

# SUMMARY OF THE TWENTIETH ANNIVERSARY

THE ACID DEPOSITION MONITORING NETWORK  
IN EAST ASIA



# 20<sup>th</sup>



# 1 What is the reason for the establishment of the EANET? What kind of activities has the EANET been implementing?

In response to the concern of acid deposition issue in the region, the Acid Deposition Monitoring Network in East Asia (EANET) was established in 2001, and in the 20 years of its existence, the EANET has implemented various activities such as monitoring and reporting, data acquisition, capacity building, research, and public awareness.

- Acid deposition has become a serious issue with the increase of sulfur dioxide ( $\text{SO}_2$ ) emissions in many East Asian countries since the 1980s, owing to the rapid development of secondary industries. Acid deposition became a more serious problem in the 1990s with the rise in nitrogen oxides ( $\text{NO}_x$ ), primarily owing to rapid development in the automobile and transportation sectors.



Figure 1. The Second Session of Intergovernmental Meeting of the EANET (Niigata, 2000)

- In 1992, the adopted “Agenda 21” stated that the experience of the Convention on Long-range Transboundary Air Pollution (CLRTAP) needed to be shared with other regions of the world. During the first half of the 1990s, countries in the East Asian region expressed the need to work together on atmospheric environment issues, such as acid deposition. The EANET started its preparatory phase in 1998, and subsequently its regular phase in 2001. Since then the EANET has been implementing the following activities:



Figure 2. The Twelfth Session of Intergovernmental Meeting of the EANET (Niigata, 2010)

- Monitoring wet deposition, dry deposition, soil/vegetation, inland aquatic environment and catchment;
- Collection, evaluation, analysis and provision of monitoring data of acid deposition in the Participating Countries;

- Capacity building on monitoring and research activities in acid deposition and related air pollution issues in the Participating Countries;
- Research activities on acid deposition and related air pollution problems and their impact on ecosystems; and
- Public awareness activities on acid deposition and related air pollution issues.

## 2 How has the EANET helped solve acid deposition and related air pollution problems in the East Asian region?

To solve acid deposition and related air pollution problems, it is essential to understand the current status and trends of acid deposition and related air pollution in the region by referring to monitoring data. The EANET provides comprehensive monitoring data in the East Asian region, and has been continuously developing its monitoring network over the last 20 years. To support policymakers, the EANET periodically produces regional assessment reports based on monitoring results from its activities.

- It is essential to understand the current status and trends of acid deposition and related air pollution to solve the problems in East Asia, by referring to the monitoring data. The EANET, therefore, has been developing monitoring activities in the East Asian region towards high-quality data. Furthermore, the EANET has been continuously developing its monitoring network over the last 20 years.
- Reliability and traceability of monitoring data are important characteristics of the monitoring network. EANET has also prioritized maintaining the quality of the monitoring data by conducting quality assurance/quality control (QA/QC) activities such as the development of standard operational procedures (SOPs) and implementation of inter-laboratory comparison projects. Capacity building activities, such as the fellowship program and individual training at the Network Center for EANET and the technical missions dispatched to the Participating Countries, have been conducted to further enhance relevant capabilities.
- EANET monitoring data are accessible to the public via the EANET Data Report/Monitoring System (<https://monitoring.eanet.asia/document/public/index>) for both research activities and air quality management according to the related rules and regulations of data management.

- EANET periodically publishes scientific regional assessment reports, Periodic Report on the State of Acid Deposition in East Asia (PRSAD), based on the results of its monitoring activities. The principal objective of the PRSAD is understanding and sharing the status and impacts of acid deposition in East Asia. EANET also publishes the Report for Policy Makers (RPM) periodically to provide science-based recommendations for decision-making processes.

