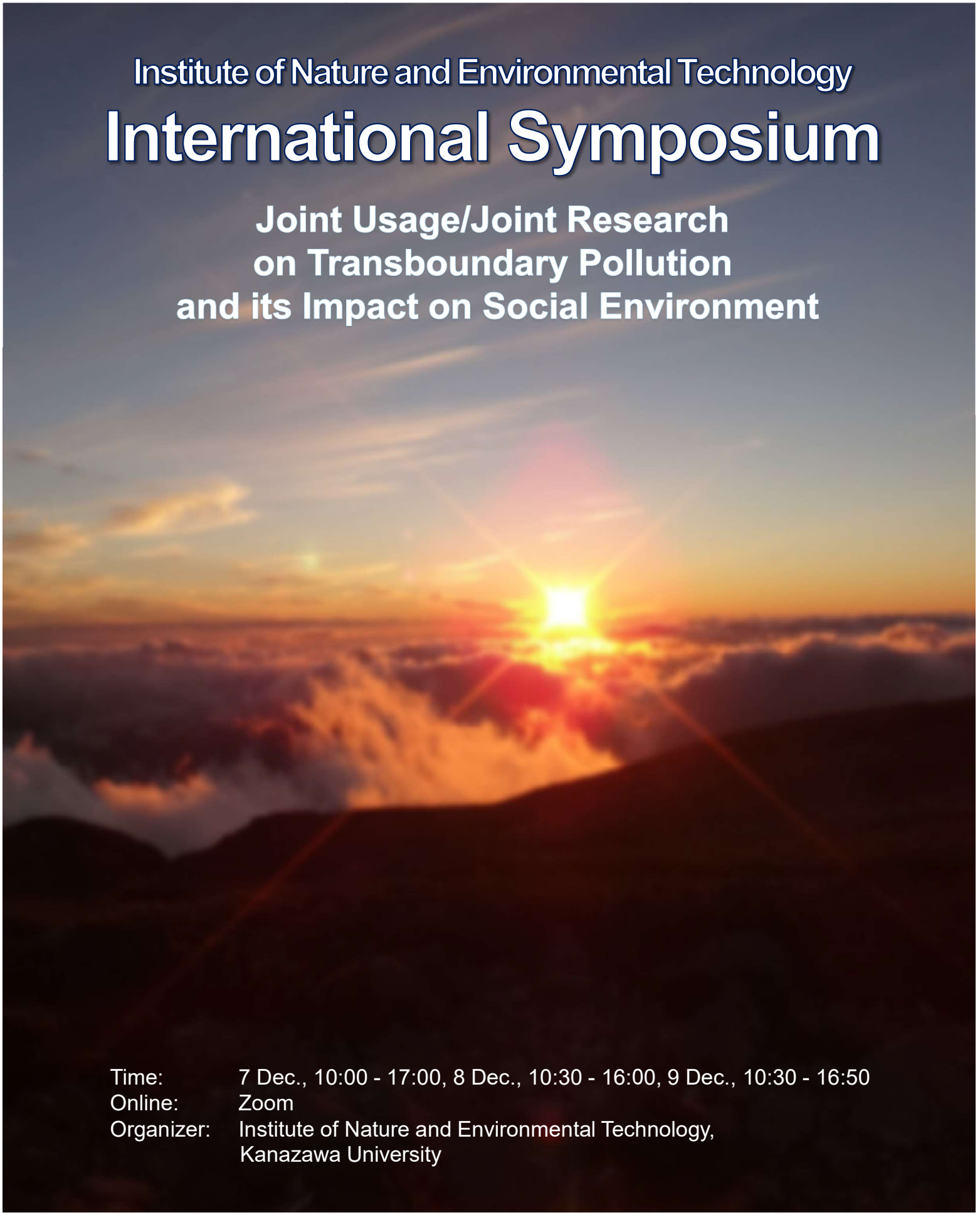
International Online Symposium



Institute of Nature and Environmental Technology

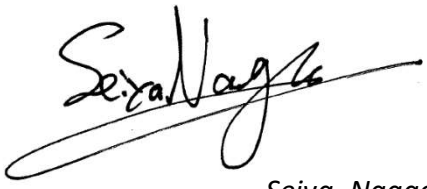
# International Symposium

## Joint Usage/Joint Research on Transboundary Pollution and its Impact on Social Environment

Time: 7 Dec., 10:00 - 17:00, 8 Dec., 10:30 - 16:00, 9 Dec., 10:30 - 16:50
Online: Zoom
Organizer: Institute of Nature and Environmental Technology, Kanazawa University

# *Forward*

The Institute of Nature and Environmental Technology (INET) at Kanazawa University was selected as one of Joint Usage/ Research Centers in Japan from April 2016 to March 2022. The name of the center is “Center of International Study on Environmental Change Caused by Transboundary Pollutants”. Our institute has studied the long-term and short-term environmental changes and their effects on ecosystem and human health in East Asia, especially the Pan-Japan Sea region over the last 30 years. The INET has been continuing the monitoring research in the Pan-Japan Sea region including Noto Peninsula. The INET also has been investigating the migration behavior of pollutants and effects of them on human health and ecosystem based on integrated environmental studies. Nowadays we face to serious problems by the COVID-19 pandemic and the Ukrainian invasion. However, the response data for decreasing economic and industrial activities in East Asia was observed for atmospheric aerosol and surface seawater after the 2020 winter season. These results are determined under the international and national collaborative studies on the basis of research networks organized by the Joint Usage/ Research Centers activities. The INET started the second phase of the Joint Usage/ Research Centers in Japan from April 2022. The project consists of four parts as follows: 1) transect research from north to south for atmosphere and ocean researches, 2) integrated environmental studies for transport and risk assessment of toxic substances to ecosystem and human health, 3) development of young researcher resources with advanced research knowledge, international sensibility, and scientific communication skill, and 4) promotion of international hub for transboundary pollution research. This international symposium is the first symposium of the second phase of Joint Usage/ Research Centers of the INET. We focus on the integrated environmental studies and their impacts on the present social and natural environments to consider the future research direction of the INET and its collaborative studies. I would like to express my thanks to Kanazawa University and the Japanese Ministry of Education, Culture, Sports, Science and Technology.



*Seiya Nagao*

*Director of the Institute of Nature and Environmental Technology*

# Information

# Online(Zoom) Access Information

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# Program

10:00-10:10 Opening remarks *by Prof. Takashi Wada, President of Kanazawa University, Japan*

## Session 1 : Atmospheric Environment

Chair: *Atsushi Matsuki*

10:15-10:35 Pretreatment method with ionic liquid-composite materials for PAHs in environmental samples *by **Ying Li** (Henan Institute of Science and Technology, China), X-N Li, H. Zhang and N. Tang*

10:35-10:55 Missing emissions from Ulaanbaatar, Mongolia: findings using FRIEND observations and an atmospheric chemical transport model *by **Hyung-Min Lee** (Ewha Womans University, South Korea), Eunlak Choi, Yong Pyo Kim, Tseren-Ochir Soyol-Erdene, Barhasragchaa Baldorj, Amgalan Natsagdorj, Zhijun Wu, Mijung Song, Changhyuk Kim, Kyoung-Soon Jang, Kwangyul Lee, Junyoung Ahn, Hye-Jung Shin, Atsushi Matsuki, Ning Tang, Yasuhiro Sadanaga, Shungo Kato, Jung-Hun Woo, Chang Hoon Jung and Ji Yi Lee*

10:55-11:15 Observe unknown OH-reactants and $HO_2$/$RO_2$ uptake by ambient aerosols in a field study as ozone production potential factors *by **Jiaru Li** (Kyoto University, Japan), N. Kohno, Y. Sakamoto, H. G. Pham, K. Murano, K. Sato, T. Nakayama and Y. Kajii*

11:15-11:35 Preliminary study of low-cost air quality sensor deployment on the telecommunication tower *by **Indra Chandra** (Telkom University, Indonesia), L. M. Rachmawati, A. S. Adiwidya, C. D. Sundari, A. Ramadhan and Y. Inomata*

11:35-11:55 Decreased trend of $PM_{2.5}$ and BC observed at central and western Japanese islands and its association with interannual changes in transboundary transport pattern *by **Yayoi Inomata** (Kanazawa University, Japan), A. Matsuki, M. Kajino, Y. Chigira, H. Kaneyasu and T. Seto*

11:55-12:00 **Group Photo Session**

## Session 2: Terrestrial Environment

Chair: *Usio Nisikawa*

14:00-14:20 Anthropogenic disturbance of geological cycle and environmental contamination of arsenic *by **Harue Masuda** (Osaka Metropolitan University, Japan)*

14:20-14:40 Microbial mediated reaction of dimethylarsinic acid in wetland water and sediments *by **So-Jeong Kim** (Korea Institute of Geoscience and Mineral Resources, Republic of Korea), Ji-Hyun Park, In-Hyun Nam, Jungho Ryu, Gi-young Jung, Young-Soo Han*

14:40-15:00 Population model analyses of the combined effects of insecticide use and habitat degradation on the past sharp declines of the dragonfly *Sympetrum frequens by **Takehiko I. Hayashi** (National Institute for Environmental Studies, Japan), Kosuke Nakanishi and Hiroyuki Yokomizo*

15:00-15:20 Monitoring the effects of pollutant exposure leading to diseases: oxidative stress and other health effects biomarkers determination *by **María-Pilar Martínez-Moral** (Biomedical Research Center of La Rioja / University of La Rioja, Spain) and Kurunthachalam Kannan*

15:20-15:40 Seasonal variability and health risk assessment of atmospheric polycyclic aromatic hydrocarbons and their derivatives in Kanazawa, Japan *by **Masato Honda** (Kanazawa University, Japan), Kazuichi Hayakawa, Lulu Zhang, Ning Tang and Hiroyuki Nakamura*

## K-INET Special Webinar I

Chair: *Noriko Hasebe*

16:00-17:00 Aerosols the Arctic: The end of an era of anthropogenic pollution and the emergence of a natural regime? *by **Julia Schmale** (École polytechnique fédérale de Lausanne, Switzerland)*

## K-INET Special Webinar II

Chair: *Sakiko Ishino*

10:30-11:30 Mobility and solubility of trace oxyanions in natural water: Field evidence of conservative behaviors of uranium and molybdenum in high pH solution *by* ***Keisuke Fukushi*** *(Kanazawa University, Japan)*

11:30-11:35 **Group Photo Session**

## Session 3: Poster Presentation

Chair: *Yoichiro Kitani*

13:00-13:50 Flash talks

13:50-14:00 **Group Photo Session**

14:00-16:00 Breakout Room

## K-INET Special Webinar III

Chair: *Nobuo Suzuki*

10:30-11:30 Assessment of Endocrine Disrupting Chemicals and Basic Biology *by* ***Taisen Iguchi*** *(Yokohama City University / Kanazawa University, Japan)*

## Session 4: Marine Environment (Environmental Science and Aquaculture)

Chair: *Toshio Sekiguchi*

13:00-13:20 Marine crustaceans as model species of marine pollution research *by* ***Kenji Toyota*** *(Kanazawa University, Japan)*

13:20-13:40 CULTURED OF SAND GOBY, *Oxyeleotris marmoratus* LARVAE IN CAGE WITH DIFFERENT FOOD *by* ***Thumronk Amornsakun*** *(Prince of Songkla University / Songkhla Inland Fisheries Development and Research Center, Thailand), Wasan Sriwatana and Nobuo Suzuki*

