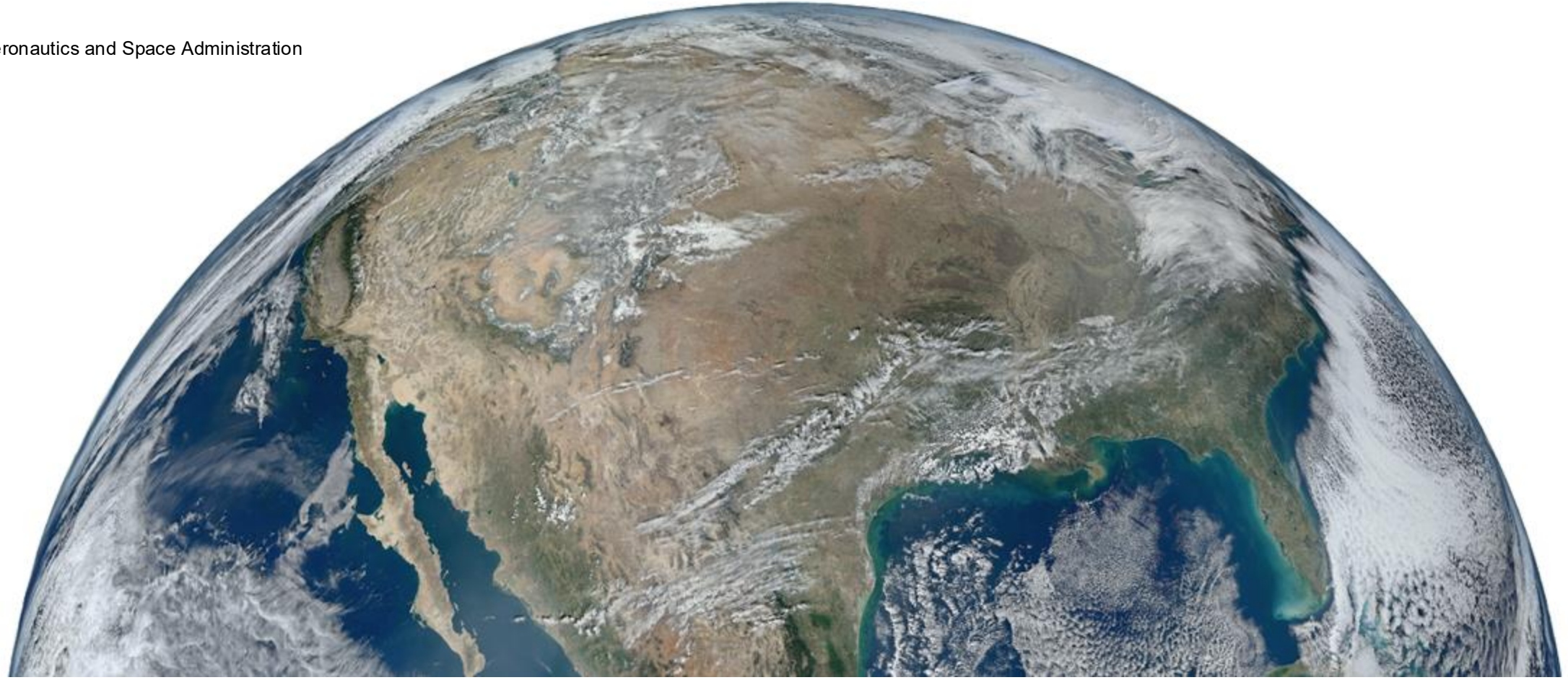
National Aeronautics and Space Administration

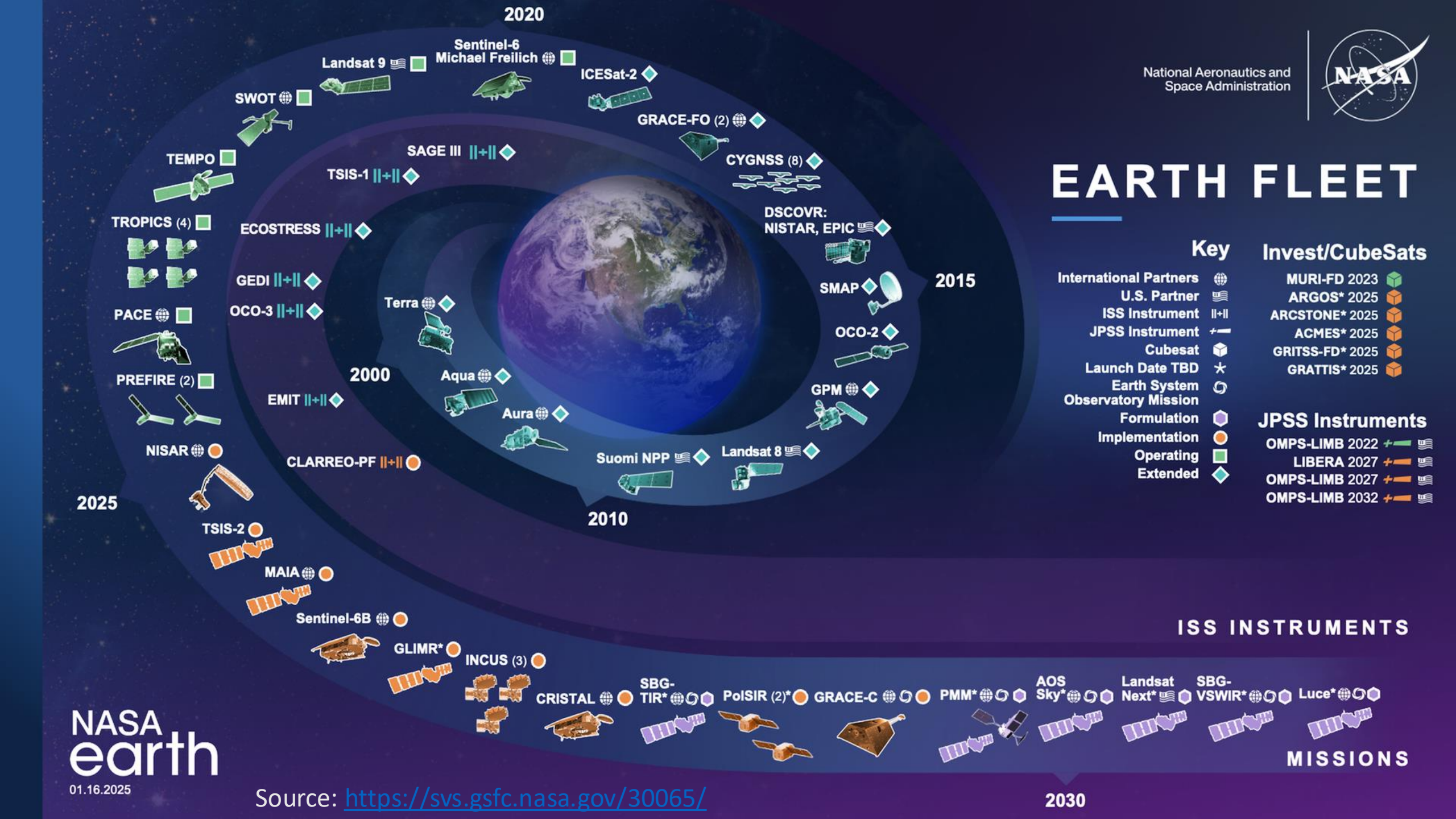


Satellite Observations for Decision Making: The NASA Applied Remote Sensing Training (ARSET) Program

Carl Malings (Morgan State University & NASA Goddard Space Flight Center)
Lead Air Quality Trainer, ARSET