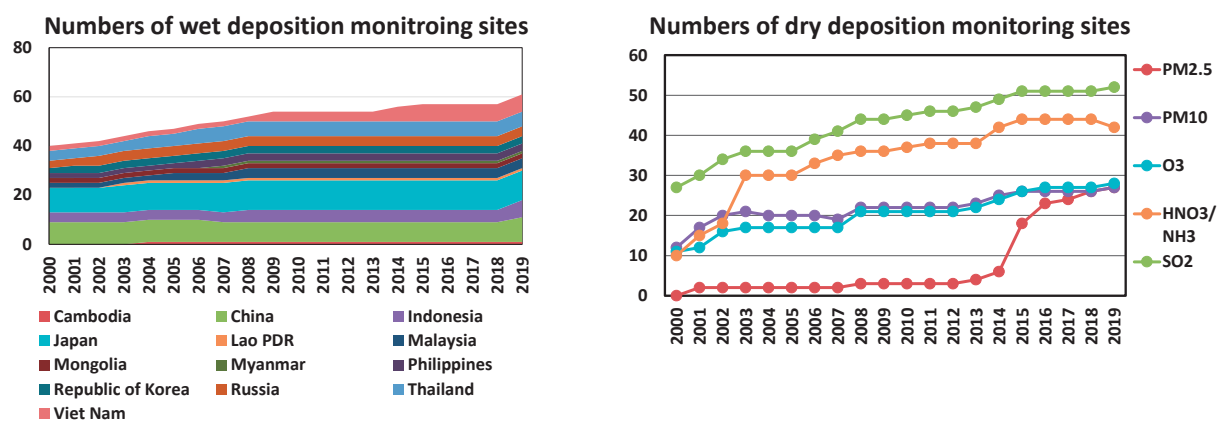
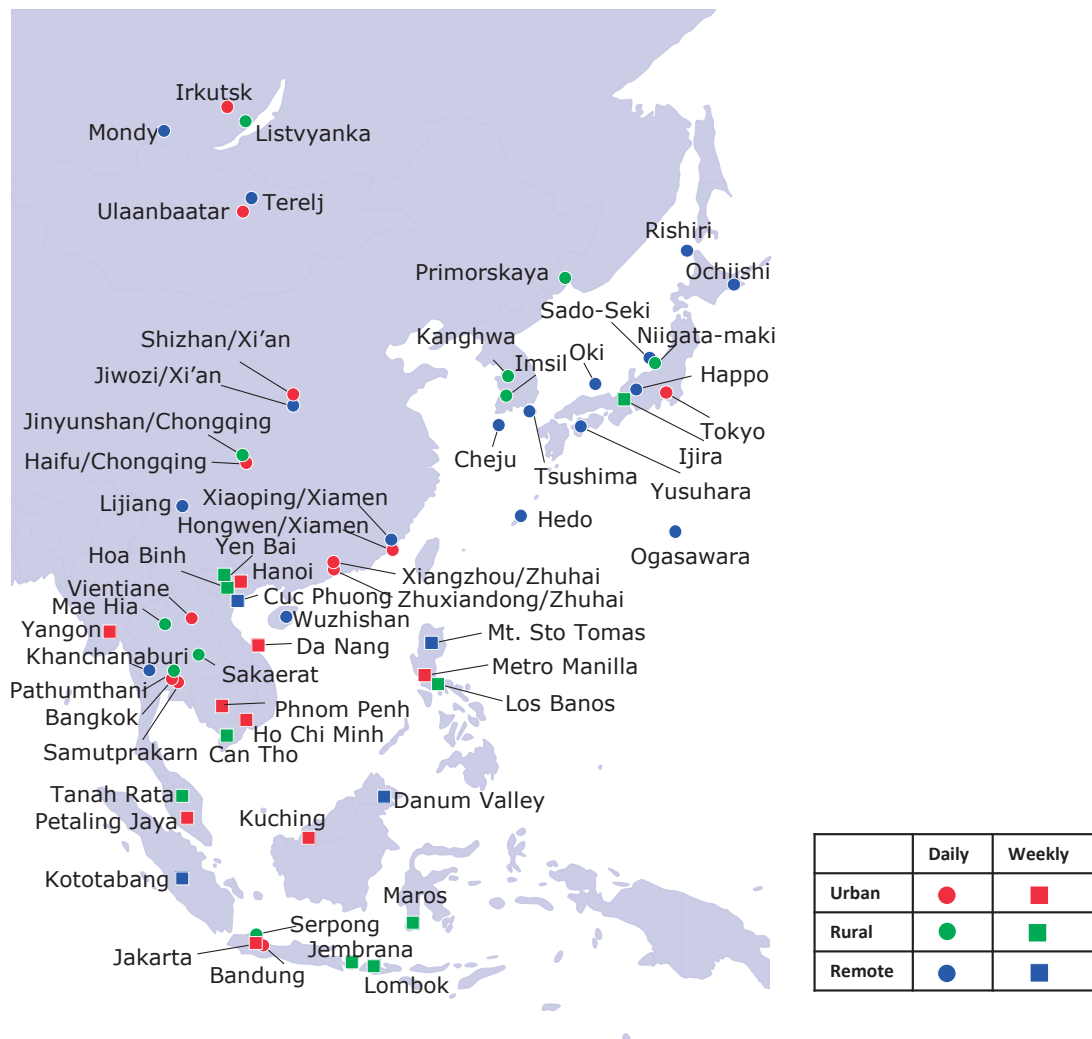