13:40-14:00 A novel ND1 mitochondrial DNA mutation is maternally inherited in growth hormone transgenesis in amago salmon (*Oncorhynchus masou ishikawae*) *by* ***Tsukasa Mori*** *(Nihon University, Japan), Tomohiko Sato, Naoko Goto‑Inoue, Ryuhei Minei and Atsushi Ogura*

14:00-14:20 Is Bandon Bay still supported the natural reproduction of oysters? The assessments of the annual reproductive cycle of farmed *Crassostrea belcheri* in Bandon Bay, Surat Thani Province, Thailand *by* ***Jareeporn Ruangsri*** *(Prince of Songkla University, Thailand), P. Pongtippatee, J. Duangmorakot and Y. Kitani*

14:20-14:40 Activity regulation mechanism of the grouper immune enzyme L-amino acid oxidase *by* ***Yoichiro Kitani*** *(Kanazawa University, Japan)*

14:40-14:45 **Group Photo Session**

## Session 5: Integrated Environment

Chair: *Tetsuya Matsunaka*

15:00-15:20 The impact of global warming on water and nutrient transport from land to the coastal ocean *by* ***Jing Zhang*** *(University of Toyama, Janan)*

15:20-15:40 Water circulation in the Southern Ocean: Implications of $^{226}$Ra and $^{228}$Ra distributions *by* ***Mutsuo Inoue*** *(Kanazawa University, Japan), H. Mitsunushi, K. Mashita, S. Hanaki, H. Kameyama, T. Matsunaka, Y. Kumamoto, Y. Inomata, M. Hayashi and S. Nagao*

15:40-16:00 Oceanic dispersion simulation of radionuclides derived from the Fukushima Daiichi Nuclear Power Station *by* ***Daisuke Tsumune*** *(Central Research Institute of Electric Power Industry, Japan) , T. Tsubono and Kazuhiro Misumi*

16:00-16:20 Ecological roles of airborne transportation of microorganisms in Antarctica *by* ***Stephen D.J. Archer*** *(Auckland University of Technology, New Zealand), Kevin C. Lee, Tancredi Caruso, Teruya Maki, Charles K. Lee, Don A. Cowan, Fernando T. Maestre and Stephen B. Pointing*

16:20-16:40 The Arctic and subpolar North Atlantic circulation: new perspectives from $^{129}$I and $^{236}$U *by* ***Nuria Casacuberta Arola*** *(Eidgenössische Technische Hochschule Zürich, Switzerland), A.-M. Wefing, M. Christl and J. N. Smith*

16:40-16:50 Closing remarks *by Prof. Seiya Nagao, Director of Institute of Nature and Environmental Technology, Kanazawa University, Japan*

# Poster Session

P-01. Study on osmoregulatory function in larvae of red-clawed crab *by* ***Ryoya Kawamura*** *(Kanazawa University), Miyuki Mekuchi, Kenji Toyota, Shouzo Ogiso, Yukina Watabe, Arata Nagami, Yusuke Maruyama, Atsuhiko Hattori, Seiji Yanai, Jun Hirayama, Hajime Matsubara and Nobuo Suzuki*

P-02. *Vibrio* sp. strain MA3 involves for the mass mortality of the summer in the pearl oyster, *Pinctada fucata by* ***Hatano Kaito*** *(Kanazawa University), Sakatoku Akihiro, Tanaka Daisuke, Tanaka Shoki, Isshiki Tadashi and Suzuki Nobuo*

P-03. Calcitonin I and II possible involvement of calcium metabolism in the female reproductive physiology of goldfish (Carassius auratus) *by* ***Kohei Kuroda*** *(Kanazawa University), Kaito Hatano, Ryoya Kawamura, Ayaka Fukushima, Yuichi Sasayama, Yoshiaki Tabuchi, Yukihiro Furusawa, Mika Ikegame, Atsuhiko Hattori, Jun Hirayama, Hajime Matsubara, Umi Kawago, Toshio Sekiguchi, Ajai K. Srivastav and Nobuo Suzuki*

P-04. Gonadal sexual plasticity in tiger puffer *Takifugu rubripes by* ***Masahiro Nakade*** *(Kanazawa University), Muhammad Ahya Rafiuddin, Hiroshi Kobayashi, Shoichi Kobayshi, Kazuhiro Sakai, Keisuke Inada, Atsushi Shigematsu, Arata Nagami, Shozo Ogiso, Kenji Toyota, Yoshiaki Tabuchi, Yukihiro Furusawa, Jun Hirayama, Tatsuro Harumi, Nobuo Suzuki and Hajime Matsubara*

P-05. Reproductive behavior of mature tiger puffer Takifugu rubripes in Noto, Japan *by* ***Shoichi Kobayshi*** *(Kanazawa University), Muhammad Ahya Rafiuddin, Masahiro Nakade, Hiroshi Kobayashi, Kazuhiro Sakai, Keisuke Inada, Atsushi Shigematsu, Arata Nagami, Shozo Ogiso, Kenji Toyota, Yoshiaki Tabuchi, Yukihiro Furusawa, Jun Hirayama, Nobuo Suzuki and Hajime Matsubara*

P-06. Effect of environmental factors on the embryonic development of the rosy seabass Doederleinia berycoides *by* ***Muhammad Ahya Rafiuddin*** *(Kanazawa University), Kazuhiro Sakai, Shoichi Kobayshi, Atsushi Shigematsu, Masahiro Nakade, Keisuke Inada, Hiroshi Kobayashi, Arata Nagami, Shozo Ogiso, Kenji Toyota, Yoshiaki Tabuchi, Yukihiro Furusawa, Jun Hirayama, Nobuo Suzuki and Hajime Matsubara*

P-07. Physiological and ecological study of infaunal marine invertebrates living in the coast of Noto Peninsula *by* ***Shouzo Ogiso*** *(Kanazawa University), Kazuki Watanabe, Hiroshi Miyake, Yusuke Maruyama, Jun Hirayama, Atsuhiko Hattori, Yukina Watabe and Nobuo Suzuki*

P-08. Material transport from land to deep ocean via the Toyama Deep-sea Channel using heavy metals and Carbon-Nitrogen isotopic ratios *by* ***Shinpei Otsuka*** *(University of Toyama),* Jing Zhang, Keiji Horikawa, Tomoharu Senjyu, Kenichi Yasue, Sota Hoshina and Itaru Aizawa

P-09. Seasonal characteristics of organic compounds in $PM_{2.5}$ at Noto site in Northeast Asia *by* ***Minami Kondo*** *(Ewha Womans University),* Zihui Teng, Ayoon Sim, KiAe Kim, Atsushi Matsuki and JiYi Lee

P-10. Characteristics and influencing factors of residential polycyclic aromatic hydrocarbons in Kanazawa, Japan *by* ***Xuan Zhang*** *(Kanazawa University),* Hao Zhang, Yan Wang, Pengchu Bai, Lulu Zhang, Masato Honda, Yongjie Wei and Ning Tang

P-11. Long-term effects of implementing air pollution control policies in Shenyang on the atmospheric polycyclic aromatic hydrocarbons (PAHs) and Nitro-PAHs *by* ***Hao Zhang*** *(Kanazawa University),* Xuan Zhang, Yan Wang, Pengchu Bai, Lulu zhang, Ming Hu, Chong Han, Qimin Wang, Zhuolun Sun, Yunping Cai, Lijiang Chen, Seiya Nagao and Ning Tang

P-12. Distribution, sources, and potential health risks of $PM_{2.5}$-bound airborne polycyclic aromatic hydrocarbons and nitro-polycyclic aromatic hydrocarbons in Singapore *by* ***Yan Wang*** *(Kanazawa University),* Hao Zhang, Xuan Zhang, Pengchu Bai, Lulu Zhang, Sim Joo Huang, Stephen Brian Pointing, Seiya Nagao, Bin Chen, Akira Toriba and Ning Tang

P-13. Long-term observation of aerosol chemical components at a Japanese background site, Wajima: Impact of the energy system transformation in China *by* ***Pengchu Bai*** *(Kanazawa University),* Hao Zhang, Xuan Zhang, Yan Wang, Lulu Zhang, Seiya Nagao and Ning Tang

P-15. A Study on the Change of air pollutants by emission Sector according to the Carbon Neutralization Policy of Northeast Asian Countries I: South Korea, Japan, and Russia *by* ***Ilyeo Park*** *(Ewha Womans University)* and Hyung-Min Lee

P-16. A Study on the Change of air pollutants by emission Sector according to the Carbon Neutralization Policy of Northeast Asian Countries II: China, Mongolia, and North Korea *by* ***Bomin Sohn*** *(Ewha Womans University)* and Hyung-Min Lee

P-17. Basement rock thermochronology and sedimentary basin analyses ppoossin the Mongolia Gobi Altai Mountains *by* ***Shi Zhe*** *(Kanazawa University),* Noriko Hasebe, Uyangaa Udaanjargal, Shuukhaaz Ganbat and Davaadorj Davaasuren

P-18. Sources and fate of cationic surfactants in the environment *by* ***Yao Dingwen*** *(Kanazawa University)* and Seiya Hanamoto

P-19. The petrological evolution of island arc structure: Amphibole-rich Ultramafic Rock from the Nishidohira Formation of the Abukuma belt *by* ***Akira Wakazono*** *(Kanazawa University),* Tomoaki Morishita, Akihiro Tamura and Keita Itano

P-20. Smart building management system *by* ***Chen Long*** *(Kanazawa University)* and Zhenjiang Shen

P-21. Molecular functional analysis of a pollutant sensor, aryl hydrocarbon receptor in a marine animal, *Ciona intestinalis* type A *by* ***Takayoshi Sakai*** *(Kanazawa University),* Takashi Yazawa, Togo Ikuta, Satoshi Nakayama, Nobuo Suzuki, Kazuichi Hayakawa, Michio Ogasawara, Shuichi Wada and Toshio Sekiguchi

P-22. Taxonomy of fossil gastropods from an Early Cretaceous hydrocarbon seep: Focus on Provannidae (Gastropoda: Abyssochrysoidea) *by* ***Haruka Fukaki*** *(Kanazawa University),* Robert Jenkins and Kenji Kashiwagi

P-23. Fabrication of fixed Z-scheme Ag|AgBr/Ag/$TiO_2$ nanocomposite film photocatalytic system for malachite green degradation with simultaneous hydrogen production *by* ***Jize Liu*** *(Liaoning University),* Hongfeng Yao, Yuqing Jia and Zhaohong Zhang

P-24. Construction of dual Z-scheme composite photocatalyst and its application in photocatalytic degradation of antibiotics *by* ***Hongfeng Yao*** *(Liaoning University),* Jize Liu, Honglu Zhang and Zhaohong Zhang

P-25. Aircraft observation of Ice Nucleating Particles over low latitude of the United States *by* ***Masayuki Toda*** *(Kanazawa University),* Ayumi Iwata, Narihiro Orikasa, Masataka Murakami and Atsushi Matsuki

P-26. Size-resolved seasonal variation of sea spray aerosol in the Noto Peninsula *by* ***Ayano Matsumoto*** *(Kanazawa University),* Daisi Onizuka , Masami Furuuchi, Mitsuhiko Hata, Yayoi Inomata, Naoto Sasaki, Koichi Watanabe and Atsushi Matsuki

P-27. Fabrication of a novel S-scheme CuS/$BaWO_4$ heterojunction and its sonocatalytic degradation of bisphenol A in aqueous environment *by* ***Yang-Cheng Liu*** *(Liaoning University),* Xuan Liu, Gui-Hong Zhang, Wei Liu, Jia-Qi Wang, Xin Wang, Chang-Lan Chen, Yang Wang and Zheng Xiang

P-28. Temporal and lateral variations of $^{7}$Be depositions in Hokuriku, Japan *by* ***Keisuke Yoshida*** *(Kanazawa University), Shingo Kato, Kengo Uchida, Masahiro Yamashita, Shinichi Okuyama and Mutsuo Inoue*

# Abstracts

# Session 1

## Atmospheric Environment

# Pretreatment method with ionic liquid-composite materials for PAHs in environmental samples

Y. Li[1], X-N Li[1], H. Zhang[2], N. Tang[3]

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As one of the major problems affecting human health, air pollution, such as that related to particulate matter (PM), has received increasing attention. Prolonged exposure to PM has been linked to a risk of both acute and chronic effects. Polycyclic aromatic hydrocarbons (PAHs) and their nitro-derivatives (NPAHs) are some of the most harmful components in PM and are mainly formed via the incomplete combustion fossil fuels and biomass. Both PAHs and NPAHs are harmful, persistent organic pollutants diffusely disseminated in the environmental samples. However, because of their extremely low concentration in environment and the complexity of matrix, high efficiency sample pretreatment methods are needed before analysis [1].

