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

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

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

Partner Institutions:
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<thead>
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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ADPC</td>
<td>Asian Disaster Preparedness Center</td>
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<td>AOD</td>
<td>Aerosol Optical Depth</td>
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<td>CEOS-WGCapD</td>
<td>Capacity Building &amp; Data Democracy programme</td>
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<td>GISTDA</td>
<td>Geo-Informatics and Space Technology Development Agency</td>
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<td>MODIS</td>
<td>Moderate Resolution Imaging Spectroradiometer</td>
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<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<td>NO2</td>
<td>Nitrogen Dioxide</td>
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<td>PCD</td>
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<td>SCO</td>
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<td>SIG</td>
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<td>USAID</td>
<td>U.S. Agency for International Development</td>
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<td>VIIRS</td>
<td>Visible Infrared Imaging Radiometer Suite</td>
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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.

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\(^1\) [https://search.earthdata.nasa.gov/search](https://search.earthdata.nasa.gov/search)
Committee on Earth Observation Satellites (CEOS)
Working Group for Capacity Building and Data Democracy (WGCapD)

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).

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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).

![Gender Inclusiveness](image)

**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](image)

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

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](image)

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).

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

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](image)

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](image)
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](image)

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).
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%

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
## SERVIR-Mekong Team (Trainers, Facilitators and Support)

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Gender</th>
<th>Organization</th>
<th>Organization Type</th>
<th>Country</th>
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<tr>
<td>1</td>
<td>Ms. Amanda Weigel</td>
<td>Female</td>
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<td>2</td>
<td>Ms. Andrea Nicolau</td>
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<td>3</td>
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<td>4</td>
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