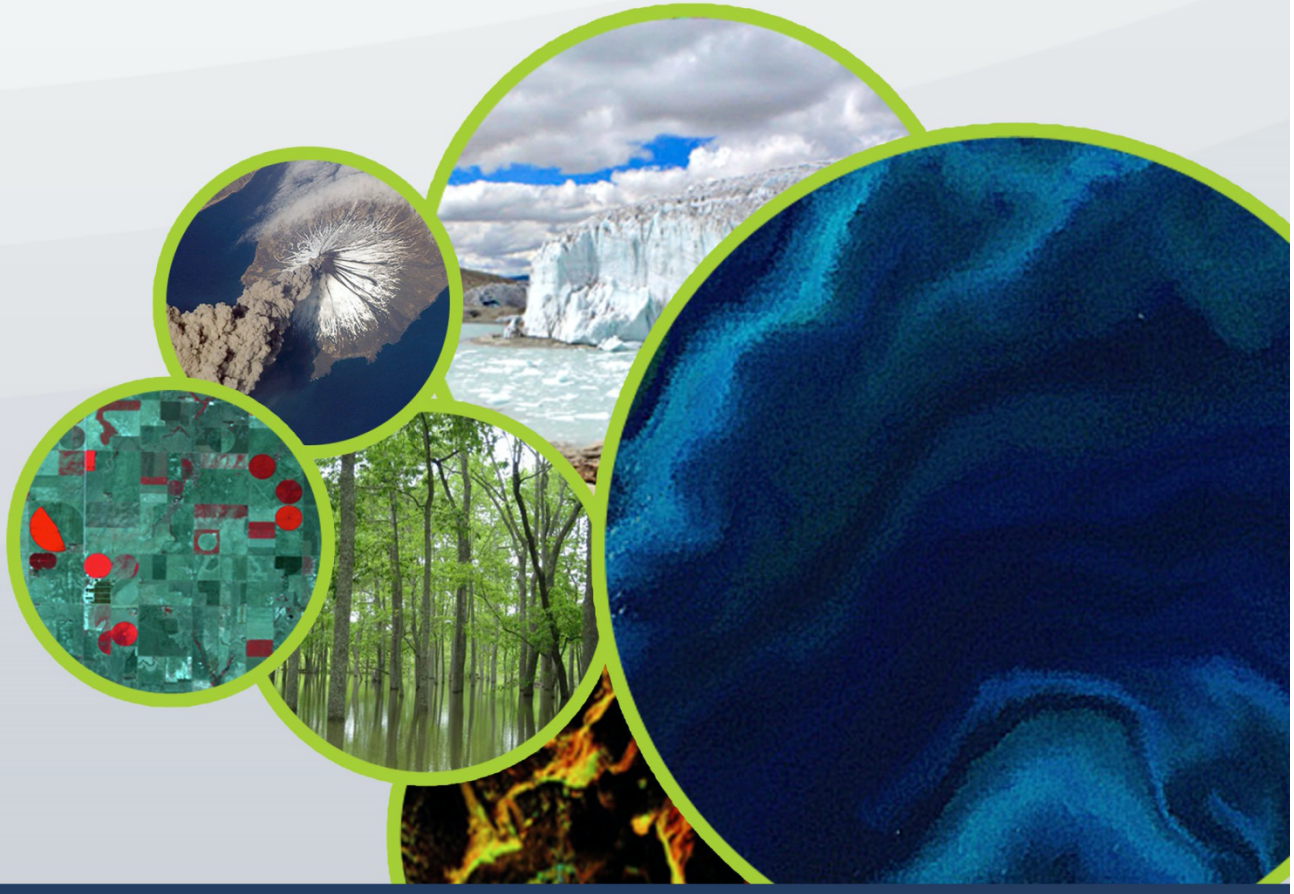
Committee on Earth Observation Satellites



CEOS WGCapD Training Report

Online Training Workshop on Satellite Remote Sensing for Air Quality Monitoring and Forecasting

August 24 and – August 26-28, 2020

Virtual Training (Thailand)

Committee on Earth Observation Satellites (CEOS)
Working Group for Capacity Building and Data Democracy (WGCapD)

Training Report

Online Training Workshop on Satellite Remote Sensing for Air Quality Monitoring and Forecasting

Report drafted by: Mr. Rishiraj Dutta (PhD), SERVIR-Mekong

Training Description: As a part of the effort to enhance capacity of Thailand's Pollution Control Department (PCD) and its partner, Geo-Informatics and Space Technology Development Agency (GISTDA), SERVIR-Mekong in partnership with the NASA Science Coordination Office organized an online training workshop titled "Online Training Workshop - Satellite Remote Sensing for Air Quality Monitoring and Forecasting", on August 24 and 26-28, 2020.

Training Objectives & Expected Outcomes: This training workshop will serve as a forum for discussion and provide the participants with an opportunity for capacity building. At the end of the workshop, the participants will be able to:

- Understand how NASA and SERVIR-Mekong resources are used in decision-making activities such as air quality forecasting, fire smoke detection, PM2.5 monitoring, and modeling;
- Access freely available NASA and SERVIR-Mekong web tools for visualizing and acquiring aerosol and trace gas data; and
- Understand the strengths and weaknesses of NASA and SERVIR-Mekong data products.

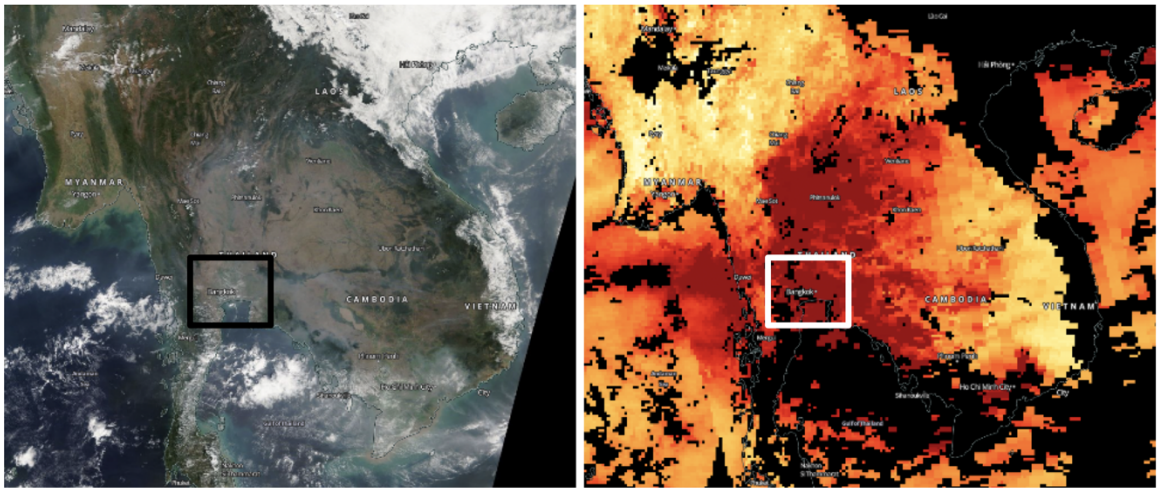
Training Type: Online Training
Training Theme: Health and Air Quality
Training Language(s): English

Host Organization(s):

Asian Disaster Preparedness Center (ADPC)/SERVIR-Mekong, NASA Science Coordination Office, Universities Space Research Association (USRA), Capacity Building & Data Democracy programme (CEOS-WGCapD) and

