LCS Monitoring for Understanding Urban Pollution Mechanisms

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March 12, 2026 / Next-Generation Monitoring and Assessment System for Air Pollution in East Asia

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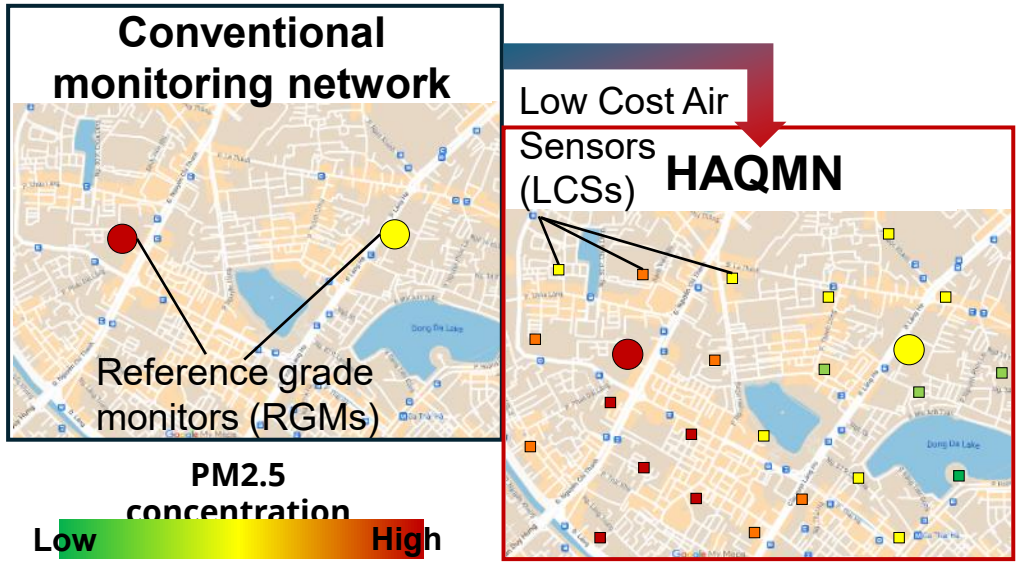
What do LCSs reveal? What are the benefits of using LCSs?

Hybrid Air Quality Monitoring Network (HAQMN)

Reliable LCSs at many sites + RGMs



HAQMN reduces monitoring costs by using many LCSs together with a few accurate RGMs, while still keeping the measurements reliable through co-location test and cross checking.

LCSs can reveal:

- ✓ Coverage of underserved areas for air quality monitoring
- ✓ Fine-scale spatial variability and urban hotspots of air pollution
- ✓ Assess local exposure and identify vulnerable neighborhoods

Key benefits of LCSs:

- ✓ Small, lightweight devices can be installed densely in targeted areas
- ✓ Complement RGMs by providing real-world and ground-level measurements
- ✓ Help to evaluate local interventions and design more effective air quality management strategies

EANET project "Methodology study for development of LCS hybrid air quality monitoring network (HAQMN)"

- Duration of project: 3 Years [2022–2024]
- Project is supported by Acid Deposition Monitoring Network in East Asia (EANET), Ministry of the Environment, Japan (MOEJ) and collaborated with Asian Development Bang (ADB)
- Research the accuracy of air quality monitoring using several types of low-cost sensors compared to a reference level monitors on a trial basis under various air quality and climate conditions in EANET participating countries.
- Develop practical technical documents that would support the introduction and operation of the hybrid air quality monitoring network (HAQMN) in EANET participating countries.

