

ACAP

Asia Center for Air Pollution Research



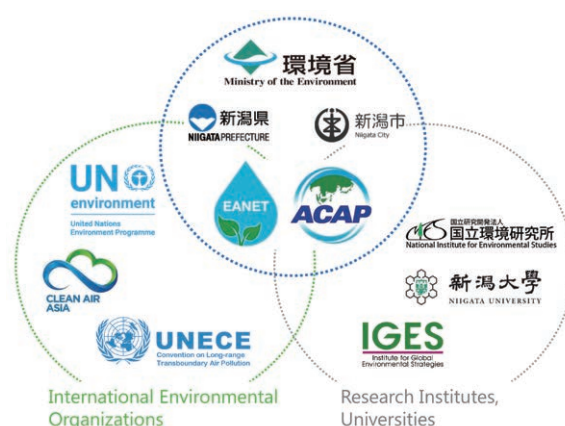
Asia Center for Air Pollution Research
Japan Environmental Sanitation Center

Introduction

In the East Asian region, environmental problems due to rapid economic growth have become more pronounced. In particular, air pollution including acid deposition is one such serious issue that needs to be resolved urgently to improve public health and achieve Sustainable Development Goals (SDGs). In order to elucidate the current situation including impacts of acid deposition in the East Asian region and organize a regional cooperative initiative on acid deposition issues, the “Acid Deposition Monitoring Network in East Asia (EANET)” was established in April 1998 under the initiative of Japan. The EANET has been operational on a regular basis since January 2001 after two and a half years of preparatory phase activities. Currently, 13 countries in the East Asian region are members of the EANET.

The Acid Deposition and Oxidant Research Center (ADORC) was established in Niigata, Japan in April 1998 as a branch office of the Japan Environmental Sanitation Center (JESC). It plays a pivotal role as the Network Center and Japan's National Center for the Network. ADORC was founded with the support from Niigata Prefecture, City of Niigata, manufacturing companies, and non-profit organizations under the leadership of the Environment Agency (which has become the Ministry of the Environment) of Japan.

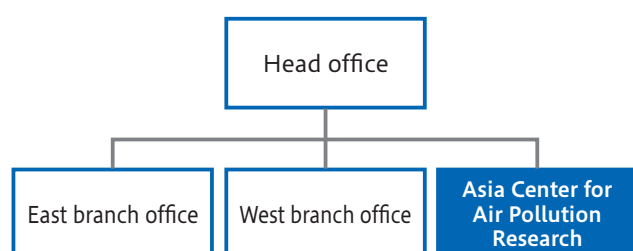
ADORC was renamed the Asia Center for Air Pollution Research (ACAP) in June 2010. With the aim to improve air quality, ACAP continuously plays a key role in monitoring and researching air pollution including acid deposition in East Asia as the Network Center for the EANET and National Center of Japan. In cooperation with international organizations, governments, local governments, and research institutions, the ACAP conducts research activities, international conferences, training, etc. and also disseminates data.



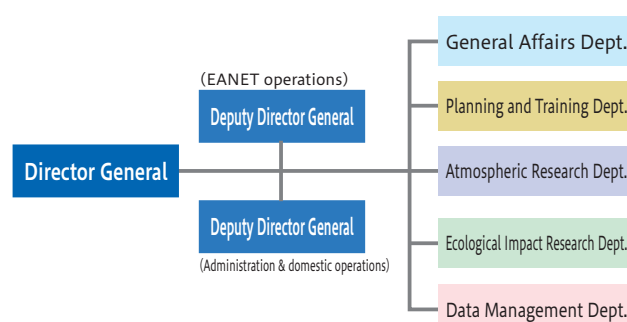
Organization

Name	Asia Center for Air Pollution Research, Japan Environmental Sanitation Center
Acronym	ACAP
Establishment	April 1998
No. of employees	30 (as of 1 April 2019)
Location	1182 Sowa, Nishi-ku, Niigata-shi, 950-2144, Japan
TEL/FAX	TEL: +81-25-263-0550, FAX: +81-25-263-0566
History	<p>April 1998 The Acid Deposition and Oxidant Research Center (ADORC) was established as a branch office of the Japan Environmental Sanitation Center (JESC)</p> <p>June 2010 ADORC was renamed the Asia Center for Air Pollution Research (ACAP)</p>

Organizational Chart of JESC (Head Office)

