# 5th International Conference on Environmental Engineering and Sustainable Development

# CEESD 2020
# In conjunction with WPCE 2020 & WSM 2020

## Conference Program

https://www.ceesd.net/

https://www.wpce.org

https://www.wsm2020.org

Conference organized by

Asia Pacific Institute of Science and Engineering (APISE)

Dec. 3-6, 2020 ● Xishuangbanna, China

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# WELCOME MESSAGE

Due to COVID-19 pandemic, we have decided to change the main conference, **5th International Conference on Environmental Engineering and Sustainable Development (CEESD 2020)** in conjunction with **5th International Conference on Water Pollution Control Engineering (WPCE 2020)** and **International Conference on Water Security and Management (WSM 2020)** to be held online, which are organized by Asia Pacific Institute of Science and Engineering.

The change of conference format will not influence on our conference's aim and pursuit. CEESD 2020 aims to present the latest research related to **Environmental Engineering, Sustainable Development**, **Water Pollution Control Engineering, Water Security and Management** and other related topics. By on-line oral presentations and poster presentation, this conference provides opportunities for the participants to exchange ideas, to establish professional relationships for future collaborations.

We emphasize that the change of conference form will not have negative impact on papers' publication and indexing. All the registered and presented papers of CEESD 2020 will be included in the volume of **IOP Conference Series: Earth and Environmental Science (ISSN: 1755-1315),** which will be submitted to **Engineering Village, Scopus, Thomson Reuters (WoS)** and other databases for review and indexing.

We would like to thank our outstanding Keynote Speakers: Prof. Caterina Valeo from University of Victoria, Canada, Prof. Gordon Huang from University of Regina, Canada, Prof. Ed McBean from University of Guelph, Canada, Prof. Yongping Li from Beijing Normal University, China, Prof. Takashi Asaeda from Saitama University, Japan and Dr. Juan Fan from Ministry of Ecology and Environment of China, China for sharing their deep insights on future challenges and trends.

We would like to thank all the committee members for their great support on organizing the conference and on reviewing the papers submitted to CEESD 2020, WPCE 2020 and WSM 2020. Special thanks to all the participants of the conference.

Prof. Gordon Huang

University of Regina, Canada;

International Society for Environmental Information Sciences

CEESD 2020 Conference Chair

# CONFERENCE SPEAKERS

## Keynote Speakers

**Prof. Caterina Valeo**
University of Victoria, Canada

**Biography:** Caterina Valeo is a Professor in the Department of Mechanical Engineering at the University of Victoria and a Professional Engineer in the Province of British Columbia. After receiving undergraduate degrees in Physics and later, a second one in Civil Engineering, both from the University of Toronto, she went to McMaster University to complete a Masters degree and eventually a PhD specializing in urban water resources in 1998. She has also worked as an Academic at various other universities in Canada in the areas of Civil Engineering and Geomatics Engineering over her 22 year plus career. These eclectic roles have allowed her to develop a unique foundation and develop her interdisciplinary research program that merges information science with environmental science and engineering. Her research interests and areas of application are wide and varied and range from researching the impacts of global scale changes on forestry and water supply to developing sensors and models to describe the role of bacteria and biofilm in treating polluted water. She has more than 200 publications including 3 co-authored books on topics as diverse as Environmental Hydraulics and Digital Terrain Modelling. She has collaborated with over 100 researchers across the globe, has received and participated in several millions of dollars in grants and is the recipient of numerous accolades including the 2014 Award of Distinguished Scientist from the International Society for Environmental Information Sciences. Today Dr. Valeo runs the Bioretention Research Laboratory and the HAL Lab at the University of Victoria and continues to conduct multi-collaborative research that uses Environmental Informatics tools to create sustainable solutions to society's modern problems.

**Keynote Lecture:** Modelling versus Measurement: Error and Scaling Impacts on Sustainable Urban Design

Environmental Informatics (EI) is present in every stage of truly sustainable research in environmental engineering and sustainable urban design. EI forms the basic support structure for effective i) data monitoring and collection; ii) processing; iii) modelling; iv) interpretation; and v) dissemination of the information/outcomes. Inherent in all stages of the design process is the accumulation of error, and rigorous EI science is always cognizant of error. Sustainable urban infrastructure for urban water resources management is undergoing a continual revolution in many countries, in which new methods are being implemented as quickly as they are being proposed. In practice, effective engineering design often involves much more emphasis on modelling and monitoring, than any of the other stages of design noted above; and with the latter activity being more and more de-emphasized because of the growing costs associated with monitoring. Both modelling and monitoring produce errors, which are not only very often ignored in the design process but these errors propagate and are magnified when scaling up. Scaling up is typical when implementing engineering designs based on prior knowledge that is often obtained at the micro or mesocosm scale. This presentation will examine the perils of ignoring scaling consequences and errors when attempting to monitor two green urban stormwater management practices: green roofs and stormwater re-use. Designs for green roofs and policy for safe stormwater re-use may be available through local municipal guidelines but the EI science that should form the basis of those design guidelines is often patchy, with little attention to error and scaling implications. This

presentation provides examples of the implications to design from the non-rigorous application of EI science.

**Prof. Gordon Huang**
University of Regina, Canada
International Society for Environmental Information Sciences

**Biography:** Gordon Huang is Tier 1 Canada Research Chair and Executive Director of Institute for Energy and Environment at University of Regina, Canada. He holds BSc from Peking University, and PhD from McMaster University (Canada). He has led over 200 energy- and environment-related projects, produced over 1000 SCI journal papers with an SCI-based H-index of 70, and supervised over 100 graduate students with Over 40 of them appointed as university faculty members (in Canada, USA, China, UK, Singapore, Hongkong). He is Fellow of Canadian Academy of Engineering, President of ISEIS, and editor-in-chief or board member for over 10 SCI journals.

**Keynote Lecture:** Modeling for energy and environmental risk management

Canada's energy sector is subject to the country's commitment of carbon-emission mitigation in the Paris Agreement. The transition to cleaner energy options in Canada will result in severe socio-economic and environmental effects. A cooperative approach for the country's decarbonization pathway is vital to achieve a more efficient and cost-effective GHG mitigations. This study is to develop energy and environmental risk management models to reflect trade-offs between minimized emission-abatement costs and maximized economic revenues. Specifically, interval, fuzzy and stochastic programming methodologies will be developed to reflect uncertainties and associated environmental and economic risks. GHG emissions from various sectors from thirteen Canadian provinces and territories under multiple scenarios will be analyzed. Issues of carbon taxes, abatement technologies, and economic effects will be addressed. The results are valuable for supporting the formulation of national policies for carbon-emission mitigation.

**Prof. Ed McBean**
University of Guelph, Canada

**Biography:** Edward McBean, Ph.D., P.Eng., P.E., FCAE, D.WRE., FCSCE, FEC, FIAH, FAGGS, is a Professor of Water Resources Engineering, a University of Guelph Research Leadership Chair Professor in Water Security, and a former Canada Research Chair in Water Supply Security at the University of Guelph. Ed received his B.A.Sc., from the University of British Columbia (1968) and his S.M., C.E., and Ph.D. (1973) from the Massachusetts Institute of Technology. Ed is an academician in Canada as Fellow of the Canadian Academy of Engineering, and in the US as a Diplomate, Water Resources Engineering of the American Society of Civil Engineers. Ed is also a recipient of numerous additional awards including the K. Y. Lo Award from the Engineering Institute of Canada for demonstrating Canadian expertise to the world, the Julian C. Smith from the Engineering Institute of Canada for achievement in the development of Canada, the Research and Development Award from the Professional Engineers of Ontario, the Lifetime Achievement Award from the University of British Columbia, and the 'Ton Duc Thang University Prize, Lifetime Achievement Award', Viet Nam.