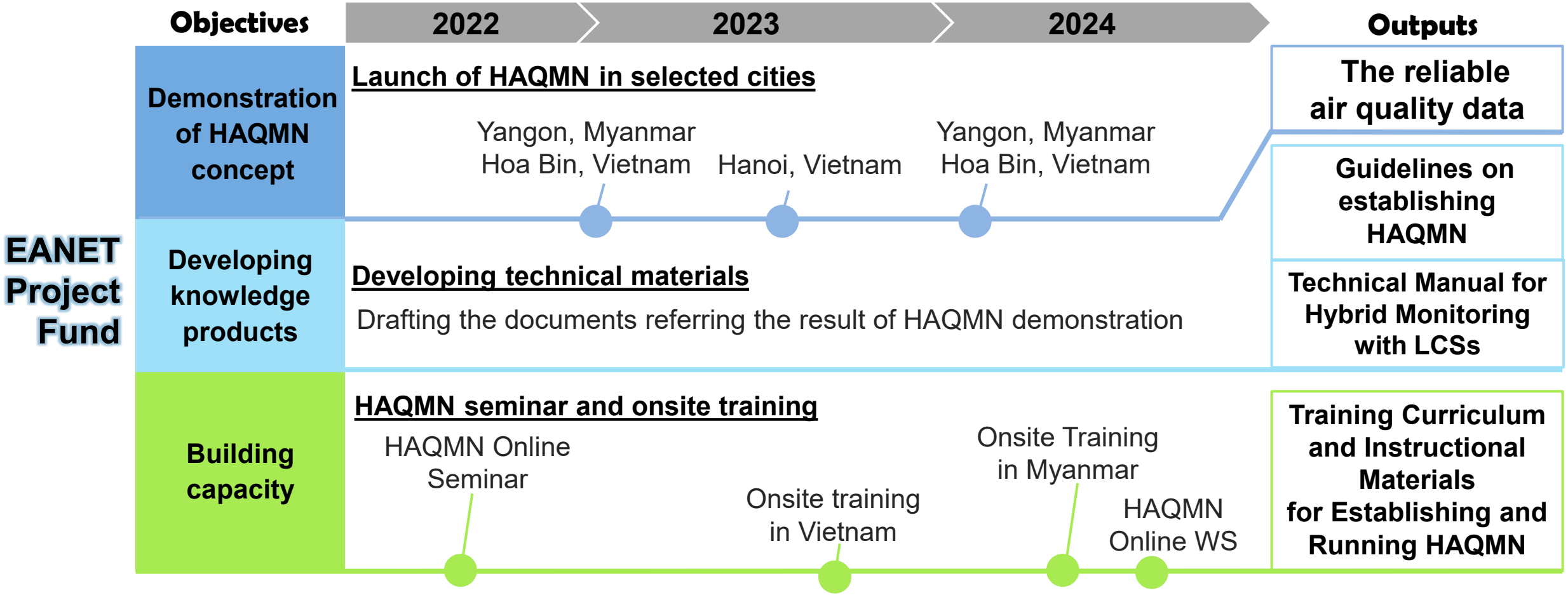
Disseminating the deliverables to EANET PCs

HAQMN seminar and onsite training for capacity building

Developing technical materials

Launch of HAQMN in selected cities
- Parallel measurement test
- Small-scale HAQMN

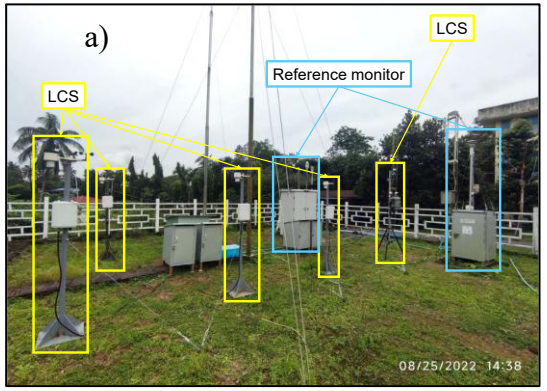
Timeline of the EANET HAQMN Project from 2022 to 2024

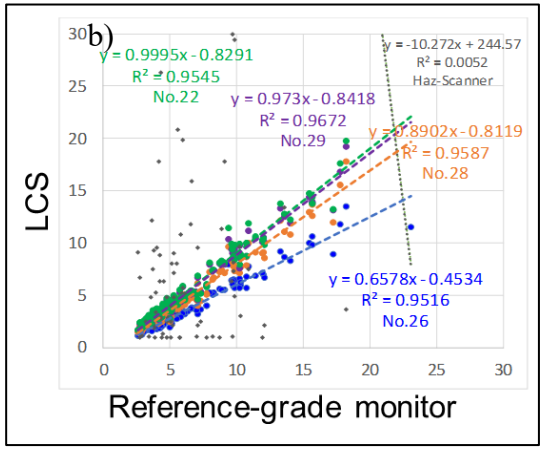


Demonstration of HAQMN concept: Technical studies in Myanmar and Vietnam

Recommended flowchart to operate HAQMN

Example of a) parallel test/co-location design and b) its correction model





OPERATION

Contact manufacturer!

