International Symposium

Institute of Nature and Environmental Technology

International Symposium

Environmental Issues in a Post-Covid 19 Society

Time : 6th March, 9:00 - 18:30

Venue : Large Meeting Room, Natural Science and Technology Library Hall, Kanazawa University (Kakuma, Kanazawa, Ishikawa Pref.)

Online : Zoom

Organizer: Institute of Nature and Environmental Technology, Kanazawa University

Contact Institute of Nature and Environmental Technology, Kanazawa University
E-mail: kannihon.ka@gmail.com TEL: 076-234-6961 URL: http://www.ki-net.kanazawa-u.ac.jp/EN/

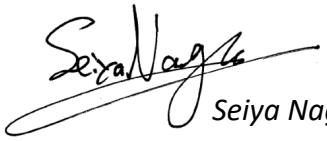
Forward

The Institute of Nature and Environmental Technology (INET) at Kanazawa University was selected as one of the Joint Usage/Research Centers in Japan from April 2016 to March 2022. The Center of International Study on Environmental Change Caused by Transboundary Pollutants at the INET has studied short-term and long- 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 programs include monitoring research in the Pan-Japan Sea region, including the Noto Peninsula, and integrated environmental studies on the migratory behavior of pollutants and their effects on human health and ecosystems.

In April 2022, the INET started the second phase of the Joint Usage/Research Centers in Japan. This phase consists of four parts: 1) atmosphere and ocean transect research from north-to-south in western Pacific region, 2) integrated environmental studies for transport and risk assessment of toxic substances on ecosystems and human health, 3) development of young researcher resources including advanced research knowledge, international sensibility, and scientific communication skills, and 4) promotion of an international hub for transboundary pollution research. In 2024-2025, the INET concluded faculty-level exchange agreements with the Atmosphere and Ocean Research Institute at the University of Tokyo, and Department of Earth and Environmental Sciences at National Chung Cheng University of Taiwan. Aerosol monitoring research was initiated in the summer and winter seasons at each site between north and south Japan. In other research, surface sea water samples are being collected from the western Pacific region to understand the spatial distribution, concentration, and composition of polycyclic aromatic hydrocarbons (PAHs). We also conduct studies on the impact of hazardous substances such as PAHs, pesticides, and heavy metals on ecosystems and human health.

Previous international symposiums had sessions related to the research content of each of the four research environmental fields (atmosphere, land, ocean, and integrated environment) to comprehensively analyze the four fields in cooperation with each other. However, starting this year, the sessions were revised to hold in-depth discussions with the participation of researchers in the relevant fields of expertise. This international symposium was held by concentrating on the atmosphere and integrated environment research fields. We hope that this symposium will be an opportunity to discuss these issues.

Finally, 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

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(password : sympo2024)

Program

9:00-9:10 Opening remarks *by Prof. Takashi Wada, President of Kanazawa University, Japan*

Keynote Speach

Chair: *Bin Chen*

9:10-10:10 Application of environmental magnetism on atmospheric aerosols *by N. Tsuchiya, K. Kawasaki, T. Nakano, S. Kato, R. Yamada, F. Ikemori, M. Hata, M. Furuuchi, Y. Iwamoto, N. Kaneyasu, T. Watanabe, T. Kameda, M. Minami, T. Nakamura and **Atsushi Matsuki** (Kanazawa University, Japan)*

Invited Speaker

Chair: *Seiya Nagao*

10:10-11:10 Subpolar marginal seas fuel the North Pacific through the intermediate water at the termination of the global ocean circulation *by **Jun Nishioka** (Hokkaido University, Japan), Hajime Obata and Ichiro Yasuda*

Chair: *Ning Tang*

12:00-13:30

Session 1 : Poster presentation

*** Poster award applicants**

*P-01. Synergistic impacts of high seawater temperature and bacterial infection on the bivalve immunity *by **Kaito Hatano** (Kanazawa University), Akihiro Sakatoku, Ryo Orita and Nobuo Suzuki*

*P-02. Indole-3-acetic acid regulates the behavior of the polychaete *Perinereis aibuhitensis by **Kouhei Kuroda** (Kanazawa University), Srivastav, A.K., Suzuki, A., Rafiuddin, M.A., Toyota, K., Endo, M., Honda, M., Watanabe, K., Maruyama, Y., Tabuchi, Y., Hattori, A., Urata, M., Matsubara, H. and Suzuki, N.*

*P-03. Dynamics of gammarid assemblages associated with Sargassum species before and after the Noto Peninsula earthquake *by **Keito Tsunoda**(Kanazawa University), Masafumi Kodama, Yukimasa Higashide, Shouzo Ogiso, Hajime Matsubara, Nobuo Suzuki and Kenji Toyota*