Ed is a recognized expert in water security, risk assessment and management, and climate change. Ed has published three books, edited 17, published more than 400 papers in the refereed

journals and presented more than 470 papers at technical meetings around the world. Ed has been involved in research in water security issues in more than seventy countries.

**Keynote Lecture:** Climate Change and Coastal Cities, The Imperative Need for Action

Issues of water security are rapidly becoming of utmost importance for many countries in the 21st century. Many factors are contributing to the water security crisis, including sporadic and intense rainfall events, destructive storm surges, increasing populations, and a scarcity of accessible, potable water. These contributing factors are all evolving to heighten the severity of water security issues and their associated repercussions. However, despite the recognition of these issues at the global level, the issues of water security are most critical in coastal regions.

While the projections of the increases in sea level noted above appear initially as relatively modest (<1.0 m increase in oceans by 2100), one of the most obvious dangers to coastal cities are storm surges. However, while the serious magnitude of impacts of enormous storm surges is widely evident, intensification of the issues related to exposure and vulnerability also require consideration of the implications associated with increasingly large populations in the coastal zones in need of enormous quantities of water supply. The impact of subsidence arising from the extraction of groundwater to meet the water demands for coastal cities is, in many locations, ominous. The 'pave, pipe and pump' philosophy that has dominated areas such as Houston for over a century has resulted in parts of Houston dropping between 3 and 4 m since the 1920s. The relative magnitudes of land subsidence in coastal cities compared to global sea level rise include Tokyo has subsided by 4.2 m, Manila by 1.5 m, and Bangkok by 1.2m.

With increasingly large percentages of the world's population expected to live on, or near, coastlines, there is clear evidence of an evolving water security crisis for coastal cities including, but certainly not limited to, Beijing, Tianjin, Manilla, Jakarta, Dhaka, Guangzhou, Bangkok, Kolkata, Miami, New Orleans, Karachi, Ho Chi Minh City, Lagos, Sao Paulo, and Shanghai. As apparent from the preceding list, the problems of subsidence are not limited to one region of the world but the largest concerns relate to population increases in the Low Elevation Coastal Zone (LECZ) are clearly the largest concerns that need to be addressed.

Issues of the damage potential in coastal zone cities are already of major concern and rapidly intensifying. This presentation will review the relative magnitudes of various types of impacts evident and predicted over the next century, as well as listing a series of possible options in response. A series of lines of evidence are described in the presentation, demonstrating that global warming is both apparent and ominous, resulting in demonstration that water security implications to coastal cities are multi-faceted, including sea level rise and storm surges, land subsidence, and burgeoning 'populations at risk'. No single action will solve the issue and the need exists to act quickly. Hard engineering approaches alone are insufficient. The evidence is widespread that humans are impacting the climate and the environment. Sea level rise is occurring and is recognized as one of the indicators that the global climate is warming. However, no single action will solve the issue, and we need to act quickly.

**Prof. Yongping Li**
Beijing Normal University, China

**Biography:** Yongping Li is a Changjiang Scholar Professor at Beijing Normal University, China. She receives her MSc and PhD Degrees from the University of Regina, Canada. Her research interests involve in energy and environmental systems analysis, environmental pollution control, water resources management, and decision making under uncertainty. Since 2005, Li has led or involved in

over 50 energy- and environment-related research projects supported by industrial, governmental and international organizations. She has produced over 320 peer-refereed international journal papers (with an SCI-based H-index of 40 in Science Citation Index under Thomson Reuters' Web of Science), and supervised over 60 Master/PhD students. She has been continuously selected as a highly cited scholar in the field of "environmental science" (by Elsevier) since 2013. Dr. Li was received a number of awards such as Distinguished Young Scientist Award, New Century Excellent Talents in University, the National Natural Science Funds for Distinguished Young Scholar, the National Award for Youth in Science and Technology, and the National Award for Youth Female Scientist.

**Keynote Lecture:** Bi-level-based chance-constrained programming methods for supporting sustainable development of Central Asia under uncertainty

Issues of water scarcity, food crisis, and ecological degradation pose great challenges to the sustainable development of Central Asia. Effectively synergetic management of water-food-ecology (WFE) nexus system is desired, which may alleviate water shortage, ensure food security, and improve ecological environment. In this study, two bi-level-based chance-constrained programming methods are developed for planning water-food-ecology (WFE) nexus system of the Aral Sea basin (Central Asia). The developed methods have advantages in balancing the tradeoffs between two-level decision makers in hierarchical structure and reflecting the synergies among multiple sub-systems under random uncertainty. Besides, water trading mechanism is introduced into the optimization framework to alleviate water scarcity, food crisis, and ecological degradation. Multiple scenarios with different combinations of food demand, ecological water requirement and water availability are examined. Results about water resources allocation to agricultural, domestic, industrial, municipal, and ecological users are obtained, which are used for revealing the interrelationships among multiple competing users. Compared with the conventional single-level optimization approach, the synergetic management of WFE nexus system based on the proposed bi-level methods can increase food production and ecological water allocation, which is beneficial to the sustainable development of water shortage regions.

**Prof. Takashi Asaeda**
Saitama University, Japan

**Biography:** Professor Asaeda received a B.A. in Civil Engineering from The University of Tokyo in 1976, where he completed his M.S. (1978) and Ph.D. (1983). Since that time he worked as a associate professor of The University of Tokyo, professor of Saitama University, and retired in 2019. For his contributions, Professor Asaeda has received numerous awards, several times of Dam Engineering Society Prize, Japan Society of Civil Engineers Prize (JSCE), Karl Emil Hydraulic Prize (ASCE), etc. He also serves as numerous critical service positions in international and domestic society and committees, including chairperson of committees of Japanese Ministry of Land, Infrastructure, Transport and Tourism, chairperson of Prefectural Committees of Saitama, Japanese Society of Civil Engineers, International Association for Hydro-Environment Engineering and Research, Editor-in-Chief of international journals, etc. Professor Asaeda's interests have broadly covered ecology, hydrology and fluid mechanics in the environment, including physical processes of watered area, structure of urban heat island, and field observation and mathematical modeling of aquatic ecology and biology. He published more than 200 journal papers.

**Keynote Lecture:** Riparian vegetation, a mixture of natural gifts and history of human activities

In human history, riparian vegetation has an interaction with human life as the enjoyment of nature, which is highly related to biodiversity or original nature, and flood control, which depends on the hydrodynamic resistance of trees against the flood water.

Currently the preserving riparian ecosystems in their typical forms has become a growing concern. In many Japanese rivers, gravelly river channels are the typical landscapes of the midstream and provide a unique habitat for pioneering species that have recently disappeared due to intensive of vegetation colonization. This phenomenon has decreased the biodiversity and the endangered species that are adapted to a gravelly habitat. By contrast, in the midstream of large continental rivers, the midstream riparian zone is covered with large aged trees growing along the shorelines.

The stony riparian zone is maintained by the gravel deposition at flood time; thus gravelly riparian zone is maintained only in upstream to midstream of large sediment yield rivers. In most of midstream of continental rivers, flowing in flat planes for long distance, the riparian zone is composed of fine sediment, and occupied by large trees, standing without flushed for several decades. Therefore, human activities increasing sediment amounts in the river channel have affected the vegetation condition in the riparian zone. The increase of vegetation coverage, often found in some countries, is caused by the reduction of coarse sediment created by harvesting, trapping by dams and the development of riparian zones. Further, the afforestation of the upstream mountainous area, which was once deforested, also changes the riparian zone from gravelly to vegetation covered area.

Simulation models were developed to simulate the vegetation coverage in the riparian zone associated with flood occurrence. There are two types of models were proposed, based on the targets, available datasets, types of floods, vegetation phase or individual tree based. The former model can be used to simulate for a long period without detailed flood records, while in the latter, tree size distribution can be obtained through details of flood records.