Not Good

Check device operation

Good

1~2 weeks

Parallel monitoring test/ Co-location

Troubles

Good

Installation

Troubles

Good

0.5~1 year

Monitoring

- ✓ Periodically check (e.g., check data, etc.)
- ✓ Maintenance

Troubles

Troubleshooting:

- ➢ Check power
- ➢ Check line connections
- ➢ Check Wi-Fi
- ➢ Restart sensor

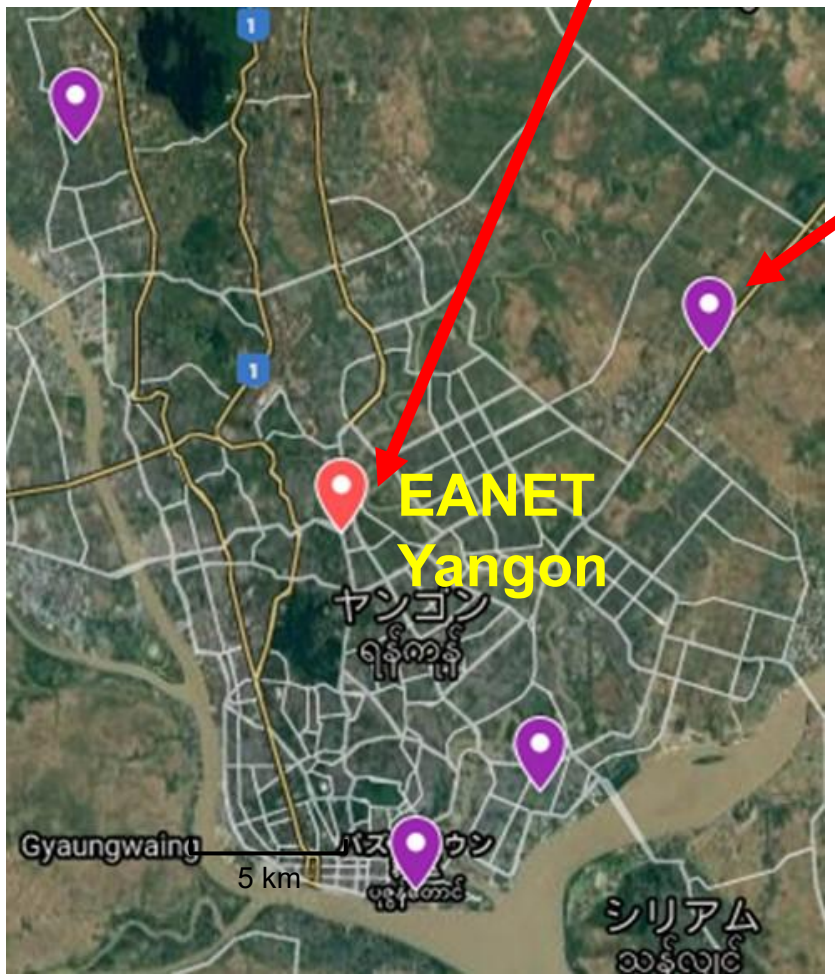
Etc.