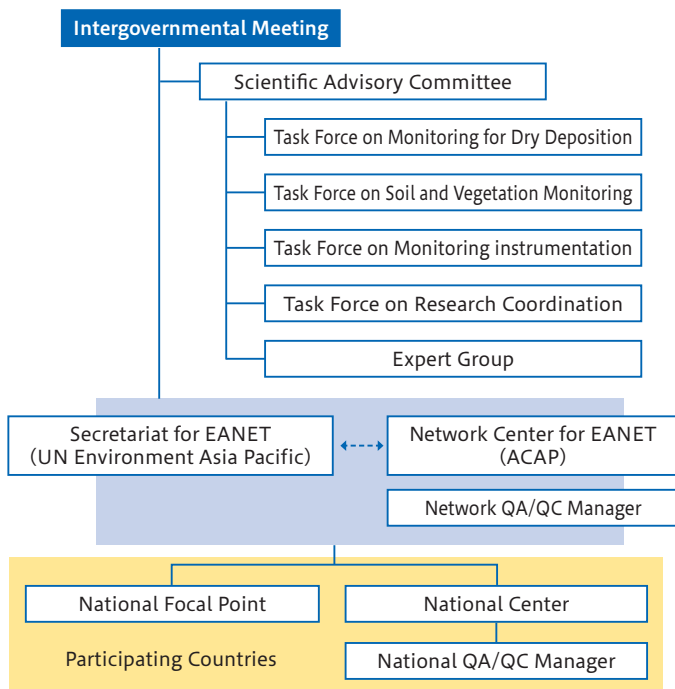


Organizational Chart of ACAP



Major Functions

Tasks as the Network Center for the EANET

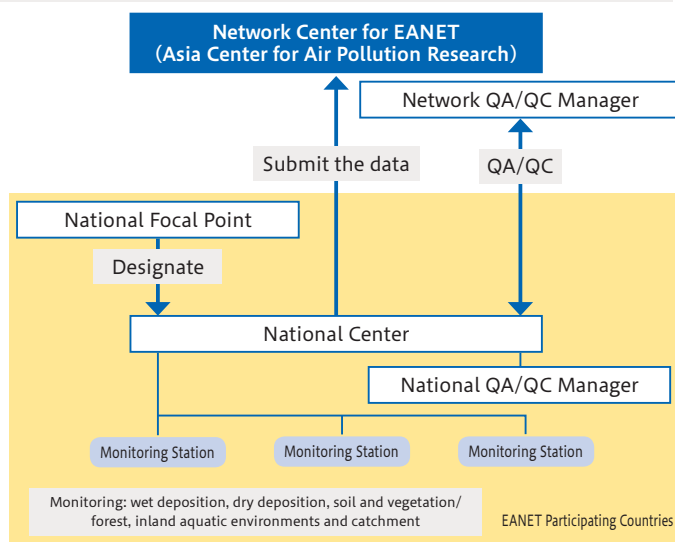


- Compilation, evaluation, storage and provision of monitoring data.
- Preparation of a report on the state of acid deposition in East Asia.
- Technical support and training for participating countries.
- Quality Assurance and Quality Control (QA/QC) activities.
- Research activities.
- Organization of EANET meetings and support of the EANET Secretariat.
- Public awareness.



Tasks as the National Center of Japan

Compile/analyze/manage/publicize the EANET monitoring data



- Compilation of transboundary air pollution and acid rain long-term monitoring plan and report.
- Maintenance and management of monitoring station and implementation of field survey.
- Compilation, evaluation, storage and analysis of monitoring data.
- Quality Assurance and Quality Control (QA/QC) activities.