P-04. Induction of flagellar excision by various local anesthetics in *Chlamydomonas reinhardtii by* ***Atsushi Nishikawa*** *(Kanazawa University), Akihiro Sakatoku, Daisuke Tanaka, Shogo Nakamura and Nobuo Suzuki*

*P-05. Basic analysis for space experiments using satellites:Investigation of culture conditions for zebrafish scales *by* ***Harumi Takino****(Kanazawa University), Jingjing Kobayashi-Sun, Isao Kobayashi and Nobuo Suzuki*

*P-06. Characteristics of concentration and emission of PM2.5-bound polycyclic aromatic hydrocarbons (PAHs) and nitro-PAHs (NPAHs) based on a comparison of urban and background stations in Shimane from 2022 to 2024 *by* ***Yan Wang*** *Kanazawa University), Pengchu Bai, Lulu Zhang, Xuan Zhang, Seiya Nagao, Shigo Matsumoto, Masasaki Yoshida, Tamon Ymashita, Ning Tang*

*P-07. Research on the characteristic of biogenic secondary organic aerosol tracers in Asia *by* ***Pengchu Bai*** *(Liaoning University), Jianxin Li, Zeyu Wang, Lijiang Chen*

P-08. Toxicokinetic Study and Environmental Risk Assessment of Chiral Herbicide Clethodim *by* ***Cong Li*** *(Liaoning University), Xuan Zhang, Pengchu Bai, Lulu Zhang, Kohei Ono, Seiya Nagao, Akira Toriba, Atsushi Matsuki and Ning Tang*

P-09. Automated machine learning-based models for predicting and evaluating antibiotic removal in constructed wetlands *by* ***Hongxu Bao*** *(Liaoning University) Wanxin Yin, Hongcheng Wang, Yin Lu, Shijie Jiang, Fidelis Odedishemi Ajibade, Qinghua Ouyang, Yongji Wang, Shichen Nie, Yu Bai, Huiliang Gao, Aijie Wang*

P-10. Development and Application of Environmentally Friendly Carboxymethyl Chitosan-Based Nanopesticides *by* ***Zeyu Wang*** *((Liaoning University), Cong Li, Lijing Chen*

13:30-13:40 **Group Photo Session**

Session 2: Atmospheric Environment (Atmospheric chemistry of transboundary pollutants)

Chair: *Yayoi Inomata*

13:40-14:05 Important yet overlooked HONO source from aqueous-phase photochemical oxidation of nitrophenols *by* ***Wangjin Yang*** *(Northeastern University, China), Hui Ji, Fu Li, Xue He, Shan Zhang, Xiangli Nan, Tao Du, Kun Li, NingTang and Chong Han*

14:05-14:30 High $\Delta^{17}O$ in Atmospheric H_2O_2 and Its Consequences on Quantifying Sulfate Aerosol Formation Pathways *by H. Guo and* ***Mang Lin*** *(Chinese Academy of Sciences, China)*

Chair: *Sakiko Ishino*

14:30-14:55 Yearly variations in long-range transported polycyclic aromatic hydrocarbons at Wajima, a background site in Japan *by* ***Ning Tang*** *(Kanazawa University, Japan) , Y. Wang, P.C. Bai, L.L. Zhang and S. Nagao*

14:55-15:20 Simultaneous determination of hydroxylated polycyclic aromatic hydrocarbons and biomass burning markers in particulate matter: An application on Thai's samples *by* ***Kim-Oahn Pham*** *(Asia Center for Air Pollution Research, Japan), Y. Inomata, T. Takahashi, K. Sato*

15:20-15:45 Characteristics of charge distributions of submicron atmospheric particles at Noto Peninsula, Japan *by* ***Tatsuhiro Mori*** *(Keio University, Japan), A. Matsuki, A. Iwata, M. Kamogawa, M. Komatsu, H. Hattori, and T. Okuda*

Session 3: Session 3: Integrated Environment (Chemical oceanography in marginal seas)

Chair: *Tetsuya Matsunaka*

15:55-16:20 Reanalysis of the formation mechanism of the Cold Water Belt in the Southern Okhotsk Sea using ^{129}I *by* ***Rodrigo Jose Mundo Duenas*** *(Instituto de Investigaciones Tropicales de El Salvador, El Salvador), T. Matsunaka, Y. Taniuchi, T. Nakanowatari*

16:20-16:45 Marine snow in the Japan Sea *by* ***Shigeyoshi Otosaka*** *(The University of Tokyo, Japan)*

