National Aeronautics and
Space Administration

ARSET

Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

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# Remote Sensing Training: Methods & Best Practices

October 20, 2016

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# Webinar Series Outline

- Week 1: Overview, October 13
  - How to develop a training program mission statement, create and perform end-user needs assessments, advertise the training, training promotion, and create a good presentation

- **Week 2: Onsite Training, October 20**
  - **Online versus onsite trainings; how to develop onsite trainings, including training levels (introductory to advanced), training structure, developing case studies and hands-on exercises, timelines, and program evaluation**

- Week 3: Online Training, October 27
  - How to develop online trainings, including training levels (introductory to advanced), designing online presentations, developing assignments and exercises, software, and timelines

# Learning Objectives

- Understand the key steps needed to develop an online or onsite training
- Learn how to conduct outreach and promote trainings
- Learn how to develop and deliver effective presentations on remote sensing topics and applications

# Seven Steps to a Successful Remote Sensing Training

1. Develop a Training Mission Statement (Week 1)
2. Assess End-User Needs (Week 1)
3. Build a Network (Week 1)
4. Training Promotion (Week 1)
5. **Develop Training Material (Weeks 1-3)**
6. **Conduct the Training (Weeks 2-3)**
7. **Evaluate the Training (Week 2)**

# Week 2 Outline

- Online vs. Onsite Trainings
- Onsite Trainings
- Training Structure
- Developing Hands-on Exercises & Case Studies
- Timeline & Deliverables
- Program Evaluation

# Review: Relevant Terms

- **Participant:** a person or organization who attends a remote sensing training

- **End-User**: a person or organization who uses remote sensing data and applies it to an environmental problem or question
  - May be a decision-maker and may use data to make decisions

- **Stakeholder**: a person or organization who benefits from or is impacted by remote sensing data, information, or decisions derived from the data

# Question

- What remote sensing topics are you teaching or training on?

# Online vs. Onsite Trainings

# Two Types of ARSET Trainings

## Online vs. Onsite Trainings

**Online Trainings**

- Online *live* webinar series; also recorded and freely available on-demand
- 60-90 min per weekly webinar, 3-5 weeks
- Course materials:
  - Presentations and demos
  - Exercises or Homework


**Onsite Trainings**

- Held in a computer laboratory
- 2-7 days in length
- Mixture of lectures and exercises.
- Course materials:
  - Presentations
  - Guided Instructions for exercises

# Criteria for Choosing Online vs. Onsite Training

## Available Resources

- Onsite: requires considerable resources for both trainers and trainees
- Online: less resources needed since there are no travel costs and trainings are shorter in duration

## Audience Size

- Onsite: best for <50 people
- Online: can reach hundreds to thousands of people

## Content

- Onsite: well suited to basic and complex remote sensing topics
- Online: can be basic or advanced; not well suited to certain types of complex analysis or types of remote sensing data

# ARSET Training Levels

## Both Online & Onsite

**Fundamentals**

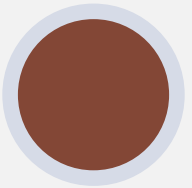
*Level 0*

- Online
- Assumes no prior remote sensing knowledge
- Examples:
  - *Fundamentals of Remote Sensing*
  - *Satellites, Sensors, Data and Tools for Land Management and Wildfire Applications*

**Basic Trainings**

*Level 1*

- Online & Onsite
- Requires Level 0 training
- Specific applications
- Examples:
  - *Introduction to Satellite Remote Sensing for Air Quality Applications*
  - *Using NASA Remote Sensing for Disaster Management*



**Advanced Trainings**

*Level 2*

- Online & Onsite
- Requires Level 1 training
- More advanced or focused topics
- Examples:
  - *Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery*

# Online vs. Onsite Trainings

- Poll: What types of trainings does your program conduct?
  - Onsite or classroom
  - Online
  - Both
  - I don’t conduct trainings yet

# Onsite Training

# Onsite Training

- Face-to-face training in a physical location with internet access
- Each participant has their own computer
- Walks participants through the processes and analysis needed to use remote sensing data
- Number of attendees: 25-50
- Length:
  - 2-3 days for a basic training (level 1)
  - 6-7 days for an advanced training (level 2)
- Large focus on exercises (individual and group) and hands-on activities
  - lecture comprises no more than 50% of training time

