

Air Quality in South Asia: Understanding the Challenges of Integrating Earth Observations into Operations

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I. Introduction

SERVIR is a joint initiative of NASA, USAID, and leading geospatial organizations in Asia, Africa, and Latin America (Fig. 1), SERVIR partners with countries and organizations in these regions to address critical challenges in climate change, food security, water and related disasters, land use, and **air quality (AQ)**. The goal is to help translate earth observation data into better informed decisions and actions on the ground. Integrating earth observations into operations is challenging and requires an in depth knowledge of the operations and capacity of individuals and institutions. During an air quality product training in Kathmandu, Nepal we had the opportunity to gain insight into stakeholders' operations and challenges in using earth observation data for air quality.

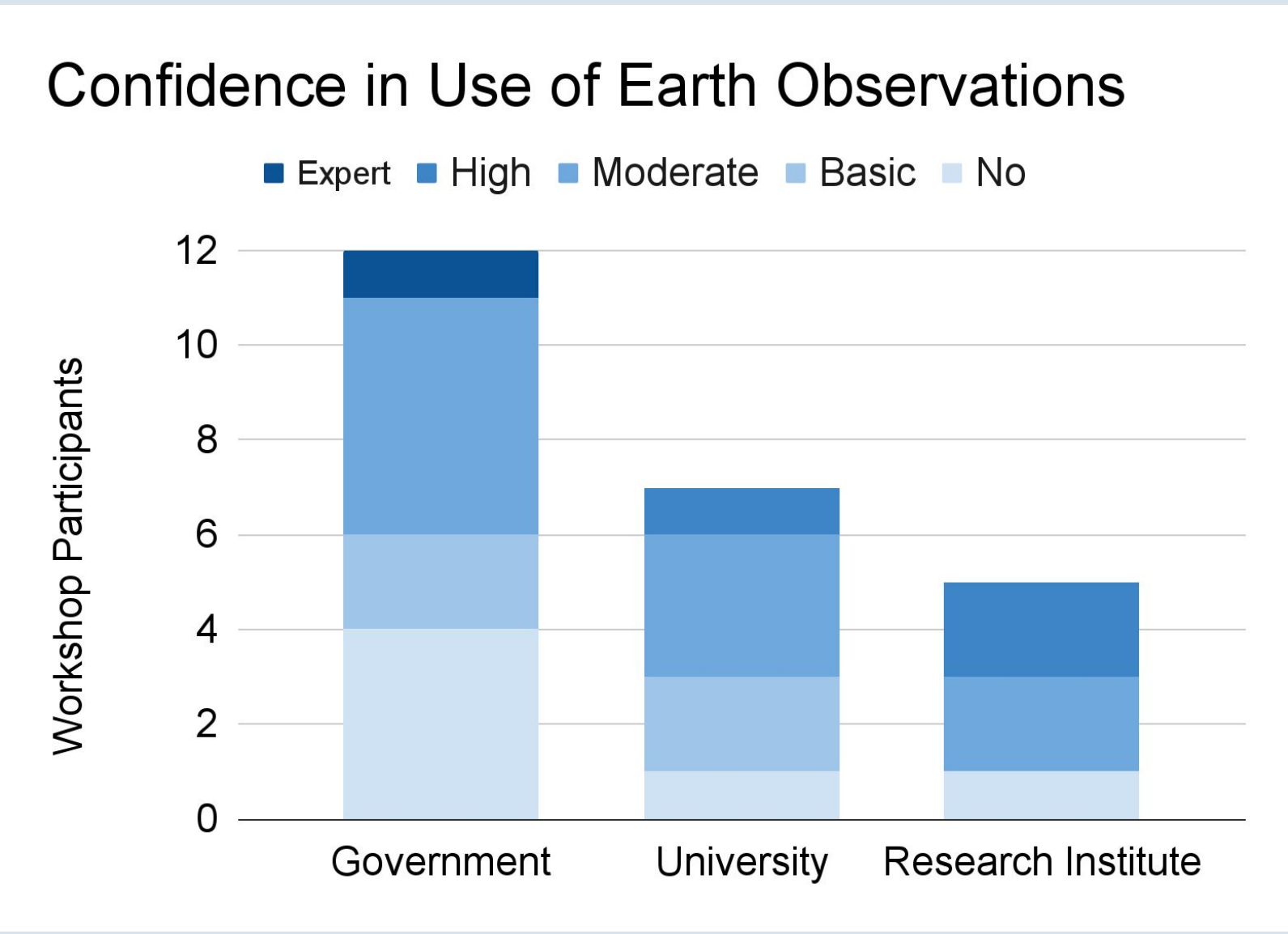
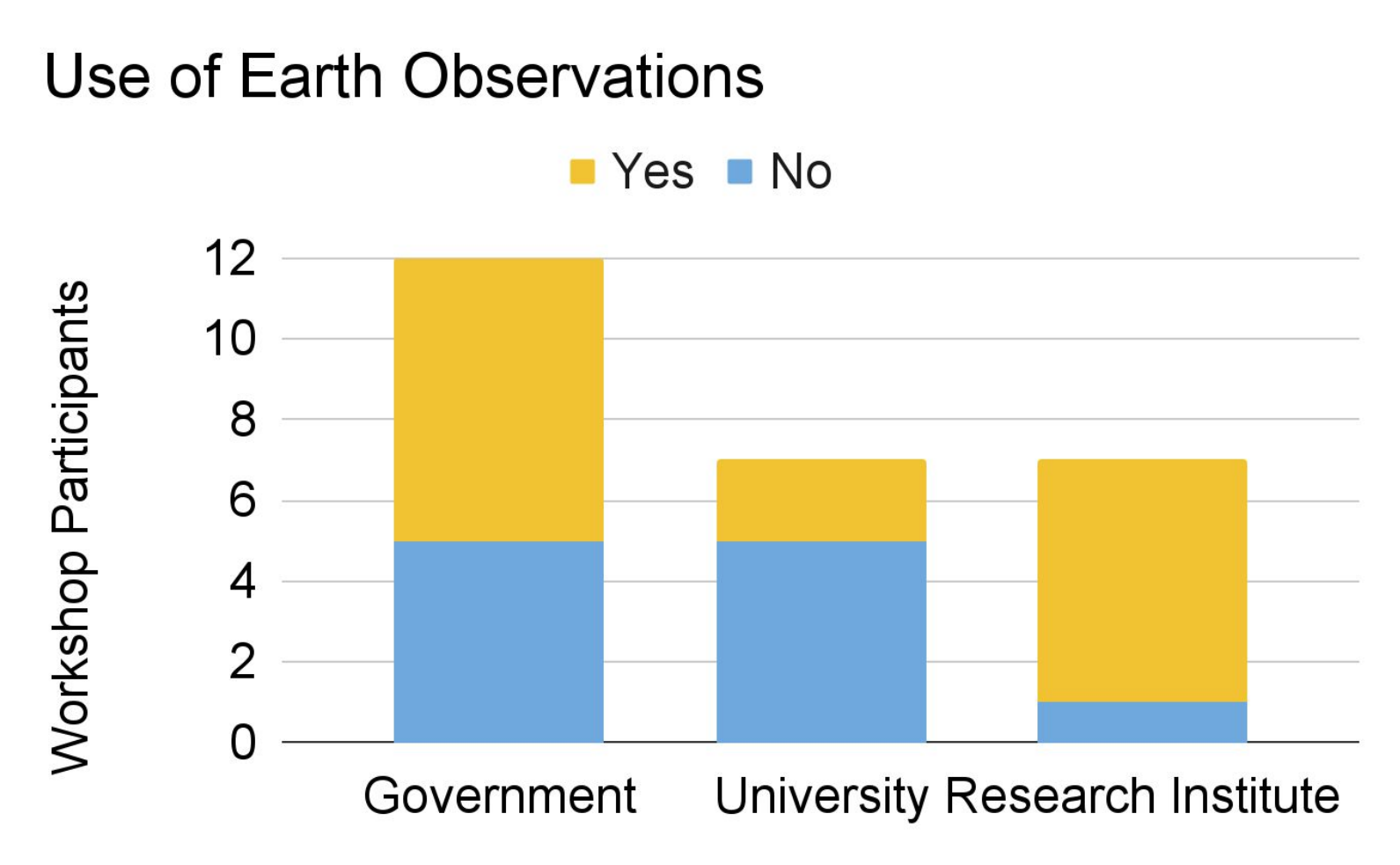