16:45-17:10 Tracing Biogeochemical Fluxes in Asia's Marginal Seas: Resolving Kuroshio Dynamics and Land-Ocean Interactions via Multi-Tracer Diagnostics *by* ***Jing Zhang*** *(University of Toyama, Japan)*

Chair: *Shinya Ochiai*

17:10-17:35 Land-ocean linkage studies at Nanao Bay, Japan *by* ***Seiya Nagao*** *(Kanazawa University, Japan), K. Kawamura, T. Suzuki, R. J. M. Duenas, T. Matsunaka and S. Ochiai*

17:35-18:00 Temporal variation of FENPP-derived radiocesium: Implication to the current systems in the Northern Pacific *by* ***Mutsuo Inoue*** *(Kanazawa University, Japan), H. Mitsunushi, S. Nagao, D. Nomura and Y. Kumamoto*

18:10-18:30 Closing remarks *by Prof. Seiya Nagao, Director of K-INET*

(Best Poster Award)

Abstracts

Keynote Speech

Application of Environmental Magnetism on Atmospheric Aerosols

N. Tsuchiya[1,10], K. Kawasaki[2], T. Nakano[3], S. Kato[1], R. Yamada[1], F. Ikemori[4,5,6], M. Hata[1], M. Furuuchi[1], Y. Iwamoto[7], N. Kaneyasu[8], T. Watanabe[9], T. Kameda[10], M. Minami[6], T. Nakamura[6], and A. Matsuki[5]

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Iron oxide (FeO_x) particles FeO_x, including magnetite (Fe_3O_4), maghemite (γ-Fe_2O_3) and hematite (α-Fe_2O_3), are representative minerals that can be detected as magnetic particles (MPs) by environmental magnetic analyses. It is expected to be highly sensitive to certain metal-containing or crustal aerosols. However, to date, no studies have attempted to rigorously distinguish the relative contribution of Asian dust and anthropogenic emissions on aerosol magnetic properties in a region under direct influence of Asian continental outflow. In order to evaluate the applicability of environmental magnetism as a novel approach for characterizing trans-boundary air pollution, atmospheric aerosols were collected continuously at the tip of the Noto Peninsula, Japan, from August 2014 to March 2016.

Magnetic properties of coarse and fine mode samples were measured, along with detailed isotopic and chemical analyses. The association of aerosol magnetization and specific emission sources were found, such that magnetic signals are most strongly enhanced by continental outflows, especially during Asian dust events, but also by anthropogenic emissions. Magnetic measurement is quick and nondestructive, requiring no pretreatment, yet provides equally relevant and/or complementary information as sophisticated and labor-intensive isotopic and chemical analyses for source fingerprinting. Our results provided a solid scientific basis for aerosol magnetism, which can be further applied to identify the impacts of Asian dust and pollution on public health safety and biogeochemical cycles, especially involving iron oxide particles.

Invited Speech

Subpolar marginal seas fuel the North Pacific through the intermediate water at the termination of the global ocean circulation

Jun Nishioka[1], Hajime Obata[2] and Ichiro Yasuda[2]

[1] *Pan-Okhotsk Research Center, Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan*

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Scientific issue around studied site and description of this study

A correct understanding of the iron and macro-nutrient dynamics at the termination of the global ocean conveyor belt circulation is critical for understanding the global carbon cycle and its changes in geological time scale. Newly obtained and compiled data sets of iron and macro-nutrients with the vertical mixing magnitude in the subarctic Pacific and marginal seas indicate the processes that determine the nutritional status of intermediate waters and the mechanisms by which sub-polar marginal seas fuel the North Pacific Ocean through the intermediate water. The intermediate water formation processes play a major role in the connection of nutrients between the deep water and the surface water above it, and sustain biological production, at the termination of the global nutrient circulation.

Biogeochemical cycle in the Pan-Okhotsk area

The mechanism by which nutrients in the deep ocean are uplifted to maintain nutrient-rich surface waters in the subarctic Pacific has not been properly described. The iron (Fe) supply processes that control biological production in the nutrient-rich waters are also still under debate. Here, we report the processes that determine the chemical properties of intermediate water and the uplift of Fe and nutrients to the main thermocline, which eventually maintains surface biological productivity. Extremely nutrient-rich water is pooled in intermediate water (26.8–27.6 σ_θ) in the western subarctic area, especially in the Bering Sea basin. Increases of two to four orders in the upward turbulent fluxes of nutrients were observed around the marginal sea island chains, indicating that nutrients are uplifted to the surface and are returned to the subarctic intermediate nutrient pool as sinking particles through the biological production and microbial degradation of organic substances. This nutrient circulation coupled with the dissolved Fe in upper-intermediate water (26.6–27.0 σ_θ) derived from the Okhotsk Sea evidently constructs an area where has one of the largest biological CO2 drawdown in the world ocean. These results highlight the pivotal roles of the marginal seas and the formation of intermediate water at the end of the ocean conveyor belt.