# Before Conducting an Onsite Training

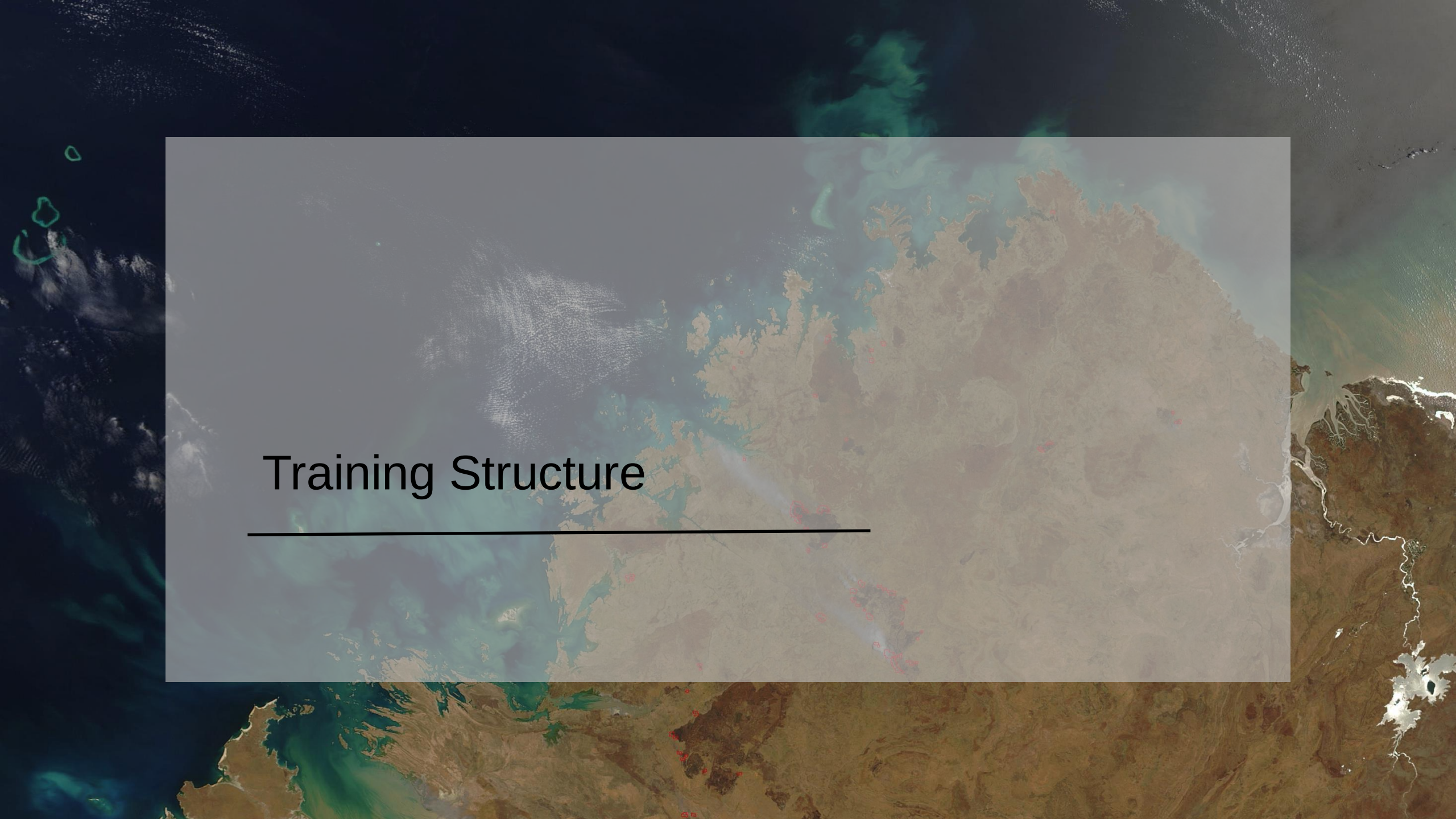
1. Conduct an end-user needs assessment (see week 1)
2. Identify one or more stakeholders who understand end-user needs and will define the training agenda and focus. They can also collaborate as trainers or participants.
3. Define and communicate ahead of time:
   - learning objectives
   - learning prerequisites
   - technical competency prerequisites

# Other Considerations for Onsite Training

- Participant Selection Criteria
  - use an application process or other type of mechanism. Criteria for selection may include:
    - Technical competency
    - Needs of the participant(s) can be addressed with remote sensing data
- Focused Agenda
  - don’t overwhelm the audience with too much information
  - focus on a specific environmental challenge or question & how remote sensing can help
- Internet Considerations
  - Internet speed should meet the training requirements
  - If unavailable, download the remote sensing data ahead of time

# Onsite Trainings

- In your experience, what are the most important elements that lead to a successful in-person training or class?
  - Actions
  - Format
  - Other considerations