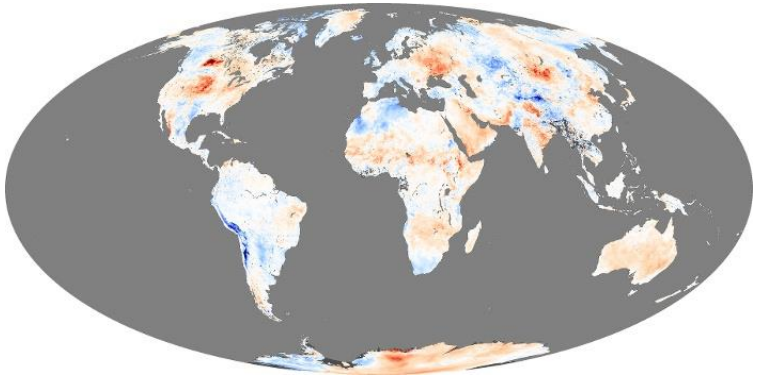


Source: https://svs.gsfc.nasa.gov/5067/

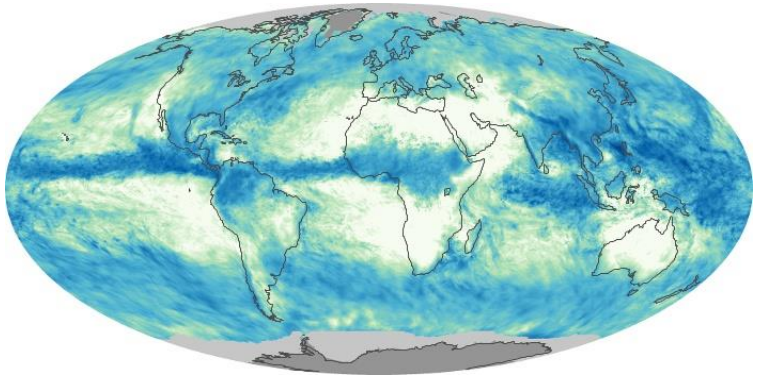


Source: https://svs.gsfc.nasa.gov/30065/

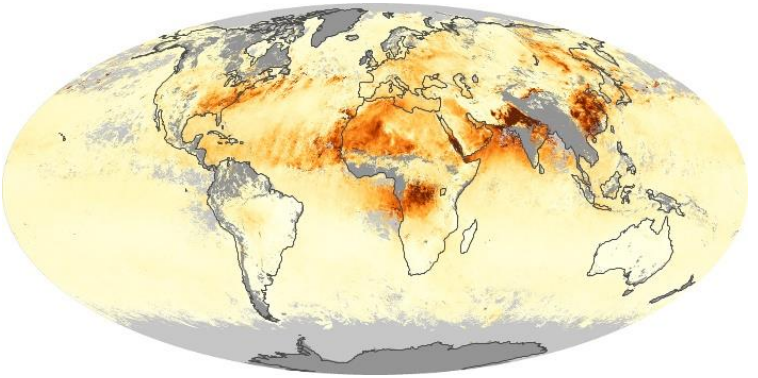
NASA Earth Science Datasets



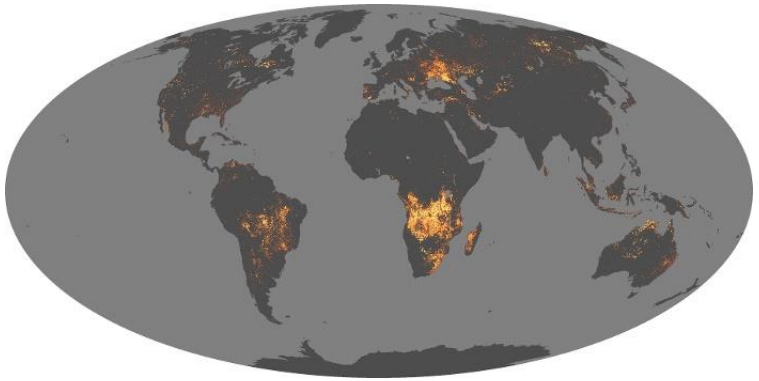
Land Temperature



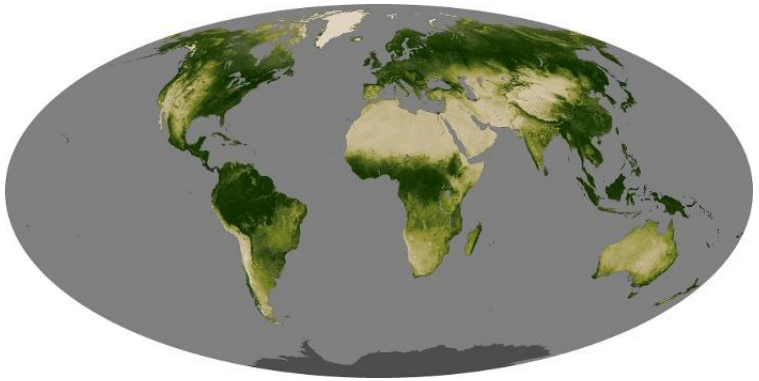
Rainfall



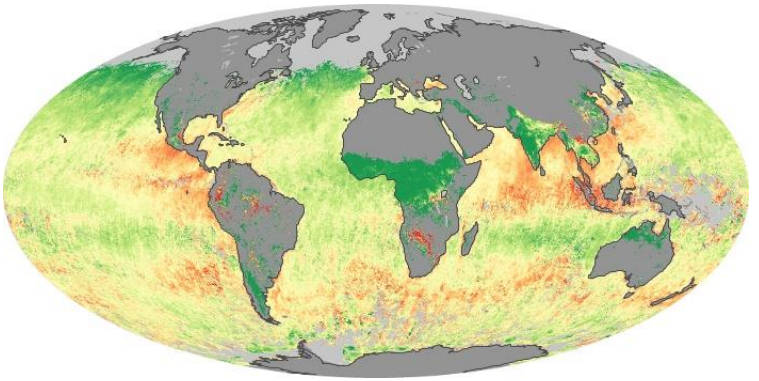
Aerosol Optical Depth



Fires



Vegetation



Aerosol Size Distribution

Source: https://earthobservatory.nasa.gov/global-maps

Earth Action

Data Delivery ➔ Decisions

Unique programs solve our planet's most pressing issues and build capacity to use Earth science information in decision-making



AGRICULTURE

CLIMATE & RESILIENCE

DISASTERS

ECOLOGICAL CONSERVATION

HEALTH & AIR QUALITY

WATER RESOURCES

WILDLAND FIRES

EARTH MISSION ENGAGEMENT

CAPACITY BUILDING

Capacity Building: Empowering people & communities



Pairs participants and partner organizations for 10-week interdisciplinary projects that apply NASA Earth observations to community concerns around the globe.



Connects with natural resource managers and community members through engagement activities and co-develops place-based in-person and online trainings focused on content relevant to Indigenous lands and territories.



Online and in-person trainings to empower the global community to incorporate Earth-observing data into environmental management and decision-making.

NASA Applied Remote Sensing Training (ARSET)

https://appliedsciences.nasa.gov/arset

The ARSET Program delivers cost-free training to increase the knowledge, awareness, and use of Earth Observations for decision making

