

Curriculum Vitae

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RESEARCH INTERESTS

Aerosol Science, New particle formation, Characterization of ultrafine particles, Cloud Condensation Nuclei activation, Implication of aerosols on Cloud Formation and Climate

EDUCATION

2012 School of Chemistry, Physics and Mechanical Engineering, **Ph.D.**
Queensland University of Technology, Australia

2005 Department of Civil and Environmental Engineering, **M.Phil.**
The Hong Kong Polytechnic University

2002 Department of Applied Physics, **B.Sc. (with First Class Hons)**
City University of Hong Kong

ACADEMIC AWARDS

2018 Significant Research Achievement (included in the *History of Academia Sinica 2008-2017*, E-book, 90th Anniversary Publication), Academia Sinica, Taiwan.
Research achievement has been published in a paper titled “*Characterization of ultrafine particle number concentration and new particle formation in an urban environment of Taipei, Taiwan*”

2015 Post-doctoral Research Fellow **Publication Award**, Ministry of Science and Technology, Taiwan

2012 Higher Degree Research Student **Publication Award** – *First Prize*, Queensland University of Technology, Australia

2008-2012 QUT Faculty of Science Scholarship

2003-2005 The Hong Kong Polytechnic University Postgraduate Scholarship

PROFESSIONAL EXPERIENCE

2021 – Present Academia Sinica, Taiwan *Assistant Research Fellow*
Research Center for Environmental Changes

Ongoing Research Project

Characterization and source apportionment of atmospheric nitrous acid in Yunlin-Chiayi-Tainan.

Principal investigator (PI) responsible for studying on the characteristics of ambient HONO and estimate its source contribution in Yunlin-Chiayi-Tainan region, a western Taiwan. An integrated research approaches including field measurement and modelling works will be adapted in this project.

2018 – 2021 Sun Yat-Sen University, Guangzhou, China *Associate Professor*
School of Atmospheric Sciences

Research Project

Study of the implication of organic acids on cloud condensation nuclei (CCN) activity of aerosols in Pearl River Estuary

Principal investigator (PI) responsible for conducting research study on the organic acids on CCN to investigate the regional impact of severe pollution sources from the Pearl River Delta region during different seasons. A chamber study is also proposed to study the interaction of organic acids, which are emitted from pollution sources, with ammonium sulfate and sea water bubble as condensation nuclei

2016 – 2018 Academia Sinica, Taiwan *Assistant Research Scholar*
Research Center for Environmental Changes

Research Project

Characterization of cloud condensation nuclei (CCN) and size-resolved chemical composition of aerosols under the influence of local and regional pollution at coastal area of Northern Taiwan.

Principal Investigator (PI) responsible for conducting research study on the long-term measurement of CCN (model: CCN-100, DMT Inc.) and its size-resolved chemical composition of aerosols at a coastal site at Cape Fugei. Advanced instruments, including Atmospheric Mass Spectrometer (Aerodyne) has been employed at the site to study the in-situ size-resolved chemical composition of aerosols along with two scanning mobility particle sizer (SMPS) systems to measure particle number size distribution (PSD) in the range of 4–736 nm. CCN analyzer was also deployed to measure CCN number concentration.

The specific aims of the study are:

- **Aim 1:** To characterize the temporal and seasonal variations of the number concentration of CCN and its activation;
- **Aim 2:** To investigate the influence of anthropogenic and marine aerosols on CCN activation by studying their size-resolved chemical composition; and
- **Aim 3:** To study the implication of nucleation burst of aerosols of new particle formation on CCN.

2012 – 2016

Academia Sinica, Taiwan

Post-doctoral Research Fellow

Research Center for Environmental Changes

Research Project

Study of long-range transportation of anthropogenic pollution at coastal site of Cape Fuguei, Taiwan

Researcher responsible for conducting research study on the long-term regional impact of winter and summer monsoon systems at a coastal site at Cape Fuguei. The aim of the research project is to investigate the new particle formation of ultrafine particles under the influence of regional pollution (largely contributed by the winter monsoon system) at the coastal site, as well as the characterization of ultra-fine and fine particles at difference seasons.