# Training Structure

# Onsite Training Structure

1) Begin with a lecture on satellite missions and instruments
2) Demonstrate tools and other resources for access to remote sensing data
3) Discuss and demonstrate analysis and application of remote sensing data to environmental questions
4) Alternate lectures with hands-on activities (lectures are less than 50% of the time)
5) Include case studies conducted individually and, if time allows, also in groups
6) Make time for discussion at the end of the training on future training
7) Disseminate surveys to assess the training

# Example Agenda: Air Quality Remote Sensing Training

**Day 1**

- 8:00: Introduction & Logistics
- 8:15: Overview of Current & Future Satellite Capabilities for Air Quality
- 9:15: Satellite Imagery, Access, Interpretation, and Tools
- 10:15: Break
- 10:30: Aerosol Observations from Satellites
- 11:15: Hands-on Activity Using Giovanni & LAADSWeb
- 12:30: Lunch
- 13:30: Hands-on Activity Using AEROSTAT/MAPPS
- 14:30: Break/Ice Breaker
- 15:00:Hands-on Activity with MODIS data

**Day 2**

- 8:00: Satellite Observations to PM2.5
- 9:00: Introduction to IDEA
- 10:00: Break/Ice Breaker
- 10:30: Hands-on Activity on PM2.5 conversion
- 12:00: Lunch
- 13:00: Satellite Trace Gas Products
- 14:00: Hands-on Activity Exploring Trace Gas Data Sets
- 14:45: Smoke/Fire and Dust Detection
- 15:30: Break
- 15:45: Space Borne & Ground Based LIDAR (with Hands-on Exercise)
- 16:45: Air Quality Case Study Orientation & Discussion Groups

# Example Agenda: Air Quality Remote Sensing Training

**Day 3**

- 8:00: Groups Prepare Case Study Analysis
- 11:00: Case Study Presentation
- 12:00: Summary/Concluding Discussion
- 12:30: Adjourn

# Developing Hands-on Exercises & Case Studies

# Hands-on Exercises & Case Studies

- Teach use of web tools or software for access & analysis of remote sensing data
- Can use exercises to introduce a topic, tool, dataset
- Emphasize science or technical concept

**Exercises**

- Provide step-by-step instruction on data access & analysis
- Provide screenshots throughout the process
- Written as an operating manual for a user that is completely unfamiliar with the software/data
- Can include questions to help participants understand use & limitations

**Case Studies**

- Participants apply skills learned to a real-world scenario: a specific event in time and place.
- Begin with pre-selected case studies first to encourage critical thinking
- Also use case studies chosen by participants so they can practice what they learned to their specific problem of interest
- Participants present their case study results to the class

# Example Case Study

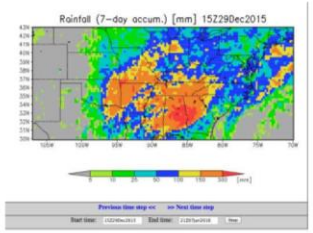
*Advanced Webinar: Using NASA Remote Sensing Data for Flood Monitoring & Management*

ARSET Advanced Webinar on Using NASA Remote Sensing for Flood Monitoring and Management:
**Week 4**

Exercise: Mississippi River Flood December 2015 - January 2016

**Part 1a: Monitor Rainfall and Flooding Intensity Using GFMS**

- Go to http://flood.umd.edu/
- Scroll down to **Rainfall (7 – day accum) [mm]**
- Using **'Pan the map'** and **'Zoom in' and 'Zoom out'** arrow zoom in on the St. Louis region
- Under the map enter **'Start time:'** 00Z28Dec2015 and **'End time'**: 21Z05Jan2016
- Click on **Animate** and observe how the rainfall changes
- Note the maximum amount of 7-day accumulated rain observed during 28 December 2015 - 05 January, 2016
- Note the approximate area (in latitude and longitude) where heavy rainfall is observed




- From the rainfall maps from GFMS which river(s) are likely to be flooded?

- Now from the **'Plot different variables:'** on the right side of the map select **'Flood Detection (Depth)'** from the drop-down menu and click on **'plot'**
- Repeat map animation steps for the **'Flood Detection (Depth)'**. That is enter **'Start time:'** 00Z28Dec2015 and **'End time'**: 21Z05Jan2016 and click on **Animate** and observe how the flood intensity is changing

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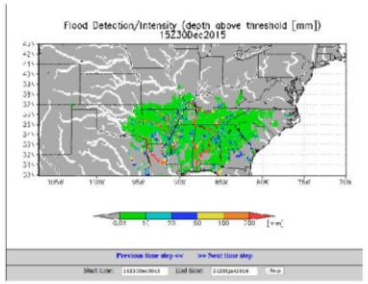
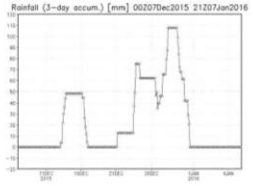
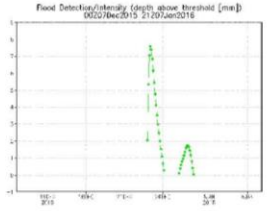



- Do the rivers you think would be flooded based on the rainfall animation show high **flood detection depth?**
- Which river had maximum intensity flooding? Note the date, time and maximum flood depth observed.

