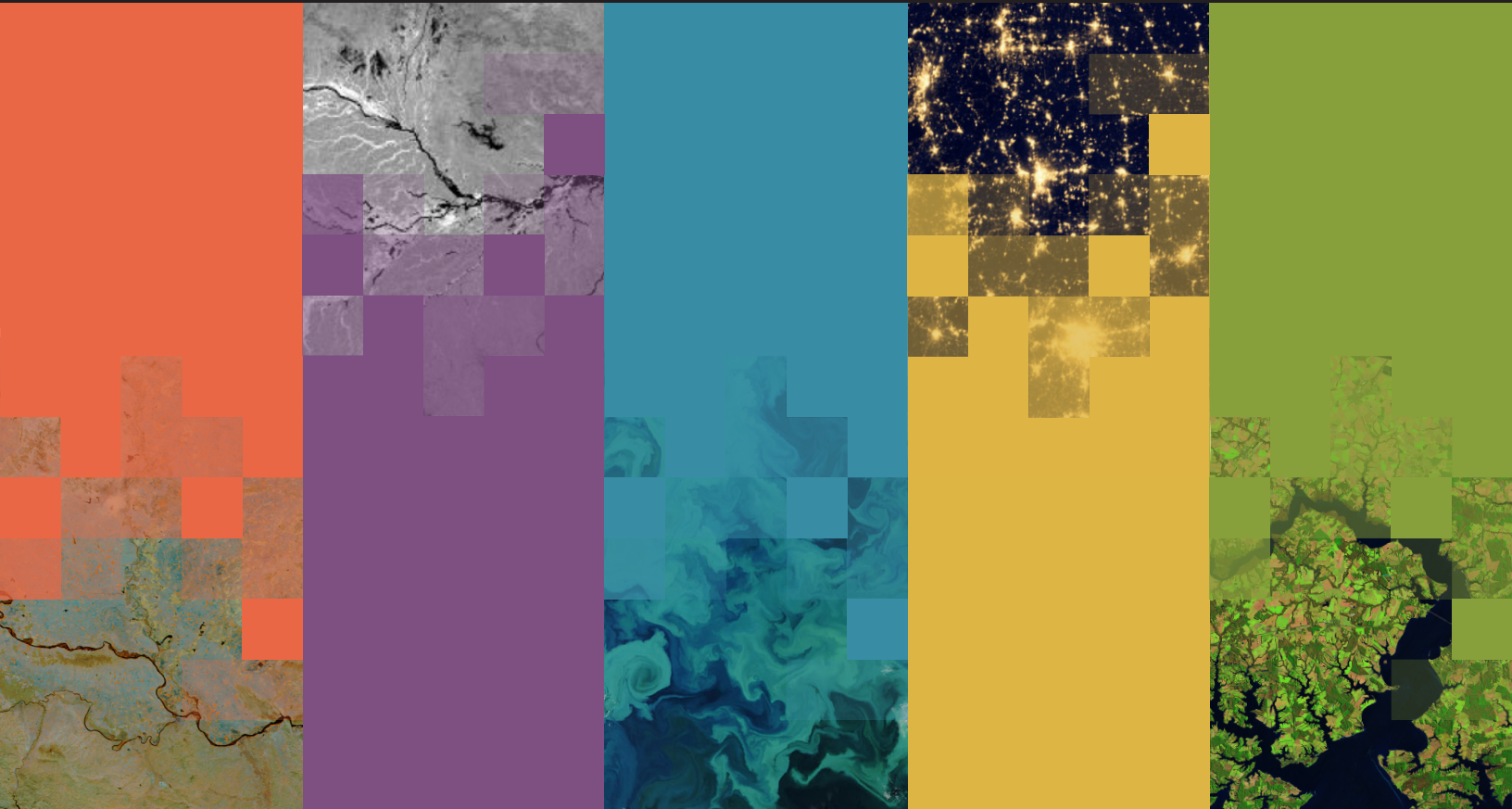


National Aeronautics and
Space Administration



**NASA's Applied Remote Sensing
Training Program**
Train. Empower. Advance.

2017 Annual Report





Introduction: Impact of ARSET Trainings in Bolivia

Since 2008, ARSET has offered more than 100 trainings. Cristina Karen Ovando Crespo has taken 22 of them, all online, between 2013 and 2017. “After 15 years of [working] experience, I’m still eager to learn more and to combine different tools and products, despite the limitations of our resources here in Bolivia,” said Ovando Crespo.

Ovando Crespo serves as a professor and researcher in the Center for Remote Sensing Research & Services (CISTEL), Agricultural Engineering Department at the San Simón University in Cochabamba, Bolivia. The knowledge and skills she acquired from NASA ARSET trainings enable her to make more comprehensive disaster management recommendations, provide data to support territory management for indigenous peoples, train peers in remote sensing applications, and increase support for her students.

Ovando Crespo says. “We combine the maps with density information and the government uses the maps and information and the government agencies do the work.”

Tracking Land Use and Resource Management for Indigenous Communities

Ovando Crespo and her team, joined by researchers from the Universidad Católica Boliviana “San Pablo” Cochabamba, San Simón University, and ISA Bolivia, funded by The Research Programme for Climate Change Adaptation use techniques and resources from ARSET trainings to provide support for Raqaypampa, an indigenous autonomous territory in Bolivia.

The community needs to decide how and where to invest resources to track water and land use. The Raqaypampa area resides in complex watersheds;

“A friend once told me “struggle yields better” and while this may be true, creativity and resourcefulness comes when it is not easy. But it is much better with capacity building programs, [such] as NASA ARSET that are really helpful.”

