Taiwan Association for Aerosol Research

台灣氣膠研究學會

2024 April

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TAAR Newsletter is a quarterly publication by the Taiwan Association for Aerosol Research

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Announcement

The 16th joint board meeting had been held on March 23, 2024. Two new individual members and four junior members were reviewed and became permanent member and junior member of the Taiwan Aerosol Research Association. Let’ s welcome them ！

Permanent Individual Member

Chau-Ren Jung

Assistant Professor

Department of Public Health, China Medical University

Che-Jung Hsu

Assistant Professor

Department of Marine Environmental Engineering, National Kaohsiung University of Science and Technology

Announcement

Junior Member

Rachmi Layina Chimayati

PhD Student

Environmental Engineering, Chung Yuan Christian University

Lailatus Siami

PhD Student

Environmental Engineering, Chung Yuan Christian University

Guo-Ping Tseng

Bachelor's degree student

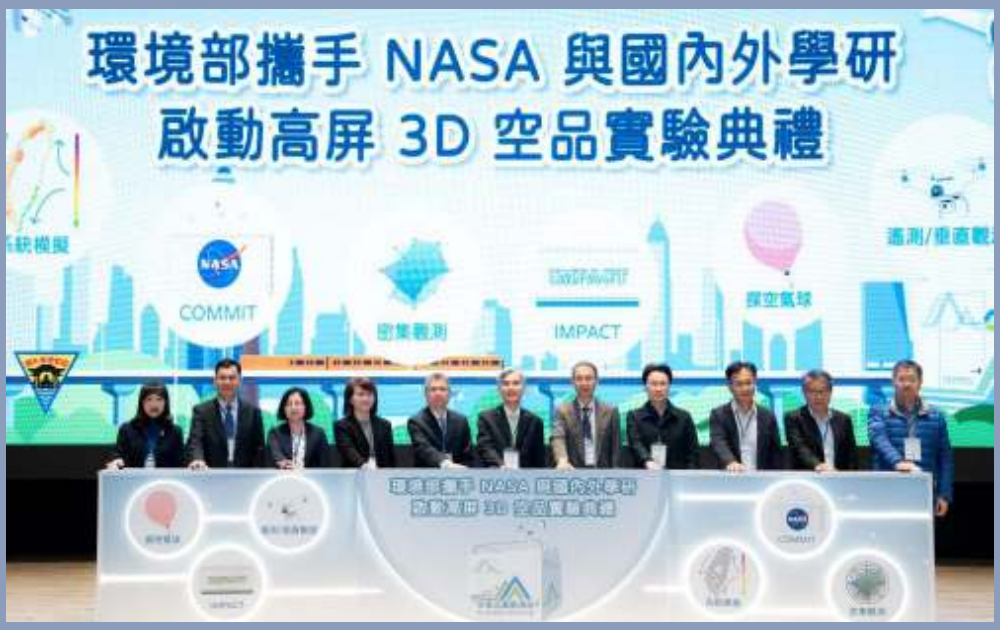
Department of Public Health, Kaohsiung Medical University

Jia-Lin Zhang

PhD Student

Department of Public Health, Kaohsiung Medical University

The KPEx



The MOENV, in collaboration with NASA and domestic and international academic research institutions, has initiated the KPEx.

The Taiwan Association for Aerosol Research (TAAR) assisted the Ministry of Environment (MOENV) in successfully completing the Kao-Ping 3D Air Quality Experiment. This marks the first large-scale international air quality monitoring and intensive observation experiment since the establishment of the Ministry of Environment. Through international cooperation and the deployment of numerous advanced scientific instruments, it contributes to understanding the causes of poor air quality in southern Taiwan during the winter and spring seasons, providing important scientific basis for future formulation of air pollution control strategies.

On January 31, 2024, the MOENVt, together with the TAAR, the National Aeronautics and Space Administration (NASA), the Central Weather Administration, and more than 20 academic units in Taiwan including National Central University, jointly launched the Kao-Ping 3D Air Quality Experiment (KPEx). Besides the Director of the Monitoring and Informative Division of the MOENV, Ping-Fei Shieh, serving as the driving force behind this project, Professor Lin Neng-Huei, the Honorary Chairman of the TAAR and a distinguished professor in the Department of Atmospheric Sciences at National Central University, took on the role of the overall project leader. He coordinated the Taiwanese academic teams and was responsible for liaising with NASA to jointly participate in the observations. Most of the research teams involved in the experiment were also members of the TAAR, each contributing their expertise in technical skills and sampling analysis methods, collectively creating the largest-scale atmospheric environmental joint observation experiment in Taiwan's history. Table 1 shows the participating teams and their manpower allocation.

The KPEx

Table 1-1 The KPEx experiment's work groups and research personnel

工作分組	研究人員	單位
計畫協調整合	謝炳輝 司長	環境部監測資訊司
	林能暉 特聘教授	國立中央大學大氣科學學系
	胡明輝 副司長	環境部監測資訊司
地面氣膠超級監測平台	蕭大智 教授	國立臺灣大學環境工程學研究所
	楊禮豪 教授	中國醫藥大學職業安全與衛生學系
	陳威翔 教授	國立中山大學環境工程研究所
	彭彥彬 教授	國立中山大學環境工程研究所
	林明彥 副教授	國立成功大學工業衛生學科暨環境醫學研究所
	丁育頡 助理教授	國立臺灣大學環境工程學研究所
	陳則綸 助理教授	國立中山大學環境工程研究所
	Si-Chee Tsay Senior Scientist	NASA/GSFC
地面氣膠化學與有害物質	王琳麒 教授	國立高雄科技大學海洋環境工程系
	袁中新 特聘教授	國立中山大學環境工程研究所
	張簡國平 教授	正修科技大學超微量研究科技中心
	蔡瀛逸 教授	嘉南藥理大學環境工程與科學系
	許桂榮 教授	國立中央大學大氣科學學系
	林聖倫 助理教授	國立成功大學環境工程學系
	紀凱獻 教授	國立陽明交通大學環境與職業衛生研究所
	梁茂昌 研究員	中央研究院地球科學研究所
	林志忠 助理教授	屏東科技大學環境工程與科學系
局部環流與垂直觀測整合	王聖翔 教授	國立中央大學大氣科學系
	賴信志 教授	長榮大學綠能與環境資源學系
	劉清煌 教授	文化大學大氣科學系
	宋偉國 教授	空軍航空技術學院軍事氣象系
地面與垂直 VOCs 監測	王家麟 特聘教授	國立中央大學化學系
	林啟燦 教授	國立高雄科技大學海洋環境工程系
	翁健二 副院長	國家海洋研究院
	王聖翔 教授	國立中央大學大氣科學系
	張志忠 副研究員	中央研究院環境變遷研究中心
	王介亨 副研究員	國立中央大學環境研究中心
	劉文治 助理教授	中原大學化學系
	陳聖博 助理研究員	國立中央大學環境監測技術聯合中心