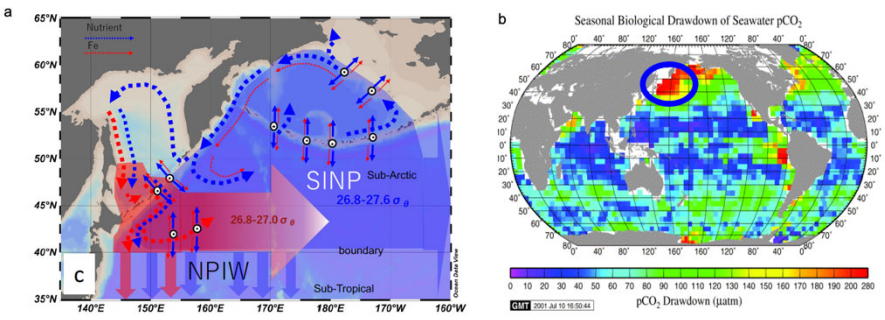

Fig. 1 (a) Schematic of horizontal circulation of nutrients and dissolved Fe in the North Pacific. (b) Seasonal biological drawdown of pCO_2, as reported in Takahashi et al. (2002).

Session 1

Poster presentation

About poster presentation

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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 ※Click the title to see poster date.	Ryoya Kawamura (Kanazawa University)	P-01 ※Click the number to see the 1min movie.	Entry
P-02	Hatano Kaito, Sakatoku Akihiro, Tanaka Daisuke, Tanaka Shoki, Isshiki 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 Kawago, 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 Nakade, Muhammad Ahya Rafiuddin, Hiroshi Kobayashi, Shoichi	Gonadal sexual plasticity in tiger puffer Takifugu	Masahiro Naka		Entry

Breakout room

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Toxicokinetic Study and Environmental Risk Assessment of Chiral Herbicide Clethodim

Cong Li[1,2], Jianxin Li[1], Zeyu Wang[1], Lijiang Chen[1,2,*]

[1]*School of Pharmaceutical Science, Liaoning University, Shenyang 110036, China*

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Clethodim, as a typical chiral herbicide, exhibits significant stereoselective differences in environmental behaviors and ecotoxicity between its two enantiomers. This study focuses on elucidating the absolute configuration of (−)-clethodim and investigating its dynamic behaviors in both organisms and environmental matrices, aiming to provide a scientific basis for agricultural pollution control.

In this study, enantiomers 1 and 2 resolved from a racemate by preparative HPLC equipped with a Chiralpak IA column were confirmed as R-(−)-clethodim and S-(+)-clethodim, respectively. Both enantiomers showed significant stereoselectivity in vivo. The AUC Supporting Information 0-72 h of R-(−)-clethodim was 4.50 and 4.90 times that of S-(+)-clethodim in plasma after intragastric and intravenous administration, respectively. However, the bioavailability of R-(−)-clethodim (12.96%) was lower than that of S-(+)-clethodim (14.14%). S-(+)-clethodim was found in a relatively high abundance in most tissues. No mutual transformation between the two enantiomers was observed in vivo, indicating that configuration conversion did not contribute to the differences in the content of the enantiomers in the plasma and tissues. In summary, the findings from this study provided novel insights into the stereoselective toxicokinetic behavior of the chiral clethodim and valuable evidence for ecological risk assessments.

Automated machine learning-based models for predicting and evaluating antibiotic removal in constructed wetlands

Hongxu Bao [a,b,1], Wanxin Yin [a,1], Hongcheng Wang [b,*], Yin Lu [d], Shijie Jiang [a], Fidelis Odedishemi Ajibade [c], Qinghua Ouyang [e], Yongji Wang [e], Shichen Nie [f], Yu Bai [g], Huiliang Gao [h], Aijie Wang [a,b,c]

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Description of the machine learning models

Machine learning models can improve antibiotic removal performance in constructed wetlands (CWs) by optimizing the operation process. However, robust modeling approaches for revealing the complex biochemical treatment process of antibiotics in CWs are still lacking. In this study, two automated machine learning (AutoML) models achieved good performance with different sizes of the training dataset (mean absolute error = 9.94–13.68, coefficient of determination = 0.780–0.877), demonstrating the ability to predict antibiotic removal performance without human intervention. Explainable analysis results (the variable importance and Shapley additive explanations) revealed that the variable substrate type was more influential than the variables of influent wastewater quality and plant type. This study proposed a potential approach to comprehensively understanding the complex effects of key operational variables on antibiotic removal, which serve as a reference for optimizing operational adjustments in the CW process.