ARSET Training Themes

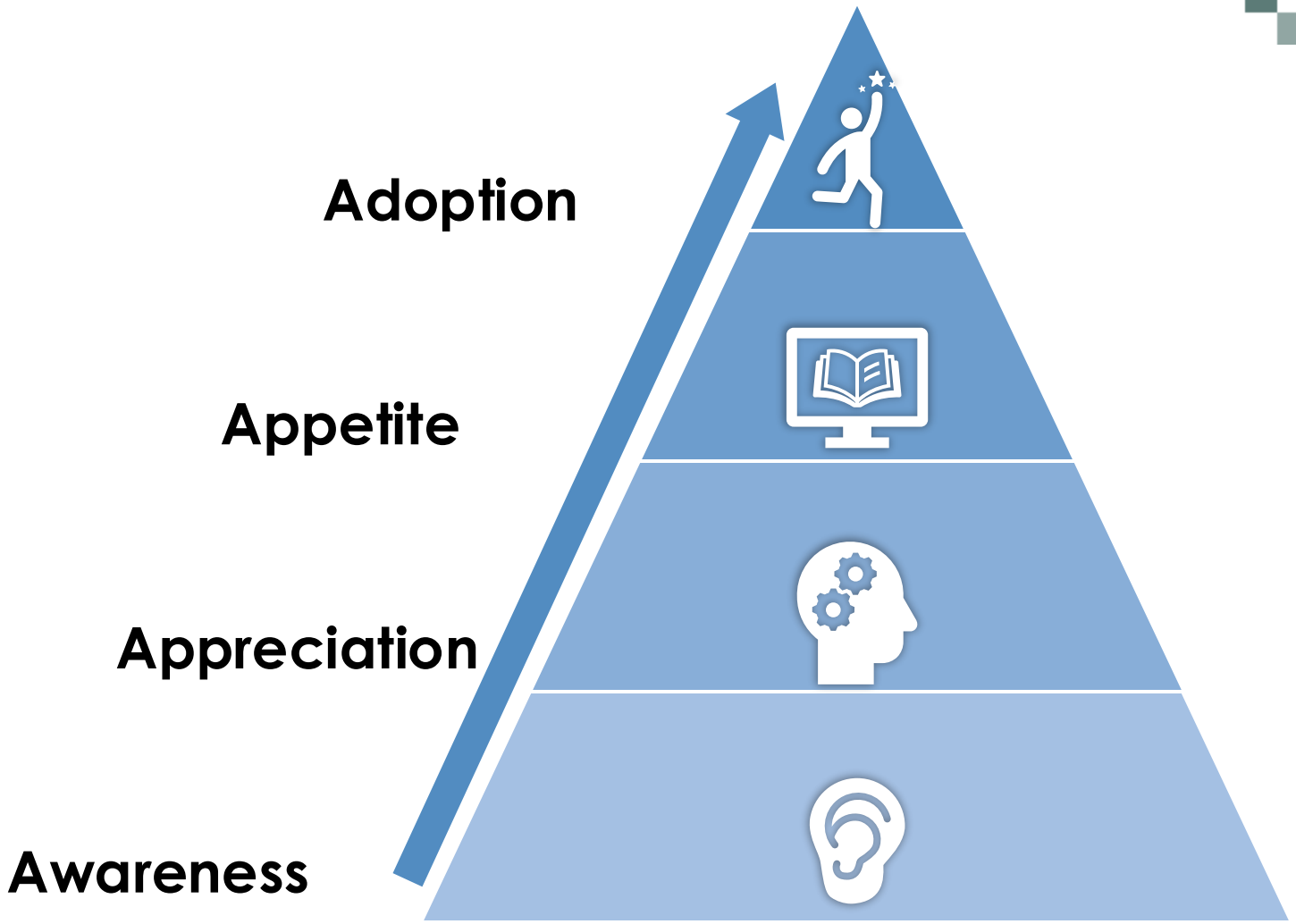
- AGRICULTURE
- CLIMATE & RESILIENCE
- DISASTERS
- ECOLOGICAL CONSERVATION
- HEALTH & AIR QUALITY
- WATER RESOURCES
- WILDLAND FIRES

EARTH SCIENCE
APPLIED SCIENCES

CAPACITY BUILDING

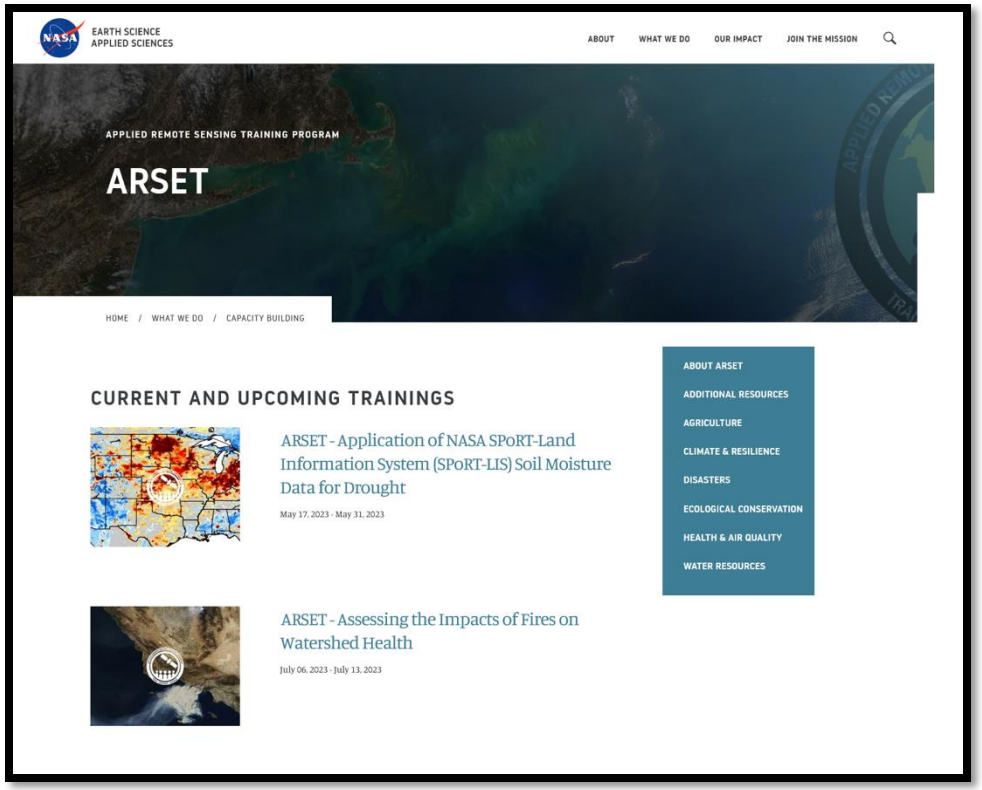
Why training?

- Accelerated use of data from awareness, appreciation, appetite, through adoption
- Improved utility of data products and tools for users
- Communicate appropriate uses of data products
- Increasing use of data in user communities enables more informed decisions



ARSET Trainings

- Our trainings are:
  - Online and in-person
  - Live and instructor-led, or self-guided
  - Online: Typically, 2 – 4 sessions, 1-2 hours each
  - Provided at no cost, with materials and recordings available from our website
  - Often multi-lingual
  - Range in level from **introductory** to **advanced**