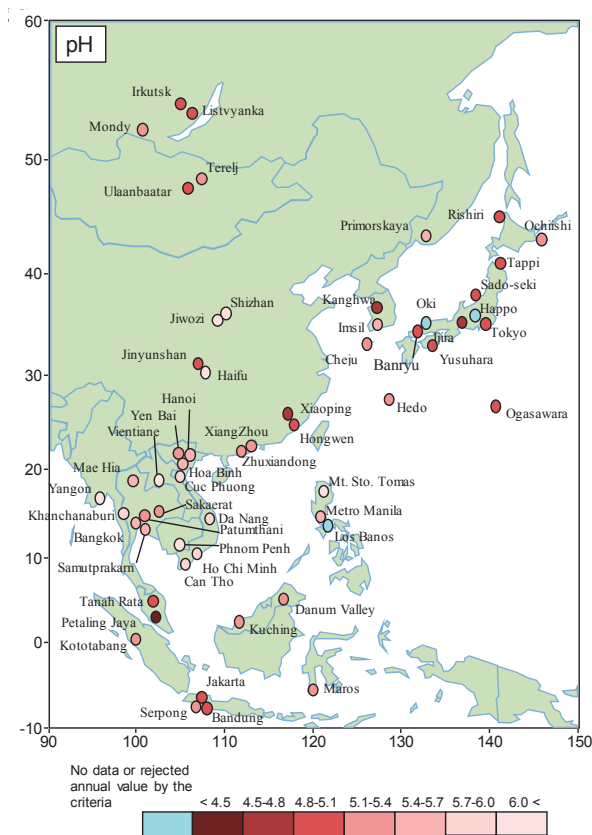
Other Tasks



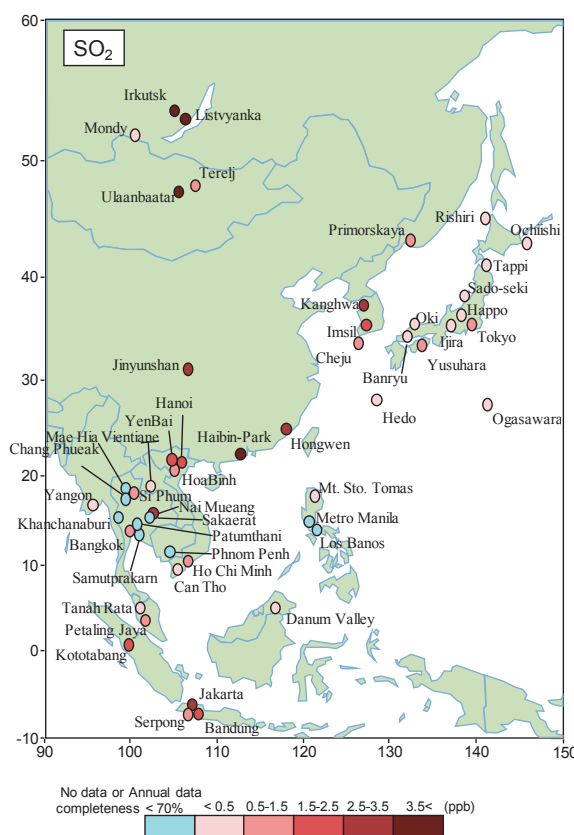
- Management and operation of some domestic acid deposition monitoring stations.
- Compilation, evaluation and storage of domestic monitoring data other than domestic network stations.
- Research activities.
- Participation in research meetings and international conferences.

Major Achievements (Network Center and National Center of Japan)

- Compilation, analysis/evaluation, and storage of monitoring data from 13 participating countries.



Distribution of precipitation pH (as of 2016)



Distribution of sulphur dioxide (SO₂) concentration in ambient air (as of 2016)

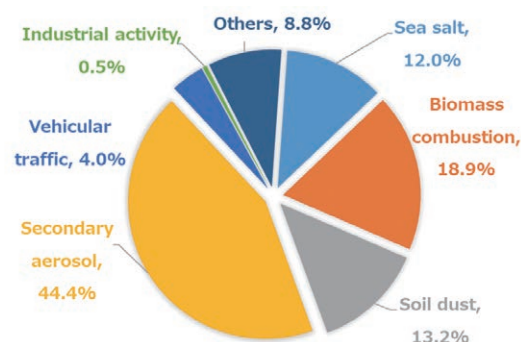
- Provision of technical support for EANET meetings, such as Intergovernmental Meeting, Scientific Advisory Committee, Working Group Meeting, etc., and organizing public awareness workshops, etc.
- Implementation of individual training at ACAP, Inter-laboratory Comparison Project, dispatch of technical missions to the participating countries, etc.
- Issuing the Report of the Session of the Intergovernmental Meetings, etc., monitoring guidelines, technical manuals, strategy papers, training materials, annual data reports, QA/QC guidebook, science bulletin of the EANET, periodic reports on the state of acid deposition in East Asia, etc.