Seasonal Flooding

The lowlands in northern Bolivia experience seasonal flooding in January and February. Ovando Crespo and emergency volunteers use web tools they learned about in NASA ARSET trainings to create maps. This assists the local governments and communities with disaster response. “We are making maps, and explaining not only to the communities, but to the authorities how flooding is increasing [...] because it is important for the communities to know where to provide supplies,”

flat areas between steep slopes, and arid and semi-arid mountainous regions. Ovando Crespo and her team use remote sensing to provide information about land and soil degradation problems so the community can allocate water resources and decide where to put forest plantations. “Applying ARSET and NASA tools and products at very low cost, we are obtaining maps and images that are or will be useful to the communities,” said Ovando Crespo. “The ARSET program is helping a lot.”

Fire Management Alerts

Prior to working with the University, Ovando Crespo worked at the Manuripi National Wildlife Reserve, a protected area in northern Bolivia. She continues to use her remote sensing skills volunteering and assisting park management, the SERNAP Pando resource and protection team within the park, and the World Wildlife Fund Pando. As a result of Ovando Crespo's participation in ARSET trainings, the park uses NASA's Fire Information for Resource Management System (FIRMS) alerts. FIRMS provides fire alerts that Ovando Crespo is able to share with the WWF Pando and the SERNAP Pando resource managers to identify and manage wildfires.

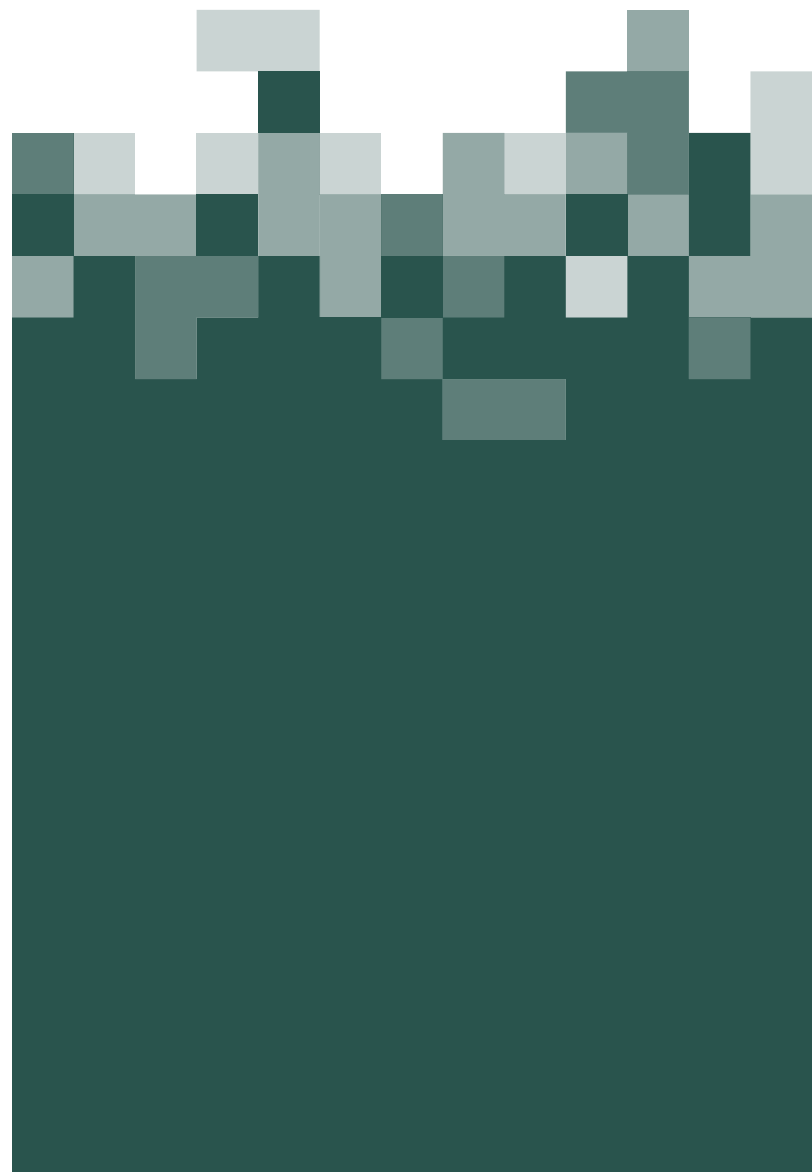
Impacting the Future Workforce

Ovando Crespo also teaches at the University of San Simón. When Ovando Crespo began taking ARSET trainings, she incorporated ARSET materials into her lectures. She values the ARSET materials not only because they teach her new skills, but because they are high quality materials, from a reliable source, and available in Spanish. "Since I have started taking the ARSET courses, the number of students interested in remote sensing has increased a lot," said Ovando Crespo. "Other researchers and professors who are interested to try new techniques and resources - because everything is online [...] if I find students or researchers or professors who are interested in the technique or product, I send them the link and because it is also in Spanish, it is easy for them to use."

Traditionally, the University of San Simón CISTEL produces two master's theses per year that use remote sensing applications. The number began increasing in 2013. By 2017, this number jumped to eight theses and reports, including three technical internships from the forestry school. Ovando Crespo believes that ARSET training materials contributed to this growth. By introducing students to open source software, ARSET increases their ability to use GIS for remote sensing applications. This will also benefit students' careers once they leave the university and no longer have access to a software license.

ARSET is committed to continuing to provide high quality materials in English and Spanish. To learn more about how you can apply NASA Earth observations to your work, visit:

<http://arset.gsfc.nasa.gov/>





In 2017, ARSET expanded the impact of Earth observations on communities across the globe



Learning More from Attendee Experiences

In 2017, ARSET provided more ways for participants to share their experiences with the program. This information is used to improve and adapt training activities, and to make strategic decisions about the program.

