applied, their understanding of the strengths and weaknesses of remote sensing, their knowledge of products appropriate to their work, and their ability to access remote sensing data and products. "Though I had a fair idea about the requirements of remote sensing data [that] would help me greatly with my work, the training helped me understand the basic principles of such remote sensing data and how to access them, which has been immensely helpful," wrote one attendee.

Applications of Remote Sensing to Soil Moisture and Evapotranspiration

September 1 - 29

Soil moisture and evapotranspiration are both important components of the water cycle. They can influence weather forecasts, droughts, flood prediction, and crop production. Satellite remote sensing data can be a useful tool in evaluating and monitoring soil moisture and evapotranspiration. In September 2016, ARSET hosted its largest ever training, focused on the access and application of NASA soil moisture and evapotranspiration data products.

An unprecedented 768 attendees from 479 organizations and 80 countries participated in the training. Participation in this single training accounted for nearly a quarter of the individuals trained by ARSET in 2016. As a result of the webinar series, 94 percent of post-training survey respondents indicated an increase in their understanding of how remote sensing data products can inform environmental monitoring and decision making. "I was struggling to present the recent El Nino driven drought of East Africa (especially soil moisture)," one attendee from Ethiopia wrote. "I think this webinar will help [me] come up with reasonable analysis and maps. I also learned how to analyze drought without considering precipitation (which is important in data scarce regions of East Africa)." A majority of survey respondents said they felt that they could successfully use NSIDC, Giovanni-4, Earthdata Search, and Worldview on their own after completing the series.

Another U.S. attendee wanted to use the skills learned in the webinar to develop "estimates of evapotranspiration on habitat blocks being managed by the Lower Colorado River Multi-Species Habitat conservation Program in California and Arizona. Prior estimates of riparian habitat are not based on the high density of cottonwood, willow, and mesquite that have been planted and are being maintained for the benefit of yellow-billed cuckoo and southwestern flycatcher birds."



Accomplishments

- First ARSET training combining air quality and land applications for wildfire management
- All attendees improved their understanding of remote sensing data

Participant Feedback

Application of Satellite Remote Sensing Data for Fire and Smoke Monitoring

"I had a pretty good understanding of remote sensing applications before this program, but was overwhelmed by the sheer number of tools available online for accessing remote sensing data. This course helped point me in the right direction, thanks!" - Attendee, Federal Government, U.S.

Training Summary

Application of Satellite Remote Sensing Data for Fire and Smoke Monitoring

November 14

This one day training was held as a preconference event for the 2nd International Smoke Symposium, organized by the International Association of Wildland Fire in conjunction with the National Wildfire Coordinating Group Smoke Committee. Attendees learned how to apply NASA Earth observations to air quality forecasting; smoke, fire, and PM2.5 monitoring; image interpretation; and image processing. The training provided practitioners in wildland fire, smoke management, public health, and air quality management with tools to incorporate satellite remote sensing into their decision-making process.

All attendees indicated in a post-training survey that their knowledge and understanding of remote sensing improved. One attendee wrote, "I wasn't aware of all of the tools available for near-real-time monitoring of fires (and smoke). The best thing I took away from this was how/where to access all of these tools, and which ones are best for specific applications. Thanks for a great course!"



Wildfires Trainings

hosted
1
in-person training



trained
15
participants



engaged
12
organizations



reached
4
countries



reached
5
U.S. states





Accomplishments

- First ARSET training designed to share ARSET best practices and build the capacity of individuals and institutions to conduct their own remote sensing training. Nearly 50% of the participants were already engaged in training.

Participant Feedback

Remote Sensing Training: Methods and Best Practices

"I enjoyed very much this training, very well organized, clear. Good pace. Very clear pronunciation from instructors." - Attendee, Federal/Central Government, Brazil

"It's really [a] very informative webinar series for me. Thank you so much." - Attendee, Federal/Central Government, India



Train the Trainers

hosted
1
online training



trained
156
participants



engaged
131
organizations



reached
46
countries



reached
23
U.S. states



Training Summary

Remote Sensing Training: Methods and Best Practices

October 13 - 27

Since its first training in 2009, NASA's Applied Remote Sensing Training Program (ARSET) has developed best practices for online and in-person training. This three session webinar series was designed for organizations or individuals with remote sensing experience looking to develop training courses or programs. The 156 attendees learned the key steps needed to develop online and in-person trainings, how to conduct outreach and promote trainings, and how to develop and deliver effective presentations on remote sensing topics and applications.

In a post-training survey, almost all respondents indicated that, as a result of the training, they improved their understanding on how to develop a mission statement, assess end-user needs, build a network, promote remote sensing trainings, develop training material, develop effective slides, conduct effective online and in-person trainings, and evaluate trainings.

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Special thanks to Nancy Searby for her support of the ARSET program

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