The KPEx

Table 1-2 The KPEx experiment's work groups and research personnel

工作分組	研究人員	單位
衛星遙測與應用	林唐煌 特聘教授	國立中央大學太空遙測中心
	Christina Hsu Senior Scientist	NASA/GSFC
	Prof. Jeong Ukkyo	Pukyong National University
大氣模式與觀測資料整合解析	林能暉 特聘教授	國立中央大學大氣科學系
	林傳堯 研究員	中央研究院環境變遷研究中心
	莊銘棟 副研究技術師	中央研究院環境變遷研究中心
	賴信志 教授	長榮大學綠能與環境資源學系
	莊秉潔 教授	國立中興大學環境工程系
	鄭芳怡 教授	國立中央大學大氣科學系
	彭祥 助理研究員	國立中央大學大氣科學系
	Lecture Prof. Joshua S. Fu	University of Tennessee
	Ass. Prof. Maggie Ooi	Universiti Kebangsaan Malaysia （UKM）
	Ass. Prof. Jackson Chang	Universiti Malaysia Sabah （UMS）
網站與資料庫	歐陽長風 副研究員	國立中央大學大氣科學系
	Ass. Prof. Stephen Griffith	國立台灣大學大氣科學系
	林家慶 技術員	國立中央大學環境監測技術聯合中心
NASA 亞洲飛航實驗協作與協調	林能暉 特聘教授	國立中央大學大氣科學系
	陳韡巖 副研究技術師	中央研究院環境變遷研究中心
	邱瑜禎 技士	環境部監測資訊司
技術或後勤支援單位	利得儀器股份有限公司 慧技科學有限公司 思維環境科技有限公司	
行政支援與資源協調	鄭春菊 簡任技正	環境部監測資訊司
	陳信雄 專門委員	環境部監測資訊司
	游智淵 科長	環境部監測資訊司
	周宥節 科長	環境部監測資訊司
	邱瑜禎 技士	環境部監測資訊司
	何佳祥 技士	環境部監測資訊司
	黃健瑋 環境技術師	環境部監測資訊司
	邱佳陽 專任助理	台灣氣膠研究學會
	吳莆馨 專任助理	國立中央大學

The KPEx

Minister Fuh-Sheng Shieu and experts and scholars from the KPEx gathered for a group photo in front of the Fengshan High School super site.

The KPEx is a spring Southeast Asia biomass burning downwind experiment under the Seven South East Asian Studies (7-SEAS) project. The main scientific focus of KPEx is to explore the correlation between air pollution and local circulation in the Kao-Ping region of Taiwan. By integrating ground-based, vertical, and satellite remote sensing monitoring capabilities, KPEx conducts three-dimensional intensive observations to analyze the dynamic and chemical mechanisms of air pollutants under the transport and diffusion of local circulation. It investigates the mechanisms of long-standing $PM_{2.5}$ /O_3 high pollution events in the Kao-Ping region, providing scientific basis for environmental policymakers to formulate air pollution control strategies.

The KPEx

The KPEx deployed advanced ground monitoring systems, conducted on-site measurements, and conducted in-depth analysis of aerosol physics and chemistry. NASA's Chemical, Optical, and Microphysical Measurements of In-situ Troposphere (COMMIT) station was set up at Fengshan High School, and National Taiwan University's Integrated Measurements of Pollution and Aerosol Composition & Transformation (IMPACT) station was set up at Nanzi High School. In addition, advanced air quality monitoring vehicles from Taichung City were also involved in the monitoring process. They integrated observations of heavy metals, elemental carbon, organic carbon, polycyclic aromatic hydrocarbons, and other air pollutants and hazardous substances to assess the impact of upwind and downwind variations on air quality in the Kao-Ping region. This was complemented by monitoring stations set up by the MOENV in Qiaotou, Nanzih, Qianjin, Fengshan, Xiaogang, and Linyuan, providing a comprehensive understanding of air quality, atmospheric visibility, and the complex transport and reactions of gaseous and particulate pollutants such as $PM_{2.5}$ and ultra-fine particles (UFP) in the Kao-Ping region. Additionally, selected air quality monitoring stations conducted manual sampling and analysis of aerosol chemical hazardous air pollutants, including soluble ions, organic acids, dehydrated sugars, aerosol carbon components (EC/OC), heavy metals (including isotopes), polycyclic aromatic hydrocarbons (PAHs), nitro-polycyclic aromatic hydrocarbons (Nitro-PAHs), organic phosphorus flame retardants (OPEs), polybrominated diphenyl ethers (PBDEs), per/poly fluoro alkyl substances (PFAS), atmospheric mercury (GEM, GOM, PBM), PCDD/Fs, PCBs, and microplastic particles and fibers. Manual sampling will further integrate real-time air quality monitoring and aerosol characteristic data obtained from the KPEx experiment to conduct hazardous air pollutant data analysis, further evaluating the impact on public health in the Kao-Ping region.

The KPEx

One of the highlights of the KPEx is the extensive and intensive deployment of unmanned aerial vehicles (UAVs), radiosondes, wind profilers, LIDARs, and sun photometers for profile observations. The UAVs are equipped with multifunctional mini sensors and sampling systems, allowing for real-time analysis of vertical variations in air pollutants ($PM^{2.5}$ and O^3) and volatile organic compounds (VOCs). This enables the investigation of the formation and distribution mechanisms of secondary pollutants, aerosols, and ozone, as well as the mixing, aging, and aged processes during long-range transport of air masses. The experiment explores the correlations among air pollutants, three-dimensional airflow fields, and terrain structures, while providing emission inventories through the Taiwan Emission Data System (TEDS) and model verification to enhance modeling capabilities.