**Part 1b: Rainfall Time Series as Flood Indicator**

- From the **'Plot different variable'** select **'Rainfall (3-day)'** from the drop-down menu
- In the **'Plot time series for an individual point (lat, lon):'** section and enter
  **T1**: 00Z07Dec2015
  **T2**: 21Z07Jan2016
- In the map zoom in enough to individual pixels
- Enter lat –lon 38.5 and -90.4 (This is close the city of St. Louis which was heavily flooded)
- Click on **'See time Series'**
- Save the time series on your computer (by dragging or right clicking the image with your mouse)
- Repeat the same time series for **'Flood detection (Depth)'**
- Examine both the time series and note the period when accumulated rainfall is rising; also examine the flooding detection depth and see if flood episodes can be deduced from the rainfall time series.

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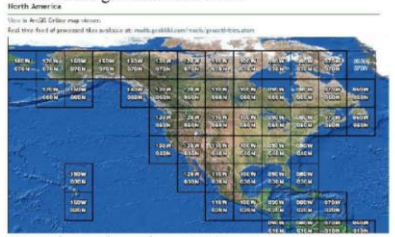
**Part 2: Examine Surface Inundation for the November-December 2015 from MODIS NRT**

- Go to the MODIS Near Real-Time (NRT) Global Flood Mapping Portal:

  http://oas.gsfc.nasa.gov/floodmap/

- Click on the **plus icon** next in the **Data Viewer** (left hand menu)
- Click on **North America**
- Click on the grid 100E and 040N



- From the top bar select **'14 Day Composite'**
- Using the calendar in the top upper left, select **7 January, 2016**
- Do you see any inundation where GFMS shows high rainfall?
- Also use the direction arrows to explore surrounding grids to see if there is surface inundation present
- Next, for **"14 Day Composite"** examine how the inundation maps change from 28 December, 2015- 10 January 2016 in the 100W 040N grid
- Click on the maps to zoom-in and see the surface inundation
- **Download the MODIS Flood Water** shapefile for the 100W, 040N grid using the 14 day composite of 7 January, 2016.

**Part 3: Use the Shuttle Radar Topography Mission (SRTM) Terrain and Slope in the Flooded Area**

- Go to the SRTM download portal:
  http://srtm.csi.cgiar.org/SELECTION/inputCoord.asp
- Download SRTM elevation using the following input coordinates:
  - **Latitude min**: 35N **max**: 40N
  - **Longitude min**: 95W **max**: 90W
- **Open QGIS** Desktop
- Load a basemap of your choice
- Import the SRTM data previously downloaded
- Using the DEM (Terrain Models) tool create a slope layer

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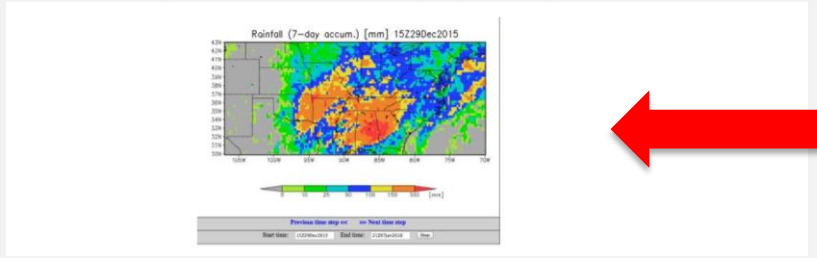
# Example Case Study

*Advanced Webinar: Using NASA Remote Sensing Data for Flood Monitoring & Management*




Screenshot or image of what you should expect to see

# Example Case Study

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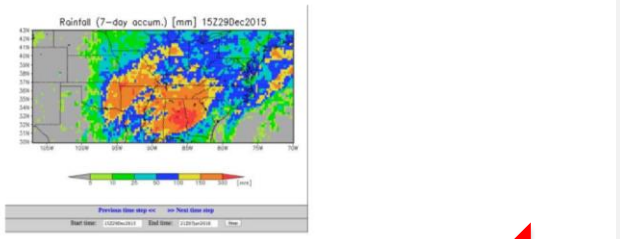