4,668

Instances of Live Participation

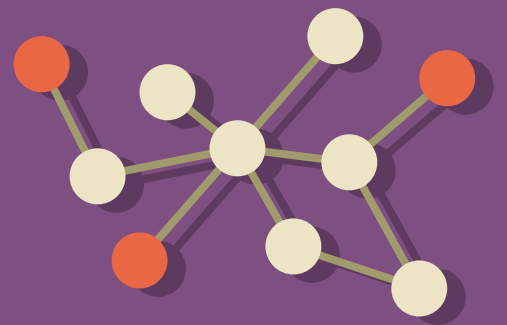
3,350

Post-Training Surveys Completed

1

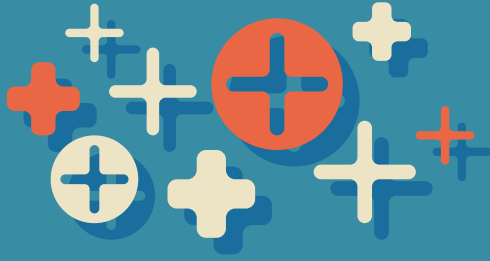
New Training Topics

New training topics contributed to ARSET's successful 2017. The program trained more attendees than ever before and had a higher fraction of attendees new to ARSET compared to previous years.



70% of ARSET's 2017 trainings were on new topics

2



New Training Approaches

ARSET meets people where they are in the process of learning about Earth observations, data, and their real-life applications. In 2017, ARSET offered more advanced webinars, more fundamentals webinars, experimented with new training formats, and increased its Spanish offerings.

8 hrs.

Longest Webinar in 2017

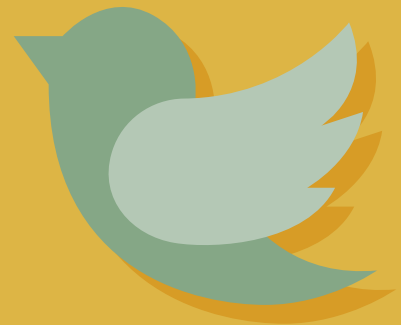
800

Registrations for Spanish Webinars

3

Expanded Twitter Presence

ARSET launched its Twitter account in 2016 and continued to build its online presence throughout 2017. By the end of the year, ARSET had over 4,700 followers.



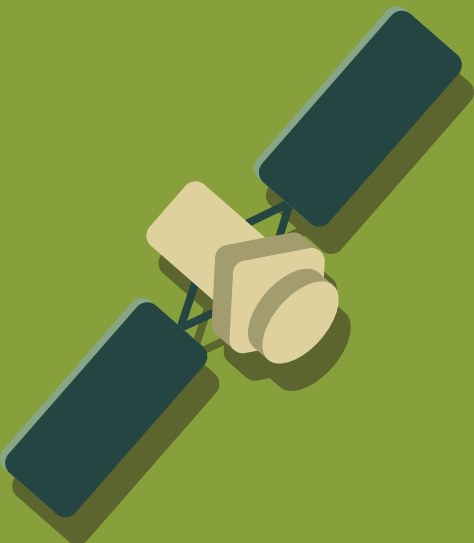
2,200

New Followers

1,583

Total Engagements

4



2017 Summary

Vision and Mission
Societal Benefit Areas

Disasters

Ecosystems

Health and Air Quality

Water Resources

Trainings

Meetings Attended

Satellites and Sensors Covered

5

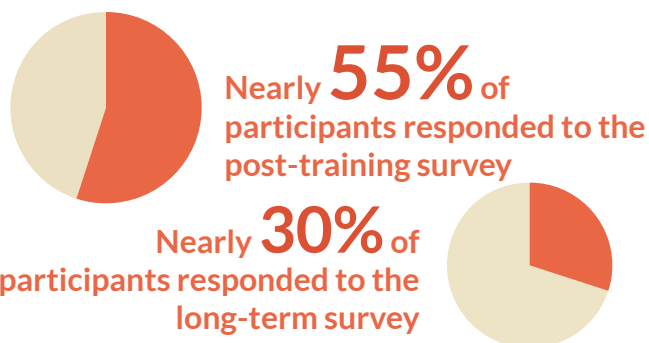
Learning More from Attendee Experiences

In 2017, ARSET provided more ways for participants to share how ARSET trainings benefit them. This information is used to improve and adapt training activities, and to make strategic decisions about the program.

In 2017, ARSET offered 18 trainings with 4,668 instances of live participation. During each training, ARSET collected feedback from participants through informal chats, Q&A sessions, and surveys.

ARSET offers participants to complete two, separate post-training surveys. One is sent immediately after a training to collect feedback on the training format, skills learned, and interest in future trainings. Participants completed this survey 2,549 times, nearly a 55 percent response rate.

In 2017, ARSET updated its second follow-up survey to assess the impact of trainings. Questions focused on participants' decision-making activities and changes in their use of satellite data as a result of their participation in ARSET training(s). This



Sampling of Questions:

- Please indicate how your understanding of remote sensing data changed as a result of this ARSET training
- How helpful was the instruction on available web tools to visualize, access, and analyze data?
- How helpful were the hands-on exercises using online web tools?
- How satisfied are you with how the training was presented and delivered?
- OVERALL SATISFACTION: How did this ARSET training compare with your expectations?
- We welcome your suggestions! Please describe what would improve this ARSET training.