End-user Organization(s):
Thai Pollution Control Department, and Geo-Informatics and Space Technology Development Agency (GISTDA)

Instructor:
Dr. Pawan Gupta, Universities Space Research Association (USRA/MSFC)
Training Coordinator:
Mr. Aekkapol (AJ) Aekakkararungroj, ADPC/SERVIR-Mekong



MODIS-Terra True Color Image
Feb 2, 2020

MODIS-Terra Aerosol Optical Depth
Feb 2, 2020

Image credit: NASA WorldView (MODIS Terra Aerosol Optical Depth of Bangkok during February 2020)

Partner Institutions:

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Abbreviations

ADPC	Asian Disaster Preparedness Center
AOD	Aerosol Optical Depth
CEOS-WGCapD	Capacity Building & Data Democracy programme
GISTDA	Geo-Informatics and Space Technology Development Agency
MODIS	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
NO2	Nitrogen Dioxide
PCD	Pollution Control Department
SCO	Science Coordination Office
SIG	Spatial Informatics Group
SEI	Stockholm Environment Institute
USAID	U.S. Agency for International Development
VIIRS	Visible Infrared Imaging Radiometer Suite

Training Background

Air quality is a global public health concern affecting millions across the globe. Recently, in the winter season of 2018 Bangkok experienced a very high concentration of PM2.5, which disrupted the everyday life of its citizens. These levels are measured from the ground-based instruments installed in various part of the Bangkok metropolitan area with an estimated population of more than 9 million. There was also extensive air pollution in Northern Thailand due to biomass burning. Besides harming human beings, air pollution also impacts crops, hence the impetus of this effort be not only focused on Thailand but to be scaled up to the Lower Mekong region.

Uses of satellite remote sensing to estimate particulate matters for air quality applications has advanced over the past decade. Many methods, data, and tools have been developed by various groups around the world to convert satellite retrieved aerosol properties into surface-level particulate matter mass concentrations for air quality monitoring. Data from several satellites are currently being used for a wide range of air quality applications for both research and operational purposes. SERVIR-Mekong initiated a co-development cooperation with Thailand's Pollution Control Department (PCD) to develop a satellite-based air quality monitoring and forecasting tool to supplement the Department's ground measurement, hence improving the public's access to air quality information overall.

As a part of the effort to enhance capacity of PCD and its partner, Geo-Informatics and Space Technology Development Agency (GISTDA), SERVIR-Mekong in partnership with NASA Science Coordination Office organized an online training workshop titled "Online Training Workshop - Satellite Remote Sensing for Air Quality Monitoring and Forecasting", on August 24 and 26-28, 2020.

SERVIR-Mekong is a regional initiative, supported by USAID and NASA, implemented by the Asian Disaster Preparedness Center (ADPC). SERVIR-Mekong's main goal is to enhance the use of applications of geospatial analysis to critical, urgent, or common policy and planning needs, especially in the context of disaster risk reduction and response, climate change adaptation, water security, food security, and landscape management. The countries covered by the Lower Mekong region are Cambodia, Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Vietnam.

Training Course Content

The training provided details on the applications of NASA resources to decision-making activities related to air quality monitoring, forecasting, smoke/fire, and PM2.5 monitoring, image interpretation, and data access. Specific data products and tools included aerosol data from MODIS, VIIRS, as well as the associated online and offline tools for visualizing and acquiring

aerosols and trace gas data. The sessions were arranged in a way that the participants were able to familiarize with the NASA Earth Data Tool[1] in terms of downloading and analysing data for PM2.5 and aerosol monitoring and also interpreting the findings. The session titles are given below:

D1P1: Overview of satellite capabilities for air quality monitoring
D1P2: Satellite imagery, data formats and access
D1P3: Basics of satellite remote sensing
D2P1: Aerosols observation from satellites: brief theory and existing products
D3P3: Hands-on exercise
D4P1: Aerosol optical depth (AOD) to PM2.5
D4P2: Hands-on exercise on AOD to PM2.5

About Training Organizers

The training was organized by SERVIR-Mekong and NASA Science Coordination Office (SCO) in partnership with Capacity Building & Data Democracy (CEOS-WGCapD) programme. NASA ARSET program supported the training by providing existing training material on the topic.

SERVIR-Mekong: The SERVIR-Global network of regional geospatial support hubs is an initiative of the United States National Aeronautics and Space Administration (NASA) and the United States Agency for International Development (USAID). SERVIR-Mekong is a geospatial data for development program designed to respond to the needs of the Lower Mekong countries. It builds the capacity of governments and other key stakeholders in the Lower Mekong countries to employ publicly available satellite imagery and geospatial technologies for decision making related to climate change, environmental management, and disaster risk management. SERVIR-Mekong is implemented by the Asian Disaster Preparedness Center (ADPC) and its technical partners Spatial Informatics Group (SIG), Stockholm Environment Institute (SEI), and Deltares.

NASA Science Coordination Office (SCO): The SCO connects NASA scientific tools to existing tools in the SERVIR hubs and provides support to and coordination of SERVIR projects globally. The team also helps coordinate among institutions within the countries and among SERVIR and its partners in the U.S. and abroad.

CEOS-WGCapD: The Working Group on Capacity Building and Data Democracy (WGCapD) under The Committee on Earth Observation Satellites (CEOS) also support this training workshop.

[1] https://search.earthdata.nasa.gov/search

Participant Overview:
Attendance: 23

Trainee Information:
Overall 23 participants attended the training that includes staff from the Pollution Control Department (PCD) and the Geo-Informatics and Space Technology Development Agency (GISTDA).

Organization	Organization Type	Country
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
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PCD	Government	Thailand
GISTDA	Public Organization	Thailand
GISTDA	Public Organization	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
PCD	Government	Thailand
GISTDA	Public Organization	Thailand
GISTDA	Public Organization	Thailand

Gender Inclusiveness

Training is a transformative process that aims to provide knowledge, techniques and tools to develop skills and changes in attitudes and behaviours. It is a continuous and long-term process that requires institutional will and commitment of all parties in order to create an inclusive environment within the workplace that recognizes the need to promote gender equality. Therefore, having understood the gender inclusivity and aiming for a transformative environment, it is very important for SERVIR-Mekong to help women and men to understand the role gender plays and to acquire the knowledge and skills necessary for advancing gender equality in their daily lives and work, so that awareness is raised and learning is encouraged

while knowledge and skills are developed. Therefore, SERVIR-Mekong through its training activities ensure that there are adequate representations of male and female participants who not only tend to gain knowledge but also develop their skills in meeting with their organizational requirements.

This training too was gender inclusive with over **43%** male representation and **57%** female representation (Figure 14).

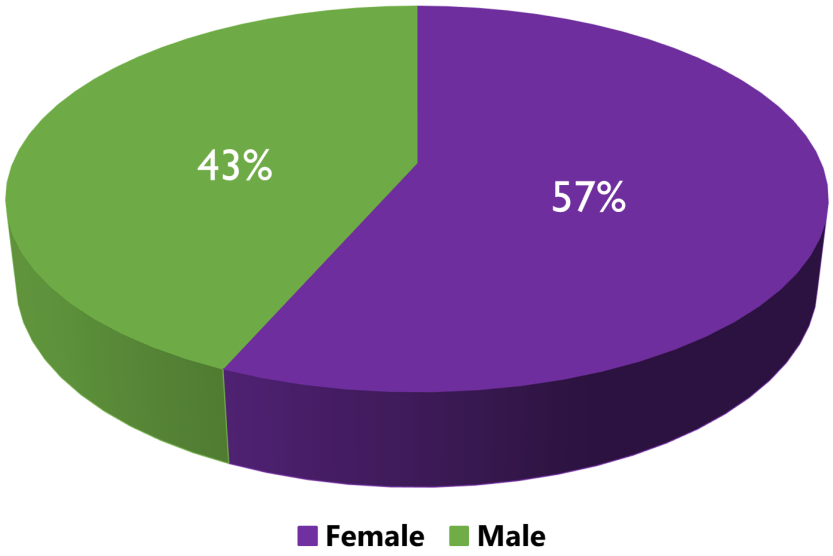


Figure 1: Gender Inclusiveness

Lessons Learned:

At the end of the training,

- Participants were able to get a thorough understanding on the existing data portals, visualization tools, and available data that are relevant to properly identify, track and measure air quality events
- Participants were able to assess the strengths and weaknesses of the data products that were derived from the existing data and tools.