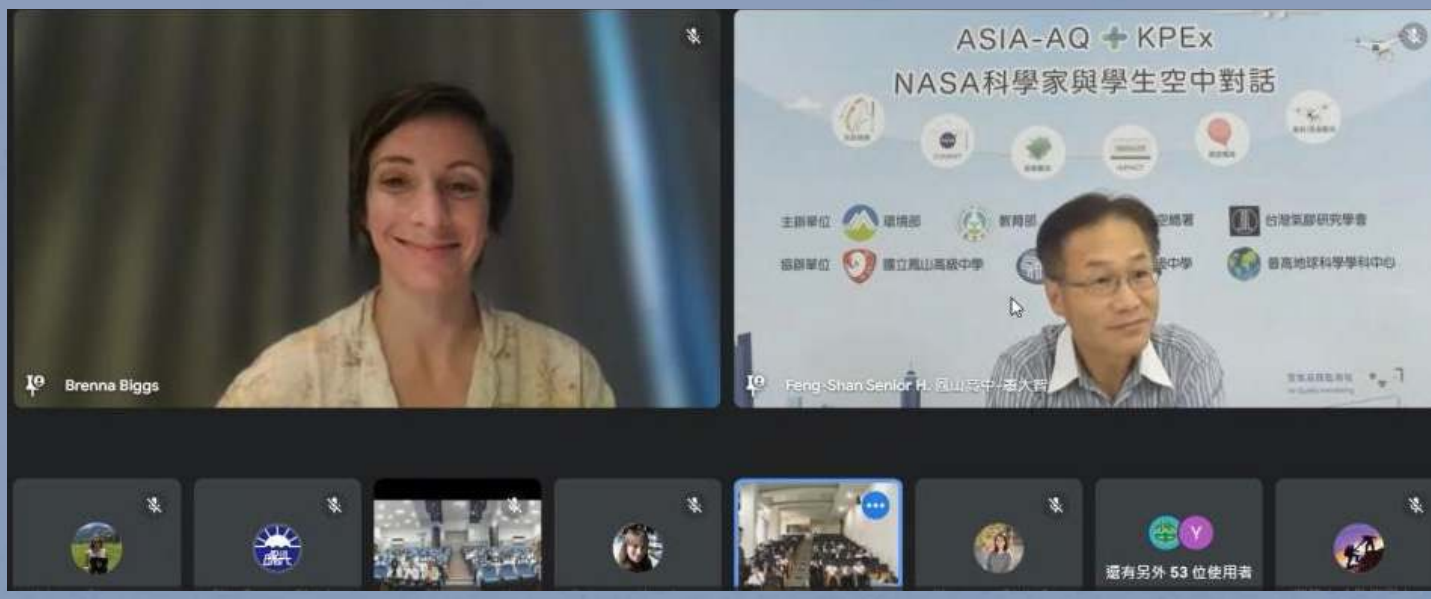
A group photo of gas sampling with unmanned aerial vehicles (UAVs) in Linyuan.

The KPEx

While KPEx was underway, it coincided with the NASA ASIA-AQ (Airborne and Satellite Investigation of Asian Air Quality) project's flight experiments. NASA, along with Taiwan, and several other countries including Thailand, South Korea, and the Philippines, conducted experiments on Asian air quality to understand the three-dimensional variations of transboundary and regional air pollutants. NASA deployed two research aircraft equipped with high-precision instruments, which flew over central and southern Taiwan on February 15, February 28, March 13, and March 27. They collaborated with the MOENV to conduct the KPEx to analyze the local causes of air pollution. The DC8 aircraft carried precision instruments for air quality monitoring, measuring various air pollutants from 46 feet (15 meters) to 11,000 feet (3,300 meters) above ground level from Yunlin-Chiayi to the Kao-Ping region. Additionally, the GIII aircraft cruised at an altitude of 28,500 feet (8,600 meters) between Taichung and Pingtung, conducting regional air quality measurements using onboard LIDAR and spectrometers. This collaboration exemplifies environmental science research and international cooperation.

NASA's DC-8 research aircraft conducting low-altitude measurements at 15 meters above ground level at Chiayi Airport.

The KPEx



NASA's Flight Research Program Communications Director, Brenna Biggs, and Director Tsai Meng-Yu from MOENV delivered opening remarks.

In addition, to promote science education among high school and higher education students in Taiwan and to increase their understanding of the causes of air pollution, the MOENV, NASA, the Ministry of Education, and the TAAR jointly organized two "NASA Scientist and Student Airborne Dialogue" events on March 20th and 21st, 2024. These events featured exciting courses and interactive exchanges with a total of five scientists, including Dr. Brenna Biggs, Director of Communications for NASA's Aeronautics Research Mission Directorate. The events received enthusiastic responses from over 1000 high school students and nearly 200 college students. This airborne dialogue represents a successful environmental education initiative, enabling students in Taiwan to connect with the international community and broaden their perspectives. In the future, in the promotion of environmental education, efforts should not only focus on local contexts but also encourage global thinking and foster more diverse international connections.

The KPEx

The success of the KPEx and its collaboration with NASA's airborne operations are owed to the concerted efforts of various domestic and international agencies, including the MOENV, NASA, the CWA, the Civil Aviation Administration o, Academia Sinica, the Air Force Meteorological Squadron, the Air Force Academy, local environmental protection bureaus, and others. The TAAR and the academic community also played crucial roles, with 45 professors and scholars assisting and participating in the planning, site selection, interdepartmental communication, and collaborative execution processes. Each intensive observation involved mobilizing over 200 personnel from various units and grassroots colleagues, who worked tirelessly regardless of the Chinese New Year holiday schedule. They completed tasks such as ground chemical sampling, radiosonde launches, UAV 3D intensive observations, and coordination with NASA's airborne missions, among others. It's believed that every participant cherishes their contributions and takes immense pride in their efforts. The subsequent data analysis and integration are complex and require further involvement. Interested members and participating teachers are welcomed to contact us to maximize the benefits of this data. Through scientific data analysis of KPEx, pollution sources can be deciphered, and reference for regulatory strategies can be provided, contributing to the ongoing efforts to improve air quality in Taiwan.

2024 T&T TFOSE

Arranger

Prof. Kai-Hsien Chi

Institute of Environmental and Occupational Health Sciences,
National Yang Ming Chiao Tung University

Organizers

National Yang Ming Chiao Tung University

Co-Organizers

Taiwan Association for Aerosol Research

Tai & Chyun Associates Industries, Inc.

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- Center for Environmental Toxin and Emerging-Contaminant Research, CENTER
- Dacian Technology Material Co., Ltd.
- KIMFOREST ENTERPRISE CO., LTD.
- Dikma Technologies Inc.