Fine particulate matter ($PM_{2.5}$) samples were collected in the summer and winter of 2015 and 2017 in Xinxiang, China. Nine PAHs and three NPAHs in $PM_{2.5}$ were detected via high-performance liquid chromatography (HPLC). The results of this study demonstrate that the decreases in PAHs and NPAHs concentrations from 2015 to 2017. Combined with reducing gaseous pollutants concentration, the reduction in this study might be attributable to emissions reductions by implementing the air pollution control regulations in Xinxiang city in 2016.

Ionic liquids, which can be tuned by choosing of the cations and anions independently, exhibited unique physicochemical properties, such as tunable miscibility with water and organic solvents, and have potential applications as electrolyte materials, green solvents, catalysts, and separation mediums. Magnetic nanoparticles (MNPs) have potential application for material science and biomedicine because of their unique superparamagnetism and large surface area. Covalent organic frameworks (COFs) are a kind of ordered porous crystalline material with large specific surface area, high porosity, good chemical stability and large conjugated structure, which were widely used in the fields of adsorption, catalysis, electrochemistry and gas separation. The composite materials based on ionic liquids, were proposed for effective and selective pretreatment of PAHs in environmental water samples.

**Table 1.** The mean concentration and the standard deviation of polycyclic aromatic hydrocarbons (PAH) and three nitro-PAHs (NPAH) in fine particulate matter ($PM_{2.5}$) for 2015 to 2017.

| Species | Ring numbers | 2015 | | 2017 | |
|---|---|---|---|---|---|
| | | Summer | Winter | Summer | Winter |
| | | PAHs (ng/m$^3$) | | | |
| FR | 4 | 0.88 ± 0.13 | 19.8 ± 18.5 | 0.46 ± 0.17 | 11.7 ± 10.9 |
| Pyr | 4 | 1.41 ± 0.29 | 15.2 ± 12.4 | 0.36 ± 0.12 | 7.01 ± 6.46 |
| BaA | 4 | 0.28 ± 0.06 | 9.76 ± 8.36 | 0.27 ± 0.17 | 4.31 ± 3.70 |
| Chr | 4 | 0.48 ± 0.12 | 10.3 ± 6.87 | 0.55 ± 0.24 | 5.33 ± 4.12 |
| BbF | 5 | 1.31 ± 0.35 | 14.9 ± 9.31 | 1.09 ± 0.67 | 7.93 ± 7.07 |
| BkF | 5 | 0.29 ± 0.09 | 4.85 ± 2.95 | 0.29 ± 0.23 | 2.44 ± 2.25 |
| BaP | 5 | 0.38 ± 0.08 | 6.16 ± 3.24 | 0.47 ± 0.33 | 3.18 ± 2.68 |
| BgPe | 6 | 0.80 ± 0.20 | 8.70 ± 4.88 | 0.77 ± 0.43 | 4.35 ± 3.58 |
| IDP | 6 | 0.54 ± 0.12 | 7.27 ± 3.76 | 0.63 ± 0.37 | 3.49 ± 2.84 |
| ΣPAHs | | 6.37 ± 1.30 | 96.9 ± 69.9 | 4.89 ± 2.67 | 49.8 ± 43.4 |

[1] Konieczka P, Wolska L, Namieśnik J. Quality problems in determination of organic compounds in environmental samples, such as PAHs and PCBs[J]. Trac Trends in Analytical Chemistry, 2010, 29(7):706-717.

# Missing emissions from Ulaanbaatar, Mongolia: findings using FRIEND observations and an atmospheric chemical transport model

Hyung-Min Lee[1], Eunlak Choi[1], Yong Pyo Kim[2], Tseren-Ochir Soyol-Erdene[3], Barhasragchaa Baldorj[4], Amgalan Natsagdorj[5], Zhijun Wu[6], Mijung Song[7,8], Changhyuk Kim[9], Kyoung-Soon Jang[10], Kwangyul Lee[11], Junyoung Ahn[11], Hye-Jung Shin[11], Atsushi Matsuki[12], Ning Tang[12], Yasuhiro Sadanaga[13], Shungo Kato[14], Jung-Hun Woo[15], Chang Hoon Jung[16], and Ji Yi Lee[1,*]

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## Description of the measurement site

Ulaanbaatar (UB) is known to its world's worst level of particulate matter (PM) concentrations during winter due to the combination of favorable weather and anthropogenic emissions. However, there are no emission inventories established at national level or modeling studies to diagnose causes and effects of the high PM in UB. Ground observations made from the first term of Fine Particle Research Initiative in East Asia considering National Differences (FRIEND) project during 2020-21 winter at five sites in Northeast Asia showed several times higher concentrations of PM components in UB compared to other sites. But such high concentrations are not reproduced with a state-of-the-science 3D chemical transport model, GEOS-Chem, mainly due to the low bias in the latest global emission inventory, CEDS.

## Estimation of anthropogenic emissions

we estimate anthropogenic emission rates of CO, NO, $SO_2$, $NH_3$, OC, and EC using the ground observation of CO, $NO_x$, $SO_2$, OC, EC, $SO_4^{2-}$, $NO_3^-$, and $NH_4^+$ from the FRIEND project. The estimates are compared with the latest regional inventories over Asia (KORUSv5 and REASv3.2). Then the impact of the estimated emissions of UB on other sites for the whole period, and high pollution episodes identified from previous study are investigated. It has been found that reproducing observations using GEOS-Chem requires increasing emissions rates of current CEDS inventory from at least 5.2 times ($SO_2$) to up to 74 times (CO) in UB. And the adjusted emissions can effectively increase OC, $NO_3^-$, and $NH_4^+$ concentrations in Beijing among other sites when the Gobi dust affects to downwind regions.

[1] B. Batsuuri et al., Estimating the Impact of Urban Planning Concepts on Reducing the Urban Sprawl of Ulaanbaatar City Using Certain Spatial Indicators. *Land* , **9**, 495 (2020)

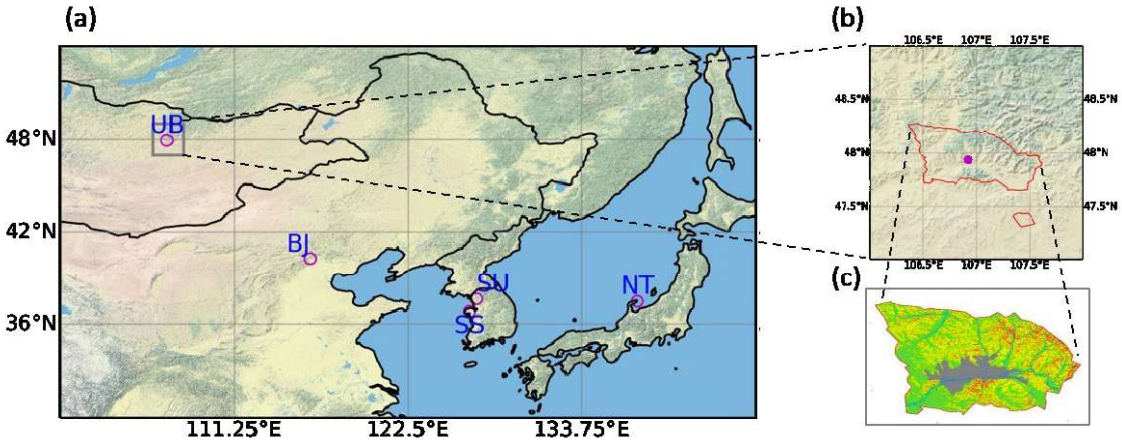


Fig. 1. (a) Map of five observation sites of the FRIEND project (UB: Ulaanbaatar, BJ: Beijing, SS: Seosan, SU: Seoul, NT: Noto). (b) Administrative boundary of UB outlined with red lines and a red dot denoting UB observation site, and (c) the figure from [1] where grey shade indicates area suitable for settlement in UB.

# Observe unknown OH-reactants and $HO_2$/$RO_2$ uptake by ambient aerosols in a field study as ozone production potential factors

J. Li[1,2], N. Kohno[3], Y. Sakamoto[1,2], H. G. Pham[1], K. Murano[1], K. Sato[2], T. Nakayama[4], and Y. Kajii[1,2],

[1] *Kyoto University, Kyoto 606-8501, JP;* [2]*National Institute for Environmental Studies, Ibaraki 305-8506, JP;* [3]*Kindai University, Osaka 577-8502, JP;* [4]*Nagasaki University, Nagasaki 852-8521, JP*

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## Background and objectives of the field study

Surface ozone is one of the major air pollutants that threats vegetation, human beings, and the ecosystem. However, its production mechanism is not well understood because ozone has non-linear relationship with its precursors (NOx and VOCs) and is the by-products of HOx (≡OH+$HO_2$+$RO_2$) cycling reactions. Moreover, ozone anomaly has been observed with the reduction of anthropogenic emissions in surface and pristine upper layers. Therefore, the exploration of ozone production procedure considering HOx chemistry would be important, especially in places expected with reduced anthropogenic emissions. Also, it is postulated that heterogeneous radical loss pathway could contribute to ozone production negatively because aerosols kill radicals which were supposed to oxidize NO to $NO_2$ for further ozone production. Therefore, this study aims to observe total OH reactivity (as the loading of VOCs), quantify OH-reactants (mostly short-lived trace species), and detect the loss rate of $HO_2$ and $RO_2$ radicals by aerosol uptake in a clean site to figure out the mystery of ozone production, which is supposed to shed light on future ozone mitigation actions.

## Results and discussion

We conducted intensive observations in Kyoto University in September, 2020, expecting reduced anthropogenic emissions during the coronavirus disease (COVID-19) pandemic. Unknown OH-reactants derived reactivity accounts for 40.5% of the total OH reactivity, which showed potential contributions from natural emissions based on the spatial distribution analysis. Those unknown OH-reactants could increase potential ozone production by a factor of 2.5 on average. On the other hand, real-time heterogeneous $HO_2$ and isoprene-derived $RO_2$ loss by ambient aerosols was measured for the first time, which showed identical negative impacts on ozone production potential, and the reduction is pronounced under low NO/NOx conditions. Both $HO_2$ and $RO_2$ loss rate by aerosol uptake could convert VOC-limited to NOx-limited regime, and the transition regime was found to change with the heterogeneous radical loss. The omission of heterogeneous radical loss could cause overestimate of VOC-limited regime. Findings established by the current study are only representative for our campaign, and it may not suit other places/seasons. For a detailed expression of this work, please refer to our publication [1].