“The presenters were very passionate and knowledgeable about the information. They are very patient with answering questions and tried to answer them thoroughly to the best of their ability.

Although there was a lot of information, they also didn't just 'skim' through it.”

Attendee, Satellite Remote Sensing of Air Quality

survey had a response rate of about 25 percent, around 800 responses. ARSET will continue to collect feedback on how attendees integrate Earth observations into their daily work.

The program also uses survey data to plan its 2018 activities. The most popular requests in each societal benefit area are shown in the table below. In 2018, ARSET will be offering trainings in each of these application areas.

From the Participants: 2017 Popular Training Requests

Societal Benefit Area	Topic
Air Quality	satellite-based emissions datasets
Disasters	identifying flood prone areas
Land Management	land use/land change
Water Resources	water budget estimations over watersheds and river basins

Image Credit: Jacques Desclotres, MODIS Land Rapid Response Team at NASA GSFC. NASA Earth Observatory.



New Training Topics

In 2017, 70 percent of ARSET trainings were on new topics. These new topics contributed to ARSET's wider audience, and allowed the program to reach 1,200 new organizations.

ARSET offered new topics in all of its societal benefit areas, including much-requested topics in disasters management and water resources. ARSET also implemented trainings focused on the UN Sustainable Development Goals.

Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) aim to “end all forms of poverty, recognizing that this goes hand-in-hand with strategies that build economic growth and address a range of social needs, while tackling climate change and environmental protection.” ([UN Sustainable Development Agenda](#)).

Earth observations can support the implementation and monitoring of SDG targets and indicators. In 2017, ARSET offered three trainings on the SDGs. Each of these trainings focused on a different goal, and approached addressing the SDGs in different ways.

The first ARSET training, *Satellite Derived Annual PM_{2.5} Datasets in Support of UN SDGs*, built on a 2015 webinar: *Satellite Remote Sensing of Particulate Matter Air Quality*. In the 2015 webinar, attendees learned how to estimate PM_{2.5} concentrations. The 2017 webinar looked at air quality SDGs, and how PM_{2.5} and WHO data can support targets 3.9.1 (mortality rate attributed to household and ambient air pollution) and 11.6.2 (annual mean levels of fine particulate matter (e.g. PM_{2.5} and PM₁₀) in cities).

New Training Topics by Societal Benefit Area

Disasters



Overview of the Global Disaster Alert and Coordination System

Introduction to Synthetic Aperture Radar

Ecosystems



Advanced Webinar: Land Cover Classification

Remote Sensing of Land Indicators for UN SDG 15

Scenario-Based Ecoforecasting

Health + Air Quality



Satellite Derived Annual PM_{2.5} Data Sets in Support of UN SDGs

Advanced Webinar: Methods in Using NASA Remote Sensing for Health Applications

Water Resources



Advanced Webinar: Remote Sensing of Drought

Introduction to Remote Sensing of Harmful Algal Blooms

Satellite Observations of Water Quality for SDG 6

The other two SDG trainings had more general topics, focused on higher-level goals and targets. *Remote Sensing of Land Indicators for SDG 15* provided an overview of Goal 15, target 15.1 (conservation, restoration, and sustainable use of ecosystems), indicator 15.1.1 (forest area as a proportion of total land area), and target 15.3 (combating desertification). *Satellite Observations of Water Quality for SDG 6* was a contribution to GEOWeek 2017 in Washington D.C., October 23-27. This in person-training, which included indicator 6.3.2, consisted of demos, discussion, and hands-on exercises on access and application of satellite data.

Disasters Management

In the disasters management societal benefit area, two trainings offered by ARSET were on new topics. Previously, the disasters portfolio focused primarily on remote sensing applications for flooding. This year, ARSET offered two new perspectives on disaster-related applications by offering a training focused on a single platform to address disasters management and a training only on radar remote sensing.

Overview of the Global Disaster Alert and Coordination System (GDACS) built capacity for attendees to use the Earth observations available on GDACS. Attendees learned to use GDACS to monitor real-time disasters, assess the impacts of an individual event, and develop response strategies for both national and international events.

The second new disasters training was *Introduction to Synthetic Aperture Radar*. Synthetic aperture radar (SAR) is a frequently requested topic by attendees. Offered in English and Spanish, the training became ARSET's most-attended webinar to date.

Water Resources

The advanced webinar *Remote Sensing of Drought*, provided a holistic view of satellite applications for drought management compared to past ARSET trainings. Topics included drought monitoring via vegetative indices, as well as drought monitoring for components of the water cycle. The last session of the webinar series combined all the data into one exercise to perform a comprehensive analysis of drought.