Opening Ceremony

Prof. Li-Wei Chou
Office of International Affairs, National Yang Ming Chiao Tung University

Prof. Jiing-Feng Lirng
College of Medicine, National Yang Ming Chiao Tung University

Yi-Chia Chen
Senior Specialist
環境部大氣環境司

Opening Ceremony

Prof. Chih-Chieh Chen

Institute of Environmental and Occupational Health Sciences, National Taiwan University

Prof. Ying-I Tsai

Taiwan Association for Aerosol Research

Keynote speaker

Prof. Puji Lestari

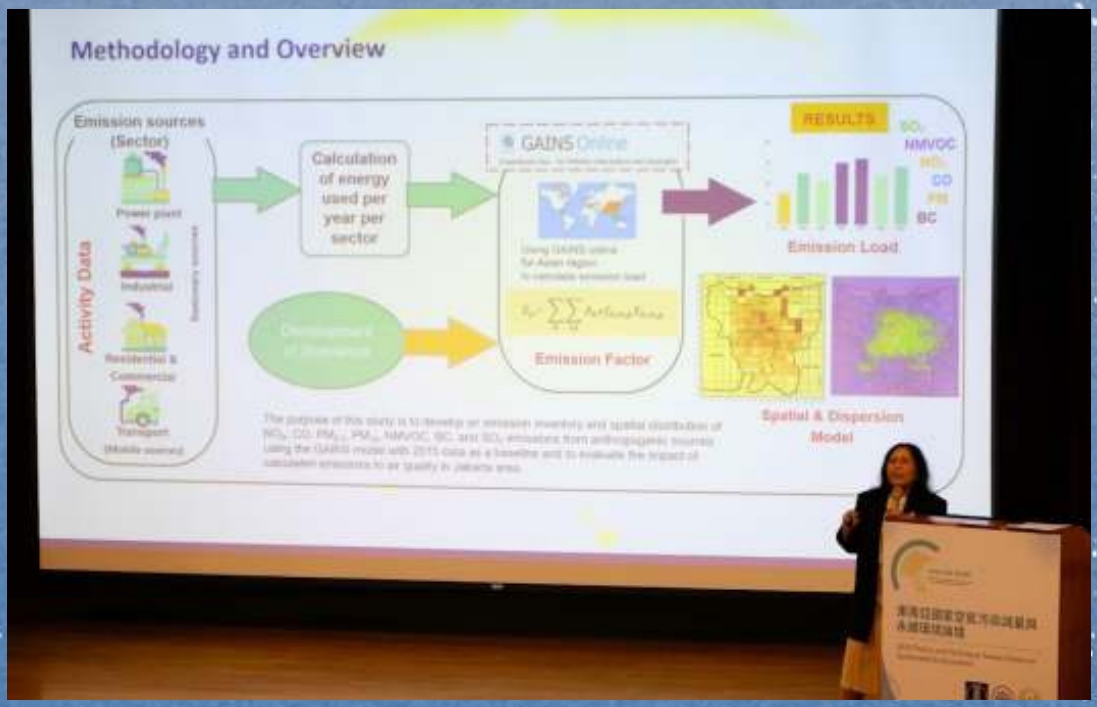
Bandung Institute of Technology, Indonesia

Expertise :

- Air quality monitoring and modeling.
- Aerosol characterization and composition.
- Emission inventory and source apportionment.
- Characterization of ambient & emission aerosols (PM_{10} and $PM_{2.5}$) from various sources.

Topic :

Air Pollution in Jakarta : Potential Sources and Impact.



Keynote speaker

Prof. Attakorn Asanakham

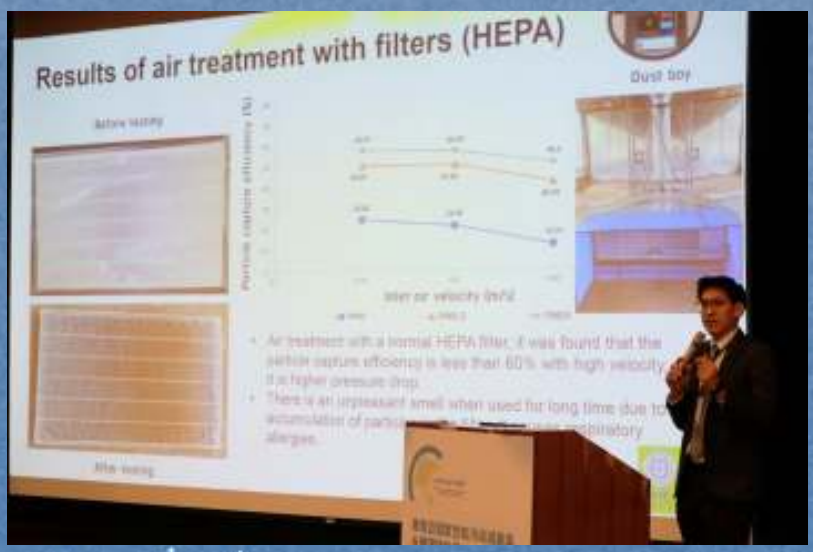
Chiang Mai University, Thailand

Expertise :

- Energy management: Solar cell enhancement, PV and PV/T applications, Battery and Fuel cell applications.
- Particle agglomeration: Electrostatic precipitator (ESP), Electrical charged mist, After-burner for oil particles.
- Heat Recovery Systems: Heat Exchanger Design, Heat Pump, Heat Transformer, System Simulation.
- Computational Fluid dynamics: Flow pattern, Heat transfer enhancement.

Topic :

Research and Innovations in Haze Management and Control.



Keynote speaker

Prof. Dr. Mohd Talib Latif

Universiti Kebangsaan Malaysia, Malaysia

Expertise :

- Atmospheric chemistry and air pollution.
- Inorganic and organic composition of atmospheric aerosols.
- Volatile organic compounds.
- Assessing the impacts of climate variables on long-term air quality.

Topic :

Atmospheric Polychlorinated Dibenzo-P-Dioxins and Dibenzofurans in Kuala Lumpur Urban Environment and Their Potential Risk to Human Health.

Keynote speaker

Prof. Gerry Bagtasa

University of the Philippines, Philippines

Expertise :

- Meteorology and climate research.
- Air pollution and air quality.
- Lidar and remote sensing technology applications.
- Portable Automated Lidar (PAL) system.
- Pollution Status and Source Resolution.

Topic :

Air Pollution Sources and the Effects of Seasonal Mesoscale Weather Patterns in Metro Manila.

Keynote speaker

Prof. Somporn Chantara

Chiang Mai University, Thailand

Expertise :

- Air pollution.
- Air quality monitoring.
- Atmospheric deposition.
- Smoke haze monitoring and assessment.
- Atmospheric acid deposition.