Summary of Survey Results:

Overall Assessment of the Training

Overall 88% of the participants rated the training to be very good when asked to rate in the scale of 1-5 (1-Worse; 2-Bad; 3-Average; 4-Good; 5-Very Good) (Figure 1).

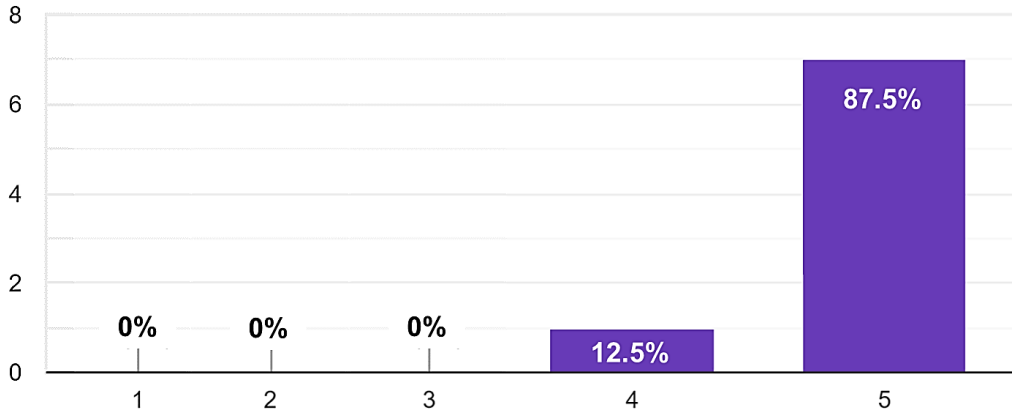


Figure 2: Chart showing the overall rating of the training

Self-Assessment Before and After the Training against learning Objective

Self-Assessment Before the Training

Before the start of the training, a self-assessment was carried out with the participants to understand their existing knowledge on the role of remote sensing data for air quality monitoring and their level of information on the freely available NASA and SERVIR-Mekong tools for air quality monitoring and forecasting.

In terms of **importance of the training**, **60%** of the participants agree that the training is very important while another **20%** of the participants found the training to be highly relevant. Overall score of **80%** (**60% + 20%**) suggest that the participants agree to the training being very important to their job (Figure 2).

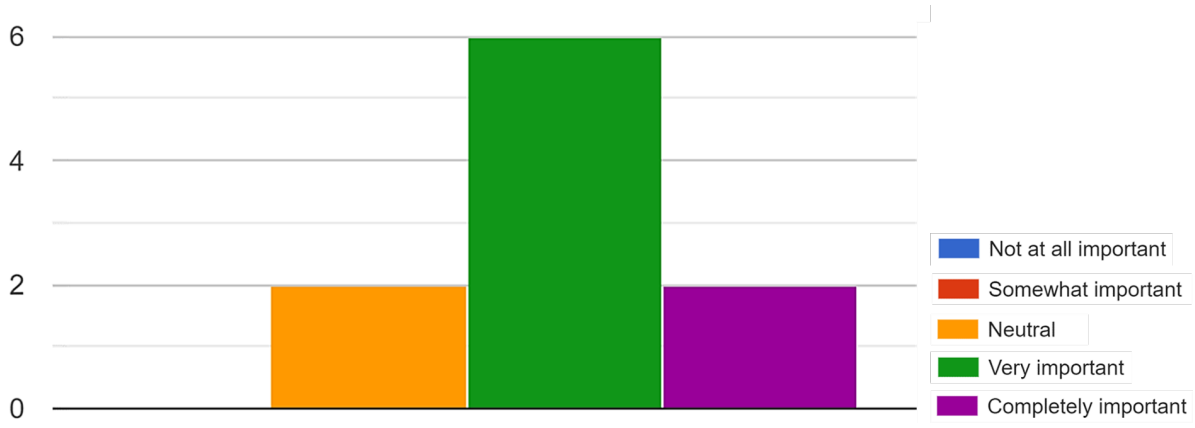


Figure 3: Importance of the training

In terms of **knowledge, skills and competencies** (Figure 3) before the training, the assessment results have shown that,

- Majority of the participants have *low to moderate level* understanding of the basic concepts of remote sensing (a).
- Majority of the participants have *low to moderate level* understanding of the basic concepts of satellite air quality measurements (b).
- Majority of the participants have *low to some level* of information on the access to freely available NASA and SERVIR-Mekong web tools for visualization and acquiring of aerosol and trace gas data (c).
- Majority of the participants have *very low level* of understanding of the basic concepts of Remote Sensing of Particulate Matter and Satellite-based PM2.5 data sets (d).
- Majority of the participants have *very low to average level* understanding of the strengths and weaknesses of NASA and SERVIR-Mekong data products (e).

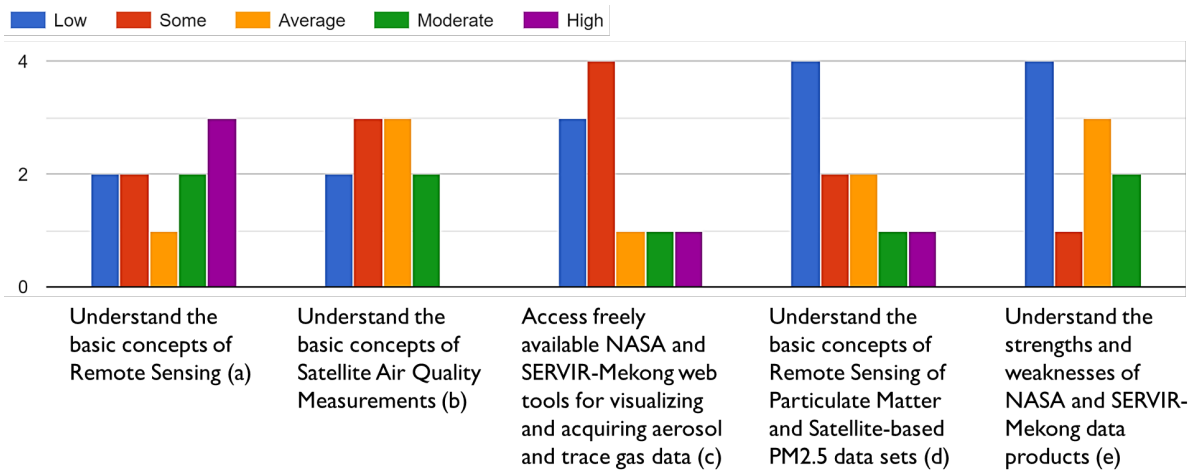


Figure 4: Chart showing the level of knowledge, skill or competency before training

Overall **80%** of the participants have taken the decision to attend the training out of personal interest. This to some extent also shows that the staff of PCD and GISTDA are interested to attend technical trainings if organized from time-to-time as part of building institutional capacity (Figure 4).