Study of the ultrafine particle number concentration and new particle formation and seasonal variation in urban environment of Taipei, Taiwan

Researcher responsible for conducting research study the characteristics of ultrafine (UFPs) and submicron particles (PM₁) and new particle formation in an urban site of Taipei. The aim of this study is to investigate the seasonal variations in the physicochemical properties of atmospheric UFPs and PM₁ in an east Asian urban area. Chemical analysis revealed that the UFPs and PM₁ were characterized by distinct composition; UFPs were composed mostly of organics, whereas ammonium and sulfate were the major constituents of PM₁.

Study of the role of anthropogenic pollution on haze and fog formation at coastal area of Kinmen, Taiwan

Researcher responsible for conducting research study on the formation of haze and fog at coastal area of Kinmen, which are majorly affected by the

regional pollution during wintertime. The characteristics of aerosols during fog events were investigated which could provide vital information on the formation pathways of aerosols as well as the impact on human health.

2008 – 2012

Queensland University of Technology, Australia *Postgraduate Researcher*
School of Chemistry, Physics and Mechanical Engineering

Research Project

New particle formation of ultrafine particles at urban and suburban areas of Brisbane, Australia

Researcher responsible for conducting research study on the concentration of ultrafine particles and the new particles formation process at an urban site (QUT) in Brisbane, Australia. The aim of this study was to characterize the new particle formation events and understand the formation processes of atmospheric particles in a subtropical urban environment in the Southern Hemisphere. The nucleation burst with particle growth which is associated with the particle precursor emitted from local traffic exhaust emission, whereas the nucleation burst without particle growth which is due to the transport of industrial emissions from the coast to Brisbane city or other possible sources.

Study of the impact of flood and post-flood cleaning on airborne microbiological and particle contamination in residential houses

Researcher responsible for the measurement of particle number concentration at residential areas in Brisbane, Australia after a major river flooding event in January 2011. The study aimed to investigate its effects on air quality and assess the role of prompt cleaning activities in reducing the airborne exposure risk. This study provides quantitative evidence of the significant impact of immediate post-flood cleaning on mitigating the effects of flooding on indoor bioaerosol contamination and other pollutants.

Consultancy Project

Study of ultrafine particle number concentration at airport of Brisbane, Australia

Researcher to conduct particle mass concentrations, ultrafine particle number concentrations and CO₂ concentrations at strategic locations within the airport. The project aimed to evaluate the vehicular emissions impacts on

atmospheric quality at the airport area, which provide vital information to formulate the air quality management strategy for the Brisbane Airport.

2002 – 2005

The Hong Kong Polytechnic University *Postgraduate Researcher*
Department of Civil and Environmental Engineering

Research Project

Observational study of PM_{2.5} and optical properties at coastal sites at Hok Tsui and Tai O, Hong Kong

Researcher responsible for sampling of fine particulate matter (PM_{2.5}) mass, major ions, and carbonaceous concentrations and optical measurements Nephelometer (light scattering) and Particle Soot/Absorption Photometer (PSAP) (light absorption) at rural sites at Hok Tsui and Tai O in southern Pearl River Delta region. The study investigates the impact of regional pollution outflow on the loading and composition of PM_{2.5}, and visibility degradation.

Study of PM_{2.5} and optical properties at Mount Tai, Shandong, China

Researcher responsible for study of fine particulate matter (PM_{2.5}) mass, major ions, and carbonaceous concentrations and optical measurements Nephelometer (light scattering) and Particle Soot/Absorption Photometer (PSAP) (light absorption) at a rural site at Mount Tai (1534m a.s.l.). The impact of regional pollution in Eastern China area was investigated.

Observational study of PM_{2.5}, particle size distribution, optical properties and gaseous pollutants (CO, SO₂, NO_y and O₃) at urban areas of Taicang, Jiangsu and Changping, Beijing, China

Researcher responsible for study of fine particulate matter (PM_{2.5}) mass, major ions, and carbonaceous concentrations and optical measurements Nephelometer (light scattering) and Particle Soot/Absorption Photometer (PSAP) (light absorption) at a few urban sites of Taicang in Jiangsu and Changping in Beijing. This study evaluated the transportation pathway of pollutants and the impact of regional pollution over wide areas of eastern and northern China.