EARTH SCIENCE APPLIED SCIENCES

CAPACITY BUILDING

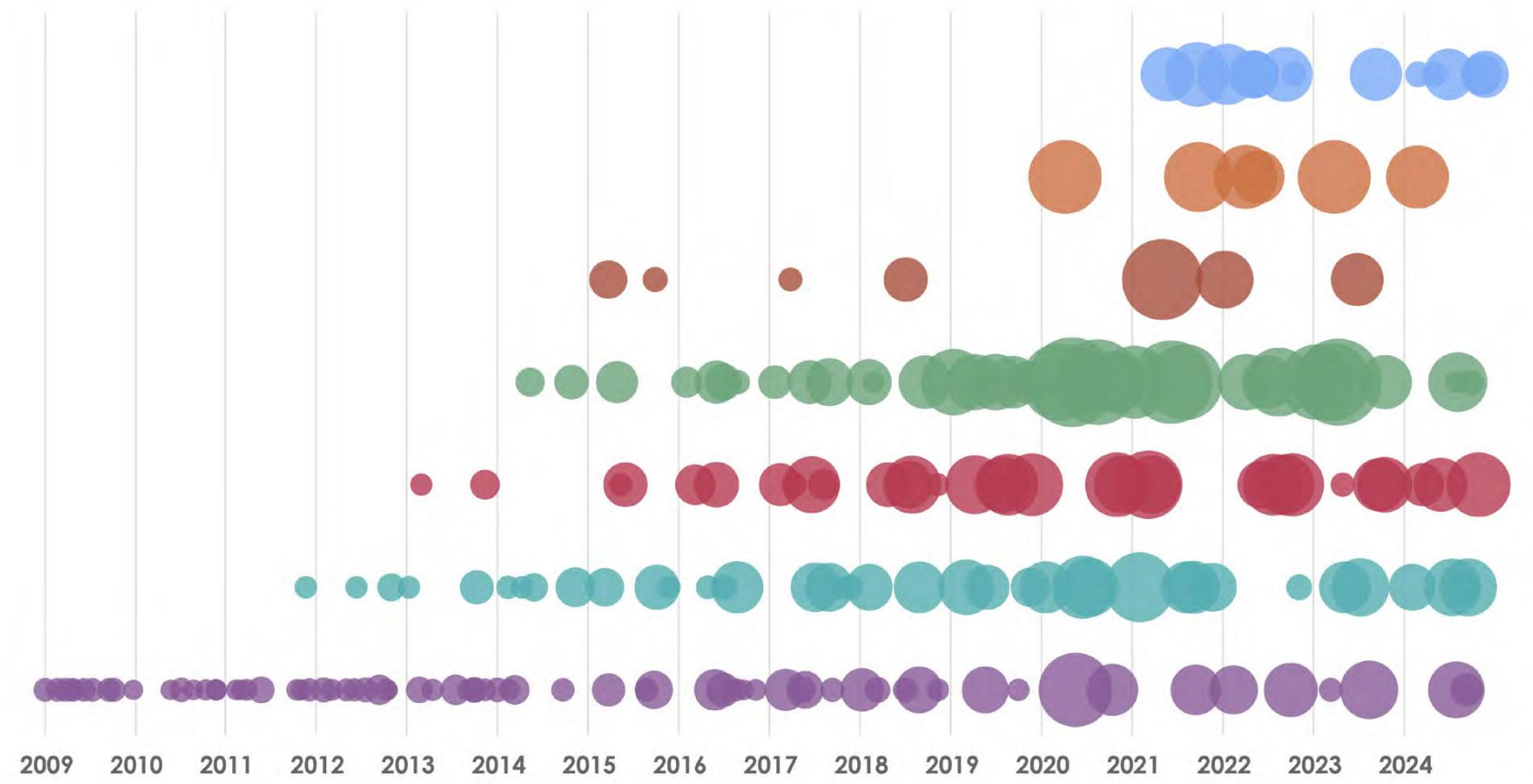
ARSET Trainings 2009 - 2023

194 trainings

130,000+ participants

186 countries

19,000+ organizations



Climate & Resilience

Agriculture

Wildland Fire

Ecological Conservation

Disasters

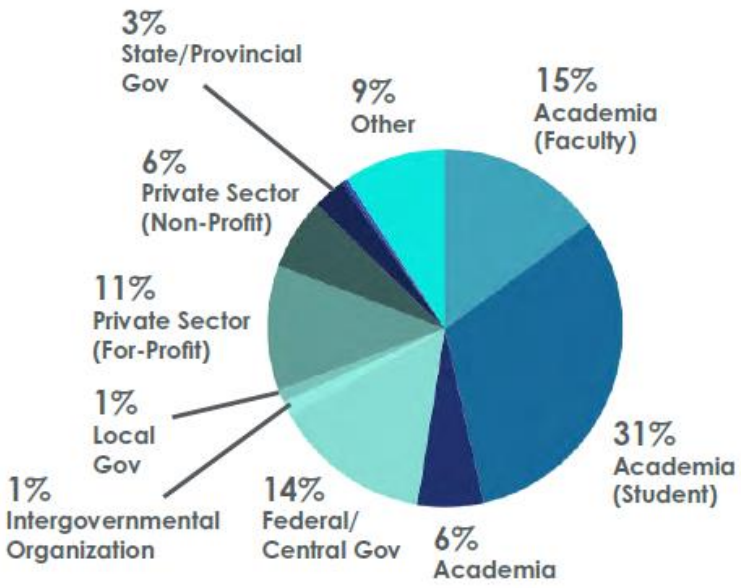
Water Resources

AQ & Health

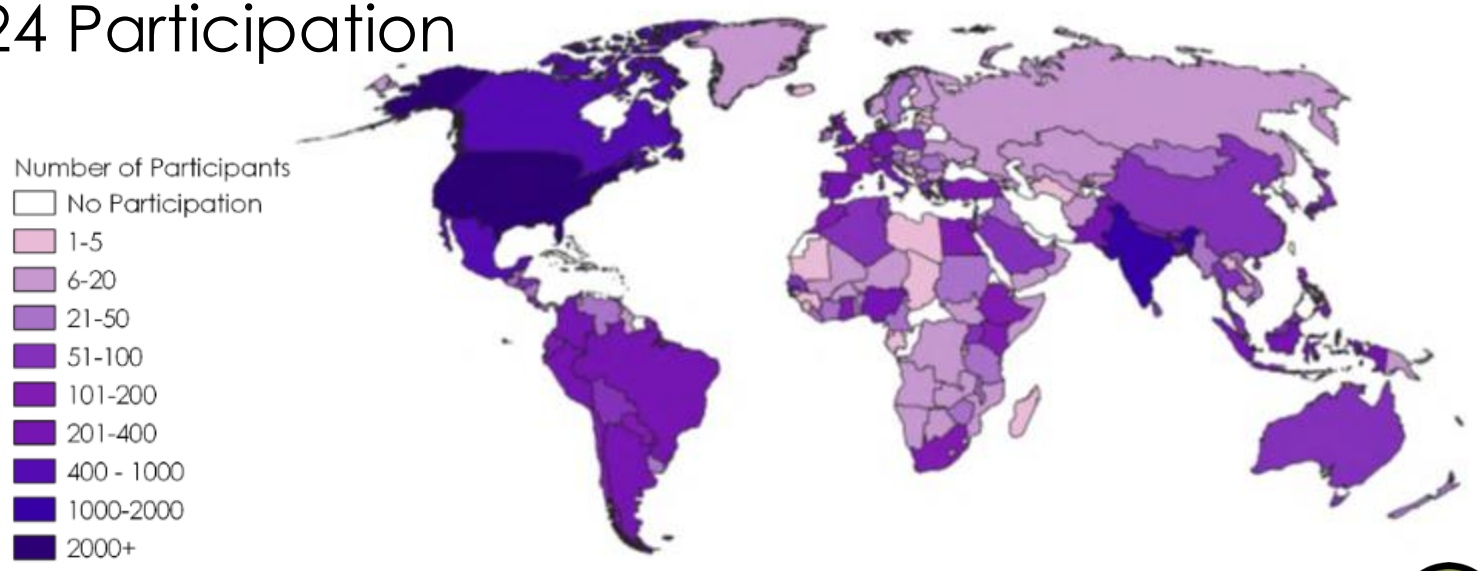
* Size of circles corresponds to number of participants

ARSET trainings serve a diverse set of communities…

- ARSET trainings are **targeted to policymakers, NGOs, and other professionals** looking to incorporate NASA remote sensing into their activities.
- ARSET also trains the next generation of Earth scientists.
  - Academia (both faculty and students) routinely make up ~50% of training attendees.



2024 Participation



ARSET Trainings Are Designed to Meet Audience Knowledge Levels



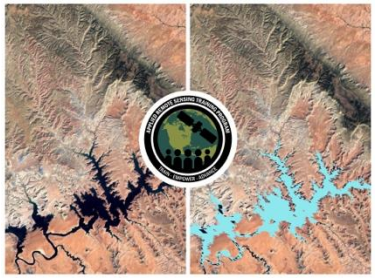
Advanced
Requires introductory or intermediate training or equivalent knowledge
In-depth and highly focused topics
Integrating Remote Sensing into a Water Quality Monitoring Program

Intermediate
Requires introductory training or equivalent knowledge
Covers specific applications
Monitoring Coastal and Estuarine Water Quality: Transitioning from MODIS to VIIRS

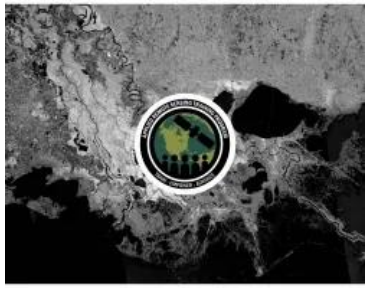
Introductory
Requires fundamentals training or equivalent knowledge
Covers specific applications
Introduction to Remote Sensing of Harmful Algal Blooms

Fundamentals
Assumes no prior knowledge of remote sensing
Fundamentals of Remote Sensing

Recent ARSET Training Examples



Fundamentals of Machine Learning for Earth Science
En Español



An Introduction to Synthetic Aperture Radar (SAR) and its Applications
En Español



Monitoring Water Quality of Inland Lakes using Remote Sensing



Accessing and Analyzing Air Quality Data from Geostationary Satellites



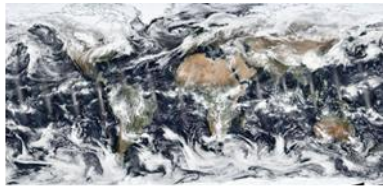
Building Climate Risk Assessments from Local Vulnerability and Exposure

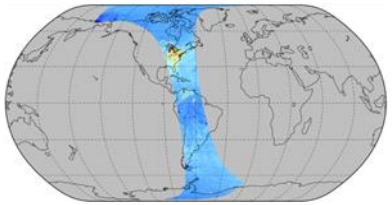


Crop Mapping using Synthetic Aperture Radar (SAR) and Optical Remote Sensing
En Español