Figure 3. Location of wet deposition monitoring sites in 2019 (upper), Numbers of the wet deposition monitoring sites (lower left) and Numbers of dry monitoring sites (lower right) in 2000-2019 (Source: EANET Data Reports 2000-2019)

### 3 What is the current status of acid deposition in East Asia?

Northeast Asia has seen a decrease in the annual amount of acid deposition, especially that of sulfuric acid deposition, over the last twenty years. At the global level, the amount of acid deposition in the East Asian region is comparatively higher than that reported by the European Monitoring and Evaluation Programme (EMEP) and the National Atmospheric Deposition Program (NADP) in North America. This may be partly a result of volcanic activity and naturally larger precipitation in East Asia.

- In the Northeast Asian region, the amount of wet deposition of non-sea-salt sulfate ion ( $\text{nss-SO}_4^{2-}$ ) and hydrogen ion ( $\text{H}^+$ ) – the representative/typical indicators of acid deposition – has decreased remarkably, not only in urban but also in rural and remote sites.
- In the Southeast Asian region, large wet deposition of these two ions along with the nitrate ion ( $\text{NO}_3^-$ ) are prominent at some urban sites, showing regional diversity.

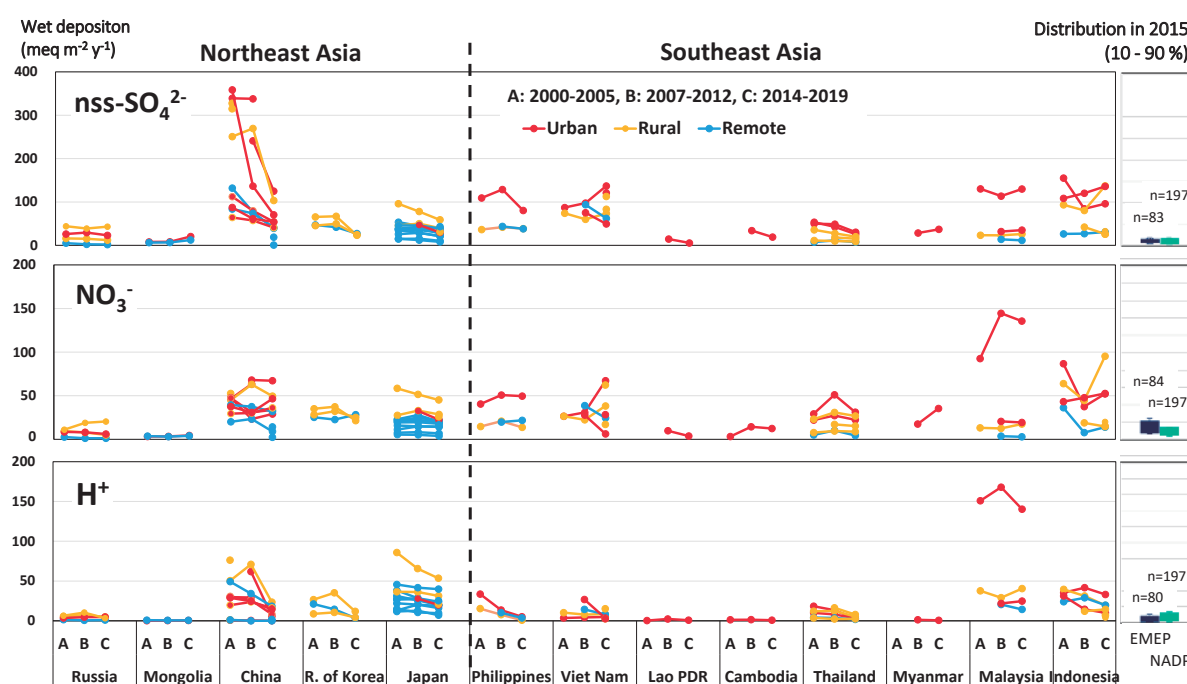


Figure 4. Trends of wet deposition in EANET monitoring sites  
(Source: EANET Data Reports 2000-2019, EMEP, NADP)



- The amount of wet deposition indicated is currently higher than that reported by the EMEP (for Europe) and the NADP (for North America), which do not target urban air pollution. Therefore, the higher amount of acid deposition in the EANET region may be due to the monitoring of urban sites. Additionally, volcanic activity in Northeast Asia and large precipitation amounts in Japan and Southeast Asia may partially contribute to the large acid deposition in this region.

## 4 How important is acid deposition as an environmental problem at present?

Acid deposition is not only a problem of acidification, but also that of various related pollutants, including nitrogen compounds, which are deposited with the acidic substances. Excessive nitrogen deposition can further influence the health and resilience of ecosystems.

Surface ozone (O<sub>3</sub>) and particulate matter (PM), generated in connection with the acidic pollutants, can also cause adverse effects on ecosystems including crops. It is thus important to monitor and control the various acid deposition and related air pollutants. The efforts of the Participating Countries have helped tackle the acid deposition problem in the region. These experiences and best practices accumulated over the past 20 years can contribute to the control and management of other related air pollutants.