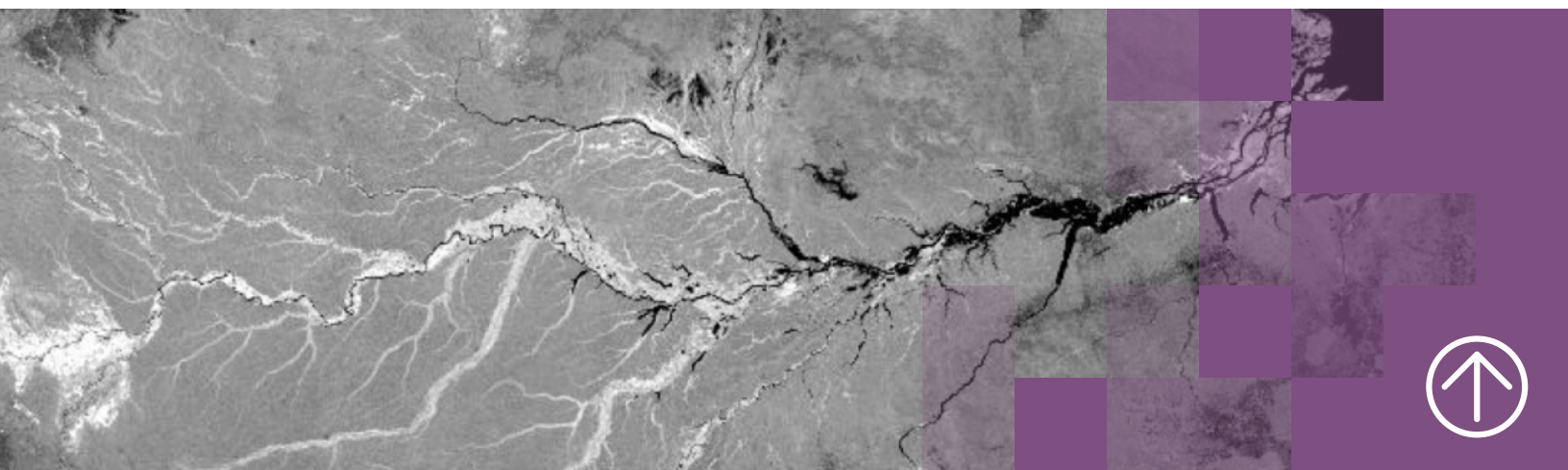
Further expanding its training portfolio, ARSET offered its first training focused exclusively on harmful algal blooms. *Introduction to Remote Sensing of Harmful Algal Blooms* showed participants through how to supplement ground-based information with satellite observations.

Looking Forward

During 2018, ARSET will add new training topics, covering new tools and portals, including:

- the variable infiltration capacity (VIC) hydrological model
- monitoring tropical storms
- urban flooding
- geostationary platforms
- advanced change detection

SMAP radar mosaic of the Amazon River Basin. Image Credit: NASA/JPL





3

New Training Approaches

ARSET meets people where they are in the process of learning about Earth observations, data, and their real-life applications. In 2017, ARSET offered more advanced webinars, more fundamentals webinars, experimented with new training formats, and increased its Spanish offerings.

This year, ARSET offered more advanced and fundamentals webinars. Of the 12 online trainings offered in 2017, two were at the fundamental level, seven were introductory, and three were advanced webinar series.

ARSET augmented its *Fundamentals of Remote Sensing* series by adding two sessions: *Session 2B: Satellites, Sensors, and Earth Systems Models for Water Resources Management* and *Session 2C: Fundamentals of Aquatic Remote Sensing*.

four hour webinar sessions, where attendees worked on exercises and then completed a homework assignment. *Remote Sensing of Drought* implemented a combination of those two styles by offering two, two hour sessions.

ARSET provides a written version of many training materials in Spanish, freely available online. In 2017, ARSET increased its reach across Latin America by providing three live trainings with audio in Spanish as well. There were two online and one in person trainings provided by native Spanish speakers.

For *Introduction to Synthetic Aperture Radar; Introducción al Radar de Apertura Sintética*, one session was completely in English and one completely in Spanish - including the question and answer period. This was an enormously popular training; the Spanish sessions reached the capacity

“Well done! One of the best [trainings] I have taken online. Given the technical nature of the subject, the instructors did a fantastic job.”

Attendee, Introduction to Synthetic Aperture Radar

The three advanced webinars were offered across ecosystems, health, and water resources societal benefit areas. They also varied in format. *Methods in Using NASA Remote Sensing for Health Applications* used a similar format as traditional ARSET introductory webinars: three one hour sessions supplemented with two homework assignments. *Land Cover Classification with Satellite Imagery* introduced a different style: two,

of the webinar software. This was also ARSET's most-watched series on the website, amassing over 3,800 views.

ARSET also offered an online series held only in Spanish, *Disaster Risk Reduction Across the Americas Discussion Sessions; La Reducción del Riesgo de Desastres en las Américas Sesiones de Discusión* was held in support of the Strengthening Disaster Risk Reduction Across the Americas Summit. In

addition to being in Spanish, the question-and-answer only format was also novel. Over the course of three weeks, trainers provided a brief background of different disaster management topics, then devoted the remaining time to answer attendee questions.

The longest multi-lingual undertaking of 2017 was *Application of Remote Sensing to Support the Management of Hydrographic Watersheds in Latin America and the Caribbean*. Trainers created 50 presentations and documents, in English and Spanish. Presentations were made available to attendees in both languages, and a majority of ARSET's presentations were given in Spanish by fluent trainers.

In 2018, ARSET will continue to offer training in Spanish and English. The program will also continue experimenting with different formats and lengths so that it can continue to adapt to new technologies and needs of attendees.

ARSET will also begin implementing self-guided trainings in 2018. Participants will be able to take trainings on demand, at their own pace, while continuing to enjoy the high quality training and supporting materials that they have come to expect from NASA and ARSET.



Application of Remote Sensing to Support the Management of Hydrographic Watersheds in Latin America and the Caribbean was ARSET's largest multi-lingual undertaking of 2017.



Image Credit: Jeff Schmaltz, MODIS Rapid Response Team at NASA GSFC. NASA Earth Observatory



4

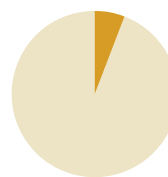
Expanded Twitter Presence

ARSET launched its Twitter account in 2016 and continued to build its online presence throughout 2017. By the end of the year, ARSET had over 4,700 followers.

In 2017, ARSET tweeted regularly to connect with current and potential attendees. The account promoted trainings, interacted with other organizations, answered questions, and completed its first organized social media campaign.