**Dr. Juan Fan**
Ministry of Ecology and Environment of China, China

**Biography:** Ms. Fan obtained her Master Degree in Environmental Law from Kunming University of Science and Technology. Since then, she has been working in the Ministry of Ecology and Environment of China, served as vice director of The Office of Environmental Emergency Response. She participated in the revision of laws and regulations such as Environmental Protection Law, Water Pollution Prevention Law and so on, organized the revision of the National Environmental Emergency Plan, she participated in the environmental emergency response of many emergencies such as "8.12 Fire and Explosion Accident of Tianjin" , and participated in law enforcement inspection and supervision activities of MEE. Currently she is committed to developing a new framework integrating flood risk assessment with emergency operation plan.

**Keynote Lecture:** Characteristics of Emergency Management in China Including a Comparison with Japan

Emergency response can be defined as a systematic process to respond to an unexpected or dangerous occurrence. The goal of an emergency response procedure is to mitigate the impact of the disaster or event on people, society and the environment. The process can be further divided into emergency response plan, review, training and implementation. The level of emergency response depends on many factors ranging from legal system, organization, regulation, infrastructure, technical capacity, community structure and even culture.

China and Japan are both counties with frequent natural and human-caused disasters and have

accumulated a lot of knowledge in dealing with emergency. Therefore, comparative studies of emergency response between China and Japan will lead to better understanding of good practices in disaster emergency response and contribute to further development of emergency response system.

The present study presents the analysis on the flood disaster occurred in China this year, aimed at providing reasons why the worst flood disaster of China since 1998 caused much less losses compared to the flood disaster in 1998. The analysis is mainly focused on the characteristics of China's emergency management, comparing with Japan's emergency management though recently cases, discussing the feasibility of mutual reference between China and Japan. The current study is intended to shed new light on the theoretical foundation of emergency response and identify plentiful opportunities for researchers seeking to advance the state-of-the-art in this very important and exciting frontier of disaster research.

# PRESENTATION PROGRAMME OVERVIEW

| Date | Time | Programme |
|---|---|---|
| Dec. 4th, 2020 | 8:30-8:40 | Opening Ceremony |
| | 8:40-9:10 | Keynote Speech 1<br>Prof. Caterina Valeo |
| | 9:10-9:40 | Keynote Speech 2<br>Prof. Gordon Huang |
| | 9:40-10:10 | Keynote Speech 3<br>Prof. Ed McBean |
| | 10:10-10:20 | Break |
| | 10:20-10:50 | Keynote Speech 4<br>Prof. Yongping Li |
| | 10:50-11:20 | Keynote Speech 5<br>Prof. Takashi Asaeda |
| | 11:20-11:50 | Keynote Speech 6<br>Dr. Juan Fan |
| | 11:50-13:00 | Lunch |
| | 13:00-14:36 | Technical Session 1<br>Technologies of Environmental Engineering |
| | 14:36 -14:40 | Break |
| | 14:40-16:16 | Technical Session 2<br>Modeling of Environmental Systems |
| | 16:16 -16:20 | Break |
| | 16:20 -18:08 | Technical Session 3<br>Sustainable resources management |
| | 18:08-18:10 | Break |
| | 18:10-18:20 | Poster Session |
| | 18:20-18:30 | Closing Ceremony |

# INSTRUCTIONS TO PRESENTATIONS

## Materials Prepared and Provided by the Presenters:

Oral Presenter:
PowerPoint or PDF files
Duration of each Presentation (Tentatively 12 minutes)
Laptops (with MS-Office & Adobe Reader)

Poster Presenter:
Poster: color printing; Add Conference Name's Acronym on the top of poster (Such as "CEESD 2020" and paper ID)

## Minutes of Q&A

Keynote Speech: 25 Minutes of Presentation and 5 minutes' Q&A
Presenter: 10 Minutes of Presentation and 2 minutes' Q&A

## NOTICE:

- Certificate of Participation will be awarded after the conference finished via fast delivery.
- One best presentation will be selected from each session. The best one will be announced when each session ends, and will be awarded with a "Best Presentation" certificate.

# Online Video Conference Operation Guide via VooV

## ● (Conference Information):

Theme：CEESD 2020 & WPCE 2020 & WSM 2020
Time: **8:30-18:30 Dec. 4, 2020 (Beijing time)**

Link: https://meeting.tencent.com/s/ZbAUsY3yGASB
Conference ID：371 518 586

## ● Testing:

All the participants can join the conference room during the testing time, the conference secretary will arrange the participants who will do the oral presentation to test one by one. (p.s. Conference ID keeps the same with testing ID)

| Testing Time | Participate | Testing ID | Link |
|---|---|---|---|
| 15:30 p.m.-17:30p.m. Nov.30, 2020 (GMT+8) | Oral Presenters | 371 518 586 | https://meeting.tencent.com/s/ZbAUsY3yGASB |

## ● Operation Guide:

### 1. Video meeting software: VooV

Download link：

A.) Chinese Version:
https://meeting.tencent.com/download-mac.html?from=1001&fromSource=1 (Mac OS)
https://meeting.tencent.com/download-win.html?from=1001&fromSource=1
(Windows)

B.) International Version
https://voovmeeting.com/download/darwin（Mac OS）
https://voovmeeting.com/download/windows （Windows）

### 2. Join the Conference：

Method 1: Click the Conference link (https://meeting.tencent.com/s/ZbAUsY3yGASB), or click "Join the conference", then input the Conference ID: 371 518 586. When you join the conference room, you need to fill in your phone number for authentication, then fill in your "Paper ID +Name" at the "Name" to join the conference.

*Tip: Should you fail to "Join the Conference" as a visitor, we suggest you register an account by method 2, then log in and join the conference.

Method 2: You can register at the APP/ website (https://www.voovmeeting.com/), log in and join the conference by the link or tap the Conference ID.

## ● Note:

- The conference committee will **call the roll 5 minutes before** our conference, please join the conference in advance for at least 5 minutes. The conference secretaries will be waiting since 8:00.
- Please **wear headphones** during the meeting to block out the outside noise. Keeping the video on and keeping online are suggested.
- Please test the video meeting software in advance.
- During the poster session, we will upload all the poster files in the"meeting room". For learning more about posters, you could download the files to read only. But please note that, all materials have not been published, please **respect the paper originality and copyright.**

  *Note: Since International version does not support the function of file transmission, we recommend you to download Chinese version, then you can upload and download file smoothly. If Chinese version is not available in your country or region, you can download International version; as for e-posters, we could email you via email box once you requested.

- Please follow WeChat for Consultation (**APISE17358663189**) for more information. CEESD & WPCE & WSM 2020 Wechat Group will update conference information in realtime.
- Should you have any further questions about this operation guide, please click https://www.voovmeeting.com/ for help. You can also contact the conference secretary at +86-17723329879(China), +852-30506939 (Hong Kong).