Topic :

Research Activities and Roles of Chiang Mai University on Air Pollution Management in Northern Thailand.

Keynote speaker

Prof. Tran Thi Tuyet Hanh

Hanoi University of Public Health, Vietnam

Expertise :

- Environmental health risk assessment and risk communication.
- Climate change and health impacts; V&A assessment.
- Emerging — reemerging infectious diseases, Ecohealth, One Health.
- Air pollution and health impacts; Water, sanitation and waste management intervention programs.
- Assessing the sustainability of public health intervention programs.

Topic :

Climate Change and Human Health in Vietnam: Vulnerabilities, Risk, and Adaptation.

Keynote speaker

Prof. Chin-Yu Hsu

Ming Chi University of Technology, Taiwan

Expertise :

- Air Pollution Measurement and Analysis
- Air Pollution Dispersion and Trajectory Simulation.
- Receptor Model Simulation and Source Apportionment.
- Risk Assessment.
- Development of Land Use Regression Model.
- Statistical Analysis and Air Pollution Management.

Topic :

Using Artificial Intelligence (AI) on Source Apportionment of Air Pollutants.

Keynote speaker

Prof. Maria Obiminda Cambaliza

Ateneo de Manila University, Philippines

Expertise :

- Atmospheric Science and Air Quality.
- Civil and Environmental Engineering.
- Greenhouse gas emissions from urban. environments and other anthropogenic sources.
- Characterization of emissions from anthropogenic sources.

Topic :

Assessment of $PM_{2.5}$ Exposure of Jeepney Drivers in Metro Manila, Philippines.

Keynote speaker

Prof. Moo Been Chang

National Central University, Taiwan

Expertise :

- Air Pollution Control.
- Waste Management.
- Investigation on the Dioxin Formation.
- Removal Efficiencies in Municipal Waste Incinerators.
- Destruction of Greenhouse Gases and VOCs via Non-thermal Plasma Technology.
- Electric Arc Furnaces.

Topic :

Mass Flows and Characteristics of Mercury Emitted from Coal-Fired Power Plants Equipped with Seawater Flue Gas Desulfurization.

Keynote speaker

Prof. Wan Wiriya

Chiang Mai University, Thailand

Expertise :

- Air pollution monitoring including particulate matter, PAHs from biomass burning .
- Atmospheric acid deposition.
- Face Mask for $PM_{2.5}$ and COVID-19.
- Clean room and IAQ monitoring.
- Science Communication.

Topic :

Ambient Air Quality of SO_2 and NO_2 in Settlements Around Coal-Fired Power Plants in Northern Thailand.

Keynote speaker

Prof. Sate Sampattagul

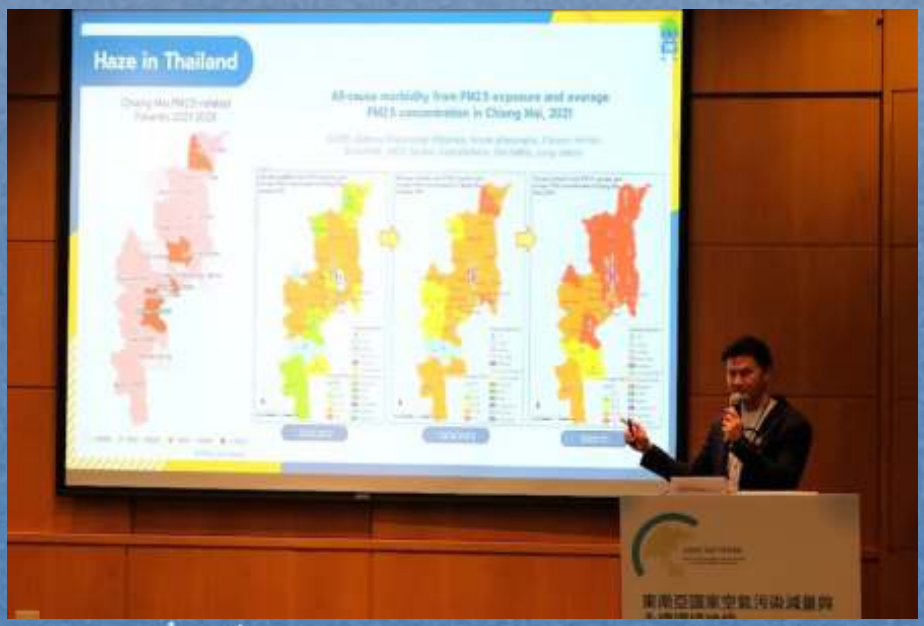
Chiang Mai University, Thailand

Expertise :

- Life Cycle Assessment(LCA).
- Climate Change Mitigation and Adaptation.
- Carbon Footprint for Organization (CFO) and Carbon Footprint of Product (CFP).
- Water Footprints(WF).
- Low Carbon City (LCC) and City Carbon Footprint (CCF).

Topic :

DustBoy" Air-Sensor of Communities for the Better Communications.



Keynote speaker

Prof. Yu-Chieh Ting

National Taiwan University, Taiwan

Expertise :

- Physicochemical and optical properties of atmospheric carbonaceous matter.
- Characteristics of atmospheric aerosols from various sources.
- Formation mechanisms of secondary organic aerosols and ozone.
- Applications of high-resolution mass spectrometer on determination of specific organic compounds .
- A novel single-process synthesis of ammonialized biochar for CO_2 capture.

Topic :

Chemical Characteristics and Formation Mechanism of Secondary Inorganic Aerosols: The Decisive Role of Aerosol Acidity and Meteorological Conditions.

Keynote speaker

Prof. Duangduean Thepnuan

Chiang Mai Rajabhat University, Thailand

Expertise :

- Analytical Chemistry.
- Environmental Chemistry.
- Air Pollution.
- Atmospheric chemistry.
- Biomass burning emission.

Topic :

Characterization of Particulate Matter from Fireworks Emission and Their Toxicity.

Sponsor Talks

The aim is to facilitate the matching of enterprises with outstanding environmental protection talents from Southeast Asia, with the goal of bridging academia and industry.
Through the understanding of Taiwan and their home countries by Southeast Asian students, it assists in expanding businesses into Southeast Asia and facilitates multidimensional exchanges with aerosol researchers and environmental peers, thereby enhancing sensitivity to the industry.

Thermo Fisher Scientific Taiwan Co., Ltd.

BioSuperStar Co., Ltd.