- ➢ Change sensor

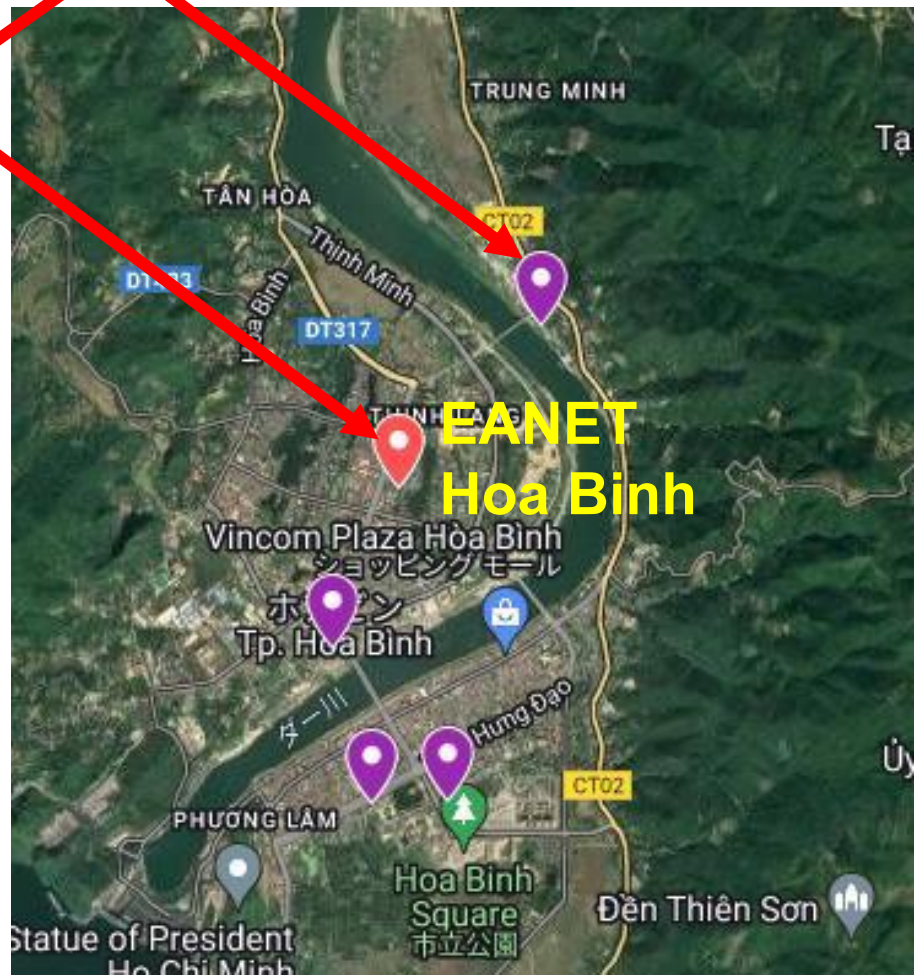
Target cities of HAQMN

LCS and Reference Grade Monitors

LCS Only



Yangon in Myanmar (from Sep. 2022)



Hoa Binh in Vietnam (from Feb. 2023)

EANET Yangon station implemented for parallel measurements

Installation of meteorological instrument (Need to check direction and horizontal plane)

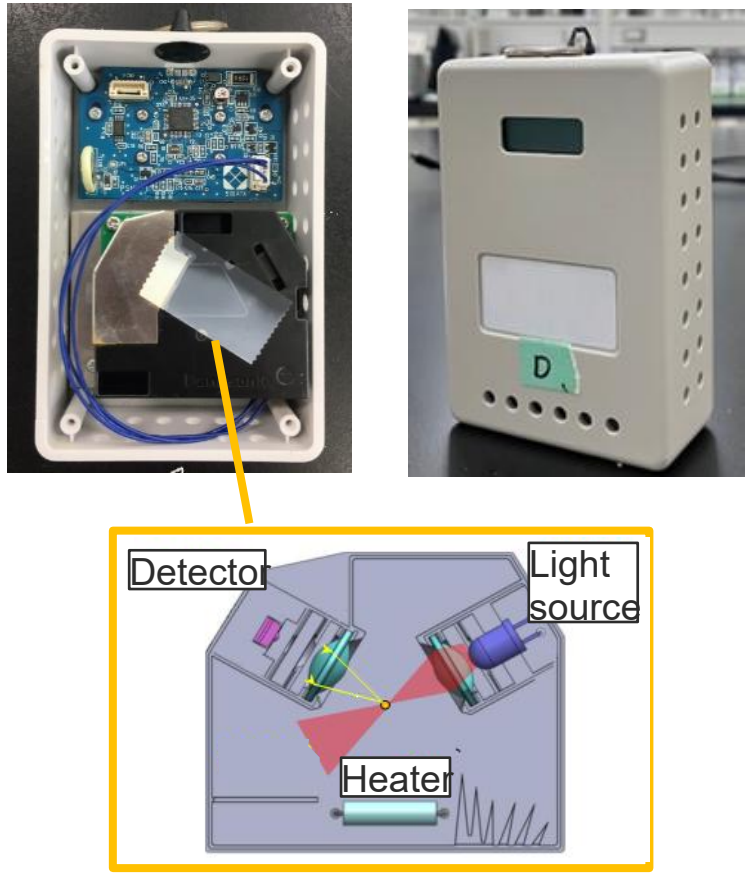
Installation of LCS unit **(GBiot FH0, Green Blue Co., Japan)**