[1] J. Li et al., Potential factors contributing to ozone production in AQUAS-Kyoto campaign in summer 2020: natural source-related missing OH reactivity and heterogeneous $HO_2$/$RO_2$ loss, *Environ. Sci. Technol.*, 56, 12926–12936 (2022).

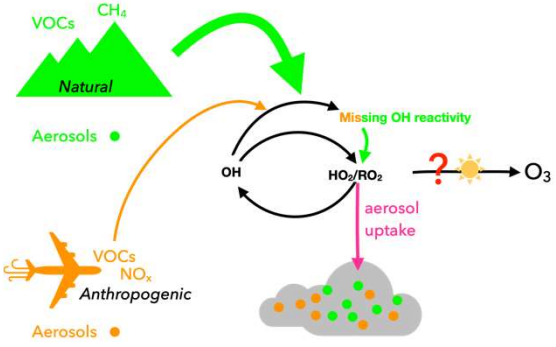


Fig. 1 Graphical abstract of this study [1].

# Preliminary study of low-cost air quality sensor deployment on the telecommunication tower

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## Potential measurement site

Urban air pollution in developing countries has many challenges, i.e., coverage area, geographical features, limited budget, security, and other technical aspects. These opportunities can have solutions, in short, that is using existing infrastructure such as telecommunication towers as a medium to place the air quality monitoring system (AQMS). More than 30 thousand towers are installed around Indonesia through one telco infrastructure company, of which 11% are in West Java. It spreads from low to high altitudes and from very polluted regions to the background air quality. All the problems including security might be solved through this solution, but the next issue is the electrical power to operate the AQMS. Two ways to address this situation are using the electrical generator on the site or utilizing solar panels (or any renewable energy provided near stations).

The density of towers as well as measurement sites will improve data availability. Low-cost sensors (LCS), then, have been added to the air quality monitoring system (LC-AQMS) [1]. The measuring station is equipped with a measuring chamber, wifi modem, and a power supply. Measurements are performed in a stainless steel-based measuring chamber which can be conditioned using temperature and relative humidity control so that sensor readings influenced by external factors are minimized. Measurements were made using sensors capable of measuring six pollutant parameters, namely $PM_{2.5}$, $CO_2$, $O_3$, $CH_4$, $SO_2$, and $HCl$. Apart from that, for pollutant data to be validated and analyzed, there are also six meteorological parameters, namely temperature ($T$), relative humidity ($RH$), air pressure ($P$), wind speed ($WS$), wind direction ($WD$), and solar radiation ($I$). Data from the sensor is then sent to the website using Arduino Uno-WIFI and a datalogger is also available as a data backup. On the web, sensor data is displayed on a daily, weekly, and monthly basis. Then there is a dashboard to observe the status of each station and the availability of data sent

## Low-cost air quality monitoring system (LC-AQMS)

To provide good quality air pollution data, LCS is calibrated beforehand by comparing the low-cost sensor reading with the reference instrument inside a vacuum chamber until the data measurement of low-cost sensors is shown good linearity compared to the reference instrument data. The limitation of the low-cost sensor itself, such as the stability issue, could be handled by applying a validation system to the LC-AQMS. Thus, AIoT (Artificial Intelligence of Things) plays an important role. The validation system is built into the hardware as the pre-validation stage, including the outlier detection and correction factor from the long-term observation research. Furthermore, data prediction/forecasting and interpolation using machine learning could fulfill the gap of information caused by the reading fault or forecast air pollution in the subsequent time.

The result of measurement will be sent via the IoT platform in real-time and then the data is collected to the website that has been created. The website includes information regarding visualization of monitoring data that has been validated at each station, data predictions, and an early warning system that functions to provide warnings via email, WhatsApp, or SMS when a parameter in an area has exceeded the set quality standards.

With the addition of $O_3$-$CH_4$ (case study A) and $SO_2$-HCl (B) measurement parameters based on low-cost sensors, the system might be can identify pollutant parameters that cause the greenhouse gas effect starting from the pattern to predict its concentrations using existing data (A) and can identify pollutants from the sea that move far (long-range transport) from the ocean to the land which causes marine aerosol deposition and is corrosive to metals.

[1] Chandra et al (2021), Chapter 15 - Utilization of microsensors for air quality monitoring system. Doi: 10.1016/B978-0-12-822121-1.00015-1

# Decreased trend of $PM_{2.5}$ and BC observed at central and western Japanese islands and its association with interannual changes in transboundary transport pattern

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## Abstract

Northeast Asia is one of the largest emissions of anthropogenic trace gas and aerosols in the world. It is well known that large amount to anthropogenic materials is emitted from the Asia and transboundary transport to the downwind region under the westerly condition.

Long-term observation of $PM_{2.5}$ and BC concentrations were conducted in the remote monitoring stations, Noto (Suzu city, 37.45ºN, 137.36ºE) and Fukue (Nagasaki, Goto, 32.8°N, 128.7°E), in Japan. Because of less anthropogenic local emission, the Noto as well as Fukue stations are considered as the suitable site to investigate the transboundary transport of air pollution emitted from the Asian Continent in the western part of Japan and coastal site of the Japan Sea. In the Noto station, $PM_{2.5}$ (TEOM 1400, Thermo) has been measured since February 2013. BC concentrations (MAAP 5012, Thermo) has been measured since June 2010. The time resolution of $PM_{2.5}$ and BC concentrations data was 30 min, respectively. The 1 HR average data was used in this study. In the case of Fukue station, mass concentrations of $PM_{2.5}$ were used in the database monitored by the Ministry Of Environment Japan (MOEJ) as Atmospheric Environmental Regional Observation System. The time resolution of $PM_{2.5}$ concentrations data were 1 HR interval.

In this study, interannual trend of $PM_{2.5}$ and BC in Noto and Fukue were investigated by using the statistical trend analysis and chemical transport model, Regional Air Quality Model 2 (RAQM2ver3).

The temporal variations of monthly averaged [$PM_{2.5}$] concentrations in Noto and Fukue are characterized as clear seasonal variation with higher in spring and lower in winter. The total reduction of monthly averaged [$PM_{2.5}$] concentrations from 2013 to 2019 in Fukue are estimated to be 3.8 $\mu gm^{-3}$. This account for 24% (4%$yr^{-1}$) of reduction. In the case of Noto, the total reduction of monthly averaged [$PM_{2.5}$] from 2013 to 2019 are 7.5 $\mu gm^{-3}$, which account for 48% (9.5% $yr^{-1}$) reduction. The total reduction rate of monthly averaged [$PM_{2.5}$] in Noto is almost two times larger than those in Fukue. Monthly averaged [BC] concentrations in Noto decrease from 2010 to 2019 with clear seasonal variations, in which higher in spring (March-April) and lower in summer (August). Total reduction of BC in Noto from 2013 to 2019 were estimated to be 0.13±0.1 $\mu gm^{-3}$, and the reduction account for 32 %.

Results with the source-receptor analysis by chemical transport model suggest that decrease of $PM_{2.5}$ and BC concentrations in Fukue and Noto is strongly influenced by decrease of transported amount from the central China (30-40°N), northern China(>40°N) and Japan (its own country) after 2015/2016. The ratios of $PM_{2.5}$/BC in Noto indicate that secondary production of $PM_{2.5}$ occurs during the transboundary transport and the contribution in summer is larger than those in winter.

# Session 2

## Terrestrial Environment

# Anthropogenic disturbance of geological cycle and environmental contamination of arsenic

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## Introduction

Arsenic contaminated groundwater was first attracted attention in the middle 1983 when arsenicosis was reported in the West Bengal, India. Since then, arsenic contaminated groundwater has been known as a case of world-wide phenomenon caused by natural sources. More than a few tens of millions poisoning patients by arsenic are estimated in the world until now. The arsenic contamination in the hydrosphere would be extended in relation to the anthropogenic activities especially increasing uptake of groundwater. The geologic cycle of arsenic and anthropogenic disturbance to cause groundwater contamination are introduced in this report.

## Geologic cycle of arsenic

Arsenic is a minor but ubiquitous element in the Earth's crust. Arsenic is one of the elements actively migrating in association with regional tectonics such as magmatic activities, orogeny, erosion and so on. The arsenic is a siderophile and/or chalcophile element in the solid Earth, while behaves as toxic water-soluble phases such as arsenate and arsenite in the hydrosphere. Primary source of arsenic is in the interior Earth and migrates to the shallow crust and surface of the Earth in association with magmatic fluids. Arsenide and sulfide minerals are the primary arsenic-bearing minerals, occasionally found in ore deposits. Hydrothermal fluids, especially containing magmatic water, directly transport arsenic as mostly arsenite on the surface. Volcanic ash also transports the arsenic onto the surface soils and sediments. Silicates or carbonates can be sources of arsenic. Although the concentrations of arsenic in the silicates, carbonates and volcanic ash are commonly low compared with those of arsenides and sulfides, those would be important sources of arsenic in the surface and shallow ground waters since those minerals release this element via chemical weathering, i. e., oxidation-dissolution in the surface water and shallow groundwater environments.

## Occurrence of arsenic contamination and anthropogenic effects

Arsenic contaminated areas typically occur in relation to the three different types of sources: sulfide ore deposits, hydrothermal fluids, and Neogene sedimentary formations. Since the solubilities of sulfide minerals are commonly low, sulfide ore deposits do not cause serious contamination without mining. However, excavation of ore deposits and smelting can extend the contamination through waste water, soils and atmosphere. High temperature hydrothermal fluids, especially magmatic water in association with volcanic activity, cause serious contamination of water and soils of the watershed. Also, development of geothermal power plants can cause outflow of highly arsenic contaminated hydrothermal waters into the surrounding aquifers.

Aquifers in the Neogene sediments are the most widely contaminated reservoir by arsenic. Anoxic aquifers are more seriously contaminated than oxic aquifers, while the contaminated oxic aquifers are more widely distributed than the others. Arsenic has been believed to release via desorption-dissolution of arsenic-adsorbing iron-oxyhydroxides through reduction of aquifers. Chemical weathering of volcanic ash and arsenic-bearing silicate minerals would release arsenic into the oxic aquifers. In both cases, excess uptake of groundwater must play an important role of arsenic dissolution into the aquifer via induced recharge of surface water to promote accelerating reaction rate between water and host phase minerals and organic matters. Extending arsenic contaminated groundwater and the resulting arsenicosis must increase with increasing demand of groundwater.

Naturally occurring arsenic contamination is one of the examples of interaction between anthropogenic activity and natural material cycle to cause an environmental disaster.

# Microbial mediated reaction of dimethylarsinic acid in wetland water and sediments

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The biogeochemical reactions of dimethylarsinic acid (DMAs(V)) were investigated using simulated wetland systems in a laboratory. DMAs(V) was injected into the wetland water, and the As concentrations in the water, plants, and sediments were monitored. Aqueous and solid-phase As speciation was evaluated, and the results revealed that the DMAs(V) was completely transported to the sediments and plants. X-ray absorption spectroscopic measurement of the As in the sediment revealed that approximately 85-95% of As existed as inorganic As species, demonstrating the important role of microorganisms in the biogeochemical reaction of DMAs(V). The influences of microbes were further investigated in smaller batches under aerobic and anaerobic conditions. The microbial batch results showed that DMAs(V) demethylation reduced the total aqueous As concentration, demonstrating that As(V) has higher affinity to wetland sediment than DMAs(V). The redox conditions were also revealed as an important controlling factor of the As reaction and, under anaerobic conditions, we observed the presence of the most toxic form of inorganic As(III) in the aqueous phase. Although this study reports one example from a specific wetland, the important roles of the redox conditions and microbial influences were identified from the comprehensive analysis of As speciation and mass balance.