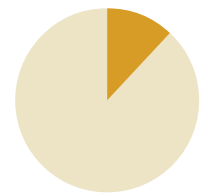
Having a dedicated Twitter account has paid off for ARSET, doubling the percentage of attendees coming to trainings via social media. In 2016, 6 percent of training attendees learned about a training through social media. That number doubled in 2017 to 12 percent.

Twitter was also part of a successful effort to increase participation in ARSET trainings. Heightened social media interest helped two trainings reach capacity early in their registration



In 2016, **6%** of attendees learned about a training through social media

In 2017, **12%** of attendees learned about a training through social media



Top Tweets

NASAARSET @NASAARSET
Learn to access & apply @GDACS information for monitoring disasters. Feb 21, 8-10 am or 5-7 pm EST go.nasa.gov/2i2JsZ7

Green Alert for Earthquake in Chile
Date Tue, 03 Jan 2017 21:19:07 GMT
Location -43.35, -74.42 (lat,lon)
Severity Magnitude 5.5M, Depth:11.47km
Population About 45996 people within 100km
Details GDACS Report
Provided by GDACS

4:34 PM - 5 Jan 2017

74 Likes

45 Retweets

30.2K Impressions

NASAARSET @NASAARSET
Learn how to conduct a land cover classification using #remotesensing & #GIS: go.nasa.gov/2gMdlEx All materials in Spanish & English

Advanced Webinar: Land Cover Classification with Satellite Imagery

2:29 PM - 12 Jun 2017

43 Likes

26 Retweets

29.4K Impressions

process, the first time ARSET experienced this since expanding the size of its online trainings.

ARSET Campaign in Support of the UN Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) aim to “end all forms of poverty, recognizing that this goes hand-in-hand with strategies that build economic growth and address a range of social needs, while tackling climate change and environmental protection.” (UN Sustainable Development Agenda)

In November 2017, ARSET conducted a month-long social media campaign. Tweets highlighted specific SDGs, NASA Earth observations to support them, and related ARSET trainings.

Twitter users engaged with the posts 992 times, including 190 likes and 154 retweets. The campaign earned a total of 47,220 impressions, and brought more people to ARSET’s Twitter profile and website with 73 profile clicks and 178 clicks on URLs in tweets.

The Society for Conservation GIS retweeted one post, writing “These webinars from @NASAARSET on Monitoring & Meeting the UN Sustainable Development Goals are a great resource!” Another Twitter user wrote, “I’ve attended these myself. People at @NASAARSET are good teachers. The resources [are] very helpful for anyone interested in monitoring land-surface events, problems, floods etc.”

More information can be found at <http://arset.gsfc.nasa.gov/sdgs>



Image Credit: Robert Simmon, using Suomi NPP VIIRS data provided courtesy of Chris Elvidge (NOAA National Geophysical Data Center). NASA Earth Observatory



5

2017 Summary

Vision

Enabling better decisions for a better planet

Mission

Empowering the global community through remote sensing trainings

Societal Benefit Areas



Disasters



Ecosystems



Health + Air Quality



Water Resources

pp. 10-13

Trainings



Online Trainings

Online training is offered as a series of webinars. Recordings and materials are freely available from the ARSET website.



In-Person Trainings

In-person training is conducted in partnership with a stakeholder to meet the needs of a specific region or community.

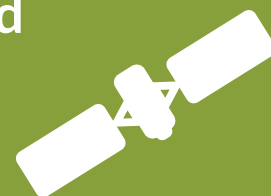
p. 14

Meetings Attended



p. 15

Satellites + Sensors Covered



p. 15



Disasters

4 Trainings



2 In Person



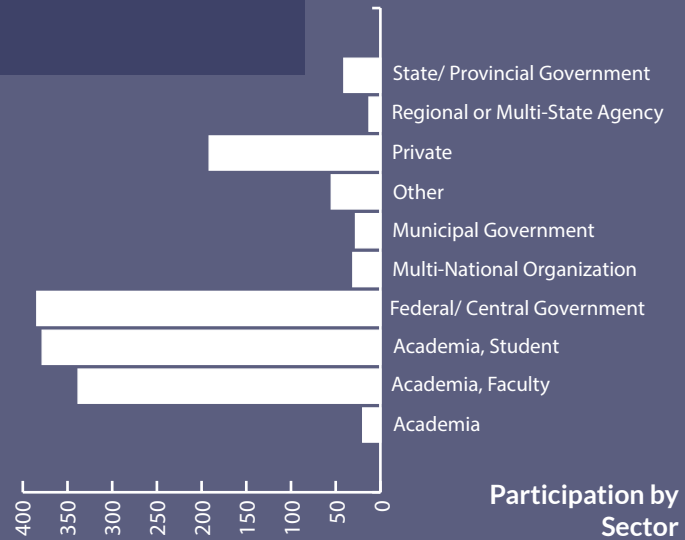
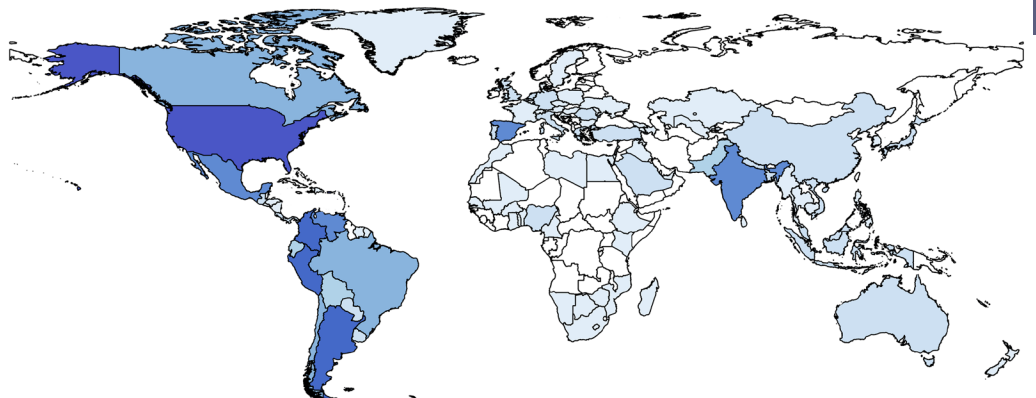
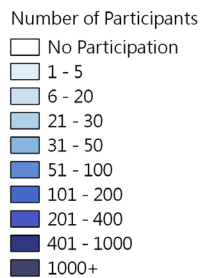
2 Online