Development and Application of Environmentally Friendly Carboxymethyl Chitosan-Based Nanopesticides

Zeyu Wang[1], Cong Li[1,2], Lijiang Chen[1,2,*]

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[2]*Liaoning Key Laboratory of New Drug Research & Development, Shenyang 110036, China*

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In modern agriculture, the inefficient utilization of conventional pesticides leads to significant loss of active ingredients (AIs), causing soil and water pollution and threatening non-target organisms and human health. Although pyrethroid insecticides are highly effective and broad-spectrum, their overuse has resulted in pest resistance and heightened aquatic toxicity. This study developed a pH/carboxylesterase dual-responsive nanopesticide delivery system (LCT@CMCS-g-PCL) based on carboxymethyl chitosan (CMCS) to encapsulate lambda-cyhalothrin (LCT) with a loading capacity of 23.14%, effectively protecting LCT from photodegradation. LCT@CMCS-g-PCL significantly enhanced pesticide deposition and foliar wettability compared to commercial microemulsions, with controlled drug release under dual pH/enzyme stimulation. The system was demonstrated to release AIs in a controlled manner under pH/enzyme dual stimulation. And it was stably deposited on plant surfaces or water bodies in weakly acidic environments, while rapidly releasing AIs in the alkaline gut of lepidopteran pests and reduced LCT resistance by binding to carboxylesterases. Bioactivity tests showed that LCT@CMCS-g-PCL was more lethal than commercial microemulsions against the codling moth, while in vitro cytotoxicity, acute toxicity in zebrafish, and microbial diversity analysis in the water column confirmed its environmental safety. This study provides a new strategy for the development of efficient and low-risk smart nanopesticides contributing to the protection of water ecosystems and promoting sustainable agricultural development.

Session 2

Atmospheric Environment

Atmospheric chemistry of transboundary pollutants

Important yet Overlooked HONO Source from Aqueous-phase Photochemical Oxidation of Nitrophenols

Wangjin Yang[1], Hui Ji[1], Fu Li[1], Xue He[1], Shan Zhang[2], Xiangli Nan[1], Tao Du[1], Kun Li[2], NingTang[3], Chong Han[1,*]

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Nitric acid (HONO) has received considerable attention because its photolysis contributes to 20%–80% hydroxyl radicals (•OH) formation in different regions. However, the current understanding of the source of NO_2^-/HONO is insufficient, and therefore hinders the accurate quantification of atmospheric oxidation capacity.

We highlighted an overlooked HONO source by the reaction between nitrophenols (NPs) and •OH in the aqueous phase, and provided kinetic data to better evaluate the contribution of this process to HONO. Three typical NPs, including 4-nitrophenol, 2-nitrophenol and 4-nitrocatechol underwent a denitration process to form aqueous NO_2^- and gaseous HONO through the •OH oxidation, with the yield of NO_2^-/HONO varied from 15.0% to 33.5%. According to chemical composition and structure analysis, the reaction pathway, where the ipso addition of •OH to NO_2 group on 4-nitrophenol generated hydroquinone, can contribute to more than 61.9% of the NO_2^-/HONO formation. The aqueous photooxidation of NPs may account HONO in the atmosphere, depending on the specific conditions. The results clearly suggest that the photooxidation of NPs should be considered in the field observation and calculation to better evaluate the HONO budget.

High $\Delta^{17}O$ in Atmospheric H_2O_2 and Its Consequences on Quantifying Sulfate Aerosol Formation Pathways

H. Guo[1] and M. Lin[1*]

[1]*State Key Laboratory of Deep Earth Processes and Resources, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China*