ARSET Trainings







FIRMS
Fire Information for Resource Management System



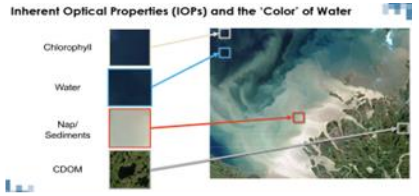
jupyter

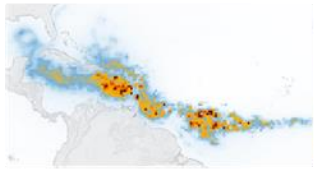
WORLDVIEW

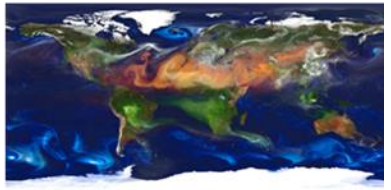
SeaDAS

EARTHDATA
OPEN ACCESS FOR OPEN SCIENCE









- Remote Sensing Basics
- Imagery
- Data Products
- Satellite Orbits and Observation Techniques
- Modeling

- How to Access Data
- Data Formats
- How to Visualize Data
- Tools for Data Analysis

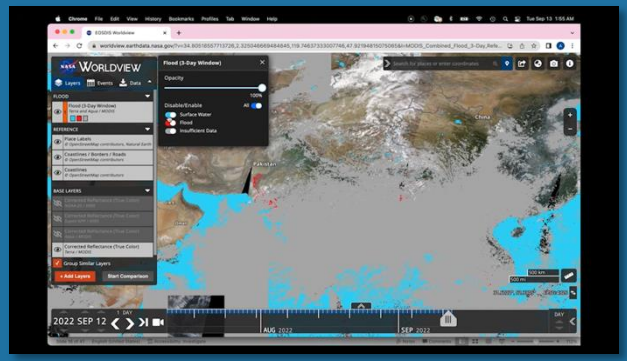
- Fire detection and smoke transport
- Water and air quality monitoring
- Coastal ocean
- Land use change
- Floods and droughts

Training Content

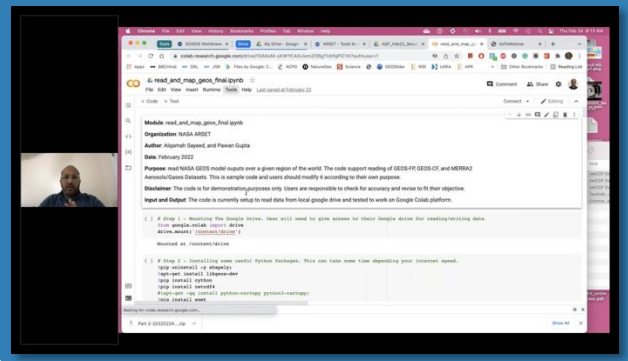
Lectures



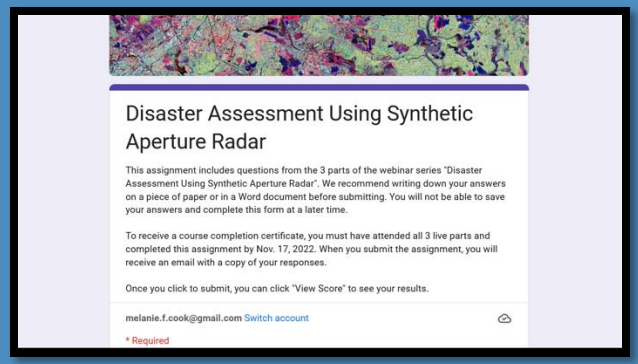
Demonstrations



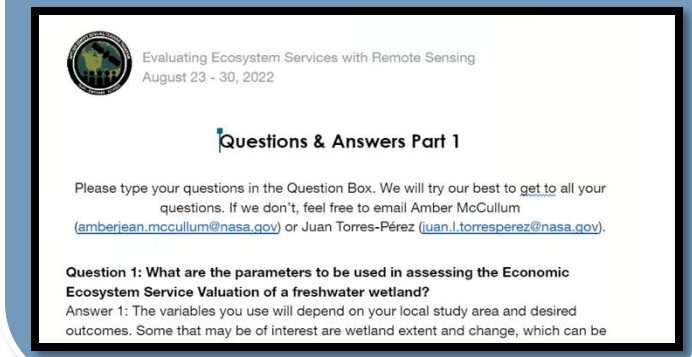
Hands-on Exercises



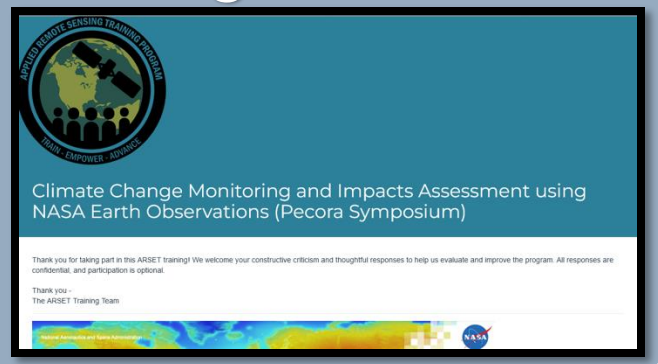
Homework



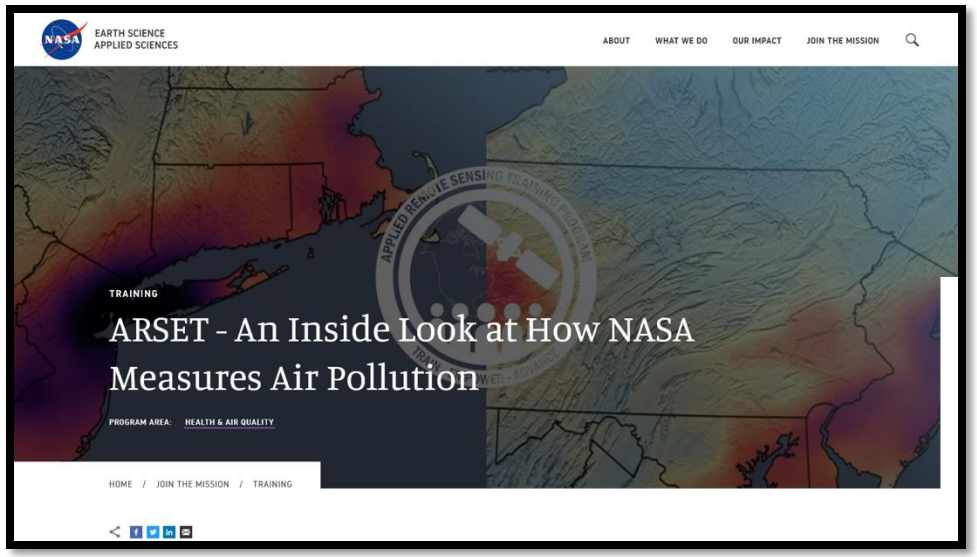
Q&A

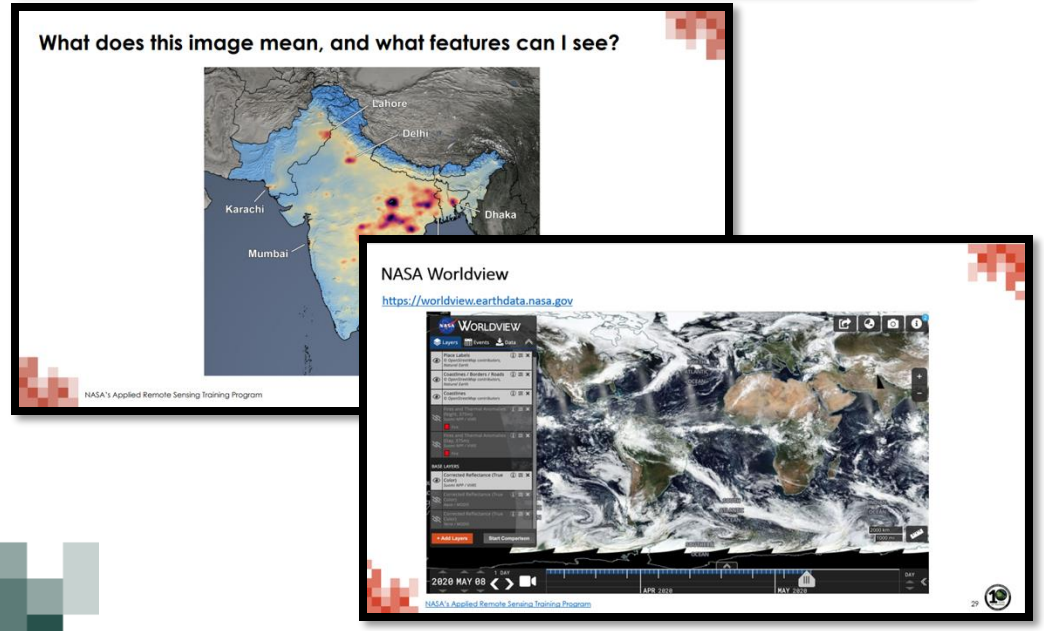


Training Evaluation



What does an Introductory/Intermediate Training Look Like?