Major Achievement (Research activities)

Study on Air Pollution at Niigata-Maki National Acid Deposition Monitoring Station

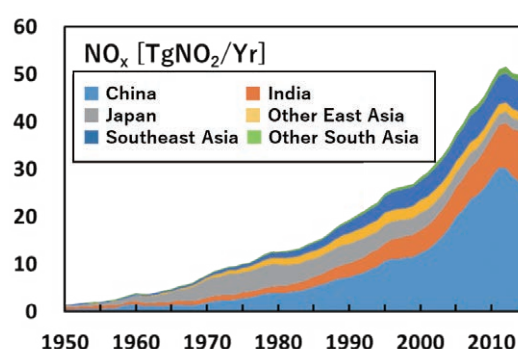
- Intensive sampling of PM_{2.5} was carried out every four seasons at the Niigata-Maki National Acid Deposition Monitoring Station, and research on source apportionment (right figure) of PM_{2.5} was conducted by using component data and receptor model (Li et al., Aerosol and Air Qual. Res. 18: 938–956, 2018)
- The carbonaceous component analysis of precipitation at three sites in Japan, including Niigata-Maki, showed significant transboundary air pollution originating from fossil combustion in winter and biomass combustion in spring (Huo et al., Atmos. Environ. 146: 164–173, 2016).



The annual mean contribution of each source to PM_{2.5} at Niigata-Maki.

Development of Asian Emission Inventory System

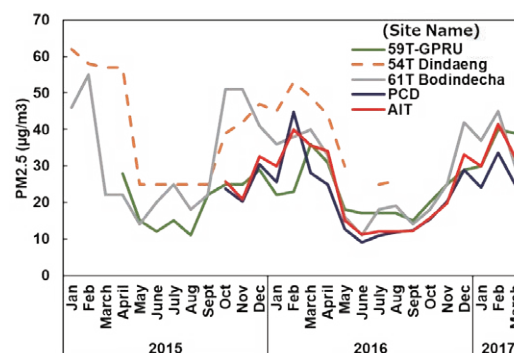
- We are developing an emission inventory of air pollutants and greenhouse gases in Asia called REAS (Regional Emission inventory in ASia) for anthropogenic sources such as fossil fuel combustion. Current status and trends of emissions in Asia are evaluated and analysed.
- Evaluation of uncertainties of emissions and improvement of emission inventories are carried out using air quality models and inverse modelling.
- Emissions of air pollutants in Asia increased significantly from middle of 20th Century (right figure). Recently, emissions in China reached their ceiling and are now showing decreasing trends. On the other hand, emissions in South and Southeast Asia are increasing. Recent trends in air pollutant emission in Asia are complicated.



Trend of NO_x emission in Asian regions (Kurokawa et al., 14th ICACGP/15th IGAC, 2018)

Joint Studies in Thailand on Atmospheric and Catchment Scale Monitoring

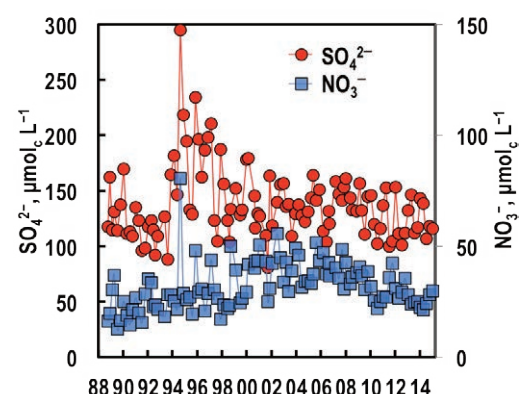
- The joint study with the Thailand Pollution Control Department, the Asian Institute of Technology and the JICA Research Institute clarified the main sources of PM_{2.5} which exceeded the air quality standard in Bangkok Metropolitan Region during the dry season (right figure). (Narita et al. Atmosphere 10(5): 227, 2019).
- In the joint research project on catchment analysis with the Royal Forest Department of Thailand and the Environmental Research and Training Center, a specific change was observed in the stream water, in which the sulphate ion concentration increased significantly. It was suggested that this phenomenon was affected by changes in climatic conditions such as precipitation pattern in the savanna climate with distinct dry and rainy seasons (Sase et al. Hydrological Processes 31: 836–846, 2017).