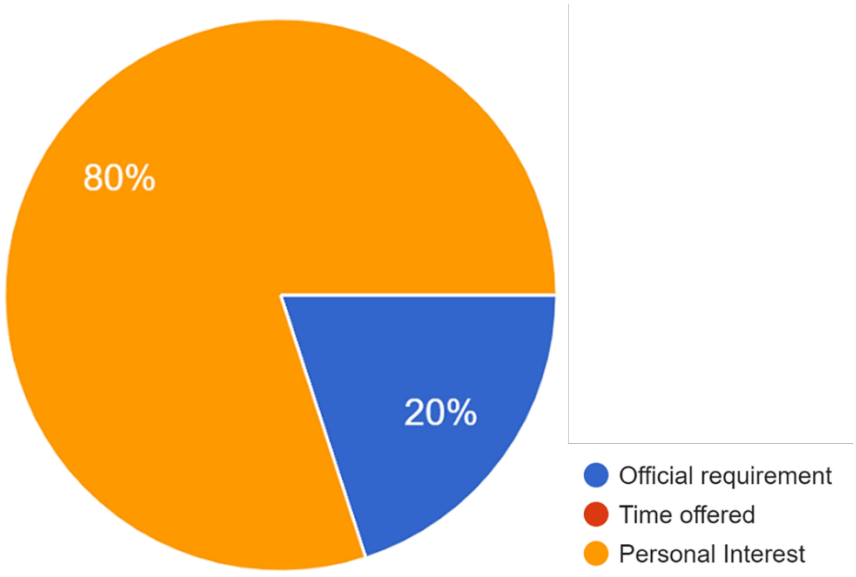


Figure 5: Reasons for taking the training course

Self-Assessment After the Training

Self-assessment carried out by the participants after the training shows that their knowledge level and understanding of sessions have significantly improved.

In terms of **knowledge, skills and competencies** (Figure 5) after the training, the assessment results have shown that,

- Majority of the participants have *high level* understanding of the basic concepts of remote sensing (a).
- Majority of the participants have *high level* understanding of the basic concepts of satellite air quality measurements (b).
- Majority of the participants have now been well informed (*moderate to high level*) on the access to freely available NASA and SERVIR-Mekong web tools for visualization and acquiring of aerosol and trace gas data (c).
- Majority of the participants have *higher level* of understanding of the basic concepts of Remote Sensing of Particulate Matter and Satellite-based PM2.5 data sets (d).
- Majority of the participants have now been well informed (*moderate to high level*) about the strengths and weaknesses of NASA and SERVIR-Mekong data products (e).

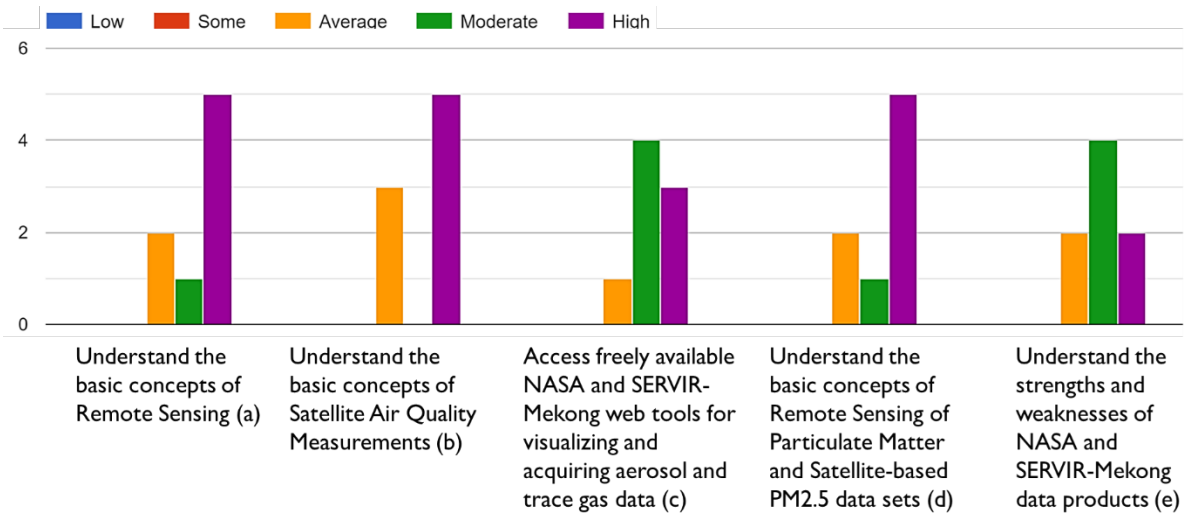


Figure 6: Chart showing the level of knowledge, skill or competency after the training

Information Circulated Prior to the Training in terms of Accuracy

100% of the participants agreed that the information circulated prior to the training was very useful to decide towards attending the event. **88%** also agreed that the information circulated

prior to the training was accurate as provided during the sessions while the remaining **12%** showed complete agreement (Figure 6).