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Abstract

Mass-independent triple oxygen isotope compositions ($\Delta^{17}O=\delta^{17}O-0.52*\delta^{18}O$) of sulfate aerosols are used as isotopic tracers to quantify sulfate formation pathways in the atmosphere [1]. This method relies on our understanding of $\Delta^{17}O$ values in various oxidants such as ozone (O_3) and hydrogen peroxide (H_2O_2). Although there have been numerous $\Delta^{17}O$ measurements of O_3, there is only one available dataset for H_2O_2 $\Delta^{17}O$, measured by Savarino and Thiemens [2] in rainwater collected in La Jolla during the late 1990s. Most global sulfate $\Delta^{17}O$ studies have assumed that H_2O_2 $\Delta^{17}O$ values are uniform around the globe, based on this single La Jolla dataset. This assumption may limit the accurate quantification of sulfate oxidation pathways due to poorly constrained spatial and temporal variabilities of atmospheric H_2O_2 $\Delta^{17}O$ values. In this study, we measured the $\Delta^{17}O$ of H_2O_2 in rainwater collected from Guangzhou, a megacity in South China, to evaluate whether atmospheric H_2O_2 $\Delta^{17}O$ are consistent globally. Our five-month measurements indicate that H_2O_2 $\Delta^{17}O$ in Guangzhou is approximate 0.7 per mil higher than that measured in La Jolla nearly 30 years ago. Based on a compiled global sulfate $\Delta^{17}O$ dataset, we utilize a Monte Carlo approach to estimate the extent to which the updated H_2O_2 triple oxygen isotope compositions may affect sulfate aerosol formation pathway quantifications. We highlight that a deeper understanding of the spatial and temporal variabilities in atmospheric H_2O_2 $\Delta^{17}O$ and their control factors id crucial for accurately quantifying formation pathways of sulfate aerosol and potentially other oxyanions.

References: [1] Lin and Thiemens (2024), Applied Geochemistry 161, 105860. [2] Savarino and Thiemens (1999), Atmospheric Environment 33, 3683-3690.

Yearly variations in atmospheric polycyclic aromatic hydrocarbons at Wajima (KUWAMS), a background site in Japan (2004 – 2024)

N. Tang[1, 2], Y. Wang[3], P.C. Bai[3], L.L. Zhang[1, 4] and S. Nagao[1]

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Abstract

Among air pollutants, polycyclic aromatic hydrocarbons (PAHs) and their nitrated derivatives (nitropolycyclic aromatic hydrocarbons, NPAHs) are well known for their carcinogenic and/or mutagenic properties. Atmospheric PAHs and most NPAHs primarily originate from the incomplete combustion of organic matter, including petroleum, coal, and biomass.

In this study, total suspended particulates were collected at Wajima, a remote background site in Japan (Kanazawa University Wajima Air Monitoring Station: KUWAMS) on the Noto Peninsula, from 2004 to 2024. Nine PAHs in the particulates were analyzed using HPLC with fluorescence detection.

The atmospheric PAH levels at KUWAMS were consistently higher during the cold seasons than in the warm seasons. Meteorological analyses indicated that in the cold seasons, a portion of atmospheric PAHs at KUWAMS were transported over long distances from Northeast China, whereas in the warm seasons, they were primarily influenced by domestic sources in Japan. While atmospheric PAH levels at KUWAMS have declined in recent years, no significant change was observed during the warm seasons. The source control measures implemented by the Chinese and Japanese governments appear to have effectively contributed to the recent reduction in atmospheric PAH levels at KUWAMS.

Simultaneous Determination Of Hydroxylated Polycyclic Aromatic Hydrocarbons And Biomass Burning Markers In Particulate Matter: An Application on Thai's samples

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Background: Hydroxylated polycyclic aromatic hydrocarbons (OH-PAHs) are infamous PAH metabolites in health research. While the toxicity of OH-PAHs has been a growing field in health research, little is known about the regional and seasonal variations of atmospheric OH-PAH concentrations. OH-PAHs have been found to be major tracers in coal combustion and biomass burning, similar to their parent PAHs. Due to low concentrations in the atmosphere and the limitation of analyzing methods, there are few research on atmospheric OH-PAHs. The atmospheric OH-PAH concentrations in a city in Western Japan increased over time from 2013 (2-OH-Flu: 0.062 pg m^{-3} and 1-OH-Pyr: 4.1 pg m^{-3}) to 2018 (2-OH-Flu: 1.45 pg m^{-3} and 1-OH-Pyr: 5.53 pg m^{-3}), leading to concern of unknown emission sources in Western Japan. The study aims to develop a method to simultaneously measure OH-PAHs and biomass burning markers. Using the developed method, we analyzed samples from 3 different sites (roadside, industry, and residential) in Thailand (2018-2019).

Characteristics of charge distributions of submicron atmospheric particles at Noto Peninsula, Japan

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Submicron charged particles are deposited in the human respiratory tract and may cause inflammation. To elucidate their behavior in the atmosphere, the number concentrations of charged and non-charged particles were measured to estimate the charge distribution of submicron atmospheric particles at Noto Peninsula, Japan, in 2023, using a system which combines a parallel-plate particle separator and optical particle counters. The average charge number (p_{ave}) of particles was obtained by fitting the estimated particle charge distribution with a Gaussian distribution. Monthly median p_{ave} values were negative in summer. The high negative polar conductivity in the atmosphere, arising from high mobility of negative cluster ions from the Pacific Ocean, likely caused the diffusion charge between ions and particles and then led to the summer seasonality of p_{ave}. The p_{ave} values also changed considerably with atmospheric electric field and the ratio of positive polar conductivity to negative polar conductivity in the atmosphere, indicating that charged particles can be produced efficiently in the atmosphere owing to the collision charge between ions and particles. These findings facilitate significant improvement of the spatiotemporal distributions of the charged particles and enhance the accuracy of predicting deposition in the respiratory tract.