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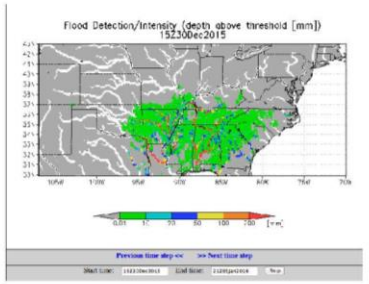


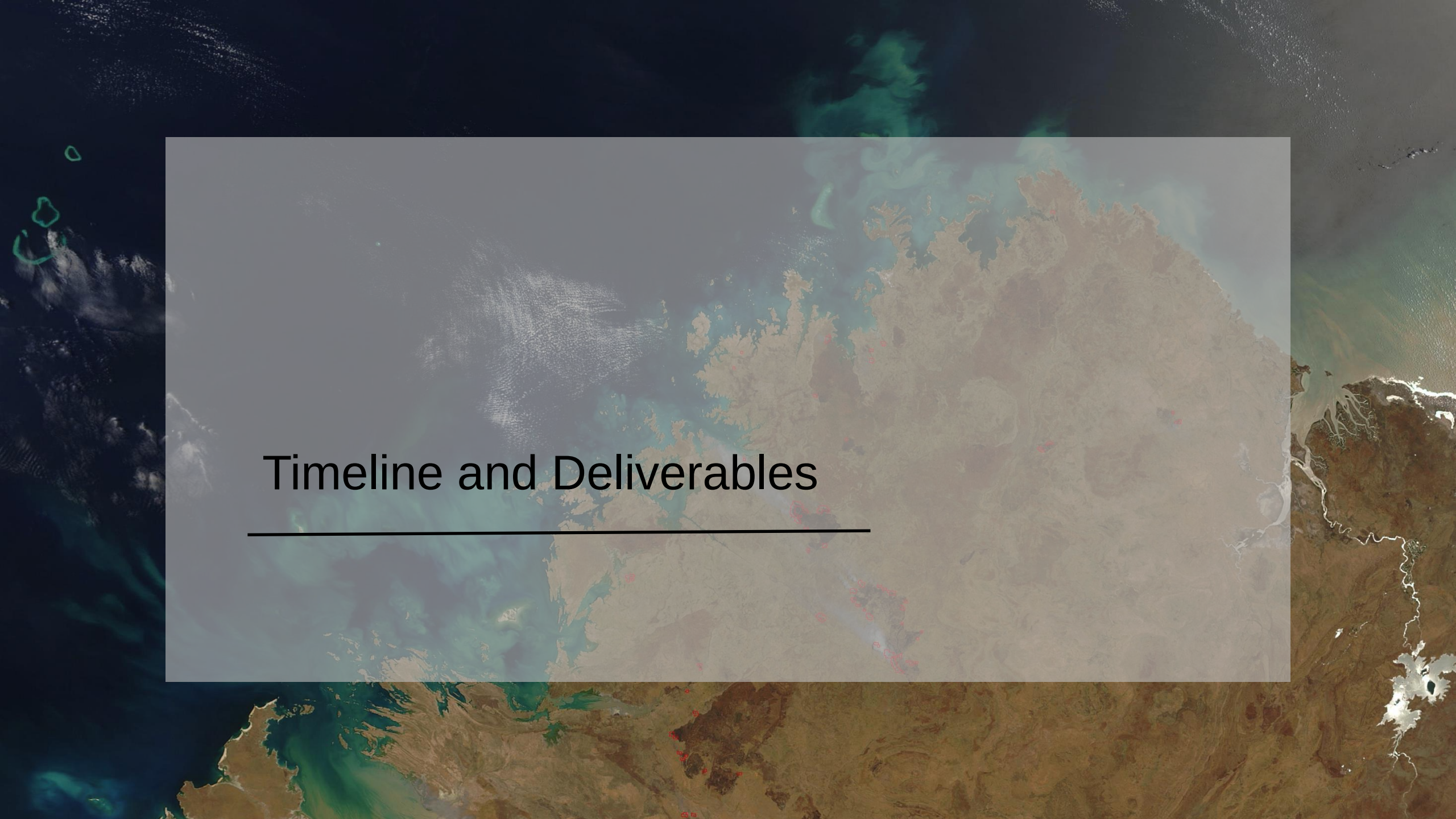

- Do the rivers you think would be flooded based on the rainfall animation show high **flood detection depth?**
- Which river had maximum intensity flooding? Note the date, time and maximum flood depth observed.