Sponsor Talks

Tai & Chyun Associates Industries, Inc.

Industrial Technology Research Institute

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Mr. Muhammad Kodri, (Indonesia), Tai & Chyun Associates Industries, Inc.

Work & Study Experience in Taiwan

Dr. Tuan-Hung Ngo, (Vietnam), Medigen Vaccine Biologics Corp.

Dr. Boopathi Subramani, (India), National Yang Ming Chiao Tung University

Dr. Firdian Makrufardi, (Indonesia), Taipei Medical University

2024 T&T TFOSE

The academic poster sessions will consist of 25 papers, offering opportunities for invited international speakers, Southeast Asian students studying in Taiwan, and Taiwanese students to engage in academic and practical discussions. This platform will facilitate exchanges on research and applications related to aerosol science, air quality, and environmental protection, allowing participants to share knowledge from various countries.

BEST POSTER

Presenter :

Thi-Huyen-Tran Ngo

Creator :

Thi-Huyen-Tran Ngo, Ya-Fen Wang, Sheng-Jie You

Topic :

Unveiling the Potential of Microwave Plasma Treated Biochar for Sustainable Automotive Shredder Residue (ASR) Management and Reduced Ecological Risk of Heavy Metals.

BEST POSTER

Presenter :

Pratomo Adinegoro

Creator：

Fefi Eka Wardiani, Pratomo Adinegoro, Lin-Chi Wang

Topic：

Enhanced Short-Term $PM_{2.5}$ Forecasting Using LSTM with Temperature and Humidity Integration.

Presenter :

Thi Thuy Nghiem Nguyen

Creator：

Thi-Thuy-Nghiem Nguyen, Manisha Mishra, Pin-Hsin Chen, Thi-Cuc Le, Chuen-Jinn Tsai

Topic：

Photochemical oxidation of VOCs and their source impact assessment on ozone under de-weather conditions in Western Taiwan.

MERIT POSTER

Presenter :

Amir Machmud

Creator：

Amir Machmud, Moo Been Chang

Topic：

Effects of carrier gas composition on C_4F_8 conversion achieved with plasma catalysis.

Presenter :

Shahzada Amani Room

Creator：

Shahzada Amani Room, Yi Chen Chiu, Shih Yu Pan, Yu-Cheng Chen, Ta-Chih Hsiao, Charles C.-K. Chou, Majid Hussain and Kai Hsien Chi

Topic：

Exploring Temporal-seasonal Patterns of $PM_{1.0}$ and $PM_{2.5}$ in Taiwan:A Comparative Study Before and During Covid-19 Lockdown Measures.

MERIT POSTER

Presenter :

Huỳnh Duy Trần

Creator :

Huynh Duy Tran, Hsiang-Yu Huang, Sheng-Hsiang Wang

Topic :

Advancements in Air Quality Assessment: The Role of Deep Learning Models.

Presenter :

Wahyu diah proborini

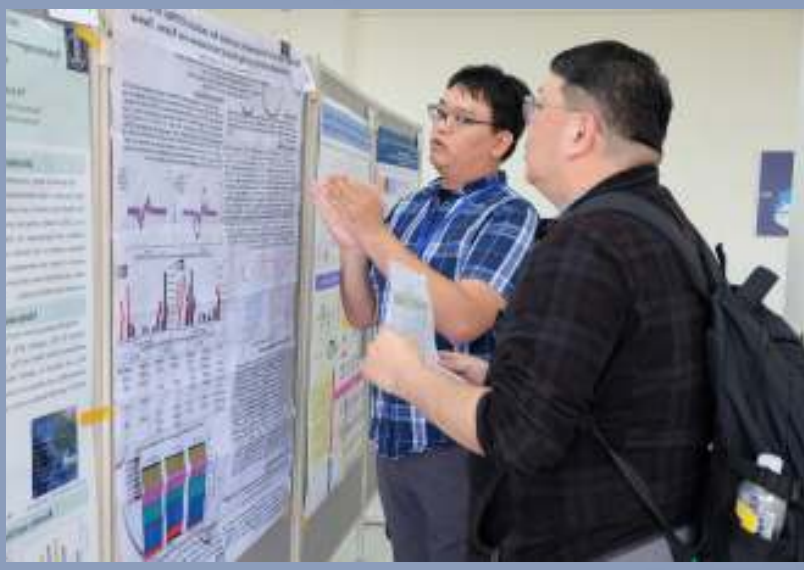
Creator :

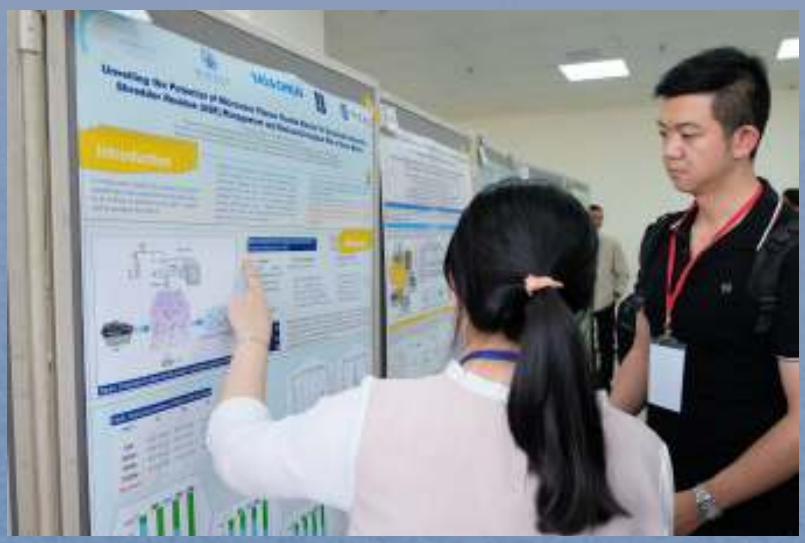
Wahyu Diah Proborini, Chun-Hsuan Wei, Wei-Ting Hsu, Ta-Chih Hsiao, Yu-Cheng Chen