New Topics 2

1577 Participants

913 Organizations

2017 Participation by Country





Ecosystems

3 Trainings



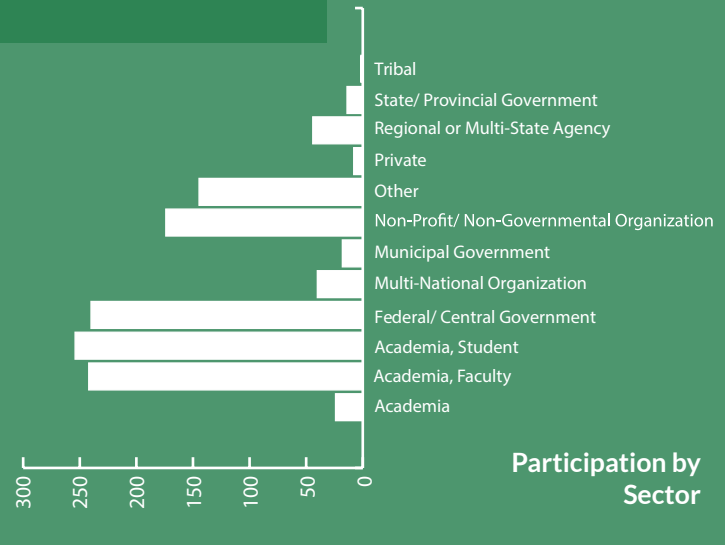
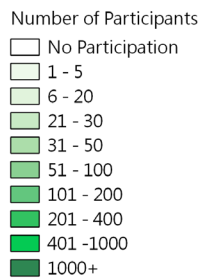
3 Online

New Topics **3**

1211
Participants

759 Organizations

**2017
Participation by
Country**



**Participation by
Sector**



Health + Air Quality

4 Trainings



2 In Person



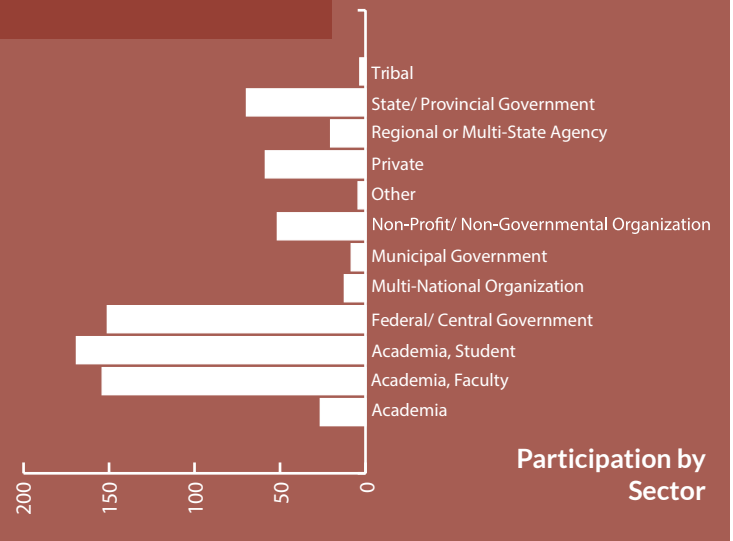
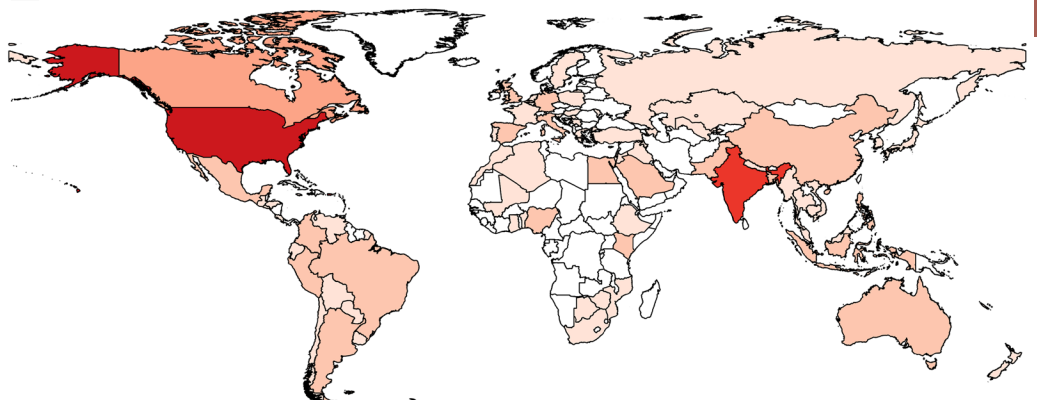
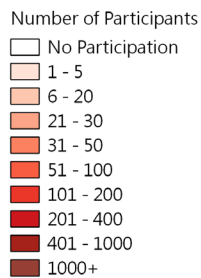
2 Online