Questions to help participant think critically about the exercise

# Example Case Study

*Advanced Webinar: Using NASA Remote Sensing Data for Flood Monitoring & Management*

Doesn't assume participants are familiar with the tool



# Timeline and Deliverables

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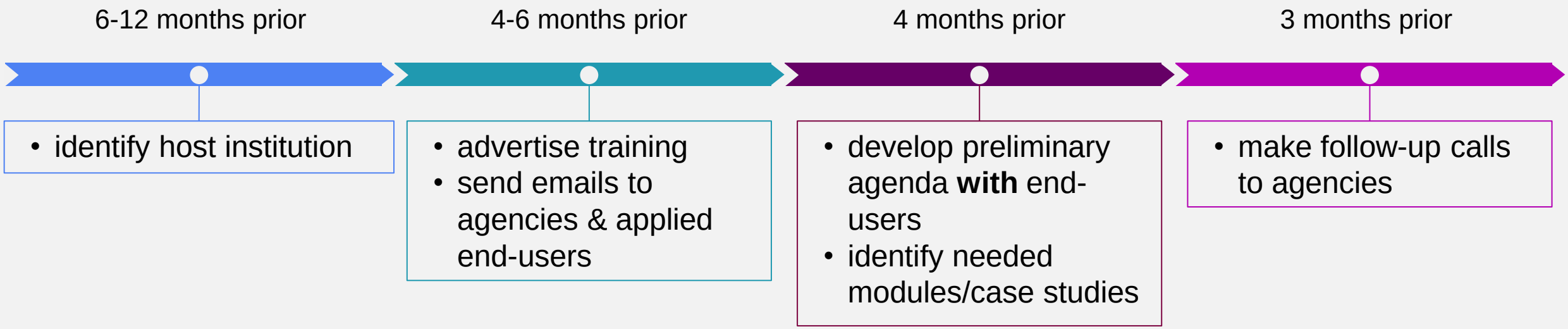
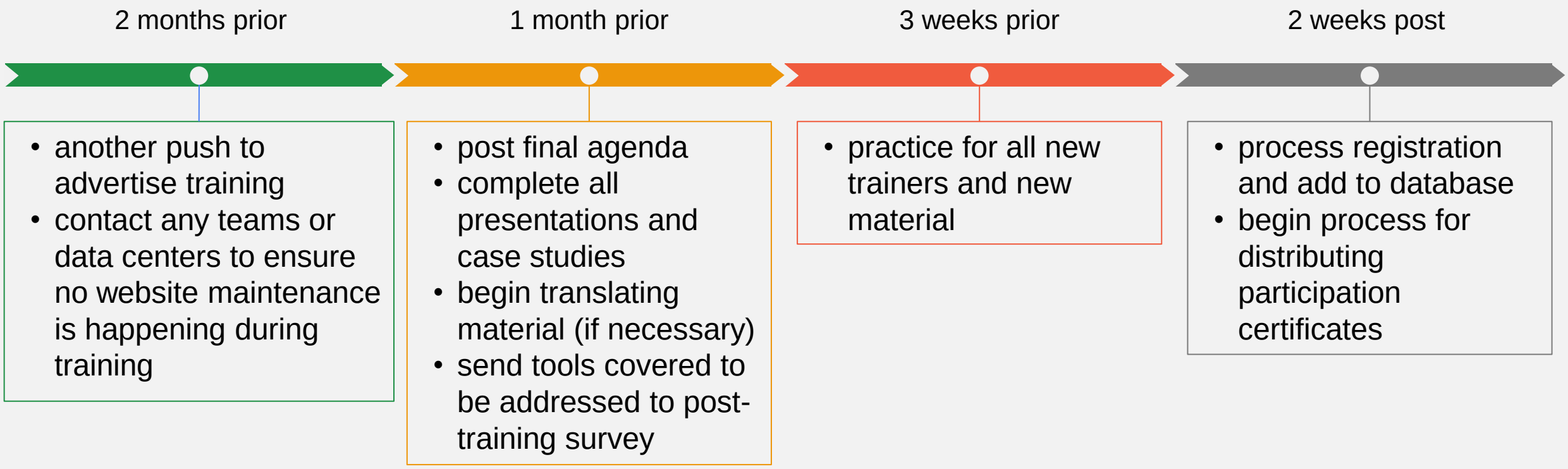
## Onsite Training



# Timelines & Deliverables

## Onsite Training



# Timelines & Deliverables

## Onsite Training

- What additional things do you include in your timeline that we didn’t discuss?

- What tips would you like to share on things to avoid for an in-person training or class?