β-ray $PM_{2.5}$ monitor using for EANET

SO_2, NOx, O_3 monitor installed by local company

EANET Hoa Binh station implemented for parallel measurements

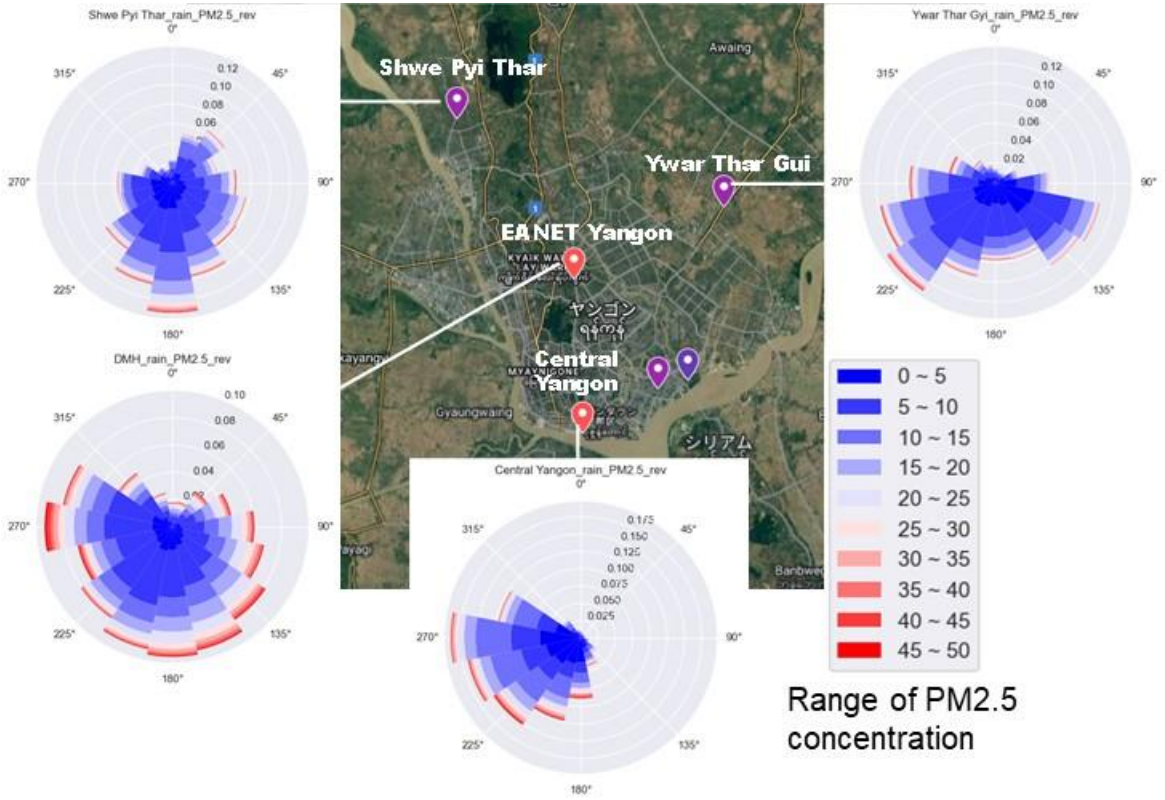
Small $PM_{2.5}$ sensor
(Co-developed by Nagoya Univ. and Panasonic Co., **Now available from Sibata Scientific Technology Ltd., Japan**)



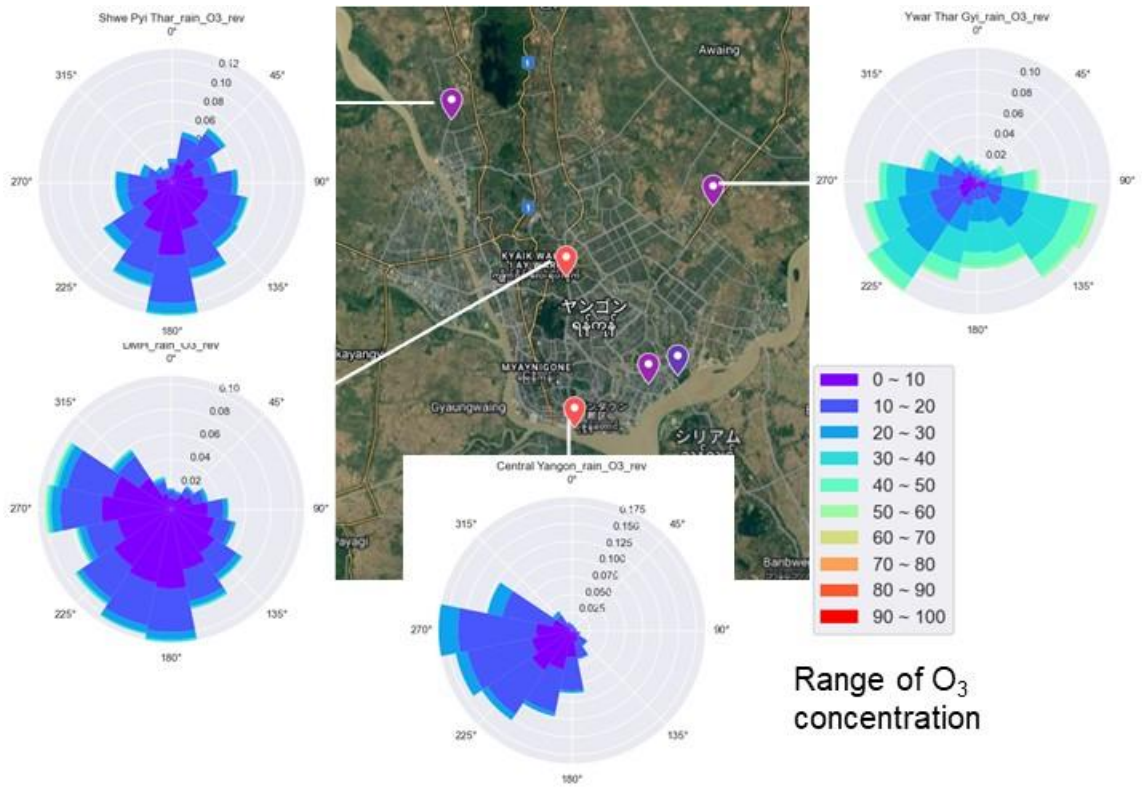
Frequency distribution of PM2.5 and O3 in Yangon