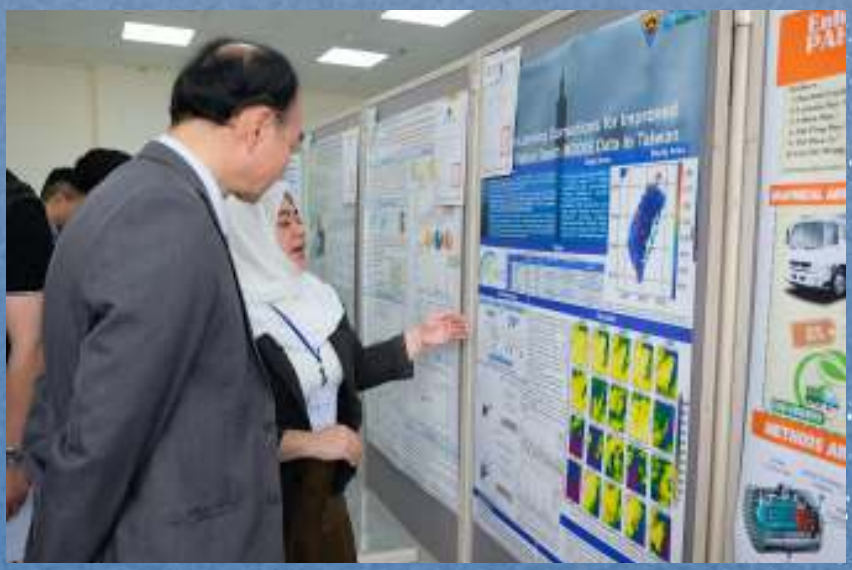
Topic :

Characteristics of Microplastics and Associated Metal Contents in The Atmosphere of Taipei City.

Poster session







Job Fair

Meanwhile, a JOB FAIR will be held during the conference, giving students from above countries the opportunities for internship and occupations in related fields. Lastly, this conference would like to further strengthen economic ties between Taiwan and above countries to create new value going forward.

Group Photo

2024 T&T TFOSE serves as a platform for international students to present their novel studies in the field of Environmental Research and to provide more research collaboration opportunities among Taiwan ASEAN, India, Thailand, Vietnam, Philippines, Malaysia, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, Australia and New Zealand.

Banquet

Yu-Tin Huang

ZHANG JIA LTD.

Banquet

Industrial Technology Research Institute

SGS Taiwan Limited

Foxwell Certification Co., Ltd.

2025 T&T FOSE (Coming Soon)

Ming-Yeng Lin

Associate Professor

Department of environmental and Occupational Health,
National Cheng Kung University

New Book on Aerosol

Health Effects of Indoor Air Pollution: Volume 2: Air Pollution, Human Health, and the Environment

Publisher : Academic Press (April 1, 2024)
Publication date : April 1, 2024
Language : English
Print length : 205 pages
Page numbers source ISBN : 0443160902

by Mohammad Hadi Dehghani, Rama Rao Karri, Teresa Vera, Salwa Kamal Mohamed Hassan

Health Effects of Indoor Air Pollution, Volume Two, Air Pollution, Human Health, and the Environment is part of a three volume series. This volume covers the various classifications of indoor air pollutants and discusses the health impact of indoor pollutants, such as gaseous pollutants and particulate matter. It also examines epidemiological studies related to different air pollutants on health and the workplace. This book begins with an overview of classifications, sources, and occurrences of indoor air pollutants. It also examines the environmental and health impacts due to organic and inorganic air pollutants and how to mitigate them through exposure and risk management. Other sections explore "sick building syndrome," which causes acute health and discomfort that appears to be linked to time spent in a building. Recent trends and control strategies for occupation exposure due to poor indoor air quality in industrial and nonindustrial workplaces to human health are also covered. This book is a valuable reference for academicians, researchers, and students in environmental health, public health, and occupational health, as well as environmental engineers, meteorologists, epidemiologists, medical researchers, and environmental toxicologists.

Introduction of Aerosol Researcher

Chau-Ren Jung

Affiliation and current Position

Assistant Professor, Department of Public Health,
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Education

PhD, Department of Public Health, China Medical University, Taiwan

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Dr. Chau-Ren Jung received his PhD degree in Public Health from China Medical University. From 2018 to 2020, Dr. Jung was a postdoctoral fellow at the Japan National Institute for Environmental Studies. He is currently an assistant professor in the Department of Public Health at China Medical University. Dr. Jung' s expertise includes the application of satellite-based measurements and air pollution spatiotemporal modeling, environmental epidemiology, machine learning and deep learning applications, and big-data analysis. His research topics include: (1) using satellite-based remote sensing data to develop air pollution estimation models; and (2) conducting epidemiologic studies related to particulate matter (PM2.5) and children health. Dr. Jung has developed high spatiotemporal resolution air pollution models using machine learning algorithms. He has also utilized these models to identify key predictors of air pollution concentrations and to estimate air pollution concentrations in areas without monitoring stations. Moreover, he has applied these models to back-extrapolate historical air pollution concentrations, addressing the limitations of traditional exposure assessments in epidemiologic studies. Additionally, He has assessed the critical time windows and exposure-response relationships between air pollution and children health effects, providing valuable insights for disease prevention and serving as a reference for air quality criteria and management strategies. Over the past five years, Dr. Jung has published fifteen peer-reviewed papers in environmental science journals, including Environment International, Environmental Research, Journal of Exposure & Environmental Epidemiology, Remote Sensing, and Science of the Total Environment. He has also served as an associate editor for Air Quality, Atmosphere & Health, and as a reviewer for many environmental science SCI journals.

Important keywords and their descriptions

1. aerosol optical depth (AOD): is a measure of the extinction coefficient of sunlight by aerosol in the atmospheric column above the earth's surface. It represents the level to which direct sunlight is absorbed or scattered by aerosol when penetrating atmosphere. A higher value represents a higher concentration of aerosol in the atmospheric column.
2. Ultrafine particles: particles with an aerodynamic diameter less than 100 nm (0.1 μm).

Recent research topics

1.Using satellite-based remote sensing data to develop air pollution estimation models

Early air pollution-related epidemiological studies generally depended on exposure data from fixed air quality monitoring stations. However, most of these stations are located in Western Taiwan, with only a few in the Eastern part and mountainous areas. This distribution reflects considerations of population density and industrial area distributions, as well as limitations related to cost and human efforts. Consequently, air pollution data are not available for areas without air quality monitoring stations. Additionally, Taiwan launched its $PM_{2.5}$ monitoring network in 2005. However, the absence of monitoring data before 2005 made it impossible to understand long-term $PM_{2.5}$ trends and evaluate the long-term effects of $PM_{2.5}$ exposures on human health.