# Program Evaluation

# Program Evaluation

**Goal:**

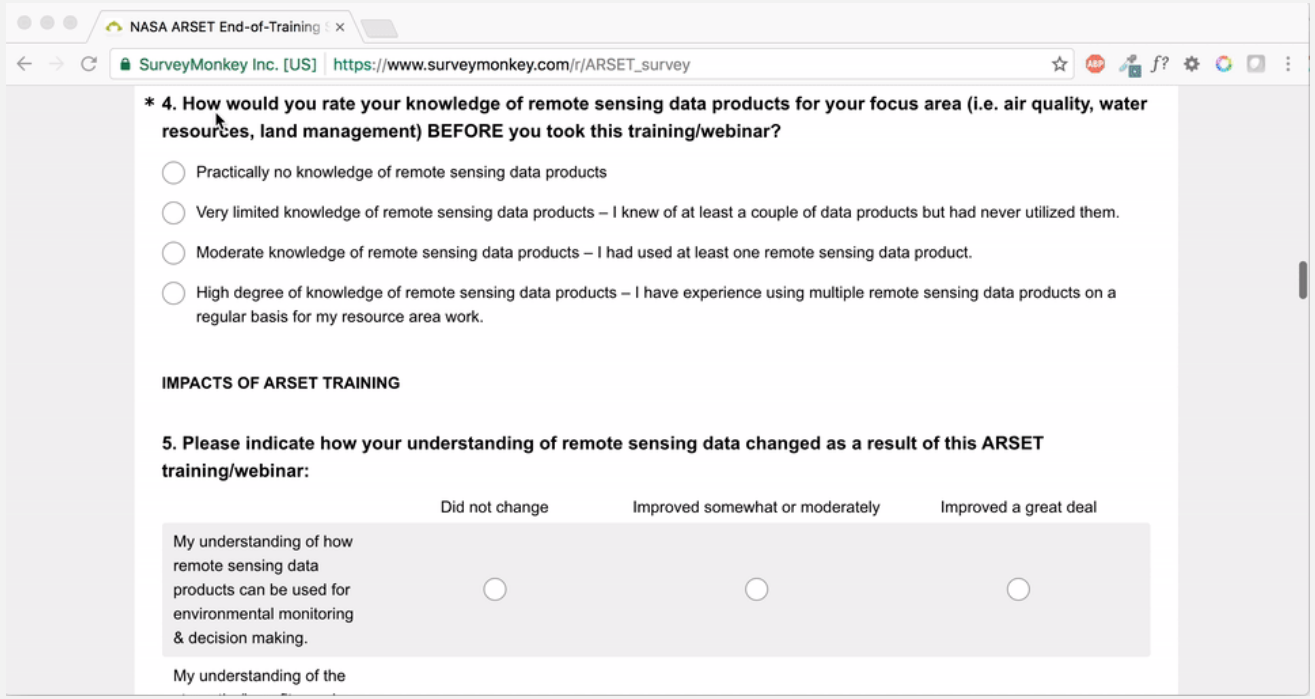
- Assess progress toward meeting learning objectives
- Assess the impact of the training
- Provide an ongoing means of improving the program

**Tools:**

- Surveys
- Interviews
- Focus groups
- Note: these tools are also used to collect end-user needs (see week 1)

# ARSET: Program Evaluation

- First survey: immediately after training
- Second survey: 6-months or more after training
- Interviews



# First Participant Survey

**Goals**

- Assess if the training met learning objectives
- Assess instructors and training format
- Assess the utility of remote sensing data sets, portals or analysis software taught
- Gauge future interest in training topics and application areas
- Use the results to inform the next training!

**Tips**

- Disseminate online rather than on paper
- Make time for attendees to complete it at the end of the training
- Send reminders to improve response rate
- Don’t make it too long, but long enough to make it useful

# Second Participant Survey

**Goals**

- *Assess the impact of the training*
- *Identify the types of decision making activities where participants are using the remote sensing resources*
- Assess the utility of remote sensing data sets, portals or analysis software taught
- Identify continuing barriers to use of remote sensing data
- Use the results to inform the next training!