PM2.5 and O3 distribution (December 2022 to January 2023)

PM2.5

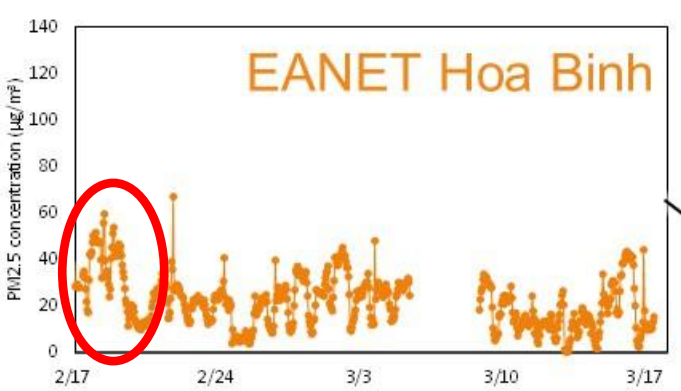


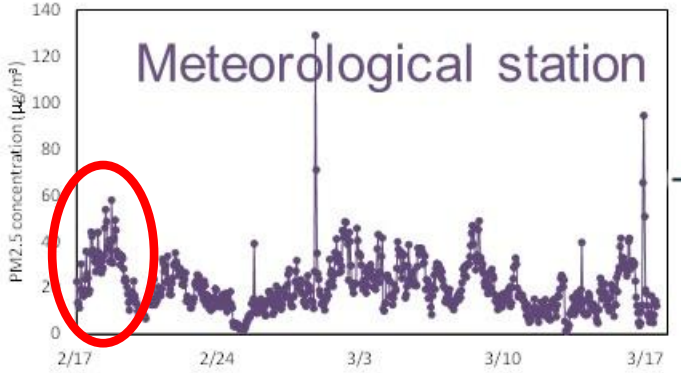
O3

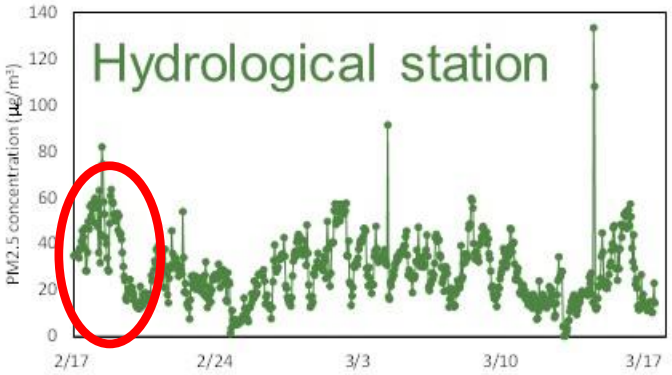


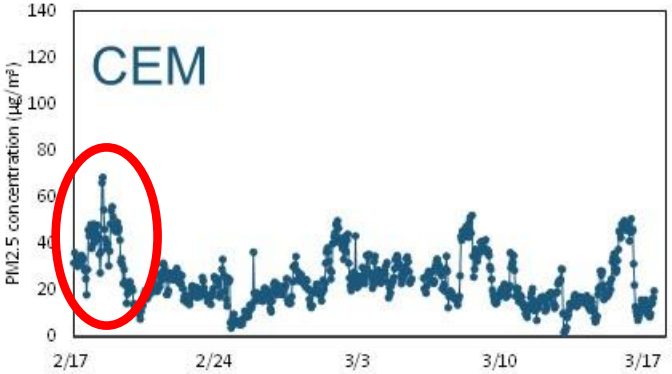
- Wind direction was dominant from south and west.
- Air concentration would be affected by emission sources in southwest direction.