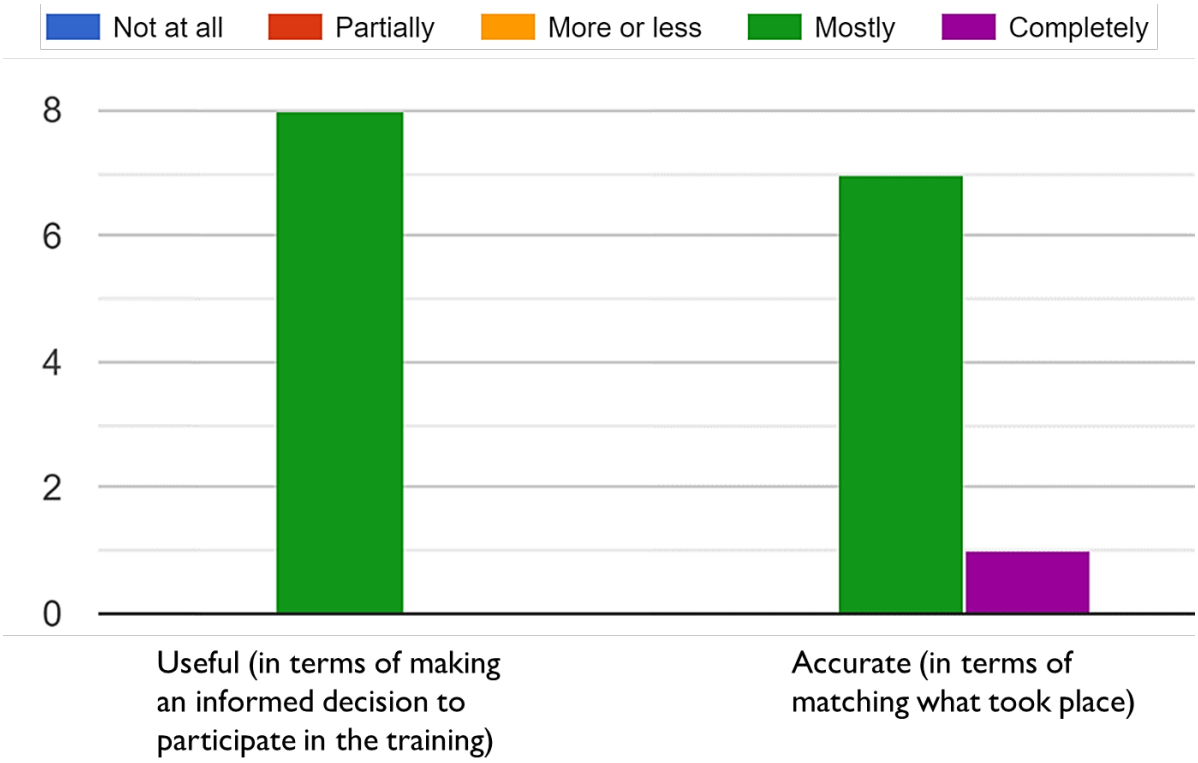


Figure 7: Information circulated prior to the training

Relevancy of the Training Sessions in Meeting with the Learning Objectives

- **63%** of the participants *agree* that the information presented during the training was new to them while **25%** *strongly agree* about the same (Overall **88%**).
- However, overall **100%** (*agree to strongly agree*) of the participant considered the content of the training to be relevant to their job.
- **63%** of the participants have agreed that they will use the information they have acquired during the training in their job while the remaining **37%** strongly agree to the same (Overall **100%**) (Figure 7).

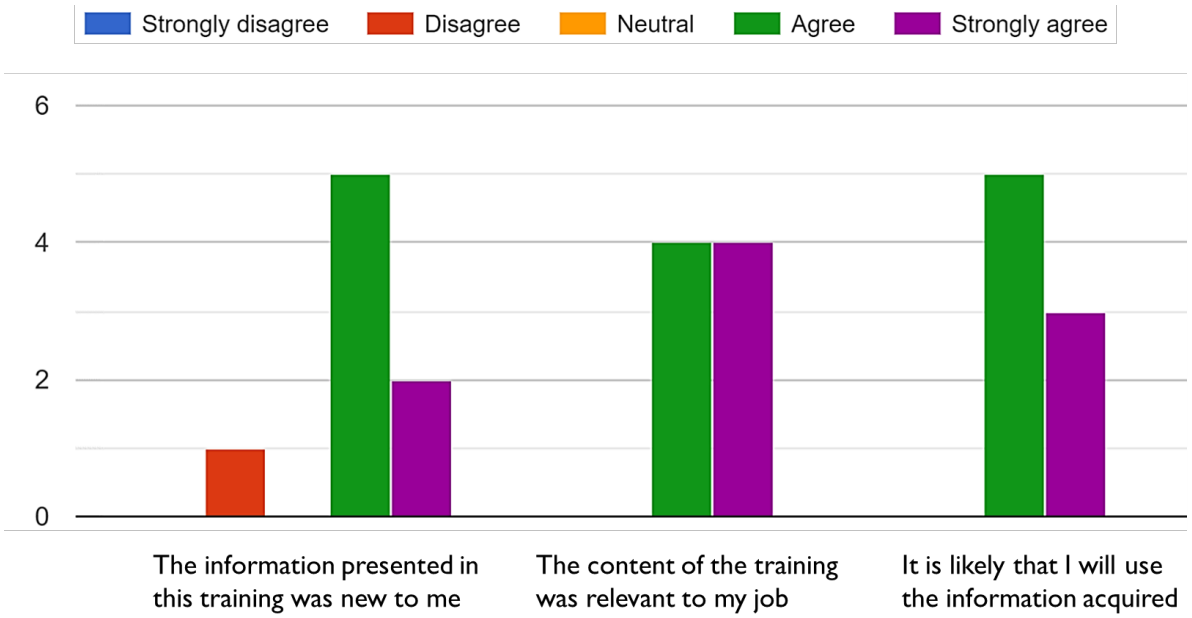


Figure 8: Relevancy of the training

Training Methodology

100% of the participants *agree to strongly agree* that the training methodology adopted was useful given the learning objectives while **100%** also *agree to strongly agree* that the course content was well organized and planned (Figure 8).

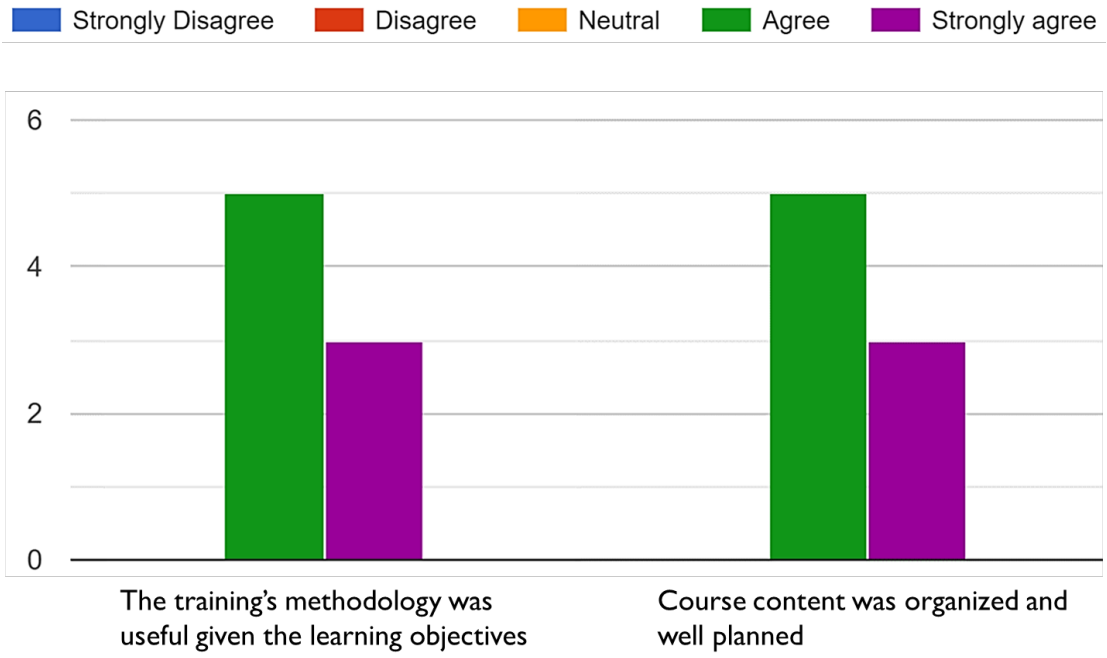


Figure 9: Chart showing the responses to the training methodology

Overall Resource Persons/Trainers Performance

100% of the participants *agree to strongly agree* that the trainers were very engaged responding to their questions promptly and presenting the sessions in a manner which is simple and easier to understand (Figure 9).