# TECHNICAL SESSION

**Keynote Speech Session**

**Session Chair: Gordon Huang (University of Regina, Canada)**

**and Guangwei Huang (Sophia University, Japan)**

**8:40-11:50, Dec. 4th, Friday | Room ID: 371 518 586**

| Time | No. | Content | Page |
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| 9:10-9:40 | KN2 | Modeling for energy and environmental risk managemen<br>***Prof. Gordon Huang,*** University of Regina, Canada | 3 |
| 9:40-10:10 | KN3 | Climate Change and Coastal Cities, The Imperative Need for Action<br>***Prof. Ed McBean,*** University of Guelph, Canada | 3 |
| 10:10-10:20 | Break | | |
| 10:20-10:50 | KN4 | Bi-level-based chance-constrained programming methods for supporting sustainable development of Central Asia under uncertainty<br>***Prof. Yongping Li,*** Beijing Normal University, China | 4 |
| 10:50-11:20 | KN5 | Riparian vegetation, a mixture of natural gifts and history of human activities<br>***Prof. Takashi Asaeda,*** Saitama University, Japan | 5 |
| 11:20-11:50 | KN6 | Characteristics of Emergency Management in China Including a Comparison with Japan<br>***Dr. Juan Fan,*** Ministry of Ecology and Environment of China, China | 6 |
| 11:50-13:00 | **Lunch** | | |

| Technical Session 1: Technologies of Environmental Engineering<br>Session Chair: Caterina Valeo (University of Victoria, Canada)<br>and Rubing Zheng (North China Electric Power University, China)<br>13:00-14:40, Dec.4th, Friday \| Room ID: 371 518 586 | | | |
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| 13:12-13:24 | E1002 | Anaerobic Membrane Bioreactors for Trace Organic Contaminants with Wastewater Treatment: A Review<br>***Yiding Wang,*** The Johns Hopkins University, USA | 17 |
| 13:24-13:36 | E1003 | Wastewater treatment plant workers exposure and methods for risk evaluation of their exposure<br>***Rui Lu,*** Chang'an Univeristy, China | 18 |
| 13:36-13:48 | E1005 (Video) | Bioretention Performance in Temperate Climates During Plant Abscission<br>***Jessica Dhami,*** University of Victoria, Canada | 18 |
| 13:48-14:00 | M003 | Achieving nitrite production and primary sludge reduction in a hydrolytic acidification coupling with partial denitrification system<br>***Liangliang Shi,*** Beijing University of Technology, China | 19 |
| 14:00-14:12 | M006 | Characterization of nutrients removal and dissolved organic matter transformation in a novel two-sludge denitrifying phosphorus removal system operated at three sludge retention times<br>***Yawen Sun,*** Beijing University of Technology, China | 19 |
| 14:12-14:24 | E1017 | Treatment of sulfamethoxazole-rich livestock sewage using multi-layer soil systems in rural areas<br>***Pei Song,*** North China Electric Power University, China | 20 |
| 14:24-14:36 | E1018 | Application of ecological wastewater treatment technology based on nature in rural areas, Southwest, China<br>***Rubing Zheng,*** North China Electric Power University, China | 20 |
| 14:36-14:40 | Break | | |

## Technical Session 2: Modeling of Environmental Systems

**Session Chair: Guangwei Huang (Sophia University, Japan)**

**14:40-16:20, Dec.4th, Friday | Room ID: 371 518 586**

| | | | |
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| 15:16-15:28 | M1014 | On linking administrative law enforcement and criminal justice in environmental management<br>***Xiaowei Ding,*** Guangdong Police College, China | 22 |
| 15:28-15:40 | E1015 | Development of a CGE-driven non-deterministic energy system planning model for China<br>***Mengyu Zhai,*** North China Electric Power University, China | 22 |
| 15:40-15:52 | E1016 | Losses of natural coastal wetlands by land conversion in the Yellow River Delta area<br>***Yong, Liu,*** North China Electric Power University, China | 23 |
| 15:52-16:04 | E1013 | Development of a multi-factorial interaction model for the emission mitigation of air pollutants<br>***Boyue Zheng,*** North China Electric Power University, China | 23 |
| 16:04-16:16 | E004 (Video) | Study on the Removal of Nitrogen-containing Waste outside the Aquaculture Pond by the Method of Electric Flocculation and Quasi Circulating Aquaculture<br>***Lee,Yu-Hsiang,*** National Yunlin University of Science & Technology, ROC Taiwan | 24 |
| 16:16-16:20 | Break | | |

| Technical Session 3: Sustainable Resources Management<br>Session Chairs: Takashi Asaeda (Saitama University, Japan) and Junhong Guo (North China Electric Power University, China)<br>16:20-18:10, Dec.4th, Friday \| Room ID: 371 518 586 | | | |
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| 16:20-16:32 | E303 | A multi-linear regression model to predict the factors affecting water consumption in Qatar<br>***Mays Mohammed Alshaikhli,*** Qatar University, Qatar | 24 |
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| 16:44-16:56 | M1006 | Flood Risk Assessment in Small Watershed Based on Catastrophe Theory<br>***Yangzhi Lv,*** Tongji University, China | 25 |
| 16:56-17:08 | M1012 | A methodological framework for operationalization of flood risk management<br>***HMM Herath,*** University of Moratuwa, Sri Lanka | 25 |
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| 17:20-17:32 | E1011 | Stepwise clustering drought projection and multi-level factorial analysis under climate change: a case study of the Pearl River Basin, China<br>***Ruixin Duan,*** Beijing Normal University, China | 26 |
| 17:32-17:44 | E1012 | Stepwise-clustered heatwave downscaling and projection for Guangdong Province<br>***Jiayan Ren,*** Beijing Normal University, China | 27 |
| 17:44-17:56 | E1014 | Investigating future climate changes over China by a high-resolution regional climate model at different resolutions<br>***Junhong Guo,*** North China Electric Power University, China | 27 |
| 17:56-18:08 | E306 | How human activities affect water quality: a machine learn-ing approach<br>***Catherine Lee,*** Saint Paul Preparatory Seoul, Republic of Korea | 28 |
| 18:08-18:10 | **Break** | | |
| 18:10-18:20 | **Poster Session** | | |
| 18:20-18:30 | **Closing Ceremony** | | |

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|---|---|
| E008 | Effects of demolition breeding area on water quality and phytoplankton in a subtropical shallow lake<br>***Jing Nan,*** Tongji University, China |
| E301 | Comprehensive Pollution Analysis of Contaminated Sediment in an Urban River, China<br>***Senjun Huang,*** Power China Huadong Engineering Corporation Limited, China |
| E2001 | Influence of Tide and Runoff on saltwater intrusion in the Qiantang River Estuary, China<br>***Jian-ge Jiao,*** Power China Huadong Engineering Corporation Limited, China |
| M007 | Hydraulic Characteristics of Microbend River with Vegetation on the Slope<br>***Yuan Yuan,*** Changjiang River Scientific Research Institute of Changjiang Water Resources Commission, China |
| M1013 | Hydrological risk management of urbanized areasin framework of the Smart City Concept<br>***V G Plyuschikov,*** RUDN University, Russia |

# ABSTRACT

| Technical Session 1: Technologies of Environmental Engineering | |
|---|---|
| **Time** | **Content** |
| 13:00-13:12 | **E009:** Cadmium Water Pollution Associated with Motor Vehicle Brake Parts<br>**Presenter:** ***Fatemeh Talebzadeh,*** University of Victoria, Canada<br>**Abstract:** With increasing industrial growth, there is a greater need to understand factory production processes, the resulting products, and the pollution caused by the fabrication processes leading to these products. Cadmium (Cd) is used in the electro-less Nickel-Cadmium bath phase of the brake manufacturing process, which provides the brake coating that produces corrosion-resistant brake parts. During the operation, the friction created during braking corrodes the Cd layer and releases Cd particles into the environment. Cd particles can enter water bodies and drinking water supplies through stormwater runoff. This research will first examine Cd pollution associated with motor vehicle brake discs from cradle to grave. Following this comprehensive look into the role of Cd in the brake manufacturing process as well as Cd speciation in natural waters, three interventions are proposed to prevent Cd pollution associated with brake parts: (i) Carbon-reinforced silicon carbide as an alternative for metal based brake parts; (ii) bacteria "coating" instead of Cd coating; (iii) permeable roads that can effectively remove Cd from runoff with nearly 98% reduction. A discussion into the advantages and disadvantages of each proposition are provided with this presentation. |
| 13:12-13:24 | **E1002:** Anaerobic Membrane Bioreactors for Trace Organic Contaminants with Wastewater Treatment: A Review<br>**Presenter:** ***Yiding Wang,*** The Johns Hopkins University, USA<br>**Abstract:** Trace organic contaminants (TrOCs) in water environment such as pesticides, personal care products (PPCPs), and industrial materials have the characteristics including low concentration, wide distribution range, stable chemical structure. Anaerobic membrane bioreactor (AnMBR) is a new biological treatment method. The device combines the advantages of membrane filtration technology and biological treatment process. What the performance of AnMBR for TrOCs removal should be noticed. Some research is focusing on this question, and most of research found that AnMBR has shown great promises in the application of the removal of TrOCs in wastewater treatment. This paper briefly overviews recent processes of different types of AnMBR for the removal of different types of TrOCs with the influence of kinds of factors such as temperature, salinity etc. We mainly discussed the construction of AnMBR, the classification of TrOCs, and the removal efficiency of chemical oxygen demand (COD), the removal efficiency of TrOCs, and the biogas production. For the types of AnMBRs, the removal efficiency of COD and TrOCs and biogas production are excellent. Also, the removal efficiency of TrOCs is very related to the types of the contaminants. AnMBR is not only a practical choice for TrOCs removal, but also a good choice |