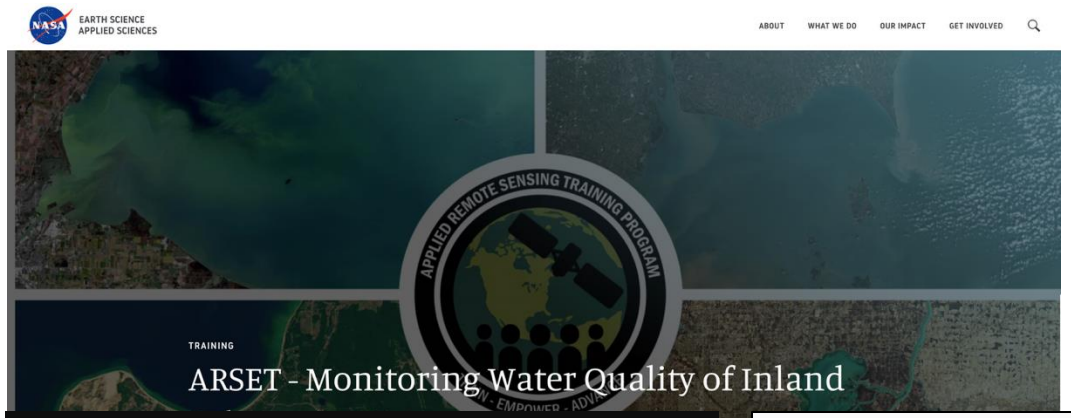
Learning objectives

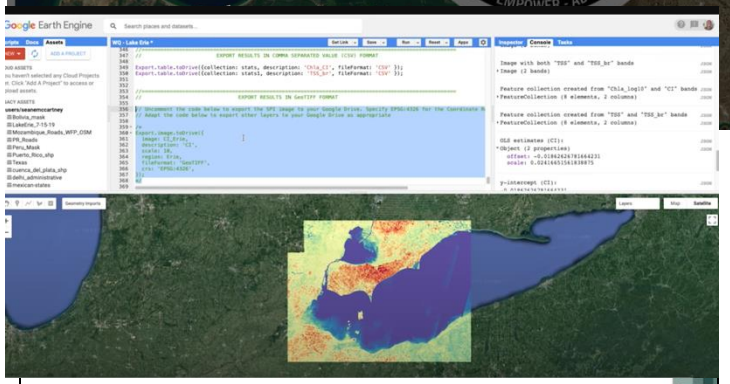
- List the pollutants that can be observed by NASA satellites
- Find and download imagery for NO2 and aerosols/particles
- Describe the capabilities and limitations of NASA NO2 and aerosol measurements

Topics

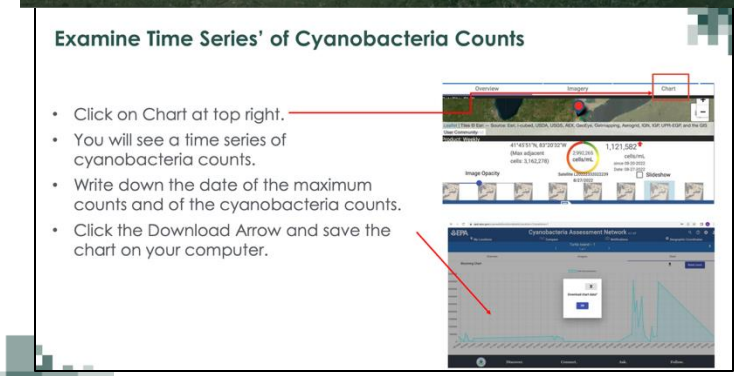
- What space-based observations are relevant for air quality and why?
- Remote sensing basics
- Interpreting satellite imagery
- Satellite columns vs ground-based measurements
- NASA webtool exercises: Worldview, Giovanni

What Does an Advanced Training Include?





GEE Code for Landsat-8 and Sentinel-2 data access, algorithm development to obtain Ch-a in Lake Erie using in situ Ch-a measurements



- Assess chlorophyll-a (Ch-a) concentration, turbidity, and Total Suspended Solids in selected inland lakes
- Develop algorithm to retrieve these parameters using in situ measurements coincident with satellite observations using Google Earth Engine (GEE)
- Learn about Cyanobacteria Assessment Network (CyAN), an early warning system to assess algal blooms in freshwater lakes will be provided

ARSET Website(s)

Home | EARTH SCIENCE APPLIED SCIENCES

APPLIED REMOTE SENSING TRAINING PROGRAM

ARSET

HOME

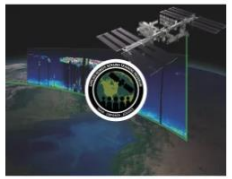
ABOUT ARSET
ADDITIONAL RESOURCES
FUNDAMENTALS
AGRICULTURE
DISASTERS
ECOLOGICAL CONSERVATION
HEALTH & AIR QUALITY
WATER RESOURCES
WILDLAND FIRES

CURRENT AND UPCOMING TRAININGS



ARSET - Fundamentals of Remote Sensing

February 18, 2025 - December 31, 2025



ARSET - LiDAR Profiling Satellite Observations for Air Quality Applications

June 04, 2025 - June 11, 2025

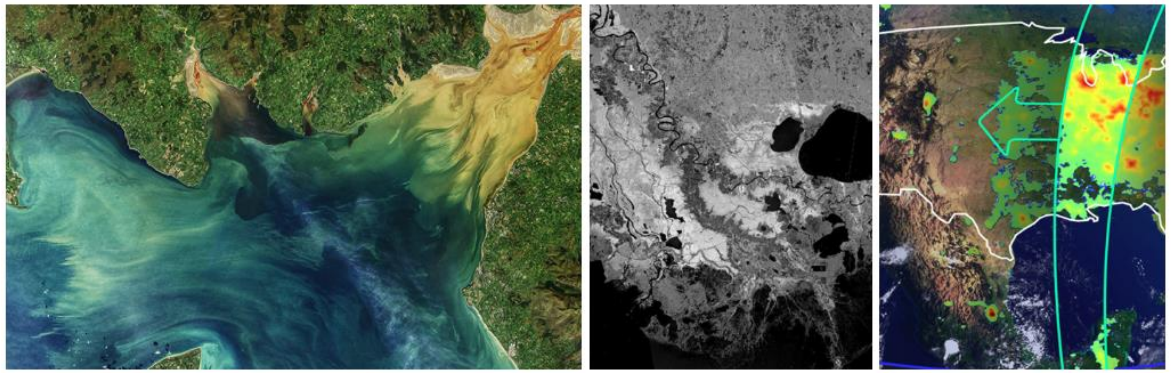
https://appliedsciences.nasa.gov/what-we-do/capacity-building/arset

https://www.earthdata.nasa.gov/data/projects/arset

EARTHDATA Data Topics Learn Centers Engage About News & Events

Overview Learn Contact Training Types and Levels Resources

Home / Find Data / Projects / ARSET



ARSET

Applied Remote Sensing Training Program

The Applied Remote Sensing Training (ARSET) program offers online and in-person trainings for beginners through advanced practitioners. Participants in our trainings build skills to use remote sensing data for a range of applications related to air quality, public health, agriculture, disasters, ecological conservation, water resource management, climate resilience, and wildland fires. From 'How do satellites work?' to 'How can I use satellite data to make a flood map?' there are trainings available for all levels of experience.