- The long-term deposition of acidic substances and excessive nitrogen compounds (nitric acid and ammonia) chronically disturb the nutrient cycle of terrestrial ecosystems, including forests. The resulting decline of tree health and biodiversity may further reduce the resilience of the affected ecosystem, resulting in its weakened carbon-sink, disaster prevention, and water storage functions. Direct exposure to air pollutants, such as O<sub>3</sub> and PM, could adversely affect trees and crops too.
- The EANET Participating Countries have also made great efforts to understand the impact of acid deposition and the importance of solving this problem over the past 20 years. The experiences and best practices accumulated can be used as references to control and manage other related air pollutants.

# 5 How to understand the importance of co-benefits towards a cleaner environment and sustainable development?

Evidence suggests that climate change and atmospheric issues are likely to be solved simultaneously if coordinated measures and actions from governments, enterprises, and the public are undertaken with consideration of co-benefits during the design and implementation of related strategies.

- Policies and actions considering climate as their primary objective could lead to more impactful results in solving atmospheric issues if co-benefits' coordination is better organized.
- The Third and Fourth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) distinguish between co-benefits (benefits that are intended by the policy maker) and ancillary benefits (unintended benefits). Under this definition, co-benefits in the climate and air areas are the benefits from policy options intentionally implemented for both climate and atmospheric purposes simultaneously.
- The co-benefits' key sectors include but are not limited to energy supply, transportation, buildings, industry and human settlements and infrastructure. Table 5.1 provides an aggregated but qualitative overview of the potential co-benefits on air pollution that could be realized if certain types of mitigation measures are enacted in different sectors such as energy supply-side transformations; technological and behavioral changes in the transport, buildings, and industrial end-use sectors, and others. Promotion of the development of renewable energy and new energy automobiles could contribute to achieving carbon reduction and cleaner air. Reduction of fuel carbon intensity and energy intensity in the transportation sector could reduce urban air pollution. In buildings sector, retrofits can achieve heating and cooling energy savings and could also contribute to the co-benefits. A sustainable lifestyle should be encouraged so as to establish a solid base for climate adaption and a cleaner atmospheric hemisphere with improved consumption patterns of the present and future generations in the region.