PROFESSIONAL SERVICES

Reviewer Atmospheric Environment

Reviewer Aerosol and Air Quality Research
Reviewer Atmospheric Research
Reviewer Terrestrial, Atmospheric and Oceanic Sciences

RESEARCH FUNDS

Project: *Characterization and source apportionment of atmospheric nitrous acid in Yunlin-Chiayi-Tainan* (Principal Investigator)

Supported by Ministry of Science and Technology, Taiwan

Funding amount: NTD\$1,917,000

Project: *Study of organic acids as cloud condensation nuclei and their hygroscopicity in Pearl River Estuary* (Principal Investigator)

Supported by University Start-up Fund – Sun Yat-Sen University, Guangzhou, China

Funding amount: RMB\$600,000

Project: *Study of organic acids as cloud condensation nuclei and their hygroscopicity in Pearl River Estuary* (Principal Investigator)

Supported by Guangdong Province Natural Science Fund, China

Funding amount: RMB\$100,000

Project: *Characterization of cloud condensation nuclei and size-resolved chemical composition of aerosols under the influence of local and regional pollution at coastal area of Northern Taiwan* (Principal Investigator)

Supported by Ministry of Science and Technology, Taiwan

Funding amount: NTD\$3,649,000

COLLABORATION

Research Center of Environmental Change

Academia Sinica, Taiwan

Dr Charles C.-K. Chou

Project: Hygroscopic properties and cloud condensation nuclei activity of atmospheric aerosols under the influences of Asian continental outflow and new particle formation at a coastal site in eastern Asia

School of Chemistry, Physics and Mechanical Engineering

Queensland University of Technology, Australia

Professor Lidia Morawska

Project: Ultrafine particles in urban and indoor environment in southern and eastern Asian region

Department of Chemistry

Graduate School of Science and Engineering

Tokyo Metropolitan University, Japan

Prof. Nobuyuki Takegawa

Project: Mixing state of black carbon particles in Asian outflow observed at a remote site in Taiwan

Institute for Environmental and Climate Research

Jinan University, Guangzhou, China

Dr Hao Wang

Project: Spatial variations of particle number concentration under the influence of summer and winter monsoon at Pearl River Delta region

PROFICIENCIES

Proficiency in languages:

English (fluent), Chinese (fluent)

Proficiency in software:

WaveMetrics Igor Pro (data analysis/graphing), National Instruments LabView (communication software with monitoring instruments), SPSS, and MS Office

TECHNICAL SKILLS

Expert in operation of a wide-range of advanced air measurement equipment:

Real-time, non-refractory, size-resolved particulate chemical composition and mass measurement by Aerosol Mass Spectrometer (AMS) (Aerodyne)

Real-time, VOCs concentration by Proton-Transfer-Time-of-Flight-Mass Spectrometer (PTR-ToF-MS) (model: 8000, Ionicon)

Cloud condensation nuclei (CCN) analyzer (model: CCN-100, DMT Inc.)

Particle number concentration measurement (CPC) (TSI Inc.)

Particle size distribution measurement (SMPS) (TSI Inc.)

Fine particulate matter sampler (Thermo Andersen RAAS2.5-400)

Real-time PM mass concentration by TEOM (model: 1405 DF, Thermo)

Real-time ions analyzer (model: AIM 9000, URG)

Time-resolved canister VOCs sampler

Traces gases analyzers (e.g. SO₂, NO₂ + NO, NO_y, CO, and O₃)

Particle light scattering and absorption instruments (Nephelometer, Particle Soot/Absorption Photometer)

PUBLICATIONS

1. Tsai, I.-C., Hsieh, P.-R., **Cheung, H.C.**, Chou, C.C.-K. (2021). *Aerosol impacts on fog microphysics over the western side of Taiwan Strait in April from 2015 to 2017*. Atmospheric Environment, 262, 118523.
2. **Cheung, H.C.**, Chou, C. C.-K., Lee, C.S.L., Kuo, W.-C., Chang, S.-C. (2020). *Hygroscopic properties and cloud condensation nuclei activity of atmospheric aerosols under the influences of Asian continental outflow and new particle formation at a coastal site in eastern Asia*. Atmospheric Chemistry and Physics, 20, 5911-5922.
3. Sun, C.Z., Adachi, K., Misawa, K., **Cheung, H.C.**, Chou, C.C.-K., Takegawa, N. (2020). *Mixing State of Black Carbon Particles in Asian Outflow Observed at a Remote Site in Taiwan in the Spring of 2017*. Journal of Geophysical Research <https://doi.org/10.1029/2020JD032526>.