FUNDING PROGRAMS

NASA Earth Action Capacity Building Program

Since 2009, our program has trained more than 140,000 participants from 186 countries and more than 19,000 organizations worldwide. ARSET is part of the NASA Earth Action Capacity Building Program.

Not sure where to start? Browse our list of trainings. You can filter by theme, training level, and training type. Or, browse our Online Resource Guide to quickly see descriptions of all of our online trainings since 2015.

Learn more about our types and levels of training.

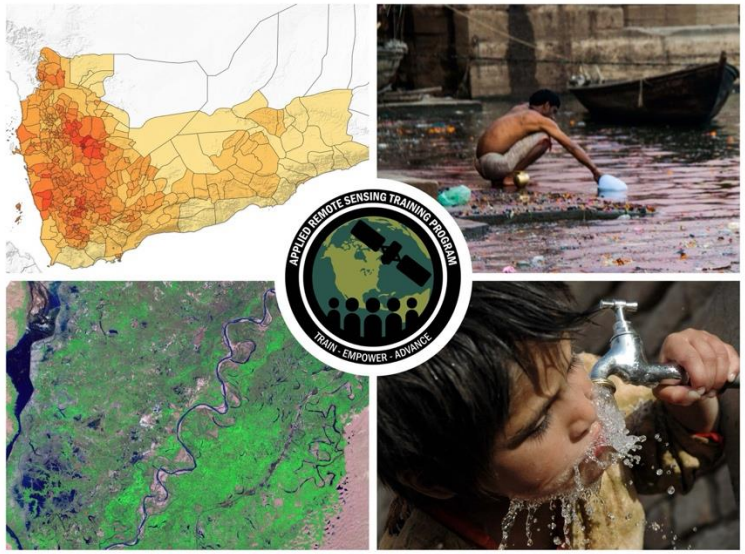
New to remote sensing and Earth observations? Check out our new interactive online, self-paced Fundamentals of Remote Sensing training on the ARSET learning management system to start learning.

Contact us or find answers to Frequently Asked Questions on our Resources page.

Application Areas

Agriculture | Climate Resilience | Disasters | Ecological Conservation | Health and Air Quality | Water Resources | Wildland Fire

The Application of Earth Observations for Assessing Waterborne Disease Risk



Online Introductory Attendance:

501 Participants

~250 Organizations

99 Countries

29 US States

Satellites/Sensors

PACE
Landsat 8/9
SNPP
GPM
SMAP
Sentinel-1/-2/-3
JPSS 1/2
Aqua
Terra

Instructors



Amita Mehta
NASA GSFC/UMBC
ARSET Instructor



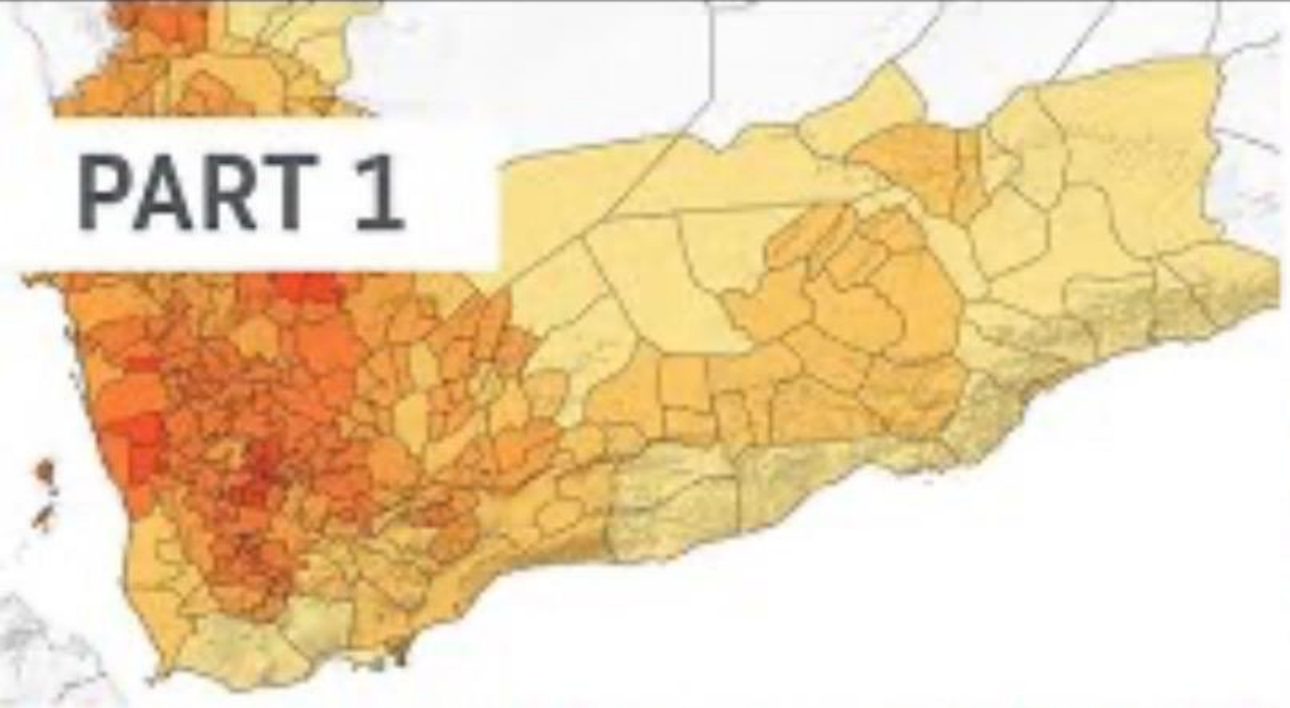
Antar Jutla
University of Florida
Guest Instructor



Bailey Magers
University of Florida
Guest Instructor

This two-part training focused on describing and accessing remote sensing observations useful as water quality indicators of waterborne diseases and presented case studies where remote sensing data are used to assess the likelihood of cholera outbreaks. More information can be found on the training webpage.

https://appliedsciences.nasa.gov/get-involved/training/english/arset-application-earth-observations-assessing-waterborne-disease



PART 1

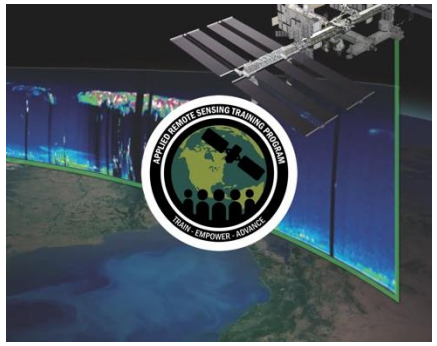




THE APPLICATION OF EARTH OBSERVATIONS FOR ASSESSING WATERBORNE DISEASE RISK

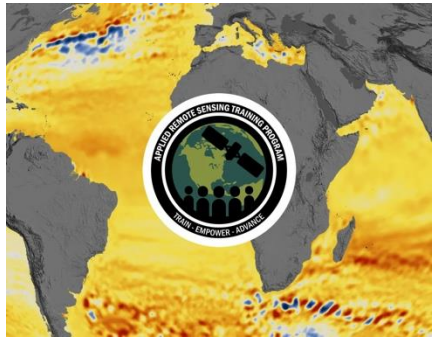


Upcoming trainings



[LiDAR Profiling Satellite Observations for Air Quality Applications]
Introductory

June 4, 11, Open for registration



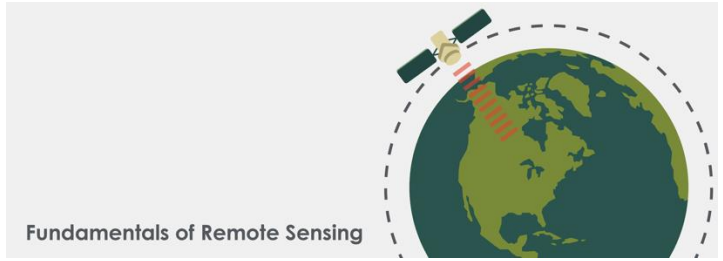
[Sea Level Change Tools for Planning and Decision Support]
Introductory

June 10, 17, Open for registration



[Introduction to NASA Snow and Ice Data Products and Applications for Water Resources Management]
Introductory