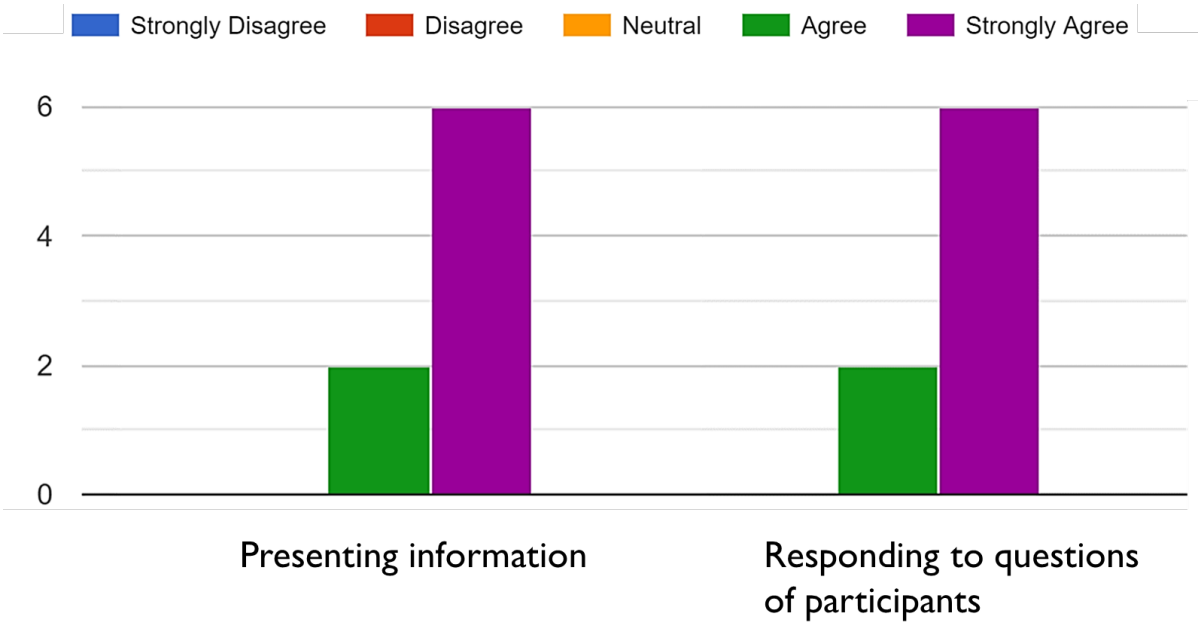


Figure 10: Performance of the trainers/resource persons

Importance of the Knowledge and Skills Acquired during the Training

100% of the participants are of the view that the **knowledge and the skills** acquired during the training are very important (Figure 10).

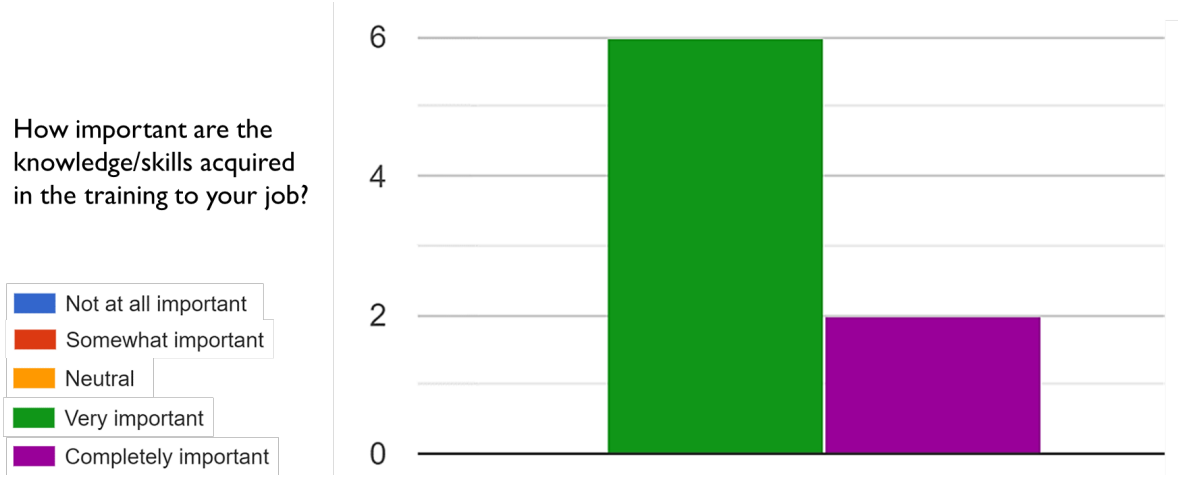


Figure 11: Importance of the knowledge and skills acquired

Rating the Overall Training

100% of the participants *agree to strongly agree* that,

- The overall training was informative;
- They would be interested to attend more such trainings in the future; and
- They would highly recommend other staff of their organization to join future trainings (Figure 11).

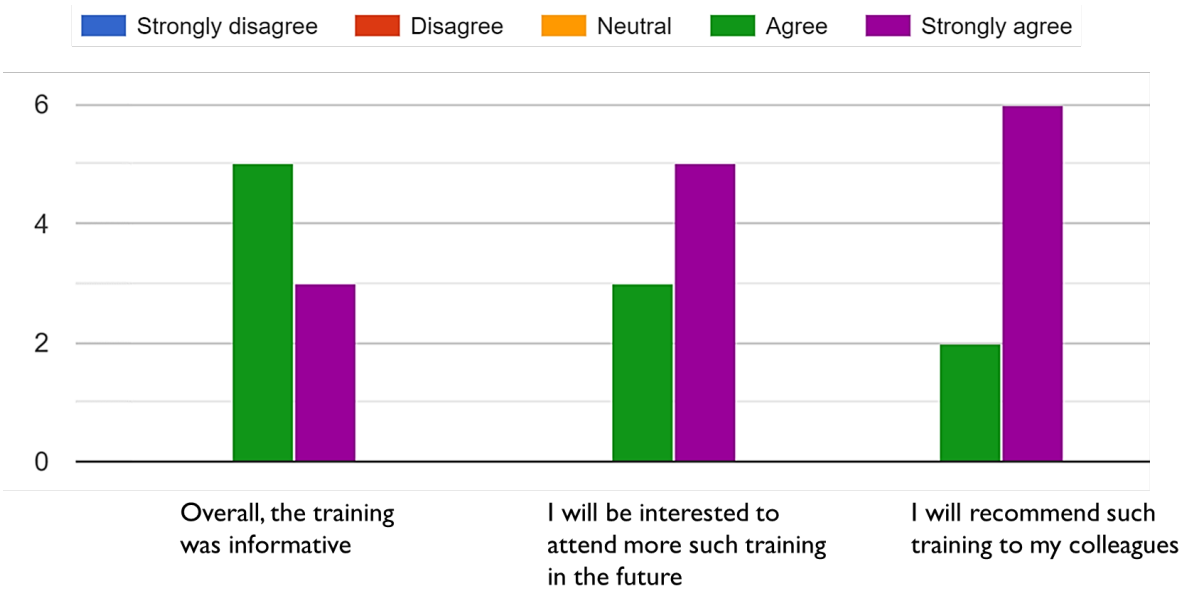


Figure 12: Overall rating of the training

Sessions of Interest

Most participants have rated the sessions on remote sensing of particulate matter and satellite based PM2.5 data set to be important (**38%**) followed by another **25%** each for the sessions on assessing and visualizing of air quality data from the web and NASA aerosol and air quality forecast tools respectively (Figure 12).