The workshop was held May 7 - 8th, 2024 at the International Centre for Intermountain Development (ICIMOD) located in Kathmandu, Nepal

Workshop Participants

- 8 Nepal, 6 India, 4 Pakistan, 3 Bhutan, 3 Bangladesh
- 11 Female/13 Male
- 12 Government, 7 University, 5 Research Institute

II. Use of Earth Observations



III. Physical Air Quality Challenges

During the workshop participants were asked to work on an air quality challenge of their choice and describe how they would use EO to monitor and address that challenge.



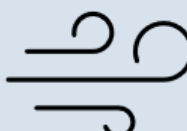
Stubble Burning

- Tools
 - Active fire incidents from MODIS, VIIRS and AMI for monitoring.
 - HYSPLIT to model trajectory of air mass after fire incident.
- Challenges
 - Cloud cover and temporal data gaps.
 - Capacity building to effectively use tools.
 - integrating aerosols and gases from ground and space based sensors into models



Smoke from Forest Fires

- Tools
 - ICIMOD forest fire detection monitoring system, NASA FIRMS, VIIRS, MODIS, FINN Fire Inventory from NCAR into CTMs, HYSPLIT
- Challenges
 - Validation for models, cloud coverage, only twice daily overpass
 - Capacity building to get sufficient technical expertise
 - Selecting the right tool
 - Need for nighttime fire detection tool



Dust

- Tools
 - Monitoring stations, satellite data and forecast models
- Challenges
 - Limited expertise in satellite data usage
 - Use for emission inventories
 - Temporal data gaps, reliability of data



Ozone Pollution

- Tools
 - In-situ monitors, National Air Quality Watch Dashboard WRF-Chem ozone forecast
- Challenges
 - Limited spatial coverage, in-situ sensors require maintenance

III. Air Quality Challenges by Organization



Government Institutions

Lack of good coverage and accurate air quality stations. Lack of technical capacity to use satellite data and forecast models. Integrating data into a decision support system. Lack of air quality regulations and challenges with enforcing existing policy. Data management and dissemination.