**Table 5.1. Potential co-benefits and adverse side-effects that could be realized if certain types of mitigation measures are enacted in different sectors**

Sectoral Mitigation Measures	Effect on Environment
<b>Energy Supply</b>	
Nuclear replacing coal power	Ecosystem impact via ↓ Air pollution (m/h) and coal mining (l/h)
Renewable energy (wind, photovoltaic (PV), concentrated solar power (CSP), hydro, geothermal, bioenergy) replacing coal	Ecosystem impact via ↓ Air pollution (except bioenergy) (m/h)
<b>Transport</b>	
Reduction of fuel carbon intensity: electricity, hydrogen (H <sub>2</sub> ), compressed natural gas (CNG), biofuels	Ecosystem impact of electricity and hydrogen via ↓ Urban air pollution (m/m)
Reduction of energy intensity	↓ Ecosystem and biodiversity impact via reduced urban air pollution (m/h)
Compact urban form and improved transport infrastructure Modal shift	Ecosystem impact via reduced ↓ Urban air pollution (r/h)
Journey distance reduction and avoidance	Ecosystem impact via ↓ Urban air pollution (r/h)
<b>Buildings</b>	
Fuel switching, incorporation of renewable energy, green roofs, and other measures reducing GHG emissions intensity	Health impact in residential buildings via ↓ Outdoor air pollution (r/h), ↓ Indoor air pollution (r/h)
Retrofits of existing buildings (e.g., cool roof, passive solar, etc.) Exemplary new buildings efficient equipment	Health impact via ↓ Outdoor air pollution (r/h), ↓ Indoor air pollution (r/h)
<b>Industry</b>	
Material efficiency of goods, recycling	↓ Ecosystem impact via reduced local air and water pollution and waste material disposal (m/m)
<b>Human Settlements and infrastructure</b>	
Increased accessibility	↑ Air quality and reduced ecosystem and health impacts (m/h)
Mixed land use	↑ Air quality and reduced ecosystem and health impacts (m/h)

(Source: IPCC main report, AR5 Mitigation, P469-471)

\*Green arrows pointing up/down denote a positive/negative effect on the respective objective or concern.

Abbreviations for evidence: l = limited, m = medium, r = robust; for agreement: l = low, m = medium, h = high.



# 6

## What are the most important issues related to air pollution, and why air pollution matters need to be assessed in East Asia?

Impacts of air pollution on public health and ecosystems remain a significant concern in East Asia. Research has been conducted on human health and possible impacts of particulate matter (PM) and surface ozone (O<sub>3</sub>) on tree species and agricultural crops in East Asia.

Recent studies suggest the complexity of air pollutants atmospheric behaviors and their effects. There is a need to assess the effectiveness of various measures contributing to reduction of acid deposition and related air pollution considering the adverse effects caused by multiple air pollutants, which could lead to applicable measures to further improve the air quality.

- Air pollution is a significant concern in the East Asian region. The main substances affecting public health are nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), O<sub>3</sub>, and PM. According to the World Health Organization (WHO) Global Air Quality Guidelines (WHO, 2021), bronchitis in children is associated with long-term exposure to Nitrogen Dioxide (NO<sub>2</sub>), while SO<sub>2</sub> can affect the respiratory system and causes eye irritation. Excessive O<sub>3</sub> exposure can cause breathing problems, aggravate asthma, and reduce lung functions. In recent years, fine particles (PM<sub>2.5</sub>) have been a significant concern, as they penetrate deep into the lungs, affecting both the respiratory and vascular systems.
- Some air pollutants also have adverse effects on the ecosystems. Possible impacts of PM and O<sub>3</sub> pose a potential threat for tree growth and agricultural production, regardless of differences in estimated losses among the various studies undertaken. PM and O<sub>3</sub> could therefore adversely affect food supply, forest resilience, and biodiversity. Considering these impacts, the reduction of acid deposition and related air pollution is of utmost importance to improve air quality.