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| | for following sustainable development because of the good biogas production. In addition, challenges of the future research are discussed also at the end of this review to give other researchers new perspectives and ideas. |
| 13:24-13:36 | **E1003:** Wastewater treatment plant workers exposure and methods for risk evaluation of their exposure<br><br>**Presenter:** ***Rui Lu,*** Chang'an Univeristy, China<br><br>**Abstract:** Work in wastewater treatment plants (WWTPs) can be associated with respiratory symptoms and diarrhea. The aim of this study was to obtain knowledge about WWTP workers' exposure to airborne bacteria and endotoxin, and the inflammatory potential (TIP) of their exposure, and to evaluate the risk posed by four different methods. A cohort of 14 workers were followed over one year. Bioaerosols were collected using personal and stationary samplers in a grid chamber house and an aeration tank area. Airborne bacteria were identified using MALDI-TOF MS, and TIP of exposure was measured using HL-60 cells. A significant effect of season, work task, and person was found on the personal exposure. A hazard index based on exposure levels indicates that the risk caused by inhalation is low. In relation to suggested occupational exposure limits (OELs), 14% and 34% of the personal exposure were exceeded for endotoxin (≥ 50 EU/$m^3$) and bacteria (≥ 500 CFU/$m^3$). From personal samples, three of 131 bacterial species, *Enterobacter cloacae*, *Staphylococcus aureus*, and *Yersinia enterocolitica* are classified within Risk Group 2. Seven additional bacteria from the stationary samples belong to Risk Group 2. The TIP of WWTP workers' exposure was higher than of a reference sample, and the highest TIP was measured in autumn. TIP of personal exposure correlated with bacterial exposure. Based on the geometric average exposures to endotoxin (9.2 EU/$m^3$) and bacteria (299 CFU/$m^3$) and based on the calculated a hazard index, the risk associated with exposure is low. However, since 43 of 106 exposure levels exceed suggested OELs, the TIP of exposure was elevated and associated with bacterial exposure, and WWTP workers were exposed to pathogenic bacteria, a continued focus on preventive measures is important. The identification of bacteria to species level in personal samples was necessary in the risk assessment. |
| 13:36-13:48 | **E1005:** Bioretention Performance in Temperate Climates During Plant Abscission<br><br>**Presenter:** ***Jessica Dhami,*** University of Victoria, Canada<br><br>**Abstract:** Bioretention cells (also known as rain gardens) are a Low Impact Development (LID) method for sustainable stormwater management. An increasingly popular form of urban stormwater infrastructure, this LID uses an engineered vegetated-soil-system to mitigate both quantity and quality of stormwater. The ability of bioretention systems to remove common pollutants from urban stormwater runoff, and reduce runoff volume though evapotranspiration, were assessed in this full scale field-based study. Rainfall run-off simulations were conducted for 5-, 10-, and 25-year return period storm events at a field site in Victoria, British Columbia, Canada. The study site is located in a temperate climate region and simulations were run during plant abscission. Field parameters were recorded for pH and dissolved oxygen (DO), in addition to lab analyses conducted to quantify COD, Nitrogen, Phosphorous, and Suspended Solids |

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| | removal from the stormwater. Minor fluctuations were observed in pH, whereas DO consistently decreased between the influent and effluent. Results show leeching of COD through the effluent, and mixed leeching/removal of Nitrogen and Suspended Solids. All tests had positive results for removal of Phosphorous and stormwater volume reduction. |
| 13:48-14:00 | **M003:** Achieving nitrite production and primary sludge reduction in a hydrolytic acidification coupling with partial denitrification system<br><br>**Presenter:** ***Liangliang Shi,*** Beijing University of Technology, China<br><br>**Abstract:** Partial denitrification (PD, nitrate ($NO_3^-N$) →nitrite ($NO_2^-N$)) has been a popular method to supply $NO_2^-N$ for the mainstream Anammox. PD bacteria enrichment and high $NO_2^-N$ production are closely related to readily biodegradable organic matters (RBOMs). However, these RBOMs involved in real wastewater are usually insufficient. Excess primary sludge treatment is another burden to the wastewater treatment plants. Primary sludge contains much slowly biodegradable organic matters (SBOMs), such as particular carbohydrates and particular proteins. Transforming these SBOMs into RBOMs via hydrolytic acidification (HA) may be helpful to replenish the lack of influent RBOMs and enrich PD bacteria. Additionally, primary sludge reduction could be achieved simultaneously. In this study, HA coupling with PD system was firstly proposed to achieve $NO_2^-N$ production and primary sludge reduction. A 10 L sequencing batch reactor with an anaerobic and anoxic mode was applied for the HA-PD. After a 167-day operation, 61.3% $NO_3^-N$ to $NO_2^-N$ transformation ratio (NTR) was finally achieved, with feeding sludge mass and influent $NO_3^-N$ concentration of 2.01 g and 50 mg/L, respectively. Additionally, 23.1% sludge reduction was simultaneously realized. The acetate (13.2%), dissolved saccharide (11.9%), and intracellular poly-hydroxyalkanoates (22.5%) were the main hydrolytic acidification products. These three matters could drive the PD bacteria, with the NTR of 59.8%, 63.7%, and 40.3%, respectively. Compared with RBOMs-based methods, the HA-based method was much more cost-efficient for the PD bacteria enrichment in actual wastewater. |
| 14:00-14:12 | **M006:** Characterization of nutrients removal and dissolved organic matter transformation in a novel two-sludge denitrifying phosphorus removal system operated at three sludge retention times<br><br>**Presenter:** ***Yawen Sun,*** Beijing University of Technology, China<br><br>**Abstract:** Denitrifying phosphorus removal, which was considered as a technically feasible and economically favorable technology to realize phosphorus and nitrogen removal simultaneously, was established for domestic wastewater treatment in a novel two-sludge continuous-flow reactor (AAO-BCO). The AAO-BCO system was operated for a period of 113 days with three sludge retention times (SRT of 35, 26 and 17 days for AAO reactor) to investigate the denitrifying phosphorus removal performance and characteristics of effluent dissolved organic matter. With real domestic wastewater at low carbon/nitrogen ratio(COD/TIN≈4), SRT of 26 days was found to be optimal for high nitrogen and phosphorus removal efficiencies of $NH_4^+$-N(99.31%), TIN(77.77%) and $PO_4^{3-}P$(95.48%) due to appropriate utilization of carbon source(68.72%) in the |