Universities

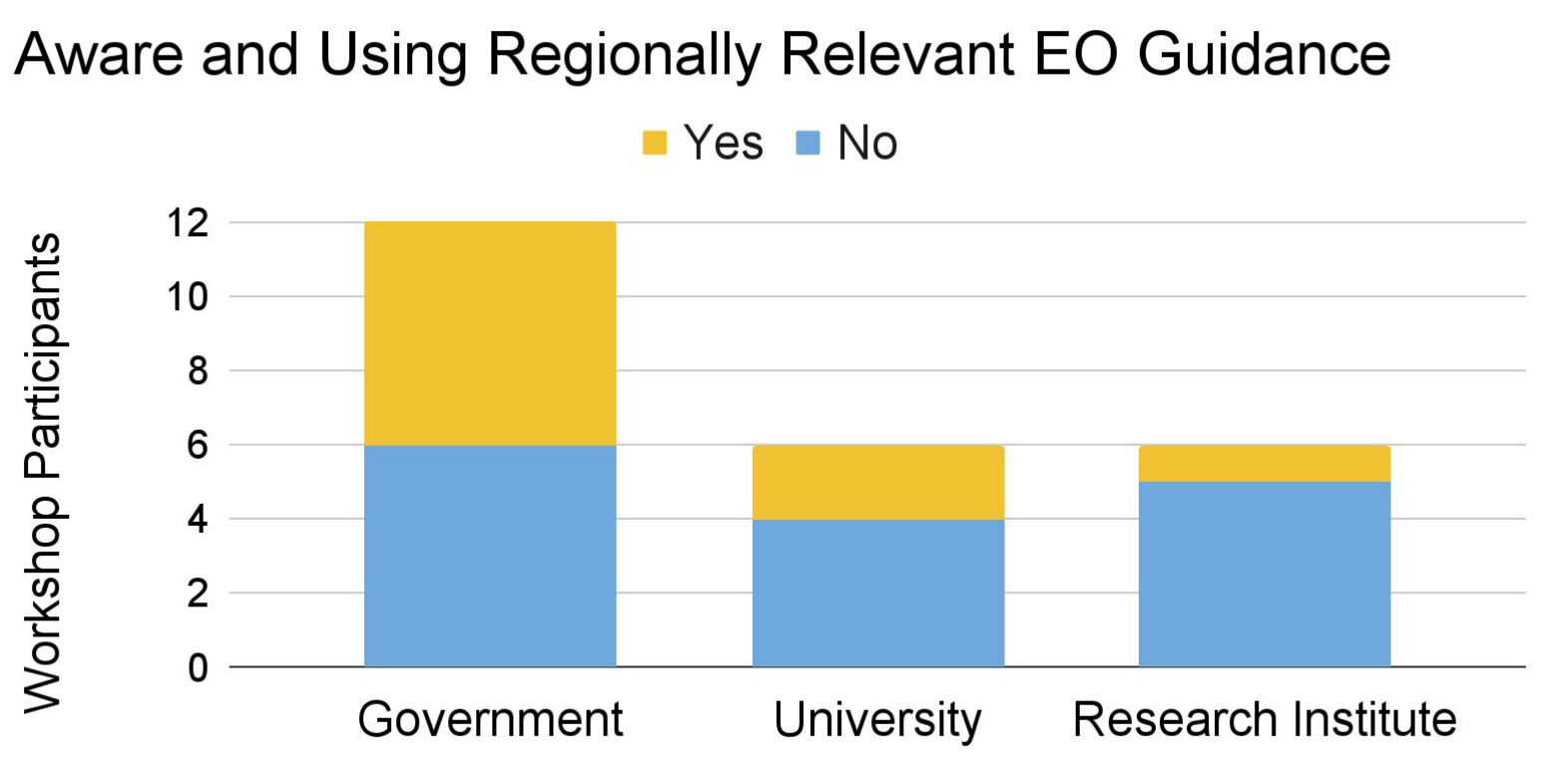
Lack of reliable in-situ sensor data, transboundary pollution, quantifying particulate matter from wildfires, forecasting hazardous events, emission inventories and source apportionment. Bridging science and policy.



Research Institutes

Validation of windblown dust emissions, emissions inventory, PM2.5 species contribution, estimating emissions using satellite data, addressing missing data from satellite products, conversion of AOD to PM2.5. Data harmonization.

V. Earth Observation Capacity Needs



Datasets and EO Resources Used by Participants

MODIS, GIOVANNI, Landsat from USGS, Sentinel imagery from Sentinel hub, ICIMOD AQ Dashboard, TROPOMI tropospheric ozone product, MODIS derived PM2.5, SAANS ambient PM2.5, VIIRS active fire counts, ERA5 climate data, MAIAC AOD, NASA LADS DAAC, ESA, RDS ICIMOD, USGS, HAQAST, FIRMS

VI. Summary & Way Forward

- EO Capacity:** While universities, research institutes, and government agencies all had some knowledge and capacity in remote sensing they applied it to different degrees. Government agencies tended to use data qualitatively and faced the challenge of integrating it into decision support systems. All agreed additional capacity building was required to integrate EO into their operations. Focusing on building relationships between research organizations and government agencies will be critical to drive data informed decisions.
- Uncertainty and Accuracy:** Government organizations need a measure of accuracy to be able to use a new data source. Since satellite data is not directly comparable to ground data we need to work closely with organizations to compare with existing data sources and to demonstrate the strength of EO and its role.
- Exposure to Satellite Training Materials:** Many participants had not heard of or used any training materials related to satellite data. Connecting with regional and local organizations will help to disseminate resources such as ARSET and HAQAST to AQ practitioners.

VII. Share your experience!

What challenges have you faced integrating EO into AQ operations?

What are some success stories? What methods or approaches are effective in integrating EO into AQ operations?