Monthly variations of PM_{2.5} in Bangkok, Thailand (2015–2017)

Catchment Studies in Kajikawa Study Site and Lake Ijira Monitoring Site

- A small catchment plot (Kajikawa study site) facing the Sea of Japan was established in a Japanese cedar forest of Shibata City (former Kajikawa Village), Niigata Prefecture to study the effects of transboundary air pollution on forest ecosystems. The isotopic study clarified that a part of nitrate derived from the atmospheric deposition was unused in the ecosystem and drained into the stream (Nakagawa et al. Biogeosciences 15: 7025–7042, 2018). It is suggested that there is an excess of nitrogen compounds (nitrogen saturation) in the forest ecosystem.
- The Lake Ijira catchment in Yamagata City, Gifu Prefecture, was heavily affected by the Chukyo area on the Pacific side, and acidification and nitrogen saturation were noted in the mid-1990s. However, in recent years, signs of recovery have been observed, and the concentrations of sulphate ion (SO₄²⁻) and nitrate ion (NO₃⁻) in river water have decreased. (right figure : Sase et al., Biogeochemistry 142: 357–374, 2019)



Ion concentrations in river water in Ijira lake catchment

Major Facilities

Equipment/ apparatus for Monitoring and Sampling

- Apparatus such as the following are available for monitoring, research and training purposes.

Equipment/instruments for Sample Analysis in Wet/Dry Deposition

Apparatus name	Use, etc.
Wet-only samplers	An apparatus that senses precipitation and opens the lid only when it is raining.
Denuder instruments	A collection system that separates particles and gas components in the atmosphere according to the difference in diffusion.
Filter pack kits	Collection system in which filters of different types are arranged in multiple stages to collect gas and particles separately.

Apparatus for Analysis of Wet/dry Deposition Monitoring Samples and Samples for Soil and Vegetation, and Inland Aquatic Environments

Ion Chromatographs	Used for measuring sulphate, nitrate and other ions contained in PM _{2.5} and precipitation.
Atomic Absorption Spectrometer (AAS)	Used to measure elements in water (such as sodium and calcium).
pH meters	Used to measure hydrogen ion concentration, which is an index of precipitation acidity.
Conductivity meters	Used to measure conductivity, which is an indicator of the number of ions in water. Conductivity, as well as pH, is an indicator of pollution to precipitation, river water and lake water.
Deionised water apparatus	Used for pretreatment such as dilution of sample solution in ultra-trace chemical composition analysis below ppb level.

Modern Equipment/instruments for Sophisticated Research Activities

Cavity Attenuated Phase Shift Spectrometer NO ₂ Monitor	An apparatus that can measure NO ₂ concentration directly in real time (a popular device measures NO concentration and estimates NO ₂ from the concentration difference between NO _x and NO).
Stable Isotope Mass Spectrometer	An apparatus that measures sulphur and nitrogen isotopes. Use isotope ratio of elements for origin estimation.
Scanning Electron Microscope	Used for observation and elemental analysis of material surfaces such as plant leaves.
Gas Chromatograph Mass Spectrometer (GC/MS)	Used for the qualitative and quantitative determination of organic substances such as volatile organic compounds in the atmosphere.
Total Organic Carbon (TOC) meter	Used for measurement of total carbon, inorganic carbon and total organic carbon in precipitation and soil.
Liquid Chromatography Mass Spectrometer (LC/MS)	Mainly used for the qualitative and quantitative determination of non-volatile organic substances and thermally unstable ones.
Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)	Used to measure ultra-trace elements in precipitation and in PM _{2.5} .
OC/EC analyser	Used for measurement of elemental carbon (EC) and thermal temperature profile of organic carbon (OC) in PM _{2.5} and for carbon origin estimation.



Ion Chromatograph



Gas Chromatograph Mass Spectrometer



Stable Isotope Mass Spectrometer



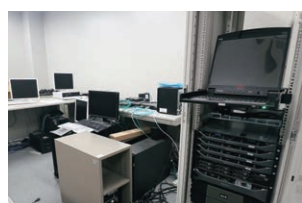
Scanning Electron Microscope

Other Modern Equipment

- A telemeter system is installed with on-line connections to ten EANET monitoring sites in Japan.
- Computer servers and software for modelling research activities on long-range air pollutants transport are available.

Facilities and Office Equipment

- The ACAP building is a two-story building that includes offices, chemical and biological laboratories, a training laboratory, rooms for trainees, meeting rooms (also used for EANET international meeting), etc.