Unlike traditional measurement methods, satellite-based measurements offer comprehensive spatial coverage and are not constrained by terrain, providing large-scale air pollution monitoring data. This method compensated uneven distribution of fixed air quality monitoring stations and provided historical air pollution data before 2005. Dr. Jung, in collaboration with Professor Wei-Ting Chen from the Department of Atmospheric Sciences at National Taiwan University, used the aerosol optical depth (AOD) product retrieved from the MODerate Resolution Imaging Spectroradiometer (MODIS) onboard NASA Terra and Aqua satellites. By integrating satellite-based data with meteorological variables and land use data, they developed a linear mixed-effect model that can accurately estimate ground-level $PM_{2.5}$ temporal and spatial distributions. Since the constraints of the algorithms, the 10-km spatial resolution model is not able to estimate intra-urban scale $PM_{2.5}$ distributions. However, with improvements in AOD algorithms, Dr. Jung's research group developed $PM_{2.5}$ satellite-based estimation models with enhanced spatial resolutions of 3-km, 1-km, and 250 m. The method can be applied in other countries as well. For instance, Dr. Jung adapted a similar approach in Japan, employing a machine learning algorithm (random forest) to develop a 1-km resolution daily $PM_{2.5}$ estimation model.

In addition to $PM_{2.5}$, Dr. Jung's research group applied column density data derived from the Ozone Monitoring Instrument (OMI) onboard Aura and the TROPOspheric Monitoring Instrument (TROPOMI) onboard Sentinel-5 Precursor. They utilized a machine learning algorithm, incorporating meteorological variables and land-use data, to build 1-km resolution daily estimation models for nitrogen dioxide (NO_2), ozone (O_3), and sulfur dioxide (SO_2). Moreover, Dr. Jung has collaborated with Professor Li-Hao Young from the Department of Occupational Safety and Health at China Medical University and Professor Ta-Chih Hsiao from the Graduate Institute of Environmental Engineering at National Taiwan University. They adapt machine learning to integrate long-term *in-situ* measurement data for ultrafine particles (UFPs), satellite-based measurements, meteorological variables, and land-use data to develop a 1-km resolution UFPs estimation model. This model can estimate spatial and temporal distributions of UFPs in central Taiwan and identify important predictors for UFPs. Their results indicated that surface pressure and traffic-related variables are significant predictors of UFP levels. Currently, in addition to criteria air pollutants, Dr. Jung has also begun investigating the correlations between satellite-based measurements and main components in particles, such as sulfate, nitrate, organic carbon, and elemental carbon. He plans to use satellite-based measurements to develop a spatiotemporal estimation model for $PM_{2.5}$ components.

2.Conducting epidemiologic studies related to particulate matter (PM2.5) and children health

$PM_{2.5}$ is associated with a variety of adverse health effects, including respiratory allergic diseases, cardiovascular diseases, brain diseases, and increased mortality. A UK physician, Professor David J.P. Barker proposed the Development Origins of Health and Disease (DOHaD) hypothesis. Building on this hypothesis, environmental epidemiologists have discovered that pregnancy and infancy are critical periods that fetuses and infants may be vulnerable to environmental toxicants. While animal studies support the hypothesis, related epidemiological studies remain limited. Dr. Jung utilized the Taiwan Maternal and Child Health Database, which is linked with the National Health Insurance Database and Death Registration Database, to construct a birth cohort. This birth cohort provides high temporal resolution and contains all medical and death records, enabling the tracking of subjects' entire life histories. Dr. Jung has employed this birth cohort to assess the associations between $PM_{2.5}$ and children health effects, including respiratory allergic diseases and neurodevelopment disorders in children.

Asthma is a common chronic respiratory disorder in children, influencing more than 300 million persons globally. Because asthma is not curable and can only be controlled using inhaled corticosteroids, it is necessary to identify possible modifiable environmental factors and the most vulnerable periods for asthma. Dr. Jung' s research group combined $PM_{2.5}$ estimates derived from the satellite-based model and birth cohort data to investigate the effects of $PM_{2.5}$ on asthma. They used the distributed lag non-linear model (DLNM) to identify vulnerable time windows of asthma. Their results gestational weeks 6 to 22 and 9 to 46 weeks after birth are the critical periods. Additionally, Dr. Jung has collaborated with Dr. Chuan-Yao Lin from the Research Center for Environmental Changes at Academia Sinica. They used the WRF/Chem model and considered 75 significant emission sources in Taiwan to estimate arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) in $PM_{2.5}$. They used the DLNM model to evaluate the associations between above mentioned heavy metals and asthma. Their results also indicated that prenatal and postnatal exposure to Pb in $PM_{2.5}$ can increase the risk of asthma.

$PM_{2.5}$ not only induces respiratory allergic diseases but can directly penetrate the olfactory bulb, cross the blood-brain barrier, induce systemic inflammation, and release cytokines and inflammatory mediators, leading to neurodevelopmental disorders. Dr. Jung has recently focused on the effects of $PM_{2.5}$ and other air pollutants on neurodevelopment disorders of infants and children. In 2022, he collaborated with Dr. Shoji Nakayama from the Japan National Institute for Environmental Studies to investigate the impacts of indoor $PM_{2.5}$ and volatile organic compound exposures on the neurodevelopment of infants and children. Their results showed that exposure to increased *m,p-xylene* and *o-xylene* can decrease neurodevelopmental scores. Additionally, Dr. Jung also assessed the associations of $PM_{2.5}$ with attention-deficit/hyperactivity disorder (ADHD) and tic disorders. His research found that exposure to high $PM_{2.5}$ concentrations during pregnancy and infancy increased the risks of neurodevelopmental disorders in children.

Currently, there are no regulatory standards for UFPs. Dr. Jung and his colleagues are using high temporal resolution statistical models to investigate the effects of UFPs on childhood asthma and neurodevelopmental disorders, attempting to understand the vulnerable periods and exposure-response relationships of UFPs on children health. Additionally, they are assessing the effect modifications of temperature and other meteorological variables on the effects of UFPs on children health as well. They hope to reduce the harmful effects of UFPs and facilitate developing regulatory standards of UFPs.

Calendar of Events

Date
August 2-4, 2024

Conferences
The 10th Theory & Technique and 1st Indonesian Aerosol Association Conference

Location
Institut Teknologi Bandung Aula Timur
Bandung, Indonesia

Website
https://2024-tat-iaac.taar.org.tw/

Date
September 20-21, 2024

Conferences
The 31st International Conference on Aerosol Science and Technology

Location
National Ilan University
Yilan, Taiwan

Date
November 3-7 , 2024

Conferences
13th Asian Aerosol Conference

Location
Sarawak, Malaysia

Website
https://www.asianaerosol2024.com/