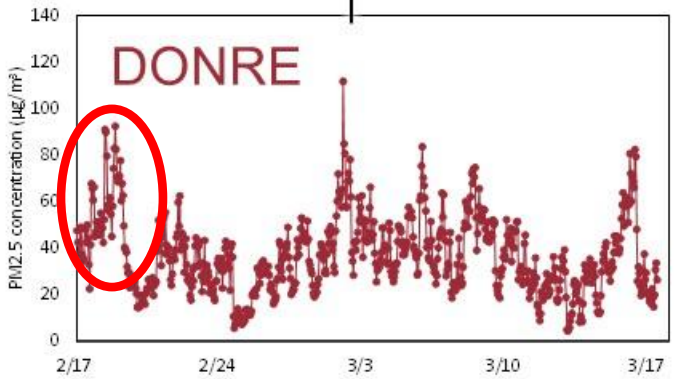
Time variation of PM2.5 in Hoa Binh (February-March 2023)











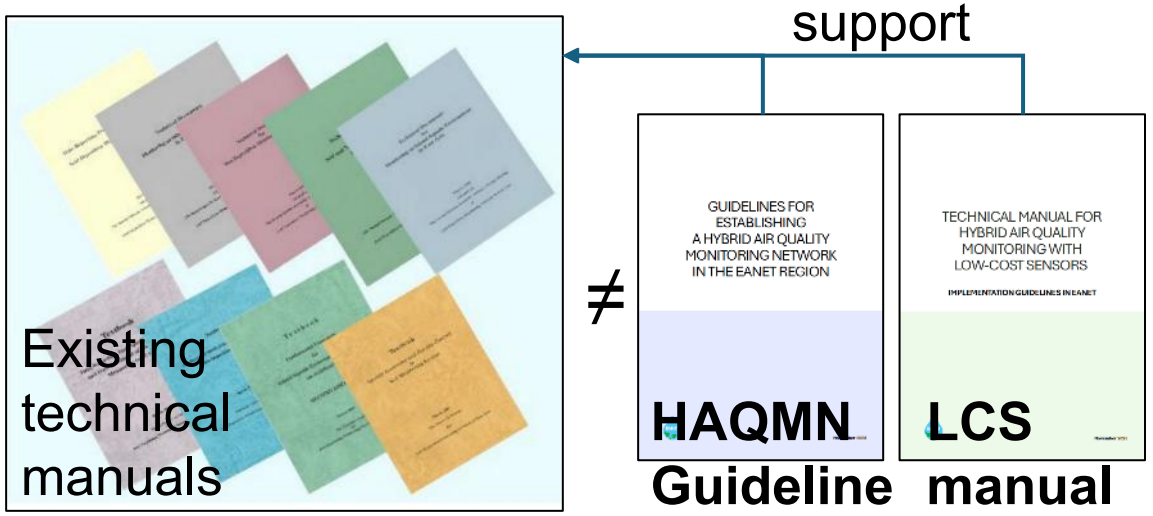
High concentration of $PM_{2.5}$ was simultaneously observed at all station on February 18 and 19.

Developing knowledge products: HAQMN Guideline and LCS manual

HAQMN Guideline and LCS manual in EANET

HAQMN guideline and LCS manual are shown in EANET Web site.