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| | anaerobic zones and $PO_4^{3-}$P /$NO_3^-$N ratio(1.54) in the anoxic zones. The PHA utilization in the anoxic zone reached up to 83% with the denitrifying phosphorus removal of 90.35%. The proteinaceous matters could be effectively decomposed by denitrifying polyphosphate accumulating organisms (DPAOs) in the anaerobic phase, however, accumulation of soluble microbial produces (SMPs) were observed during denitrifying phosphorus removal processes. Increasing SRT in the AAO reactor can significantly reduce the amount of dissolved organic matter (DOM), but that may increase its aromaticity and reactivity. Furthermore, BCO reactor showed positive effect of reducing humic-like compounds in the effluent dissolved organic matter (EfOM), which facilitated to alleviate adverse impact on subsequent advanced treatment processes. |
| 14:12-14:24 | **E1017:** Treatment of sulfamethoxazole-rich livestock sewage using multi-layer soil systems in rural areas<br><br>**Presenter:** ***Pei Song,*** North China Electric Power University, China<br><br>**Abstract:** Antibiotics such as sulfamethoxazole are commonly used in illness prevention, infection treatment, and growth promotion of agricultural livestock. However, a mass of unused antibiotics will be gradually excreted following livestock ingestion, which leading to the antibiotic pollution issue in decentralized rural areas. The gravity-driven multi-layer soil system (MLSM) in this study operating as a functional bioreactor outperforms conventional soil-based sewage treatment processes under complex conditions. However, the treatment of sulfamethoxazole in sewage using MLSM under different conditions have not yet been studied.<br><br>This study constitutes the first use of factorial analysis in the investigation of the effects of multiple state variables (material of permeable layer, concentration of sulfamethoxazole, and pH of influent) and their internal interactions in the sulfamethoxazole treatment process. The most significant negative and positive factors for sulfamethoxazole removal in MLSMs were concentration of sulfamethoxazole and material of permeable layer, respectively. Favorable medical stone could intensify the adsorption of sulfamethoxazole under both acidic and alkaline conditions. The findings also show an obvious increase in sulfamethoxazole removal efficiency as the sulfamethoxazole concentration in the influent decreases. The MLSM exhibited optimal sulfamethoxazole removal efficiency (>91%) when using medical stone as the material of permeable layer to treat sewage, with low sulfamethoxazole concentration and an acidic environment.<br><br>As an economical, ecological, and efficient sewage treatment technology, MLSM is an attractive option for treatment of sewage containing sulfamethoxazole in rural areas. |
| 14:24-14:36 | **E1018:** Application of ecological wastewater treatment technology based on nature in rural areas, Southwest, China<br><br>**Presenter:** ***Rubing Zheng,*** North China Electric Power University, China<br><br>**Abstract:** With the promotion of Rural Revitalization Strategy in China, more and more people are aware of the environmental problems in the process of rural development, such as the rapid increase of garbage, sewage discharge, black and |

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| | odorous water body, which seriously threaten people's health and community sustainability development. During the 13th Five Year Plan period, a large number of rural sewage treatment projects have been implemented. However, the problem of water pollution in rural areas has not been effectively solved due to the phenomenon of sewage treatment facilities shutdown appears in some areas, because of adaptability of technology and high operating costs such as energy consumption. Considering the high cost of construction and operation, the traditional wastewater treatment is not suitable in the rural area. In this research, natural materials such as soil, gravel, plants and microorganisms are more commonly used to construct the ecological treatment technology of domestic sewage, which reduces the construction cost, operation cost and secondary pollution, and improves the efficiency and stability of water environment protection in the process of rural development. |
| **Technical Session 2: Modeling of Environmental Systems** | |
| 14:40-14:52 | **E1007:** Optimization of water-food nexus system under dual uncertainties<br>**Presenter:** ***Yuan Ma,*** North China Electric Power University, China<br>**Abstract:** In this study, a fuzzy chance-constrained programming (FCCP) method is developed to synergetic plan water-food nexus (WFN) system under dual uncertainties. The developed method can tackle uncertainties expressed as probabilistic distribution and flexible parameter. Then, a FCCP-WFN model is formulated for the city of Jinan (China), in which 72 scenarios are designed with the consideration of different food demand levels, constraint-violation risk levels, and satisfactory degrees. Results indicate that (i) surface water would be the main water source for Jinan (accounting for 62.7% of water supply), and agriculture would be the largest water consumer (accounting for 55.5% of water allocation), therefore, rational management of surface water and reduction of agricultural water allocation are essential to alleviate the water shortage problem in Jinan; (ii) the annual arable land area is 628.4×103 ha to 683.4×103 ha, of which grain crops account for 62.1%, and the sufficient grain planting area can ensure food security in Jinan; (iii) uncertainties have significant influence on water allocation schemes, thus, managers should consider the impact of uncertainties during decision-making process, and make different management schemes according to different attitudes to system risks under undetermined conditions. |
| 14:52-15:04 | **M011:** A Comparative Study on Nitrate Contents in Vegetables between Northern Part of China and the Watershed of Lake Tega in Japan<br>**Presenter:** ***Huan liu,*** Sophia University, Japan<br>**Abstract:** Humankind is continuously exposed to nitrate through water and food. Excessive intake of nitrate could lead to health problems. Among the food products consumed by human beings, both fresh and processed vegetables are the major source of dietary nitrate intake. In this study, investigations on nitrate contents in vegetables are conducted in the northern part of China and the watershed of Lake Tega in Japan. Four groups of vegetables, leafy, brassica, root and tuber, and fruiting, were sampled for testing. The study focuses on the differences of the nitrate distributions in various crops. As a developed country, Japan has a much stricter regulation on the utilization of nitrogen in fertilizers, with a recommended |

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| | yield goal N rate of 250 kg/ha/year. Whereas in China, the recommended N rate is 450 kg/ha/year. Meanwhile, the watershed of Lake Tega in Japan has an average annual precipitation of 1348 mm, which is much higher than the Northern part of China. High concentration of nitrate was found in vegetables grown in both Northern China and the watershed of Lake Tega, although the social and environmental conditions are drastically different in these two regions. |
| 15:04-15:16 | **M016:** Tempered stable Ornstein–Uhlenbeck model for river discharge time series with its application to dissolved silicon load analysis<br><br>**Presenter:** ***Hidekazu Yoshioka,*** Shimane University, Japan<br><br>**Abstract:** We identify stochastic process models describing the time series of inflow and outflow discharges of Obara Dam in Hii River, Japan. These models are based on tempered stable Ornstein–Uhlenbeck (TSOU) processes that have not been utilized in hydrological analysis but can capture both large and small fluctuation of the time series data. In addition, the models can be exactly simulated in a statistical sense by utilizing a recent tailored discretization algorithm, serving as efficient stochastic tools. We show that the identified models accurately reproduce statistical moments of the time series data and probability density functions. Based on the mathematical framework of backward stochastic differential equation (BSDE), the identified model is applied to a unique dynamic stochastic analysis of dissolved silicon (Dsi) load flowing into the reservoir associated with Obara Dam. We thus contribute to the first application of TSOU processes and a BSDE to hydrological analysis. |
| 15:16-15:28 | **M1014:** On linking administrative law enforcement and criminal justice in environmental management<br><br>**Presenter:** ***Xiaowei Ding,*** Guangdong Police College, China<br><br>**Abstract:** Linking administrative law enforcement and criminal justice in environmental management promotes the cooperation between environmental administrative law enforcement departments and criminal justice institutions in combating environmental crimes and ensuring environmental safety. Problems arise in their joint efforts in combating environmental crimes in recent years, such as low case-transfer rate, unclear transfer criteria, difficulty in evidence conversion and test identification, as well as unavailability to network information-sharing platforms. It is imperative to build up evaluation system, standardize case transfer criteria, clarify evidence conversion rules, and establish network information-sharing platforms. Only in this way can the two laws converge effectively, and a harmonious environmental management order be maintained. |
| 15:28-15:40 | **E1015:** Development of a CGE-driven non-deterministic energy system planning model for China<br><br>**Presenter:** ***Mengyu Zhai,*** North China Electric Power University, China<br><br>**Abstract:** China is currently facing an unprecedented pressure in terms of socio-economic consequences of carbon emission intensity mitigation. Associated with such a pressure, there exist extensive uncertainties among various socio-economic and environmental subsystems, leading to relevant risks under |