- The Sixth Assessment Report of the IPCC pointed out the complex atmospheric behaviors of air pollutants and their effects; further, reducing emissions of SO<sub>2</sub>, the precursor of sulfate aerosol, would increase the amount of sunlight reaching the ground and thus affect the climate. It is therefore important that the Participating Countries cooperate to deal with adverse effects caused by acid deposition and related air pollutants.
- During the past 20 years, the EANET Participating Countries have made great efforts to reduce emissions of acidifying substances and related pollutants through methods such as effective policies and advanced technologies and best practices from their former experiences. Therefore, there is a need to assess the various measures and their effectiveness in reducing acid deposition and related air pollution, which could lead to applicable measures to further improve air quality.

## 7 How will the EANET activities change in the future?

The EANET could expand its scope from its current activities of focusing on monitoring acid deposition to atmospheric environmental substances and related activities, subject to the approval of all the Participating Countries. The EANET could continuously enhance and strengthen cooperation and collaboration among the Participating Countries by introducing new joint projects.

Simultaneously, the EANET could strengthen its cooperation with relevant international organizations, research institutes, and countries, including the diversification of its funding mechanisms. Subsequently, the EANET could flexibly deal with atmospheric environmental problems and promote a synergy in the East Asian region.



- The EANET has been monitoring acid deposition in East Asia since 2001. However, as described previously, owing to recent air pollution issues caused by PM<sub>2.5</sub> and O<sub>3</sub>, their impacts on human health and ecosystems are of significant concern in the East Asian region. Therefore, the EANET aims to expand its scope from focusing on monitoring of acid deposition to that of atmospheric environmental-related substances and related activities. The Decision of the Twenty-second Session of the Intergovernmental Meeting on the EANET (IG22) stated that some activities relating to air pollution are of major interest to the EANET Participating Countries but may be beyond its current scope. Therefore, it was decided to start to expand the scope of the Instrument for Strengthening the Acid Deposition Monitoring Network in East Asia.
- The EANET will continuously enhance and strengthen cooperation and collaboration by introducing new joint projects among the Participating Countries such as the policy dialogues and capacity building activities on PM<sub>2.5</sub> and/or O<sub>3</sub> and impact study on agricultural crops, forest ecosystems, and inland water systems to improve the atmospheric environment in the East Asian region.
- Concurrently, the EANET will strengthen cooperation with relevant international organizations and initiatives/programs, and the diversification of its funding mechanisms subject to the approval of all the Participating Countries, to deal with atmospheric environmental-related issues and promote a synergy in the East Asian region. The relevant international organizations initiatives/programs to cooperate may include the Asia Pacific Clean Air Partnership (APCAP), the Integrated Programme for Better Air Quality in Asia (IBAQ), the North-East Asia Clean Air Partnership (NEACAP), the European Monitoring and Evaluation Programme (EMEP) and Working Group on Effects (WGE) under the Convention on Long-range Transboundary Air Pollution (CLRTAP), Climate and Clean Air Coalition (CCAC), World Meteorological Organization (WMO), World Health Organization (WHO) etc.

# EANET

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[www.eanet.asia](http://www.eanet.asia)

### Secretariat

**United Nations Environment  
Programme Asia and the Pacific**  
2nd Floor, United Nations Building  
Rajdamnern Avenue, Bangkok 10200,  
Thailand  
Tel: +662 288 1627  
Fax: +662 288 2829  
Email: [eanetsecretariat@un.org](mailto:eanetsecretariat@un.org)  
[www.unenvironment.org](http://www.unenvironment.org)

### Network Center

**Asia Center for Air Pollution  
Research (ACAP)**  
1182 Sowa, Nishi-ku,  
Niigata-shi, 950-2144,  
Japan  
Tel: +81-25-263-0550  
Fax: +81-25-263-0566  
Email: [eanet@acap.asia](mailto:eanet@acap.asia)  
[www.acap.asia/en/](http://www.acap.asia/en/)