https://www.eanet.asia/publications/

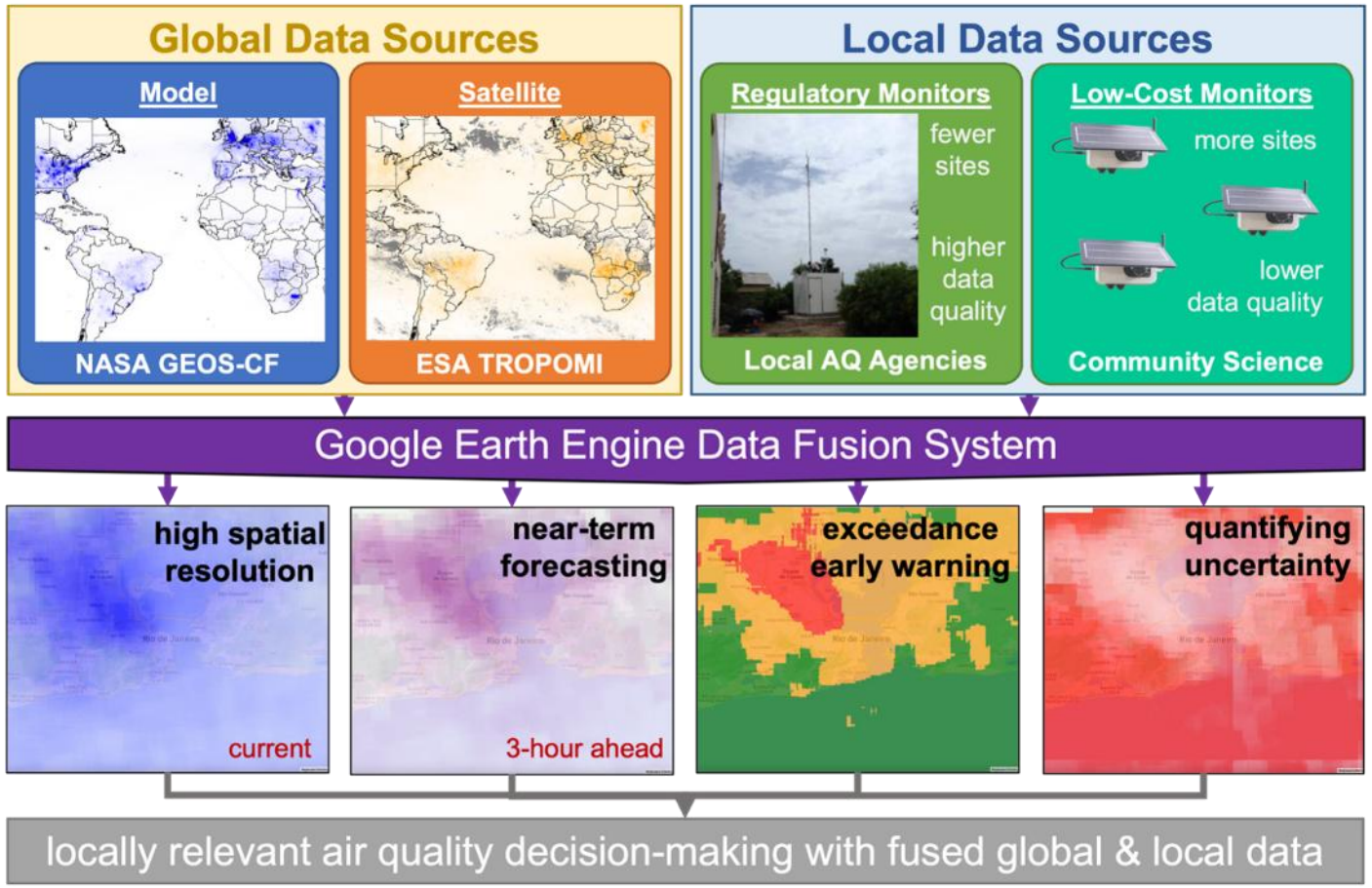


Main contents and intended audience of HAQMN Guideline and LCS manual

Documents	Main contents	Intended audience
Guidelines on establishing HAQMN	Information on deploying LCSs together with RGMs network by local and national government and research institution	Senior governmental officers who manage the air quality monitoring action plans
Technical Manual for Hybrid Monitoring with LCSs	Detailed operational procedures for LCSs (LCS assembly, maintenance, QA/QC etc.)	Especially practitioners who operate LCS and analyze the LCS data

Future prospective:
Utilization of LCS and satellite for air quality decision making

Data fusion by using air quality model, satellite, RGMs and LCSs



Source: NASA GMAO https://gmao.gsfc.nasa.gov/science-snapshots/google-earth-engine-data-fusion-tool-to-support-air-quality-managers/

- NASA is developing a data-fusion tool that integrates air quality model, satellite, RGMs and LCSs for visualizing the spatiotemporal distribution of air pollutants.
- These analyses can contribute to health impact assessments and urban policy.

Summary

- Low Cost Air Sensors (LCSs) can significantly strengthen urban air quality management in East Asia when they are properly integrated with reference-grade monitors (RGMs) to establish HAQMN.
- Even with limited monitoring budgets and resources, integrating RGMs, LCSs, and satellite data enables clearer understanding of urban air quality and provides actionable information for policy and public health protection.

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Thank you for listening

For any questions, feel free to reach out to

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