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| | different management policies. Robust approaches are desired for supporting the management of energy system risks from various SEE perspectives. Therefore, the objective of this research is to develop a CGE-driven non-deterministic energy system planning model for facilitating clean energy transition and SEE risk management. Trough integrating computable general equilibrium models into non-deterministic optimization model as an innovation for tackling specific socio-economic sectors in energy system planning. In detail, i) the socio-economic effects induced by various energy-related effects will be firstly assessed through CGE models; ii) the energy- and environment- related effects will be then quantified using the outputs of CGE; iii) cost-effective energy transition plans will be generated though inputting these effects into the optimization model, allowing reflection of trade-offs among various energy, environmental and socio-economic criteria. Results show that It is expected that a number of robust decision alternatives would be generated to support policy formulation within a Chinese context. |
| 15:40-15:52 | **E1016:** Losses of natural coastal wetlands by land conversion in the Yellow River Delta area<br><br>**Presenter:** ***Yong, Liu,*** North China Electric Power University, China<br><br>**Abstract:** Coastal wetlands, having experienced serious losses of area and ecological function, are currently facing worldwide challenges due to coastal development and global climate change. With the region forecast to be a hotspot of urbanization, this study attempted to explore patterns and possible factors driving loss of natural coastal wetlands in the Yellow River Delta (YRD), China in the period of 1970 to 2015. In total, YRD has lost 32.5% of its natural coastal wetlands in the study period, where tidal flat wetland suffered the biggest reduction with a rate of 49.78%, and natural coastal wetlands decreased more seriously before 1990 than that after 1990 at the same time. The natural coastal wetland area was substantially lost due to land conversion highly related to regional economic development such as culture pond expansion, salt span expansion, and cropland expansion. Directly human induced natural coastal wetlands loss counts for 39.33%, 59.52%, 73.24%, 83.05%, 88.37% of the total loss in different periods among 1970 to 2015 respectively. Reclamation of coastal wetlands is likely to intensify, owing to the increasing scarcity of land in coastal areas and the low cost and rapid pace at which these areas can be developed. The conclusion obtained may provide coastal development strategies that minimize wetlands loss and protect remaining coastal wetlands. |
| 15:52-16:04 | **E1013:** Development of a multi-factorial interaction model for the emission mitigation of air pollutants<br><br>**Presenter:** ***Boyue Zheng,*** North China Electric Power University, China<br><br>**Abstract:** The success of Chinese economy has come partly at the expense of over natural resource exploitation and significant impacts on the environment. Among all environmental issues, air pollution caused by energy utilization has become one of the bottlenecks for the development of regional economy. The adverse impacts on environment and economy can make China subsequently take up serious economic loss and associated health burden. In this study, a multi-factorial |

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| | interaction model is developed to examine the air pollutants (i.e. SO2, NOX and dust) triggered by energy exploitation and utilization. Provincial and sectorial factors are identified through production- and consumption-based accounting to further investigate their individual and interactive effects on the systematic performances. It is found production- and consumption-related emission vary significant due to the different of energy reserves and economic development levels of various regions. Moreover, economic structure and population increase stimulate huge emission despite the decline of emission intensity. Individual effect dominates the systemic performances, which can provide insight into emission mitigation through their effect. In addition, interaction effect of provincial and sectorial factors exists in the response of systematic robustness and efficiency, which can promote systematic resistance against shocks. |
| 16:04-16:16 | **E004:** Study on the Removal of Nitrogen-containing Waste outside the Aquaculture Pond by the Method of Electric Flocculation and Quasi Circulating Aquaculture<br><br>**Presenter:** ***Lee,Yu-Hsiang,*** National Yunlin University of Science & Technology, ROC Taiwan<br><br>**Abstract:** When the waste containing ammonia nitrogen is removed by electric flocculation circulating aquaculture, not only the colloidal impurities and suspended impurities are coagulated and precipitated, but also a variety of pollutants and bacteria in the water can be removed due to the oxidation of the anode and the reduction of the cathode. In this project, PWM (pulse width modulation) technology is used to overcome the power consumption problem of traditional electric flocculation method, high-voltage pulse and anode-cathode pole exchange technology is used to overcome the iron consumption and plate passivation problem, and echelon potential method is used to solve the difficulty of plate exchange. Compared with the traditional chemical and biological treatment technology, electrocoagulation can ensure the sustainable development of aquaculture without adding oxidants, flocculants and other chemicals.<br><br>At present, electronic technology and Internet of things technology are used in aquaculture fields to monitor the water quality data in the pond and control the growth of aquaculture organisms in the most suitable environment in real time, so as to increase income, reduce human power and save water and electricity. Therefore, with mature sensing technology, IOT, Im, cloud computing, big data and AI, we can build an intelligent aquaculture production, marketing and digital service system to improve the overall production efficiency, energy and quality, and accelerate the transformation of aquaculture industry. |
| **Technical Session 3: Sustainable Resources Management** | |
| 16:20-16:32 | **E303:** A multi-linear regression model to predict the factors affecting water consumption in Qatar<br><br>**Presenter:** ***Mays Mohammed Alshaikhli,*** Qatar University, Qatar<br><br>**Abstract:** Water scarcity is increasingly encouraging water-saving techniques and urban water management schemes committed to reducing the consumption of |

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| | natural resources and the effects on the ecosystem. A comprehensive understanding of the nature of water supplies is required to design strategies for safe and effective use of water. Water management networks are complex. Consumption of water is affected by various variables, and therefore, the relationship of these variables is also complex. This study examines water consumption determinants in the State of Qatar, focusing on the factors linked to seasonal months by using a multiple linear regression model. The regression model was developed to accurately estimate the water consumption in Qatar to help the government's plan for water usage In Qatar |
| 16:32-16:44 | **M018:** The Construction of Water-Sensitive Urban Design in the Context of Japan<br>**Presenter:** ***Yajing Zhang,*** Fuzhou University, China; Kanazawa University, Japan<br>**Abstract:** Water Sensitive Urban Design (WSUD) is a critical sustainable development theory in the urban water environment, which is attracting more and more attention worldwide. Meanwhile, as an island country, Japan attaches great importance to water resources and water environment, and have achieved fruitful result in urban water management. Based on the framework of WSUD, this research introduces Japan's practical experience from the perspectives of water source protection, flood control, and waterfront space landscape, aiming to summarise Japan's experience and provide a new perspective. By explaining the thoughts of water sensitivity design contained in Japanese practice, this research expands the scope of WSUD, provides a meaningful research framework for Japanese researchers, and provides compelling cases for researchers on water-sensitive design around the world. |
| 16:44-16:56 | **M1006:** Flood Risk Assessment in Small Watershed Based on Catastrophe Theory<br>**Presenter:** ***Yangzhi Lv,*** Tongji University, China<br>**Abstract:** Flood system is a complex system affected by many control factors and has typical system characteristics, such as irreversibility, fuzzy characteristics, gray characteristics, etc. Catastrophe theory is a well developed singularity theory, which has been initially applied in some leaping disaster systems. However, in the field of flood risk management, the application of catastrophe theory is relatively few. In this paper, a small watershed in the mountainous area of southwest China is taken for an example. The catastrophe assessment theory is adopted to conduct flood risk assessment. By analyzing the characteristics of the flood system and selecting flood risk factors, the flood risk assessment index system is established and the catastrophe theory flood risk assessment model is conducted, thus conducting flood risk zoning and management according to the assessment result, which provides a new reliable method for flood risk assessment and offers foundation for disaster reduction department. |
| 16:56-17:08 | **M1012:** A methodological framework for operationalization of flood risk management<br>**Presenter:** ***HMM Herath,*** University of Moratuwa, Sri Lanka<br>**Abstract:** Flood risk management has undergone significant transformations during the recent past. Socio ecological system conceptualizations suggests that resilience is the key to managing complex systems and to reduce vulnerability |