July 24, 31, August 7, Open for registration



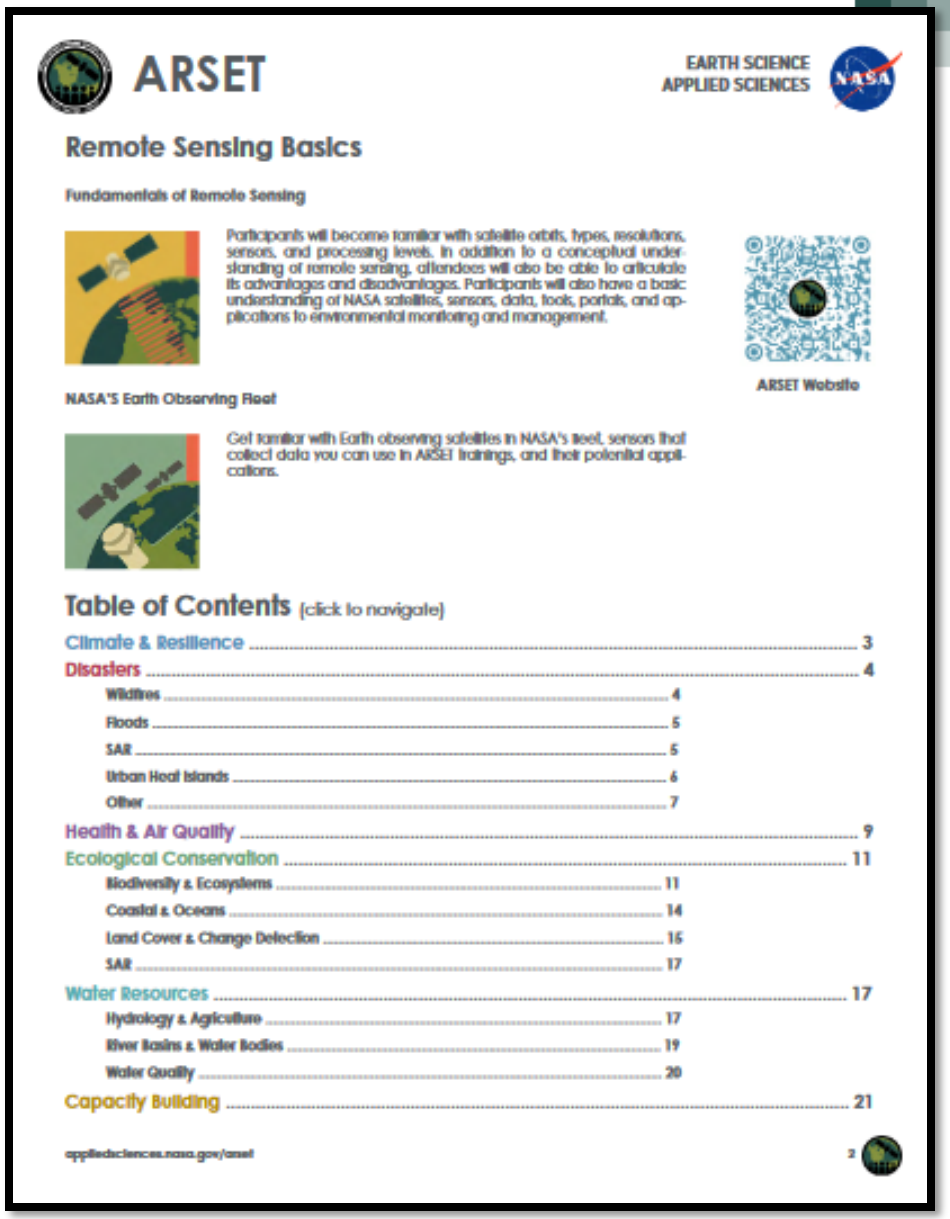
New! Self-paced Fundamentals of Remote Sensing

go.nasa.gov/3EVfr9T

Connect with ARSET

https://appliedsciences.nasa.gov/arset

- **View all recordings and materials** from previous trainings
- **Register** for an upcoming training
  - We use training survey responses to assess the effectiveness of each component of the training and get **ideas for future trainings.**
- Browse all our previous trainings since 2015 in our **Online Resource Guide**
- Take our **new self-paced training** on Fundamentals of Remote Sensing
- **Sign up for our listserv and follow us** on Twitter/X (@NASAARSET) to find out about our newest trainings



ARSET

EARTH SCIENCE APPLIED SCIENCES

Remote Sensing Basics

Fundamentals of Remote Sensing

Participants will become familiar with satellite orbits, types, resolutions, sensors, and processing levels. In addition to a conceptual understanding of remote sensing, attendees will also be able to articulate its advantages and disadvantages. Participants will also have a basic understanding of NASA satellites, sensors, data, tools, portals, and applications to environmental monitoring and management.

ARSET Website

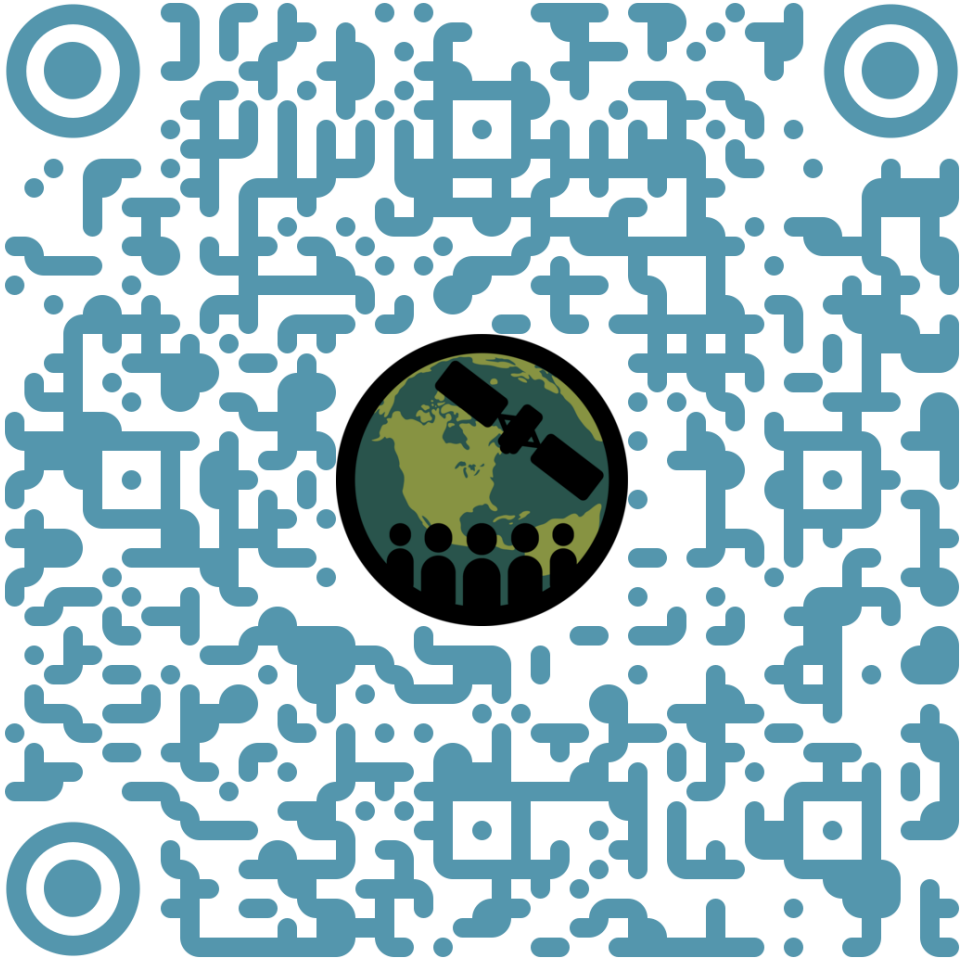
NASA'S Earth Observing Fleet

Get familiar with Earth observing satellites in NASA's fleet, sensors that collect data you can use in ARSET trainings, and their potential applications.

Table of Contents (click to navigate)

Climate & Resilience 3
Disasters 4
Wildfires 4
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Other 7
Health & Air Quality 9
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Coastal & Oceans 14
Land Cover & Change Detection 15
SAR 17
Water Resources 17
Hydrology & Agriculture 17
River Basins & Water Bodies 19
Water Quality 20
Capacity Building 21

appliedsciences.nasa.gov/arset 2



Thank you!