# Population model analyses of the combined effects of insecticide use and habitat degradation on the past sharp declines of the dragonfly *Sympetrum frequens*.

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Over the past few decades, many dragonflies have become endangered. For example, *Sympetrum frequens*, one of the most common dragonflies in Japanese rice paddies, has experienced a sharp decline in populations in many areas since around the late 1990s. Previous studies considered systemic insecticides (especially fipronil) to be the leading cause of the decline but did not examine agricultural factors other than insecticide use or the combined effects of the two. In this study, we constructed a population model of *S. frequens* using agricultural land intensification rate, midsummer drainage, crop rotation/abandoned paddy field area, insecticide use, and summer temperature as survival parameters and analyzed the effects of each factor on population dynamics through numerical simulation [1].

As a result, our population model was able to reproduce the past rapid population declines of dragonflies in the three regions. Numerical simulations with hypothetical parameters showed that the use of systemic insecticides was not necessarily a sufficient cause since the sharp population declines did not occur when agricultural land intensification rates remained at low levels (before the 1980s). On the other hand, the use of highly toxic insecticides was suggested to be a necessary condition for the rapid population decline since the population decline did not occur at toxicity levels lower than those used (Fig. 1). In summary, the results suggest that the rapid population decline of *S. frequens* in the late 1990s was due to the combined effects of insecticide use and agricultural land clearance, which converted paddy fields to well-drained rice paddies. Dragonfly conservation plans should consider the combined effects of habitat degradation and insecticide use.

[1] K. Nakanishi et al., Population model analyses of the combined effects of insecticide use and habitat degradation on the past sharp declines of the dragonfly *Sympetrum frequens*, *Sci. Total. Env.*, 787, 142526 (2021) https://doi.org/10.1016/j.scitotenv.2021.147526

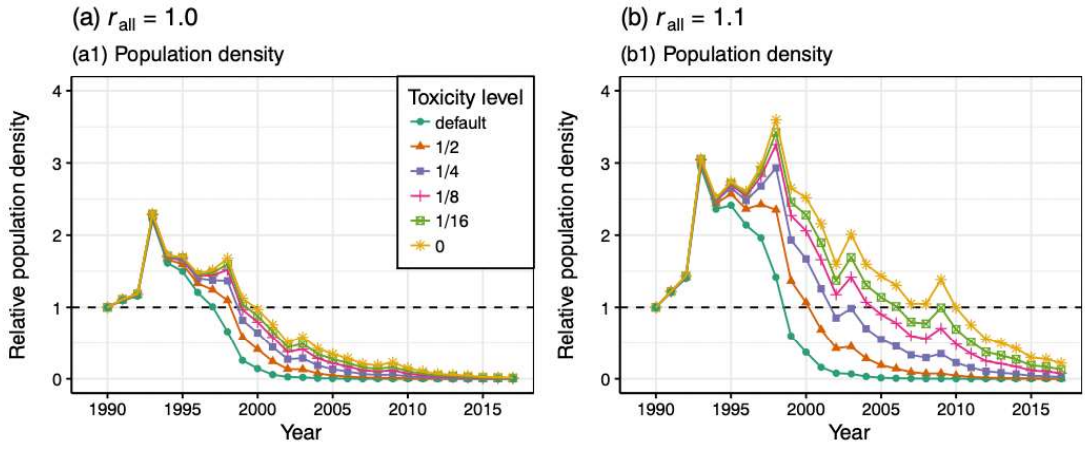


Fig. 1 Simulated dynamics of relative population density of *Sympetrum frequens* in Toyama Prefecture assuming the effective population growth rate in 1990 was (a) 1.0 and (b) 1.1. Population densities were calculated using the default levels and carious toxicity level of the insecticides below the default level.

# Monitoring the effects of pollutant exposure leading to diseases: oxidative stress and other health effects biomarkers determination

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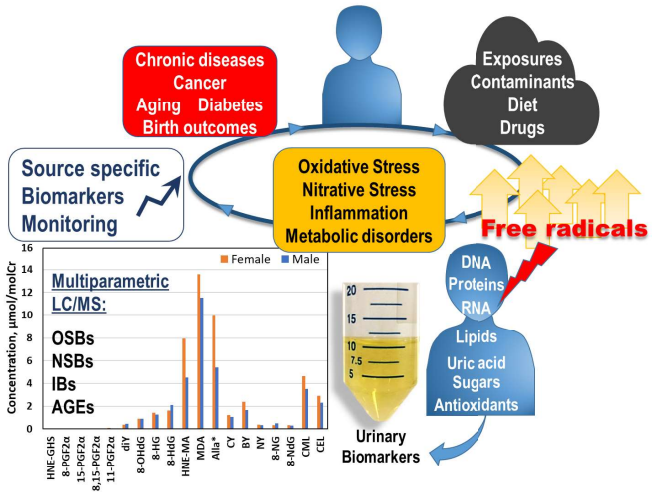
It is well known that the exposure to contaminants like air pollutants, organic contaminants or metals is responsible for population health deterioration, leading to diseases. However, the events that happen in the organism after the exposure and that lead to the health outcome remain not fully understood.

It has been evidenced that oxidative/nitrative stress, that takes place after an increase of the levels of reactive species (reactive oxygen species (ROS) and reactive nitrogen species (RNS)), plays a role in the development of diseases. It has been also observed that endocrine disruption or inflammation are also health effects produced by pollution. All those health effects may occur simultaneously, but there is a lack of studies following a multivariate approach in order to study the interaction between them and with the disease of interest.

When the levels of reactive species are increased above the antioxidant capacity of the organism those free radicals react with lipids, proteins and DNA besides antioxidants. Those reactions produce a panel of biomarkers that can be detected in urine to give multisource indicators of oxidative stress and nitrative stress. There are also urinary biomarkers which levels are directly related with eosinophilia and neutrophilia and give information about the inflammation status. Lastly, the advanced glycation end products (AGEs) are biomarkers related with metabolic alterations. In this work, we present a method for the determination of a set of 19 urinary biomarkers selected to show the oxidative stress, inflammation and metabolic status of the organisms; and that may be used to study the routes leading to disease after the exposure to contaminants.




[1] M.P. Martinez-Moral & K. Kannan. Anal. Bioanal. Chem. 414, pp 2103–2116 (2022)
[2] M.P. Martínez-Moral & K. Kannan. Environ. Sci. Technol. Lett., 6, pp 283–288 (2019)

# Seasonal variability and health risk assessment of atmospheric polycyclic aromatic hydrocarbons and their derivatives in Kanazawa, Japan

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Polycyclic aromatic hydrocarbons (PAHs) and their derivatives, hydroxylated PAHs (OH-PAHs) are ubiquitous atmospheric pollutants that are a concern because of their high toxicity including endocrine disrupting activities. In this study, seasonal air sampling was conducted in 2017 and 2018 in Kanazawa, Ishikawa Prefecture, Japan [1]. The concentrations and seasonal variations of PAHs and OH-PAHs were analyzed, and health risks of individual congeners were evaluated based on their relative endocrine activity. The atmospheric concentrations of PAHs and OH-PAHs showed seasonal trends with higher concentrations in the winter (daily average ± standard deviation: 1.00 ± 0.26 ng/m$^3$ for PAHs and 75.06 ± 23.38 pg/m$^3$ for OH-PAHs) and lower concentrations in the summer (0.30 ± 0.09 ng/m$^3$ for PAHs and 17.08 ± 4.83 pg/m$^3$ for OH-PAHs). There were significant positive correlations between the concentrations of atmospheric PAHs and OH-PAHs. Additionally, the health risk from the endocrine disrupting potential of each OH-PAH was evaluated using relative estrogenic and anti-estrogenic activities. PAHs with four rings, such as OH-chrysenes and OH-benz[*a*]anthracene, had particularly high health risks. In conclusion, these results suggest that atmospheric OH-PAHs are a potentially health risk for organisms including human and thus warrant further research.

[1] M. Honda et al., Seasonal Variability and Risk Assessment of Atmospheric Polycyclic Aromatic Hydrocarbons and Hydroxylated Polycyclic Aromatic Hydrocarbons in Kanazawa, Japan, *Appl. Sci.*, 12(19), 9469 (2022)

# K-INET Special Webinar I

# Aerosols the Arctic: The end of an era of anthropogenic pollution and the emergence of a natural regime?

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The Arctic is undergoing rapid environmental change due to accelerated warming. This invokes changes in natural emissions of aerosols and their precursors. At the same time, anthropogenic emissions that have dominated Arctic atmospheric pollution substantially over the past decades are recently changing. This change has an impact on today's Arctic atmosphere and climate. In this presentation I will address whether an emerging "new Arctic" atmospheric chemical regime can already be determined from changes in natural and anthropogenic emissions. We will discuss results from long-term observations as well as detailed process studies from e.g., the yearlong MOSAiC campaign.

# K-INET Special Webinar II

# Mobility and solubility of trace oxyanions in natural water: Field evidence of conservative behaviors of uranium and molybdenum in high pH solution.

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Understanding the mobility and solubility of elements in natural water and the ability to predict changes in that mobility are important research topics in geochemistry. The mobilities of trace elements in natural water are important research topics in environmental science, because most trace elements are toxic to life at high concentrations. In contrast to trace metals that take cationic forms in natural water, the factors controlling solubility/mobility of trace oxyanions have been little understood. My research group in the Institute of Nature and Environmental Technology, Kanazawa University, has focused on the understanding and prediction of the trace oxyanions behaviors in natural water. We have conducted laboratory experiments and the theoretical geochemical modeling approaches to understand the trace elements behaviors [1]. In addition to these approaches, field observations are also important and essential to tackle with the understandings. However, it is usually difficult to find appropriate research sites to study trace oxyanions behaviors in Japan, because the natural water which allows the high mobility of trace elements is limited in Japan.

We recently have opportunities to study natural water in Mongolia as an academic corroboration with National University of Mongolia. We have conducted two field research in Mongolia to focus on the trace oxyanions behavior in natural water (Figure 1). The first is the systematic temporal and spatial observations of molybdenum (Mo) contamination in rivers in Erdenet city, which has one of the biggest Cu-Mo mine in Mongolia [2]. The second is the long-term observations of uranium (U) contamination in Orog lake in the Valley of Gobi Lakes in South Mongolia [3]. By combining with the laboratory experiments, we showed that Mo and U exhibit unique behaviors under specific conditions of water chemistry.