Computer Room



Laboratory for Trainees



Meeting Room for Trainees



Large Meeting Room

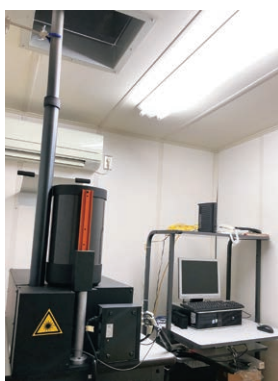
■ Equipment/Apparatus as International Monitoring Network

< Monitoring Network for KOSA >

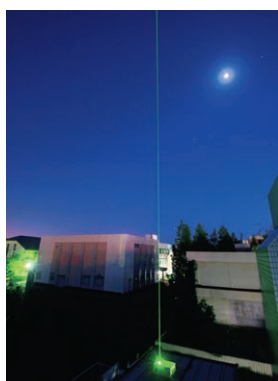
- The Ministry of the Environment, Japan has installed Lidar Aerosols Monitoring System on the roof of ACAP as a part of the monitoring network for KOSA in Northeast Asia to conduct observations.
- In 2017, it was honoured “The Environment Prize” for cooperating with the activities of the KOSA Lidar Network Group.

< AERONET (AERosol RObotic NETwork) >

- Sun Sky Lunar Multispectral Photometer (CE-318) has been installed on the roof of ACAP as AERONET (Aerosol RObotic NETwork) Site which NASA expands all over the world to measure the aerosol optical depth and for conducting observations.



Lidar Aerosols Monitoring System



Lidar observation*1



Monitoring Equipment on the roof of ACAP



Sun Sky Lunar Multispectral Photometer*2

* 1 : A radar using laser light, which remotely observes the vertical distribution of aerosols such as KOSA passing above.

* 2 : A radiometer that senses direct sunlight from the sun and the moon for eight specific wavelengths and measures their radiation intensity. An equipment to monitor Aerosol Optical Depth.

■ Monitoring Station and Site in Japan

< Niigata-Maki National Acid Deposition Monitoring Station >

- Wet and dry deposition sampling can be undertaken for research and training purposes at the Niigata-Maki national acid deposition monitoring station, located approximately 15 minutes by car from ACAP.

< Kajikawa Study Site >

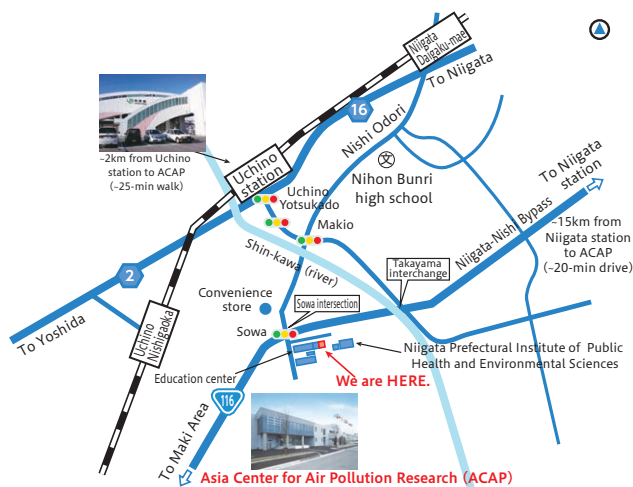
- The Kajikawa study site is located approximately 1 hour by car from ACAP, which was established in cooperation with Niigata University and Niigata Prefecture. Studies on dynamics and cyclic processes of atmospheric pollutants in forest ecosystems and their effects on the stream water have been conducted since 2002.



Niigata-Maki Acid Deposition Monitoring Station



Kajikawa Study Site



Directions for access to the Asia Center for Air Pollution Research (ACAP)

- **From the Kan-etsu Highway “Niigata-Nishi” exit:**

Go through the Niigata west bypass to the Uchino area and continue straight ahead for about five minutes. Turn left at the Sowa intersection, turn left in front of the Niigata Prefectural Training Institute for Local Government Personnel. From here, the ACAP building is about 250 meters ahead on the right side.

- **From the Maki area via Route 116**

Take Route 116 to Niigata. Turn right at the Sowa intersection.

- **From Narita Airport to Niigata**

The fastest way to get to Niigata is to take the JR Narita Express (NEX), which takes roughly one hour for the one-way journey. Change trains to the JR (MAX) Toki (Joetsu Shinkansen) at Tokyo Station (takes about two hours from Tokyo). At Niigata Station, change to the JR Echigo line (local line) and get off at Uchino Station, and then take a taxi at Uchino Station to ACAP (five-minute trip).

- **From Niigata Airport**

Shuttle bus service is available between Niigata Airport and Niigata Station. Get off at the South exit of Niigata Station. Take the train to Uchino Station (on the Echigo line). Take a taxi at Uchino Station to ACAP (five-minute trip).



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