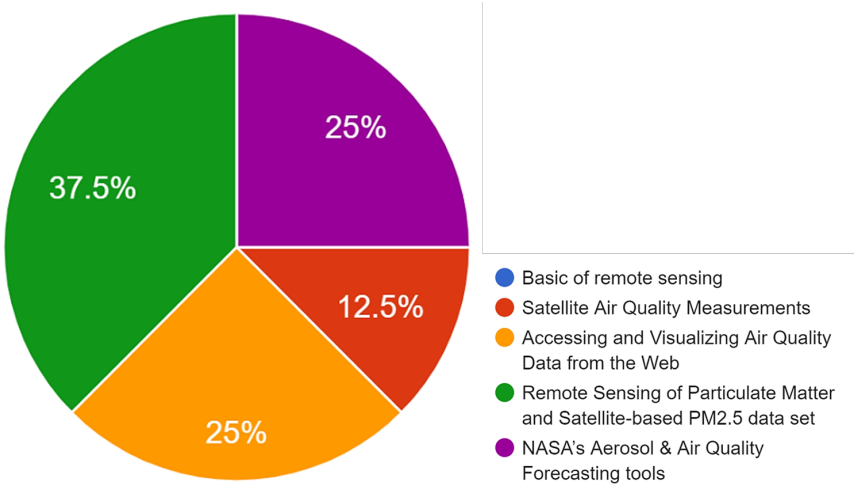


Figure 13: Sessions that participants found informative and interesting

Preference for Future Training

When asked the participants on their preference for future trainings (Figure 13), two responses were obtained as given below:

- Request for intermediate training **50%**
- Request for advanced level training **50%**

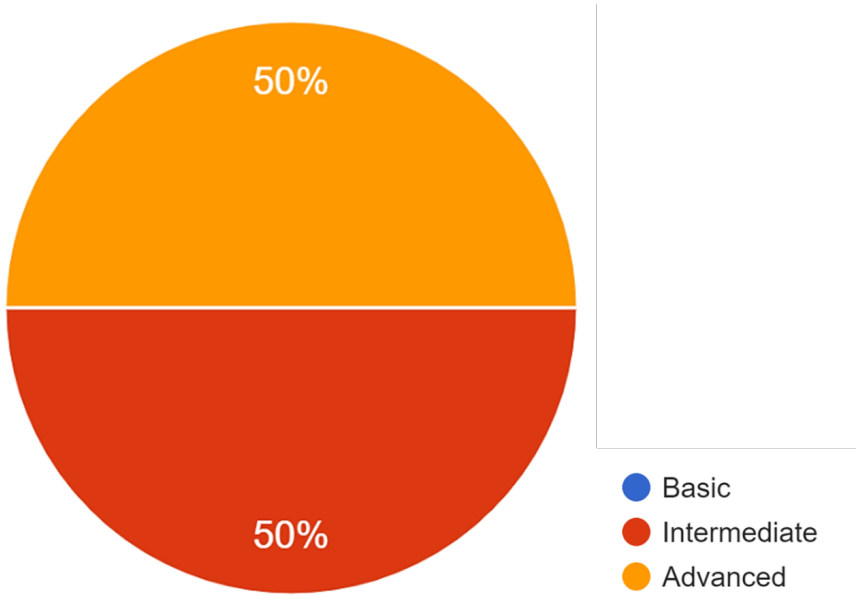


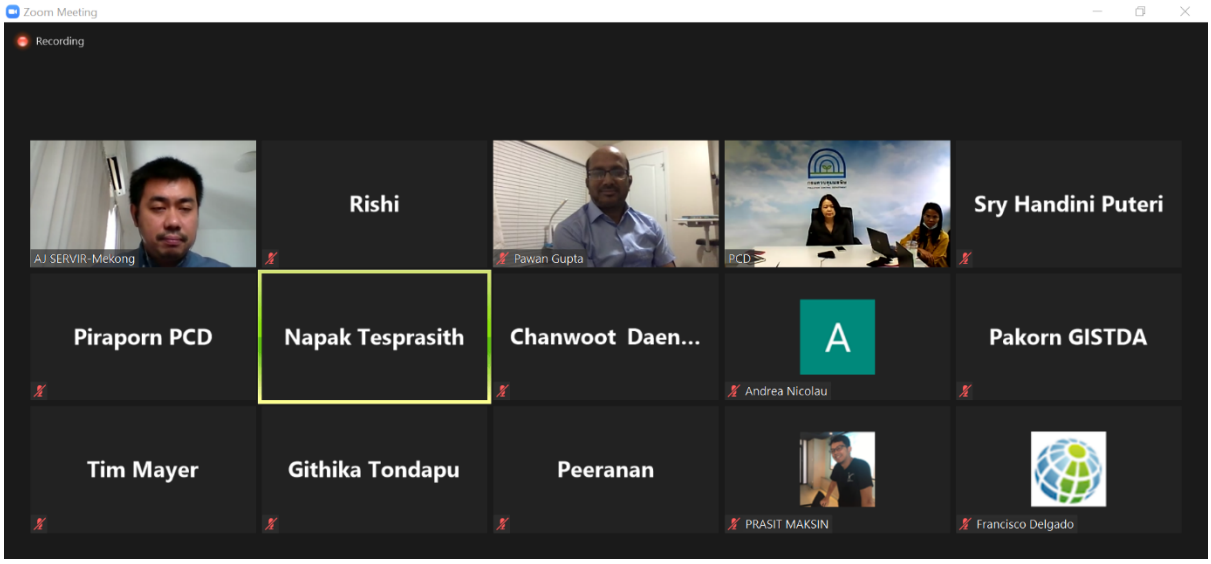
Figure 14: Preference for future trainings

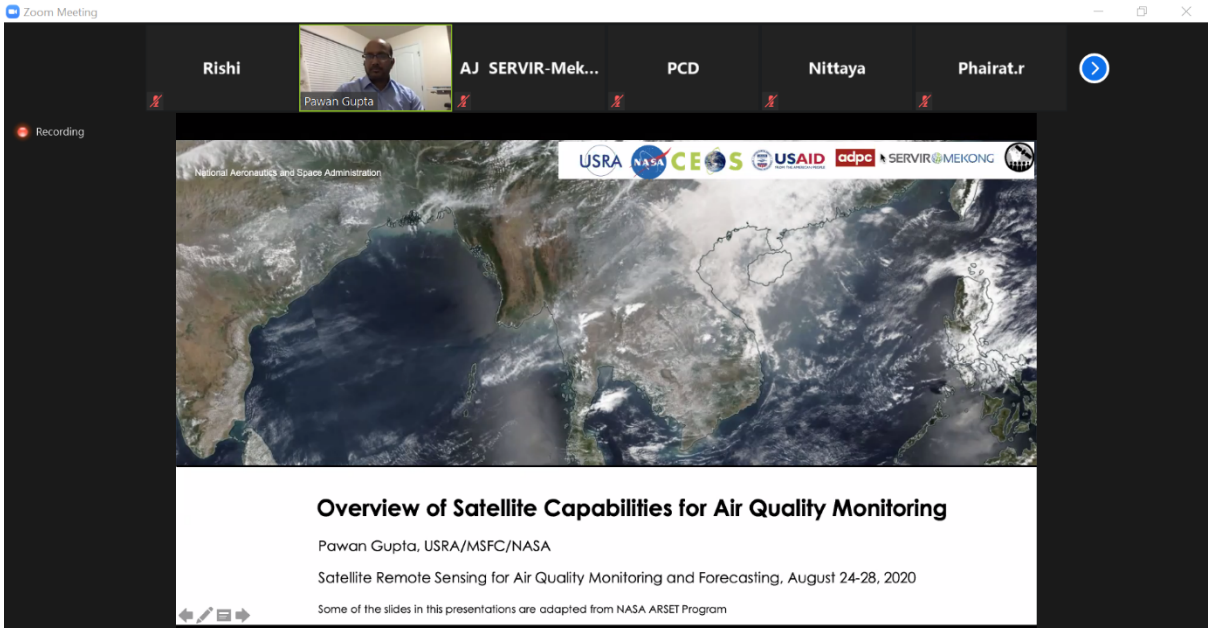
Going by the participants responses, the next future training could be planned along these lines.