Session 3

Integrated Environment

Chemical oceanography in marginal seas

Reanalysis of the formation mechanism of the Cold Water Belt in the southern Okhotsk Sea using ^{129}I

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The southern Okhotsk Sea is an excellent fishing ground, producing 352 ktons/year of scallops, crabs, salmon, etc. Fed by the Soya Warm Current (SWC, high salinity) and the East Sakhalin Current (ESC, cold and low salinity), the surface water of southern Okhotsk can be grouped into Coastal and Offshore areas. The Cold Water Belt (CWB) is formed by the upwelling of cold subsurface seawater. The formation mechanism of CWB has been studied, leaving two theories: 1. upwelling due to resonance, and 2. Elevation of the thermocline through baroclinic wave adjustment. However, both theories allocate the source of CWB before and after the Soya Strait (at the intermediate cold water, ICW). To elucidate the nutrient cycle in the southern Okhotsk Sea, it is necessary to clarify the formation mechanism of CWB. Prior to this study, we found that ^{129}I was carried southward by ESC. Likewise, in surface waters ^{129}I (Offshore > Coastal) anti-correlates with salinity. In this study, after identifying different water masses based on their physical properties, we found that 1. The highest $^{129}I/^{127}I$ ratio was observed at the OSW subsurface (1.33-1.53 $x10^{-10}$), which was modified by Sea Ice melting. 2. Dense-SWC, as Japan Sea's winter-mixed water, has higher $^{129}I/^{127}I$ ratios than SWC but lower than the Okhotsk Sea surface water (offshore area). 3. It is likely that ICW does not have a high $^{129}I/^{127}I$ ratio. 4. CWB had a low $^{129}I/^{127}I$ ratio (< 1.10 $x10^{-10}$), even lower than that of ICW's. From the difference in $^{\text{the }129}I/^{127}I$ ratios of the endmembers, it is likely that the main water mass conforming to the CWB originated in the subsurface waters of the Japan Sea. A mass balance of endmembers, including 129I/127I ratios, TS, chlorophyll-a, and macronutrients, will be used to clarify the role of upwelling from resonance and bottom Ekman processes.

Marine snow in the Japan Sea

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The Japan Sea is known as "miniature ocean" where the effects of various phenomena on the surface of the ocean are likely to propagate and accumulate to the interior of the sea. The vertical transport of sinking particles from the surface to the interior of the ocean is an important factor that governs material transport on relatively short time scales ranging from a few days to several tens of days. Although the distribution of particulate flux of sinking particles (amount of particle sedimentation per unit area and time) in representative regions of the Japan Sea has been clarified, there are few observations near the Tsushima Warm Current (TWC) region, which is a major ocean current in the Japan Sea. In this study, seasonal changes in particulate flux are summarized based on the results of sediment trap experiments conducted in the middle reaches of the TWC for about one year, and the factors that control particle transport are discussed.

Sediment traps were placed at depths of 890 m at Sta FATO (38° 43' N, 137° 48' E) to collect sinking particles. The traps in each layer were set to collect samples for 13 periods between June 2022 and May 2023. Sinking particles were collected on a membrane filter and the dry weight was measured to determine the total mass flux. The particles were then subjected to measurements of silicon, aluminum, calcium, manganese and lanthanum and ytterbium. These elements were selected as indicators to characterize the terrestrial and biogenic components of the particles.

Total particle flux measured by the sediment trap at a depth of 890 m ranged from 198 to 564 mg m^{-2} d^{-1}, with two maximums, one in winter (January-February) and one in spring (March-April). Approximately 60% of the sinking particles in winter are composed of aluminosilicates, and the vertical transport of aluminosilicates, which increased remarkably from around December, was a factor in the high total mass flux in winter.

The elemental composition in sinking particles observed at FATO showed a clearer seasonal variation than the results of previous studies in the major basins of the Japan Sea. This is thought to be because the sinking particle flux at FATO, which is closer to TWC axis and the shelf edge, responded sensitively to changes in oceanographic structures near the surface of the surrounding regions.