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| | which is a result from the inherent uncertainty of flood risk. Theoretical understanding of flood risk management has advanced over the years but it is still seen that there are visible shortcomings in the operationalization concepts and methods. This is mainly due to the lack of a framework for clear recognition and understanding of the components of flood risk management for all stakeholders. Therefore, this research has questioned the current status of flood risk management and provide recommendations for operationalization. |
| 17:08-17:20 | **E1010:** Multi-level factorial analysis for ensemble hydrological prediction<br>**Presenter:** ***Feng Wang,*** Beijing Normal University, China<br>**Abstract:** Impacts analysis of multiple factors is a necessary prerequisite for developing reliable models for hydrological projections. This study introduces an integrated data-driven approach for quantifying the impacts of boundary conditions on response variables through the multi-level factorial analysis. The proposed computational approach can diagnose and quantify the individual and their multi-level combined effects from multiple factors. In this approach, Bayesian model averaging (BMA) scheme is applied to exploit the diversity of skillful predictions from different (linear or non-linear) models. Copula function is applied for reintroducing residuals into simulated responses systematically, in a stochastic manner, to refine residual distributions. After that, the impacts of out-of-scope influencing factors on modeling results and reliabilities are also investigated through model residual analysis. Taken the rainfall-runoff response over China as an example. The results of statistical inference and factorial analysis have revealed the temporal and spatial heterogeneity of rainfall-runoff response in China. In detail, the monthly climate factor is the main influencing factor (57.73%-61.63%) of streamflow in south China. However, in north China, the pre-climatic conditions have a great influence (28.43%-65.65%) on the runoff change. The impacts of out-of-scope influencing factors on runoff modeling are 1.91%-24.7% over China. This study has revealed the boundary response heterogeneity of rainfall-runoff relationship over China, which is of great significance to the management and optimization of the water environment system. |
| 17:20-17:32 | **E1011:** Stepwise clustering drought projection and multi-level factorial analysis under climate change: a case study of the Pearl River Basin, China<br>**Presenter:** ***Ruixin Duan,*** Beijing Normal University, China<br>**Abstract:** Climate change has significant impacts on the Pearl River Basin (PRB), and the regional ecological environment may face severe challenges in the future due to changes in temperature and precipitation, as well as their derivative disasters (e.g., drought). In this study, the potential changes in temperature, precipitation, and drought conditions were projected through a stepwise clustering projection (SCP) model driven by multiple GCMs under two RCPs. Meanwhile, a multi-level factorial analysis was employed to explore the major contributing factors to the variations in projecting drought conditions. The results suggested that the PRB would suffer significant increasing trends in $T_{mean}$ (i.e., 0.25-0.34℃ per decade under RCP4.5 and 0.42-0.60℃ per decade under RCP8.5), and the annual mean precipitation would increase under both RCPs. The drought events lasting for 1-2 months would be decreased by 7.7%, lasting for 3-4 months would |

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| | be increased by 4.3%, and lasting for more than five months would be increased by 3.4% under RCP4.5, respectively. While they changed to 6.1%, 1.4%, and 4.7% under RCP8.5, respectively. More medium and long-term drought events with higher drought severity would occur. GCM has dominant influences on four different responses of drought duration, accounting for 50.20%, 52.61%, 56.71%, and 56.24% of total variabilities, respectively. Meanwhile, the effects explained by GCM*RCP interactions cannot be neglected. |
| 17:32-17:44 | **E1012:** Stepwise-clustered heatwave downscaling and projection for Guangdong Province<br><br>**Presenter:** ***Jiayan Ren,*** Beijing Normal University, China<br><br>**Abstract:** Increasing attention has been attracted to heatwave events (i.e., HWs) over Guangdong in recent years under changing climate conditions. It is desired to explore the future changes of HWs due to its associated consequences on society economy and environment. In this study, a stepwise-clustered heatwave downscaling approach (i.e., SCHW) was developed for the projection of HWs in Guangdong. The indicators (occurrence, duration, magnitude, intensity, frequency, and accumulated intensity) were investigated based on both the absolute and relative definitions of HWs (i.e., AHWs and RHWs) under two representative concentration pathways (RCPs). The trends (i.e., 0.22 – 0.39 ℃ per decade under RCP4.5 and 0.39 – 0.74 ℃ per decade under RCP8.5) of the projected daily maximum temperature indicate that Guangdong would experience continuous warming in the future. The occurrence, frequency, and accumulated intensity of HWs would increase by 185%, 207%, and 238% in the 2080s (i.e., 2066 – 2095) under RCP8.5 compared to the historical period (i.e., 1976 – 2005), respectively. Moreover, the three indicators of HWs are projected to have more substantial increases over inland Guangdong than its costal parts. The spatial variation of HWs is greater under RCP8.5 than those under RCP4.5. The relative definition of HWs is somewhat more appropriate to exhibit extreme high-temperature events than absolute definition over Guangdong. Hence, the projections of future HWs can help provide valuable information for assessing extreme climate change and identifying desired adaptation strategies. |
| 17:44-17:56 | **E1014:** Investigating future climate changes over China by a high-resolution regional climate model at different resolutions<br><br>**Presenter:** ***Junhong Guo,*** North China Electric Power University, China<br><br>**Abstract:** Previous studies have suggested that dynamical downscaling to global climate models can produce improved climate simulations at regional and local scales. However, the expensive computational requirements of dynamical downscaling inevitably add a limit to the spatial resolution of the resulting regional climate simulations. In order to find a balance between computational requirements and simulation improvements, it is extremely important to investigate how the spatial resolution of regional climate simulation affects the added values of dynamical downscaling; yet, it is still not well understood. Therefore, in this study, we conduct long-term climate simulations for the entire country of China with the PRECIS regional climate model at different spatial resolutions. The purpose is to evaluate whether a fine-resolution model simulation, given its |

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| | considerable requirements for computational resources, would add more valuable information for understanding regional climatology than a coarse-resolution model simulation. |
| 17:56-18:08 | **E306:** How human activities affect water quality: a machine learn-ing approach<br>**Presenter:** ***Catherine Lee,*** Saint Paul Preparatory Seoul, Republic of Korea<br>**Abstract.** We suggest a practical method to figure out how human activities affect water quality. Especially in this COVID-19 era, we witness that water quality is better than ever while human activities are significantly reduced. Many research projects have been conducted in order to analyze the impact of human activity on the surrounding environment in various locations. This reflects that there is a correlation between the two. In order to account for the multiple variables that affect water quality and avoid using instrument variables explicitly, we use machine learning in this research. Those approaches include support vector machine, logistic regression, and deep neural networks and are compared in a view of data structure. Then, we introduce our datasets: human tracking data from mobile phone companies in the U.S. and water quality for water supply and sewerage in the U.S. Our proposed approach begins with implementing machine learnings to classify obtained datasets. Support vector machine and principal component analysis both confirm that dissolved oxygen works as an important water quality measure. Activity tracking data is well fitted to the dissolved oxygen under the deep neural network, which clearly reflects that increased human activity pollutes water supplies. We then find an optimal activity point to reduce water pollution in view of their correlation. |

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