4. Salvador, C.M., Chou, C.C.-K., **Cheung, H.C.**, Ho, T.-T., Tsai, C.-Y., Tsao, T.-M., Su, T.-C. (2020). *Measurements of submicron organonitrate particles: Implications for the impacts of NO_x pollution in a subtropical forest*. Atmospheric Research, 245, 105080.
5. Lee, C.S.L., Chou, C.C.-K., **Cheung, H.C.**, Tsai, C.-Y., Huang, W.-R., Huang, S.-H., Chen, M.-J., Liao, H.-T., Wu, C.-F., Tsao, T.-M., Tsai, M.-J. and Su, T.-C. (2019). *Seasonal variation of chemical characteristics of fine particulate matter at a high-elevation subtropical forest in East Asia*. Environmental Pollution, 246, 668-677.
6. Wang, Z., Wu, Z., Yue, D., Shang, D., Guo, S., Sun, J., Ding, A., Wang, L., Jiang, J., Guo, H., Gao, J., **Cheung, H.C.**, Morawska, L., Keywood, M. and Hu, M. (2017). *New particle formation in China: Current Knowledge and further directions*. Science of the Total Environment, 577, 258-266.
7. **Cheung, H.C.**, Chou, C.C.-K., Chen, M.-J., Huang, W.-R., Huang, S.-H., Tsai, C.-Y. and Lee, C.S.L. (2016). *Seasonal variations of ultra-fine and submicron aerosols in Taipei, Taiwan: implications for particle formation processes in a subtropical urban area*. Atmospheric Chemistry and Physics, 16, 1317-1330.
8. **Cheung, H.C.**, Chou, C.C.-K., Jayaratne, E.R. and Morawska, L. (2015). *Impact of particle formation on atmospheric ions and particle number concentrations in an urban environment*. Atmospheric Research, 157, 127-136.
9. Johnson, G.R., Juwono, A.M., Friend, A.J., **Cheung, H.C.**, Stelcer, E., Cohen, D., Ayoko, G.A. and Morawska, L. (2014). *Relating urban airborne particle concentrations to shipping using carbon based elemental emission ratios*. Atmospheric Environment, 95, 525-536.
10. He, C., Ling, X., Crilley, L., Huygens, F., Ayoko, G., Knibbs, L., **Cheung, H.C.** and Morawska, L. (2014). *The Impact of Flood and Post-Flood Cleaning on Airborne Microbiological and Particle Contamination in Residential Houses*. Environment International, 69, 9-17.
11. **Cheung, H.C.**, Chou, C.C.-K, Huang, W.-R. and Tsai, C.-Y. (2013). *Characterization of ultrafine particle number concentration and new particle formation in an urban environment of Taipei, Taiwan*. Atmospheric Chemistry and Physics, 13, 8935-8946. (granted with Publication award by Ministry of Technology in 2015).
12. **Cheung, H.C.**, Morawska, L., Ristovski, Z.D. and Wainwright, D. (2012). *Influence of medium range transport of particles from nucleation burst on particle number concentration within the urban airshed*. Atmospheric Chemistry and Physics, 12, 4951-4962.
13. **Cheung, H.C.**, Morawska, L. and Ristovski, Z.D. (2011). *Observation of new particle formation in subtropical urban environment*. Atmospheric Chemistry and Physics, 11, 3823-3833. (granted with Higher Degree Student Publication award by QUT in 2012).
14. Jayaratne, E.R., Johnson, G.R., McGarry, P., **Cheung, H.C.** and Morawska, L. (2011). *Characteristics of airborne ultrafine and coarse particles during the Australian dust storm of 23 September 2009*. Atmospheric Environment, 45, 3996-4001.
15. Morawska, L., Wang, H., Ristovski, Z., Jayaratne, E.R., Johnson, G., **Cheung, H.C.**, Ling, X. and He, C. (2009). *JEM Spotlight: Environmental monitoring of airborne nanoparticles*. Journal of Environmental Monitoring, 11, 1758-1773.

16. **Cheung, H.C.**, Wang, T., Baumann, K. and Guo, H. (2005). *Influence of regional pollution outflow on the concentrations of fine particulate matter and visibility in the coastal area of southern China*. Atmospheric Environment, 39, 6463-6474.

THESES

Cheung, H.C. (2012). *Study of new particle formation in subtropical urban environment in Brisbane, Australia*. Thesis of PhD., Queensland University of Technology, Australia.

Cheung, H.C. (2005). *Study of optical and chemical properties of fine particulate matter in China*. Thesis of M. Phil., The Hong Kong Polytechnic University, Hong Kong