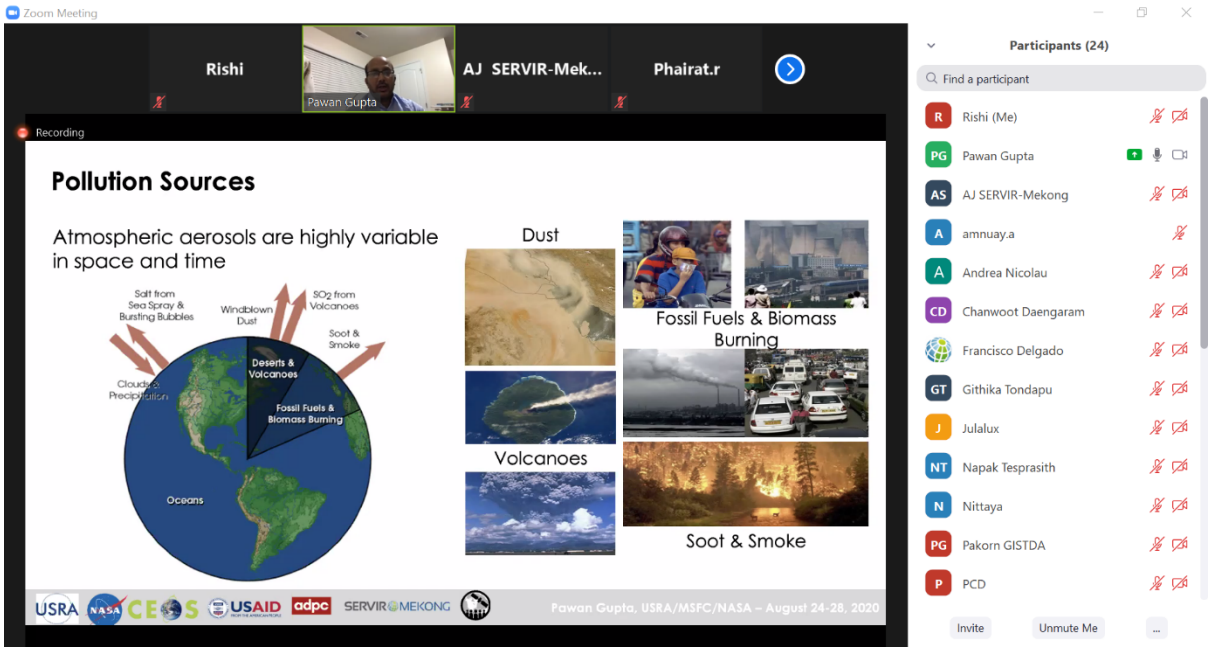
Appendix:

**** Note: the separate trainee list spreadsheet should accompany this document ****

Photos from the Training






Zoom Meeting
Rishi
Pawan Gupta
AJ SERVIR-Mek...
Phairat.r
Recording
Pollution Sources
Atmospheric aerosols are highly variable in space and time
Salt from Sea Spray & Bursting Bubbles
Windblown Dust
SO2 from Volcanoes
Soot & Smoke
Clouds & Precipitation
Deserts & Volcanoes
Fossil Fuels & Biomass Burning
Oceans
Dust
Volcanoes
Fossil Fuels & Biomass Burning
Soot & Smoke
USRA
NASA
CEOS
USAID
adpc
SERVIR MEKONG
Pawan Gupta, USRA/MSFC/NASA – August 24-28, 2020
Participants (24)
Find a participant
Rishi (Me)
Pawan Gupta
AJ SERVIR-Mekong
amnuay.a
Andrea Nicolau
Chanwoot Daengaram
Francisco Delgado
Githika Tondapu
Julalux
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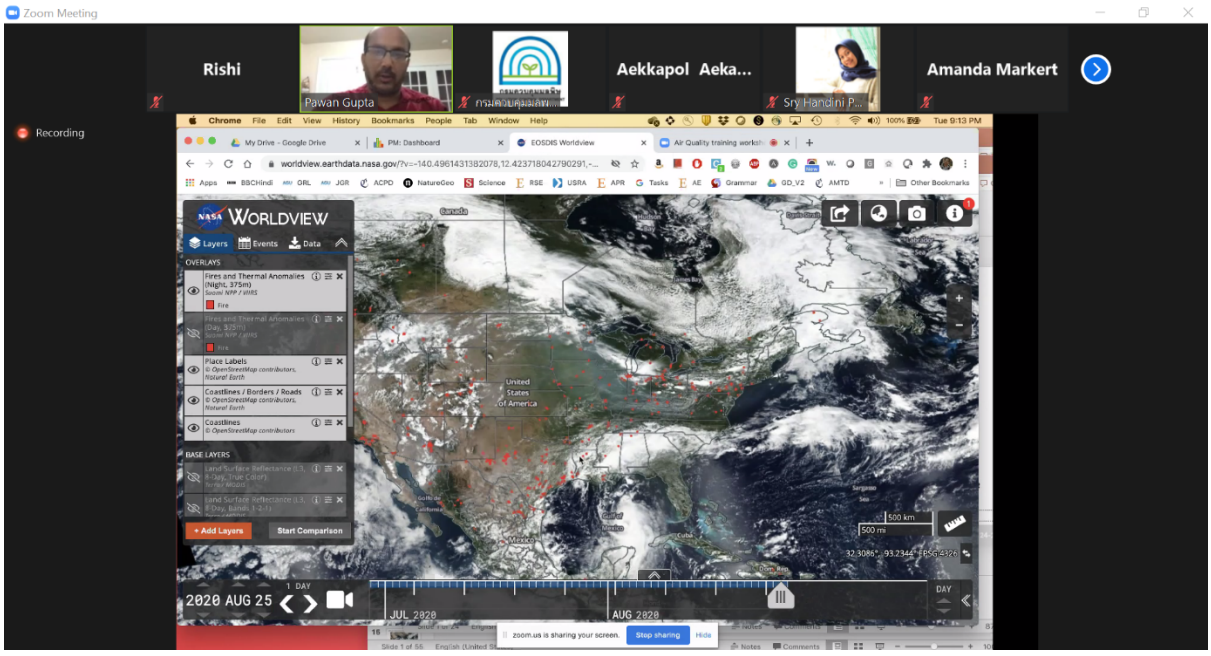
Zoom Meeting
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Pawan Gupta
Aekkapol Aeka...
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Data
OVERLAYS
BASE LAYERS
+ Add Layers
Start Comparison
2020 AUG 25
1 DAY
JUL 2020
AUG 2020
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SERVIR-Mekong Team (Trainers, Facilitators and Support)

No	Name	Gender	Organization	Organization Type	Country
1	Ms. Amanda Weigel	Female	NASA	Government	USA
2	Ms. Andrea Nicolau	Female	NASA	Government	USA
3	Ms. Githika Tondapu	Female	NASA	Government	USA
4	Ms. Napak Tesprasith	Female	USAID RDMA	Government	Thailand
5	Ms. Thannarot Kunlamai	Female	ADPC	Intergovernmental	Thailand
6	Ms. Sry Handini Puteri	Female	ADPC	Intergovernmental	Indonesia
7	Mr. Dhyey Bhatpuria	Male	SEI	International NGO	India
8	Dr. Pawan Gupta	Male	NASA	Government	USA
9	Mr. Francisco Delgado Olivares	Male	NASA	Government	USA
10	Mr. Tim Mayer	Male	NASA	Government	USA
11	Mr. Aekkapol (AJ) Aekakkararungroj	Male	ADPC	Intergovernmental	Thailand
12	Mr. Rishiraj Dutta	Male	ADPC	Intergovernmental	India