Remote Sensing Training: Methods & Best Practices

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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?
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


**Part 1a: Monitor Rainfall and Flooding Intensity Using GFMS**
- Go to [http://gfms.nasa.gov](http://gfms.nasa.gov).
- Scroll down to Rainfall (7-day accumulation) [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": 06/28Dec2015 and "End time": 21/05Jan2016.
- Click on Animations 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 rivers 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:" 00/28Dec2015 and "End time:" 21/05Jan2016 and click on Animations and observe how the flood intensity is changing.

**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: 00/27Dec2015
  - T2: 21/07Jan2016
- In the map zoom in enough to individual pixels.
- Enter lat: 38.5 and lon -90.4 (This is close to 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.

**Part 2: Examine Surface Inundation for November-December 2015 from MODIS NRT Global Flood Mapping Portal:**
- Go to [http://esrin.esa.int/finset](http://esrin.esa.int/finset).
- Click on the plus icon next to 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/400N grid.
- Click on the maps to zoom-in and see the surface inundation.
- Download the MODIS Flood Water Shapefile for the 100W, 400N 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/SELECTTION/InputCoord.wf](http://srtm.csi.cgiar.org/SELECTTION/InputCoord.wf)
- 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.
Example Case Study


Part 1: Monitor Rainfall and Flooding Intensity Using GFMS
- Go to [GFMS link]
- Scroll down to Rainfall 7-day (mm)
- Using "Pan the map" and "Zoom in" and "Zoom out" arrow zoom in on the St. Louis region
- Under the map click "Start time": 00/2330 on 2015 and "End time": 21/035 on 2016
- Click on Animation and observe how the rainfall changes
- Note the maximum amount of 7-day accumulated rain observed during 28 December 2015 to 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?

- 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 2: Examine Surface Illumination for the November December 2015 from MODIS NIR
- Go to [MODIS NIR Global Flood Mapping Portal]

Part 3: Use the Shuttle Radar Topography Mission (SRTM) Terrain and Slope in the Flooded Area
- Go to the SRTM download portal

Screenshot or image of what you should expect to see
Example Case Study


Questions to help participant think critically about the exercise
Example Case Study


- Doesn't assume participants are familiar with the tool

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

- 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 1a: Monitor Rainfall and Flooding Intensity Using GFMS

- Go to [GFMS link]
- Scroll down to view 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 titles "Start time": 00Z/20Dec2015 and "End time": 21/03Jan2016
- Click on Animatie 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

Part 1b: Use GFMS for Flood Monitoring

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

Doesn’t assume participants are familiar with the tool
Timeline and Deliverables
Timelines & Deliverables
Onsite Training

6-12 months prior
• identify host institution

4-6 months prior
• advertise training
• send emails to agencies & applied end-users

4 months prior
• develop preliminary agenda **with** end-users
• identify needed modules/case studies

3 months prior
• make follow-up calls to agencies
Timelines & Deliverables

Onsite Training

2 months prior
• another push to advertise training
• contact any teams or data centers to ensure no website maintenance is happening during training

1 month prior
• post final agenda
• complete all presentations and case studies
• begin translating material (if necessary)
• send tools covered to be addressed to post-training survey

3 weeks prior
• practice for all new trainers and new material

2 weeks post
• process registration and add to database
• begin process for distributing participation certificates
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)
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
Next Week: Online Trainings

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