Tracing Biogeochemical Fluxes in Asia's Marginal Seas: Resolving Kuroshio Dynamics and Land-Ocean Interactions via Multi-Tracer Diagnostics

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Accelerating climate change and anthropogenic pressures are disrupting hydrological and biogeochemical cycles in Asia's marginal seas, necessitating advanced quantification of material fluxes. This study integrates two critical mechanisms:

1. Kuroshio Nutrient Transport: As a western boundary current, the Kuroshio delivers nutrient-rich subsurface waters to shelf regions, modulated by topography, stratification, and mixing. Long-distance transport routes were traced, with half of subsurface nutrients (400m depth) originating from the Kuroshio reaching the East China Sea and Tsushima Strait.
2. Land-Ocean Interaction: Synergistic physical mixing (riverine/groundwater discharge, pore water) and biogeochemical processes (flocculation, remineralization) govern material transfer. Oxygen-depleted seabed waters were linked primarily to pore water inputs and organic matter breakdown.

Chemical tracers developed under GEOTRACES and allied research initiatives provide robust tools for identifying and quantifying water mass mixing and material transport across diverse spatiotemporal domains. Our methodology leverages multi-tracers - including radiocesium, oxygen/sulfur isotopes, neodymium-radium isotopes, and rare earth element signatures - to systematically resolve these complex marine processes. We quantified nutrient sources—Kuroshio Intermediate/Subsurface Water, Taiwan Warm Current, pore water—and vertical mixing near Luzon/Tokara Straits. This methodology resolves water-mass mixing ratios and material fluxes, offering a transferable framework for global shelf-sea biogeochemical budgets and ecosystem modeling.

Land-ocean linkage studies at Nanao Bay, Japan

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Coastal oceans are supplied with dissolved elements and suspended particles from land areas through rivers, which play a role in maintaining the marine ecosystem. The characteristics and concentrations of the dissolved elements and suspended particles supplied are intricately intertwined with controlling factors such as land use patterns, topography, and precipitation in the river basin, and show different characteristics for each river basin environment. In recent years, it has been feared that the impact of climate change on the land environment will spread to the coastal ocean through fluctuations in flow rate and concentration of nutrients supplied. In this presentation, we targeted the semi-closed western bay at the Nanao Bay, located in the center of the Noto Peninsula in Ishikawa Prefecture, and collected suspended particles in the Kumaki River water and seabed sediments. The migration behavior of suspended solids from the upper to the downstream and marine area was studied by using multi-tracer methods such as ^{7}Be, ^{14}C, ^{210}Pb, and polycyclic aromatic hydrocarbons (PAHs). The concentration of ^{7}Be and ^{210}Pb (excess Pb-210: ^{210}Pb$_{ex}$) derived from atmospheric fallout used and considered the deposition and mobility of suspended particles from the horizontal distribution characteristics of its abundance and deposition rate, as well as its concentration. The ^{210}Pb$_{ex}$ inventory of the sediments lower than the deposition amount in the forest soil except for the river mouth, suggesting that fine particles adsorbed ^{210}Pb supplied from the atmosphere are less likely to accumulate, and some of the suspended particles flow out of the bay. PHAs are chemicals released into the environment by human activities. The concentrations of PAHs recorded in marine sediments off the coast of the Ninomiya River reached a peak around 1975, and this change in vertical distribution coincided with the changing demographic trends of the river basin. The river POC-^{14}C was also measured in suspended particles collected from the Kumaki River. As a result, ^{14}C values decreased downstream, suggesting that apparently older organic matter was being supplied from the lower reaches of the river and discharged to costal marine environment.

Temporal variation of FDNPP-derived radiocesium: Implication to the current systems in the Northern Pacific

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Both the timing and source area of Fukushima Dai-ichi Nuclear Power Plant (FDNPP)-derived ^{137}Cs in seawater are known (i.e., March 11, 2011, close to the FDNPP). Thus, FDNPP-derived ^{137}Cs has become a useful chemical tracer of water circulations, including global circulations since the FDNPP accident. We collected seawater samples in the northern North Pacific, particularly in the Bering Sea during R/Vs *Mirai* and *Oshoro Maru* expeditions in 2022–2024 and examined the spatial distributions of ^{137}Cs concentrations by low-background γ-spectrometry. The concentrations of FDNPP-derived ^{137}Cs at the surface was evidently detected in the Bering Sea, showing small variation in 2022–2024 (0.7–1 mBq/L). This predominantly indicates the effect of FDNPP-derived ^{137}Cs transported by the counterclockwise Alaskan Stream and/or long residence time of ^{137}Cs in the Bering Sea.

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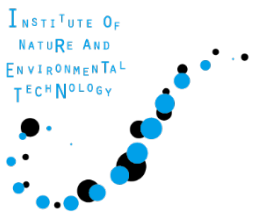
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