New Topics 2

739 Participants

471 Organizations

2017 Participation by Country





Water Resources

3 Trainings



1 In Person



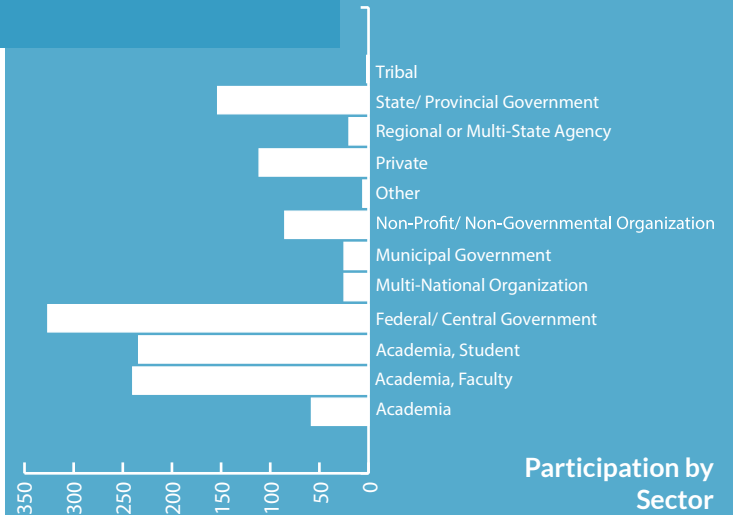
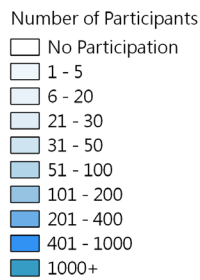
2 Online

New Topics 3

824 Organizations

1319 Participants

2017 Participation by Country







Participation by Sector




Trainings

Key:




Focus Areas:

















































-  Disasters
-  Ecosystems
-  Health + Air Quality
-  Water Resources

Types:

-  Online
-  In-Person

Levels:

-  Level 0 - Fundamentals
-  Level 1 - Introductory
-  Level 2 - Advanced

-    **Advanced Webinar: Land Cover Classification with Satellite Imagery**
-    **Overview of the Global Disaster Alert & Coordination System (GDACS)**
-    **Satellite Derived Annual PM2.5 Data Sets in Support of the United Nations Sustainable Development Goals**
-    **NASA Earth Science Data for Wildland Fire Decision Making**
-   **Satellites, Sensors, and Earth Systems Models for Water Resources Management**
-   **Fundamentals of Aquatic Remote Sensing**
-    **Satellite Remote Sensing of Air Quality: Data, Tools and Applications**
-    **Advanced Webinar: Methods in Using NASA Remote Sensing for Health Applications**
-    **Remote Sensing of Land Indicators for Sustainable Development Goal 15**
-    **Introduction to Synthetic Aperture Radar**
-    **Advanced Webinar: Remote Sensing of Drought**
-   **Disaster Risk Reduction Discussion Sessions**
-    **Introduction to Remote Sensing for Harmful Algal Blooms**
-    **Introduction to Remote Sensing for Scenario-Based Ecoforecasting**
-    **Satellite Remote Sensing of Air Quality**
-    **Earth Observations for UN Sustainable Development Goal 6**
-    **Application of Remote Sensing to Support the Management of Hydrographic Watersheds in Latin America and the Caribbean**

Meetings Attended

Opportunities to Apply Remote Sensing in Boreal/Arctic Wildfire Management and Science, Apr 4-6,

Surface Water and Ocean Topography Meeting, Apr 6-7, 2017

LCLUC Spring Science Team Meeting, Apr 12-13, Rockville, Maryland

ISRSE 2017, May 8-12, Tshwane, South Africa

NASA Biodiversity and Ecological Forecasting Team Meeting 2017, May 23-25, Washington, D.C.

LPDAAC User Working Group, May 31 and June 1, Fort Collins, CO

NASA Water Resources Science Team Meeting, July 18-19, Pasadena, CA

MERRA2 Applications Workshop, Jun 19

Transboundary Water and Global Water Security Meeting, Aug 15-16, Silver Spring, MD

NOAA VIIRS & ABI Aerosol Workshop, Aug 25-26, College Park, MD

TechRaking: Space Journalism, Sep 8, San Francisco, CA

GES DISC User Working Group Meeting, Sep 19-20

NASA Water Quality Workshop, Sep 27

LANCE User Working Group Meeting, Oct 3

GEO-XIV Plenary, Oct 23-26, Washington, DC

NASA Earth Science Communications Retreat, Oct 17-18, Greenbelt, MD

Societal Applications of Satellite Data for OceanHealth and Fisheries, Nov 2, Washington, DC

Satellites and Sensors Covered

Satellite	Sensor
Aqua	MODIS
Aura	OMI
CALIPSO	CALIOP
GPM	DPR
Landsat	ETM+, OLI
Suomi NPP	VIIRS
Terra	ASTER, MISR, MODIS
TRMM	



HAQAST 3, Nov 28-29, Palisades, NY

UNDP, Oct 26-27, New York, NY

AGU, Dec 11-15, New Orleans, LA

Image Credit: Joshua Stevens, using Landsat data from the U.S. Geological Survey. NASA Earth Observatory



Contact Us

The ARSET website: <http://arset.gsfc.nasa.gov/>

Twitter: [@NASAARSET](https://twitter.com/NASAARSET)

Email: ana.i.prados@nasa.gov

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National Aeronautics and Space Administration
NASA Headquarters
300 E Street SW
Washington, D.C. 20024-3210