**Figure 1** Locations of research fields in Mongolia

[1] Fukushi K., Okuyama A., Takeda N., Kosugi S., Parameterization of adsorption onto minerals by Extended Triple Layer Model, *Applied Geochemistry,* 134, 105078, (2021), doi: 10.1016/j.apgeochem.2021.105087 (open access)

[2] G. Baasansuren, Fukushi K., D. Davaadorj, Imai E., Kitajima T., U. Uyangaa, G. Tuvshin, Sekine Y., Takahashi Y., Hasebe N., Arsenic and uranium contamination of Orog Lake in the Valley of Gobi Lakes, Mongolia: Field evidence of conservative accumulation of U in an alkaline, closed-basin lake during evaporation, Journal of Hazardous Materials, 436, 129017, (2022), doi: 10.1016/j.jhazmat.2022.129017

[3] T. Solongo., Okuyama A., O. Altansukh, Y. Ariuntungalag, O. Enkhjin, B. Taivanbat, M. Enkh-Uur, Takahashi Y., Munemoto T., Honda M., Fukushi K., Mo Contamination in Rivers near the Erdenet Mining Area, Mongolia: Field Evidence of High Mobility of Mo at pH >8, *ACS ES&T water*, 1, 1686-1694, (2021), doi: 10.1021/acsestwater.1c00046

# Session 3

## Poster presentation

# About poster presentation

[KINET International Symposium]

**Poster page:　(password : sympo2022)**

https://www.ki-net.kanazawa-u.ac.jp/symposium/sympo2022/2022sympo_poster/

| Poster No. | Authors | Title (*Click to open PDF files) | Presenter (Affiliation) | 1min movie (*Click to see the introduction movie) | Student Poster Awards |
|---|---|---|---|---|---|
| P-01 | Ryoya Kawamura, Miyuki Mekuchi, Kenji Toyota, Shouzo Ogiso, Yukina Watabe, Arata Nagami, Yusuke Maruyama, Atsuhiko Hattori, Seiji Yanai, Jun Hirayama, Hajime Matsubara and Nobuo Suzuki | Study on osmoregulatory function in larvae of red-clawed crab<br>※Click the title to see poster date. | Ryoya Kawamura (Kanazawa University) | P-01<br>※Click the number to see the 1min movie. | Entry |
| P-02 | Hatano Kaito, Sakateku Akihiro, Tanaka Daisuke, Tanuka Shoki, Ishiki Tadashi and Suzuki Nobuo | Vibrio sp. strain MA3 involves for the mass mortality of the summer in the pearl oyster, Pinctada fucata | Hatano Kaito (Kanazawa University) | P-02 | Entry |
| P-03 | Kohei Kuroda, Kaito Hatano, Ryoya Kawamura, Ayaka Fukushima, Yuichi Sasayama, Yoshiaki Tabuchi, Yukihiro Furusawa, Mika Ikegame, Atsuhiko Hattori, Jun Hirayama, Tatsuya Fukuda, Shinji Uekura, Hajime Matsubara, Umi Kawapo, Toshio Sekiguchi, Ajai K. Srivastav and Nobuo Suzuki | Both calcitonin I and II involves in female reproductive physiology in the goldfish, Carassius auratus | Kohei Kuroda (Kanazawa University) | P-03 | Entry |
| P-04 | Masahiro Nakadu, Muhammad Ahya Nafiuddin, Hiroshi Kobayashi, Shoichi | Gonadal sexual plasticity in tiger puffer Takifugu | Masahiro Naka | | Entry |

# Breakout room

You can join the breakout room **on Dec 8th, 14:00-16:00**.
Please enter the zoom meeting below and choose any breakout rooms as you like.

***Meeting ID is all the same through the events.**

[Zoom Meeting Details : KINET International Symposium]

**Join Zoom Meeting**
**https://zoom.us/j/96383592501?pwd=UWhkRXdXOSsxTzQ0NENIdnN5Sm5rdz09**

**Meeting ID: 963 8359 2501**
**Passcode: 192504**

# K-INET Special Webinar III

# Assessment of Endocrine Disrupting Chemicals and Basic Biology

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## Developmental Effects of Estrogens and Endocrine Disrupting Chemicals

Estrogen-independent abnormalities in mouse vagina were found as a result of perinatal exposure to estrogens by Takasugi, Bern and DeOme (1962). Eight years later, vaginal cancers were found in young women exposed *in utero* to a synthetic estrogen, diethylstilbestrol (DES) by Herbst et al. (1970), called as "DES syndrome". Bern and his associates found that female mice exposed neonatally to a plant estrogen (1985) and to a fungus estrogen (1989) showed some persistent changes in the genital tracts. Burlington and Linderman (1950) reported that DDT has an estrogen-like action on the development of roosters' secondary sex characters. Thus, the developing organism is particularly sensitive to estrogens and estrogenic substances inducing long-term changes in various organs including the reproductive organs. McLachlan (1980, 1985, 1995) organized a series of conferences, "Estrogens in the Environment", aiming to determine what an estrogen is and how it works, and what effect estrogenic substances might have on human health. In 1991, Colborn organized the Wingspread workshop to discuss environmental chemicals possibly affecting reproduction of wildlife, and human health. The participants of this workshop reached a consensus, that "a large number of man-made chemicals which have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine system of animals, including humans", and so on (Colborn and Clemens, 1992). At the Wingspread workshop, Prof. Bern (1992) described the long-term changes reported in the reproductive tracts and other compartments of human and mouse endocrine systems as the result of exposure in the womb to DES, based on the "Fragile Fetus". Colborn et al. (1996) published a book, "Our Stolen Future", based on the workshop. This is the dawn of endocrine disrupting chemicals (EDCs) issues. After the workshop, Prof. Bern asked Iguchi to conduct studies on the developmental effects of estrogen and estrogenic chemicals using fish and amphibian species in addition to mice (Iguchi et al., Differentiation, 118, 4-23, 2021).

## Endocrine Disruptor Issues in Japan, Europe and USA

In 1997, White House (Smithsonian) meeting was held to discuss EDCs Issues at Washington, DC. OECD started test method development for EDCs in 1998. Japanese Environment Agency listed 67 chemicals and conducted Japanese environmental monitoring in 1998. *In vitro* and *in vivo* fish (Japanese medaka) tests and rat one-generation tests were conducted for 36 chemicals on the list. Four chemicals were suspected to have endocrine disrupting effects in fish tests but not in rat tests (2014). Ministry of the Environment Japan (MOE) established two-tiered framework on testing and assessment of chemical substances; Tier 1 for screening:, reliability evaluation of literatures based on chemicals detected in the Japanese environment, *in vitro* reporter gene assays, and short-term *in vivo* assays (TG229, TG230) and Tier 2 for definitive test: medaka (TG240), *Xenopus laevis* (TG241) and *Daphnia magna* (TG211 Annex 7). Current outcomes of the assessment of environmental chemicals will be explained.

Basic studies on the evolution of medaka estrogen receptor (Esr) and androgen receptor (AR), Esr-knockout (Esr-KO) and AR-KO medaka; *D. magna* juvenile hormone receptor and environmental sex determination have contributed to the test methods development. Temperature-dependent sex determination in American alligator will be explained.

# Session 4

## Marine Environment (Environmental Science and Aquaculture)

# Marine crustaceans as model species of marine pollution research

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Marine pollutants, including wastewater produced by human activities, chemicals used in agriculture and fisheries, pharmaceuticals, and microplastics derived from marine debris, are recognized as one of today's global environmental problems. Chemical analysis technologies have improved the detection level of trace amounts of pollutants in seawater, but their toxic effects on living organisms have not yet been fully discussed.

Water fleas, genus *Daphnia*, are mostly freshwater zooplankton, and have long been used as the environmental indicators, because of their sensitivity to environmental changes as well as being a keystone species in the food chain of aquatic ecosystems. Since I was a graduate student, I have been conducting basic biological research to elucidate the molecular mechanisms underlying environmental sex determination of *Daphnia*, and have also been studying the toxic effects of endocrine disrupting chemicals such as insect growth regulators (juvenile hormone and molting hormone) and oil dispersants used in marine oil spills, using toxicity tests (OECD TG202: 48-hour acute toxicity test, OECD TG211: 21-day reproductive toxicity test).

Recently, I and colleagues has been developing new toxicity effect assays using decapod crustacean larvae. We have found that exposure of agonists of either juvenile hormone or molting hormone reduced larval survival rates, molting frequency, and metamorphosis rates in a dose-dependent manner in the larvae of kuruma prawn and red claws crab. These data suggest the possibility of assessing the toxic effects of marine pollutants in marine crustaceans, and we hope to establish toxicity assessment criteria by assaying for various other pollutants in the future.

Furthermore, only a few marine species are known, and preliminary surveys have revealed that *Penilia* sp. and *Evadne* sp. can be collected on the Japan Sea, although the daphnids are basically freshwater organisms. In the future, I aim to establish a method for collecting and rearing these marine water fleas in the Noto Peninsula by comparing my long-accumulated knowledge on the developmental physiology of *Daphnia*.

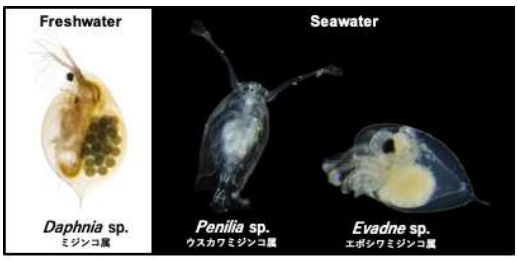


Fig. 1 Water fleas (Branchiopoda, Crustacean) in the freshwater and seawater

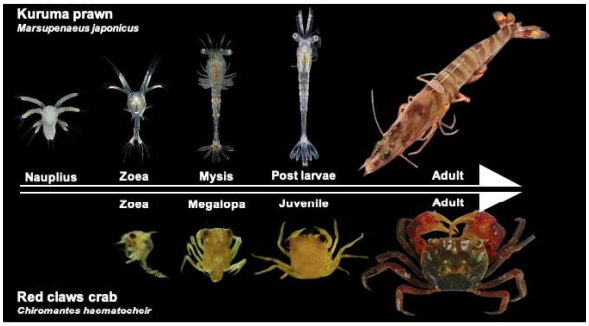


Fig. 2 Staging of larval metamorphosis of the kuruma prawn and red claws crab (Malacostraca, Crustacean).

# CULTURED OF SAND GOBY, *Oxyeleotris marmoratus* LARVAE IN CAGE WITH DIFFERENT FOOD

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Study on cultured of sand goby larvae in cage with different food experiments were done in nylon cage (50 x 50 x 50 cm in size). Sand goby larvae of 1 cm in total length were stocking densities 50 fishes per cage to feed with three different food which were *Moina*, grinding fishes and *Moina* with grinding fishes twice a day until the larvae were 2.5 cm in total length. It was found the date of sand goby larvae from 1 cm to 2.5 cm to feed with *Moina*, grinding fishes and *Moina* with grinding fishes which were 28, 44.3 and 21 days, respectively, it is significantly different ($P<0.05$) between among different food. The total length of sand goby larvae were cultured during 21 days to feed with *Moina*, grinding fishes and *Moina* with grinding fishes which were 2.15, 1.51 and 2.59 cm, respectively, it is significantly different ($P<0.05$) between among different food. And survival rate of sand goby larvae fed with *Moina*, grinding fishes and *Moina* with grinding fishes which were 70, 80 and 84.67 %, respectively, it is significantly different ($P<0.05$) between among different food. So the cultured of sand goby larvae (1 cm in total length) feed with *Moina* with grinding fishes is the suitable.