**Tips**

- Disseminate online rather than on paper
- Expect a lower response rate (due to time), but still send reminders
- Don’t make it too long, but long enough to make it useful

# Interviews

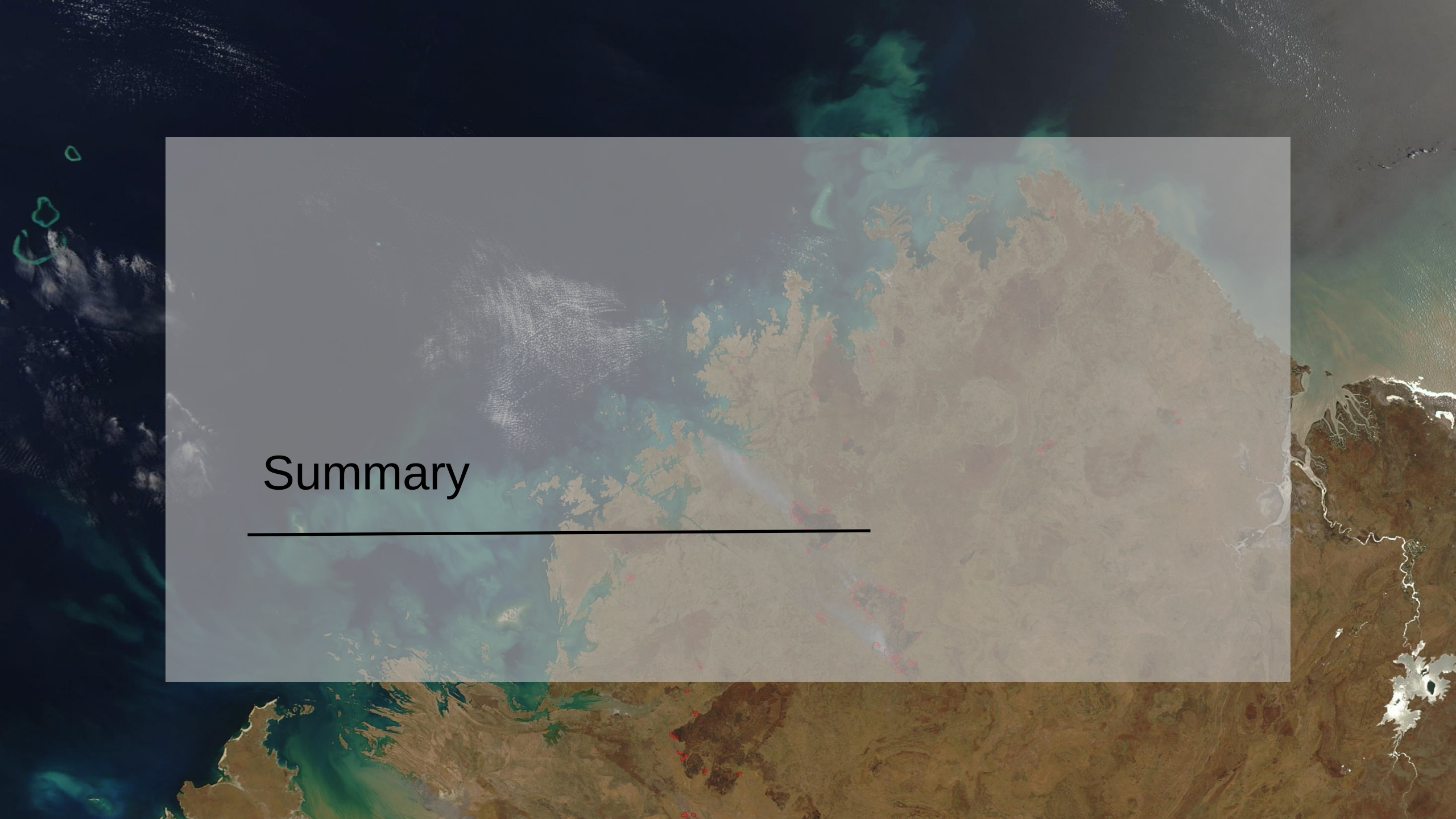
- Used early in the program to identify key barriers and needs, and to help construct the surveys
- Used after the trainings to gain deeper insight on the benefits of the training

"NASA is doing the right thing, if you want people to use your data,
you have to help them in how to do this – otherwise it is intimidating to use."
- *from an interview of an onsite training attendee*

# Evaluation

- Poll: Which type of training evaluation methods do you employ?
  - Formal surveys
  - Interviews
  - Other
  - Do not currently evaluate

- Do you conduct an evaluation of your program for assessing impacts or successes? (Whether it is for trainings or something else)



# Summary

# Seven Steps to a Successful Remote Sensing Training

1. Develop a Training Mission Statement (Week 1)
2. Assess End-User Needs (Week 1)
3. Build a Network (Week 1)
4. Training Promotion (Week 1)
5. Develop Training Material (Weeks 1-3)
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# Week 2 Outline

- Online vs. Onsite Trainings
- Onsite Trainings
- Training Structure
- Developing Hands-on Exercises & Case Studies
- Timeline & Deliverables
- Program Evaluation

# Next Week: Online Trainings

- Online Trainings
- Training Structure
- Developing Assignments & Exercises
- Software
- Timelines & Deliverables