**KEYWORDS**: Feeding; Larviculture; Sand goby, *Oxyeleotris marmoratus*

# A novel ND1 mitochondrial DNA mutation is maternally inherited in growth hormone transgenesis in amago salmon (*Oncorhynchus masou ishikawae*)

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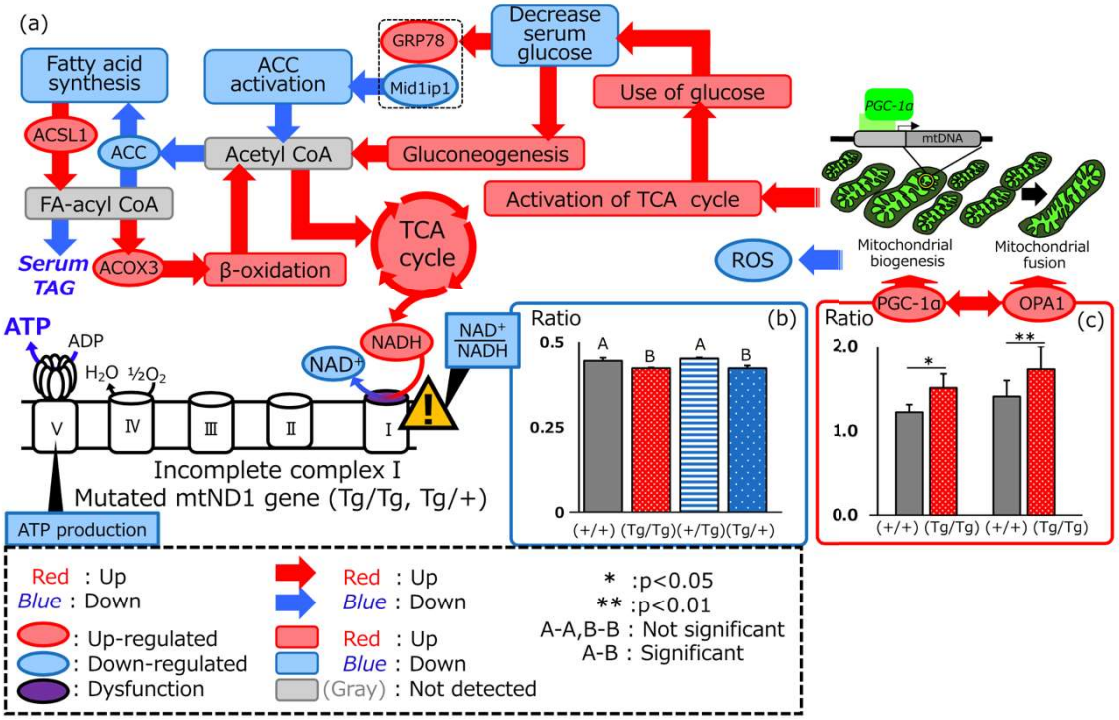
## Summary

Growth hormone (GH) transgenesis can be used to manipulate the growth performance of fish and mammals. In this study, homozygous and hemizygous GH-transgenic amago salmon (Oncorhynchus masou ishikawae) derived from a single female exhibited hypoglycemia. Proteomic and signal network analyses using iTRAQ indicated a decreased NAD+/NADH ratio in transgenic fish, indicative of reduced mitochondrial ND1 function and ROS levels. Mitochondrial DNA sequencing revealed that approximately 28% of the deletion mutations in the GH homozygous- and hemizygous-female derived mitochondrial DNA occurred in ND1. These fish also displayed decreased ROS levels. Our results indicate that GH transgenesis in amago salmon may induce specific deletion mutations that are maternally inherited over generations and alter energy production.

## Physiological conditions of GH homozygous fish




(**a**) Summary of physiological conditions in the (Tg/Tg) and (Tg/+) fish. Differential expression of the glucose starvation gene (*GRP78*), MID1 interacting protein 1 (*MID1IP1*), A long-chain-fatty-acid-CoA ligase 1 (*ACSL1*), acetyl-CoA carboxylase (*ACC*), and acyl- CoA oxidase 3 (*ACOX3*) in (Tg/Tg) fish was obtained from Sugiyama et al.[18]. (**b**) The $NAD^+$/NADH ratio was measured using LC–MS ($n = 3$: different fish), which was significantly decreased [$p < 0.05$; ANOVA followed by PLS. A–B indicate significant differences in (Tg/Tg) and (Tg/+) fish vs. control and (+/Tg) fish]. (**c**) Peroxisome proliferator-activated receptor γ coactivator-1 (*PGC-1α*) and mitochondrial dynamin-like GTPase (*OPA1*) levels were quantified by western blotting (See "Supplementary Information" and "Supplementary figures"). The intensities of the four *PGC-1α* and *OPA1* signals were divided by the β-actin signal; the vertical bars represent standard errors. Statistical significance was obtained by Student's *t*-test. *$p < 0.05$; **$p < 0.01$.

# Is Bandon Bay still supported the natural reproduction of oysters? The assessments of the annual reproductive cycle of farmed *Crassostrea belcheri* in Bandon Bay, Surat Thani Province, Thailand

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## Description of the investigation site and study backgrounds

Bandon Bay is located in Surat Thani Province which is on the east coast of southern Thailand. The bay is received the freshwater runoff through the main river and several canals (Fig. 1) that suitable for aquaculture activities. Bandon Bay is classified as the largest oyster farming in Thailand for more than two decades. In the past, changes in the water environment of Bandon Bay and oyster farms mainly depended on the amount of freshwater runoff and monsoons. Presently, besides the global warming is inevitable, the change appears to be influenced by many sources, such as flooding, growing community, coastal aquaculture activities, agriculture and industrial factories that discarded the harmful pollutants. These effectors may impact the natural reproduction of oysters in Bandon Bay, while oyster farming is mainly relying on the natural source of oyster spats. Somehow, since 1994 there is no data reported on the reproductive cycle of oyster in Bandon Bay. Therefore, through this study, we assess the annual reproduction of adult white scar oyster, *Crassostrea belcheri* farmed in Bandon Bay. The condition index (CI), the development of reproductive organ determined from the gonad index (GI) and the reproductive cell stages of adult farmed oysters were analyzed monthly from January to December, 2019. Some water parameters i.e., salinity, pH, chlorophyll a, orthophosphate, total suspended solid (TSS), $NH_4$-N and $NO_2$-N from the same sampling sites were also analyzed. The data received from this study could be used to evaluate the natural reproduction capacity of this particular oyster in Bandon Bay.

## Reproductive Organ Development and Reproductive cycle of *C. belcheri*

The study results revealed that the reproductive organs of farmed oysters were developed throughout the year. CI ranges from 2.23 (in December) to 6.29 (in May) which similar to GI values that ranges from 17.71 (in January) to 42.87 (in May) and the greater CI were correlated to the higher GI of oysters. Histological observation found that farmed oysters collected from at each sampling point forms different reproductive cell stages with temporal variation. The cells ripped highest in May (71.43%) and spawning peak in July (80%), followed by during October-November (50%). Water parameters changing throughout the sampling period but still in optimum ranges for oysters' adaptation and reproduction. Taken together of the above results could be suggested that Bandon Bay is still support the natural reproductive cycle and farming of oysters in Thailand.

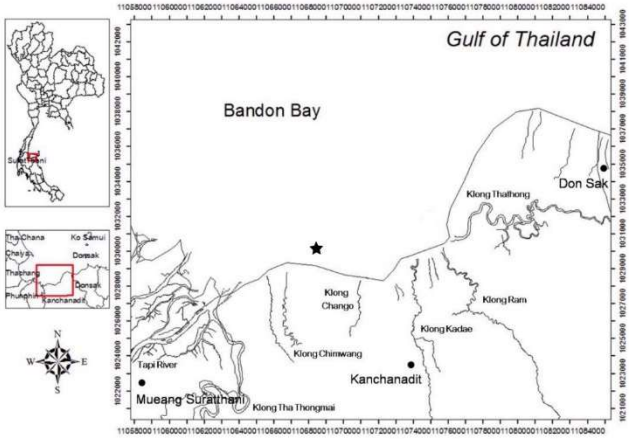


**Fig. 1** Geographical setting of Bandon Bay and sampling station (★) in the present study.

# Activity regulation mechanism of the grouper immune enzyme L-amino acid oxidase

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L-amino acid oxidases (LAOs) catalyze the oxidative deamination of L-amino acid and generate α-keto acid, ammonia, and hydrogen peroxide as byproducts. LAOs showed the variety of bioactivity by the resulting hydrogen peroxide. The serum of the red-spotted grouper *Epinephelus akaara* contains an LAO (Ea-LAO, 450 kDa, 67 kDa subunits) with the potential to kill bacterial pathogens *Aeromonas salmonicida* and *Vibrio anguillarum* via hydrogen peroxide. However, it is unknown how the grouper tolerates the harmful effects of the hydrogen peroxide and ammonia—these are serum Ea-LAO byproducts. In this study, the grouper LAO kinetics were analyzed to understand how it escape the toxicity of byproducts. The LAO activity of grouper serum was suppressed in low-salt solutions such as NaCl, $CaCl_2$, $MgCl_2$, and diluted seawater. The activity was non-linearly increased and fitted to the four-parameter log-logistic model. The $EC_{50}$ of the seawater was calculated to have a 0.72-fold concentration. This result suggested that the Ea-LAO could be activated by mixing with seawater. The results of circular dichroism spectroscopy showed that the α helix content was estimated to be 12.1% and 5.3% in a salt-free buffer (inactive condition) and the original concentration of seawater (active condition), respectively, indicating that the secondary structure of the Ea-LAO in the active condition was randomized. In addition, the grouper plasma and artificial seawater mixture could generate hydrogen peroxide and show the hydrogen peroxide aided antibacterial activity against *V. harveyi* by utilization of the plasma free amino acids as substrates. Taken together, this indicates that the Ea-LAO is normally on standby as an inactive form, and it could activate as a host-defense molecule to avoid pathogen invasion via a wound when mixed with seawater.

# Session 5

## Integrated Environment

# The impact of global warming on water and nutrient transport from land to the coastal ocean

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## The influence of global warming on water and nutrient transport from land to the coastal ocean

The temperature in Japan has been rising 1.7 times faster than the world's average due to ongoing global warming. The effects of the dramatic change have also begun to appear in the weather and the water cycle of some coastal cities. The rise in temperature has turned snowfall into rainfall, and as a result, the amount of snowfall in these area has decreased by up to 50% over the past 40 years. The reduction in the snowfall caused a deterioration in the function of water storage and groundwater recharge. These shifts are expected to increase river water and shallow groundwater volume and a shortened residence time before flowing to the coastal ocean, eventually decreasing nutrient concentrations in the terrestrial water. In order to adapt to the continuing global warming, it is vital to understand the current status of the water and nutrient dynamics in this area and then adopt appropriate measures based on scientific evidence in cooperation with the government. In this presentation, a three year ongoing project (Environment Research and Technology Development Fund) will be introduced, including (1) elucidation of the mechanisms of water and nutrient cycling in the region, (2) identification of factors causing changes in these processes due to climate change, and (3) future forecasts based on observational data and consideration of adaptive measures. Our goal is leading to conserve sustainable water and appropriate nutrient management.

## Healthy and sustainable terrestrial and coastal waters

An ongoing UN Ocean Decade Incubator-WESTPAC programme, "Healthy, Productive and Sustainable Asian Marginal Seas: Understanding changes in the marine environment in response to global climate change", will also be briefly introduced during the presentation. Achieving a healthy and sustainable terrestrial and coastal water requires keeping track and assessing how these areas are changing. By tracking contaminants in the water, assessing environmental change, physical, chemical, and biological observations enable coastal communities to make the best decisions for their environment. We believe the time has come to enable people to make use of cutting-edge science, technology and build a network to develop an international strategy for a better understanding of coastal and terrestrial ecosystems particularly in the Asian Marginal Seas and its environs.

# Water circulation in the Southern Ocean: Implications of $^{226}$Ra and $^{228}$Ra distributions

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The distribution of $^{228}$Ra (half-life: 5.75 y) concentrations revealed the circulation of seawater in contact with the shallow continental shelf and coastal sediments. Additionally, owing to its long half-life (1600 y), $^{226}$Ra concentrations in seawater also indicate the contribution of deep waters. However, concentration data of radium isotopes in the Southern Ocean were insufficient for the study of current systems. We collected seawater samples in the Southern Ocean from December 2019 to March 2022 during the expeditions of "*Mirai*" and "*Shirase"* and examined the spatial variations in $^{226}$Ra and $^{228}$Ra activity concentrations.

Notably, the $^{226}$Ra concentrations in the Southern Ocean along the transect 60–65°S (40–120°E) were highest in other oceans and seas (Fig. 1). Additionally, $^{226}$Ra concentrations increased from the eastern and western areas (from 2.5 to 3.0 mBq/L). Depletion of $^{228}$Ra was also observed. These results indicated a large contribution from deep/old waters (e.g., Upper Circumpolar Deep Water) with the contribution of mixing of the southward surface layer waters, particularly to the eastern area in the Southern Ocean.

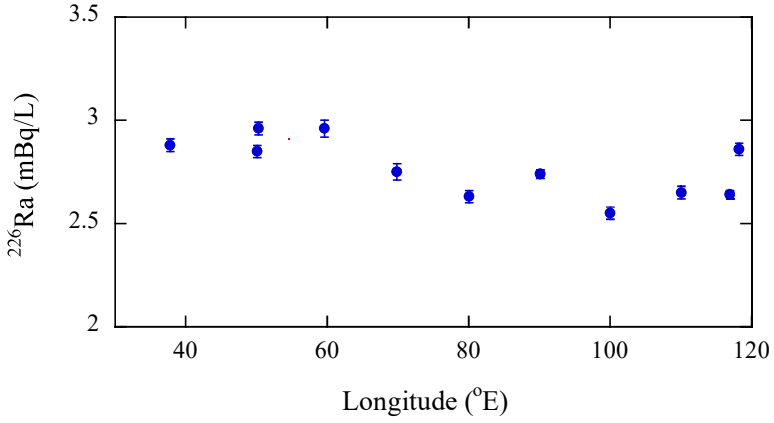


Fig. 1: Lateral distributions of $^{226}$Ra concentrations of surface waters in the Southern Ocean (60–65°S).

**Acknowledgments**

We are grateful to the researchers, captain, and crew onboard the "*Mirai*" and "*Shirase"* for their assistance during sampling.

# Oceanic dispersion simulation of radionuclides derived from the Fukushima Daiichi Nuclear Power Station

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## $^{137}$Cs simulation

Oceanic simulations were carried out for the environmental dynamics of $^{137}$Cs derived from the Fukushima Daiichi Nuclear Power Station (F1NPS). The observed data are spatio-temporally insufficient, therefore the numerical model simulations were useful to elucidate the environmental dynamics. The possible sources to the ocean in the F1NPS accident include direct release from the F1NPS site, atmospheric deposition, and supply from rivers and groundwater after deposition on land. The direct release rate is estimated from ocean dispersion simulations and observed results adjacent to the F1NPS, and this result is also consistent with results from several different methods. On the other hand, there are large uncertainties in estimating the rate of deposition to the atmosphere and the rate of supply from rivers and groundwater after deposition on land. Direct comparison between simulated and observed results is difficult because the distribution of $^{137}$Cs activity concentration in the ocean shows large spatio-temporal variations due to the influence of meso-scale eddies and the Kuroshio Current. We confirmed that the simulation results attributable to direct release of the annual mean activity concentration distribution are in good agreement with the annual mean observed one (Fig. 1). We also confirmed that the annual mean surface concentration distribution from 2013 to 2016 is almost similar when normalized by the direct release rate. In other words, it was found that the annual mean surface activity concentration distribution can be predicted if the release rate is known [1]. The reproducibility of southward advection was improved by increasing the horizontal resolution from 1 km to 200 m. The higher resolution simulation also made it possible to reproduce the discharge from the seafloor 1 km offshore.

## $^{3}$H simulation

The distribution of $^{3}$H activity concentration in the ocean by the discharge of the ALPS treated water from the Fukushima Daiichi Nuclear Power Plant (F1NPS) was predicted by higher resolution oceanic dispersion model. We predicted the distribution of annual mean $^{3}$H activity concentrations when the ALPS treated water is discharged at 2.2 x $10^{13}$ Bq/year as $^{3}$H. The background $^{3}$H activity concentration ranged from 0.07±0.01 Bq/L in the North Pacific. $^{3}$H activity Concentration areas above 0.1 Bq/L, which is considered to be detected, were found only in the coastal area of Fukushima Prefecture. In more distant areas, the concentration is diluted by oceanic diffusion effects, so it cannot be distinguished from the background concentration and is not detected.

[1] D. Tsumune et al., Impacts of direct release and river discharge on oceanic $^{137}$Cs derived from the Fukushima Dai-ichi Nuclear Power Plant accident, *J. Environm. Radioacti.*, 214-215 (2020)

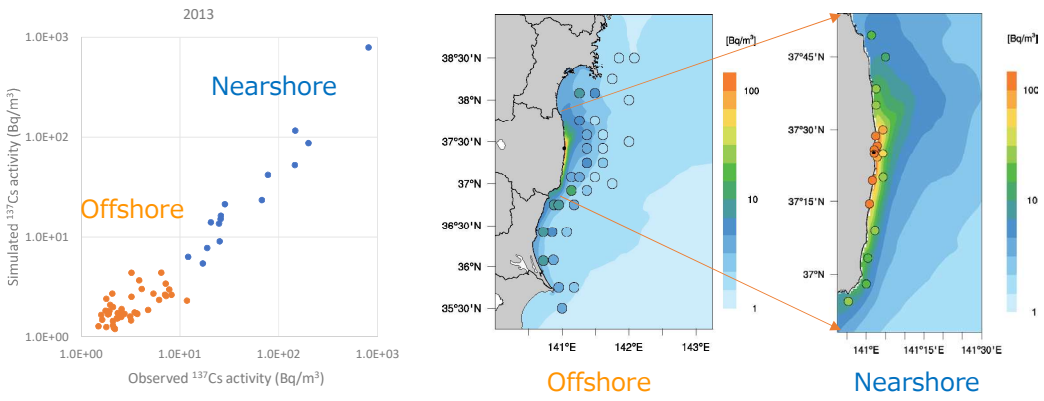


Fig.1 Comparison between observed and simulated surface $^{137}$Cs activity in 2013

# Ecological roles of airborne transportation of microorganisms in Antarctica

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Microbial transport by air to and within Antarctica is believed to play a critical role in the structuring of the microbial-dominated Dry Valleys ecosystem. However, persistent knowledge gaps remain despite decades of microbiology done in Antarctica. In this study, we surveyed air and soil samples along two transects in the Wright Valley to determine the contributions and sources of microbial aeolian transportation. Bioaerosols were collected with a highly-sensitive high volume liquid impingement protocol which we developed and validated for this purpose. Microbial communities therein were profiled using amplicon sequencing of prokaryotic 16S rRNA and fungal ITS1 regions. We identified that some taxa from local soil communities were shared with aerosol samples, exhibiting a distance related trend indicating local transportation. However, soil communities tended to be more variable with a distinct community structure suggesting additional inputs to both ecosystems and niche filtering in soil. Based on microbial species and back trajectory analysis, we were able to identify putative air inputs from non-soil sources, including marine, and global terrestrial environments. When compared with comparative temperate aerosol samples, Antarctic air communities shared some taxa but were less diverse, and their communities structure were distinct, particularly for fungi. This study not only demonstrated the local transportation of biologicals in Antarctic air at high temporal resolution but also provided evidence of a ubiquitous, globally transported, bioaerosol community.

# The Arctic and subpolar North Atlantic circulation: new perspectives from $^{129}$I and $^{236}$U

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Releases of anthropogenic radionuclides from European nuclear fuel reprocessing plants enter the surface circulation of the high-latitude North Atlantic and are transported northward into the Arctic Ocean and southward from the Nordic Seas into the deep North Atlantic, thereby providing tracers of water circulation, mixing, ventilation, and deep-water formation. Recent work has benefited from advances in accelerator mass spectrometry to enable the measurement of the conservative, long-lived radionuclide tracers $^{129}$I and $^{236}$U, that added to the former use of $^{137}$Cs. Latest studies of these tracers include the use of transit time distributions (TDs) to accommodate circulation timescales and mixing, providing a rich inventory of transport data for circulation in the Arctic and North Atlantic Oceans that are of great importance to global thermohaline circulation and climate.

In this talk I will present a summary of the work we have been doing in the last decade at ETH Zürich, and the future plans within the TITANICA project. In particular, results of $^{129}$I and $^{236}$U from three expeditions that took place under the Arctic GEOTRACES programme in 2015 and 2016. Distribution of these two radionuclides in the three sections offered an unprecedented snap-shot of the pathways of Atlantic waters flowing into the Arctic Ocean during an atmospheric anti-cyclonic regime (Figure 1). The combination of the two tracers, having different input functions but same sources, allowed us to constrain tracer ages at the surface, and transit time distributions at the Atlantic layer, updating the previous dataset that was built a decade ago using $^{137}$Cs instead of $^{236}$U [1]. Existing time series at Labrador Sea and deep North Atlantic (Line W) from 1990s and 2000s show the penetration of $^{129}$I at the deep Labrador Sea and downstream at the Deep Western Boundary Current thus proving the connectivity between the Arctic and the Atlanic Oceans. Future work at ETH will cover several sections in the Arctic and subpolar North Atlantic Ocean, and will make use of the newly developed $^{129}$I-$^{236}$U tracer pair to understand flow features and timescales of Atlantic Meridional Overturning Circulation.

[1] N. Casacuberta & J. Smith. Nuclear Reprocessing Tracers Illuminate Flow Features and Connectivity between the Arctic and Subpolar North Atlantic Oceans, *Annu. Rev. Mar. Sci.* 15:16.1-16.19 (2022).

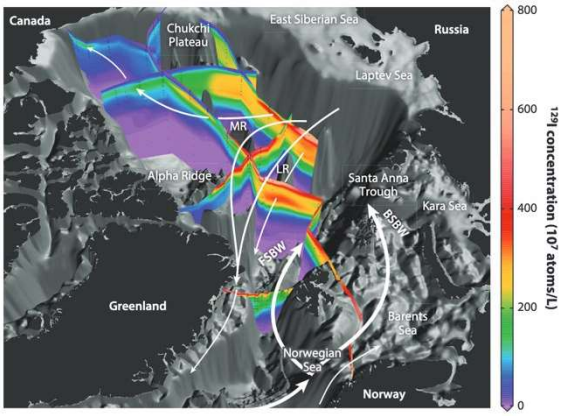


Fig. 1 Distribution of $^{129}$I in the Arctic Ocean and Fram Strait (2015, 2016).

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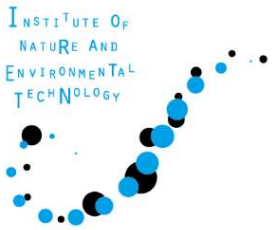
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