

## Visiting Professors' Report

### Prof. Chuan-Chou (River) SHEN

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#### A Wonderful Time with AORI Colleagues

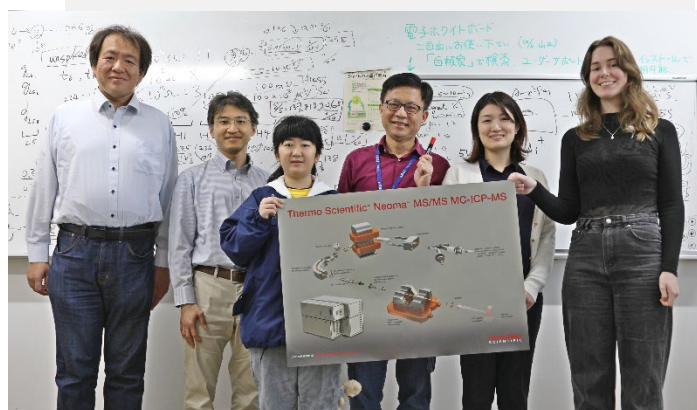
It was a great honor to be invited by Prof. Yusuke Yokoyama to be a visiting professor at the AORI from April 1, 2024, to March 31, 2025. I truly enjoyed working with the Paleoenvironmental Research and Environmental Analysis Group led by Prof. Yusuke Yokoyama, and other colleagues in Japan.

During my time at AORI, my main objectives were to: 1. share the fundamental theory and practical applications of U-Th dating with colleagues and students; 2. help establish U-Th chemistry workflows and instrumental analyses; 3. collaboratively prepare and publish scientific manuscripts; 4. give lectures on U-Th dating and paleoclimate studies; and 5. run a special Union session, Advanced Understanding of Quaternary and Anthropocene Hydroclimate Changes in East Asia, at the 2024 JpGU Meeting with Profs. Yokoyama, Kaoru Kubota, and Li Lo.

My family joined me from Taipei and spent an extended stay in Tokyo, enjoying the Japanese food culture and numerous tourist attractions. We are deeply grateful for the hospitality and the opportunity to share such meaningful time with you all in office, labs, and fields. Thank you again for the invitation and for making our stay so memorable. I look forward to continuing fruitful collaborations with colleagues at the AORI and other institutions in Japan. See you soon, and much love to you all!

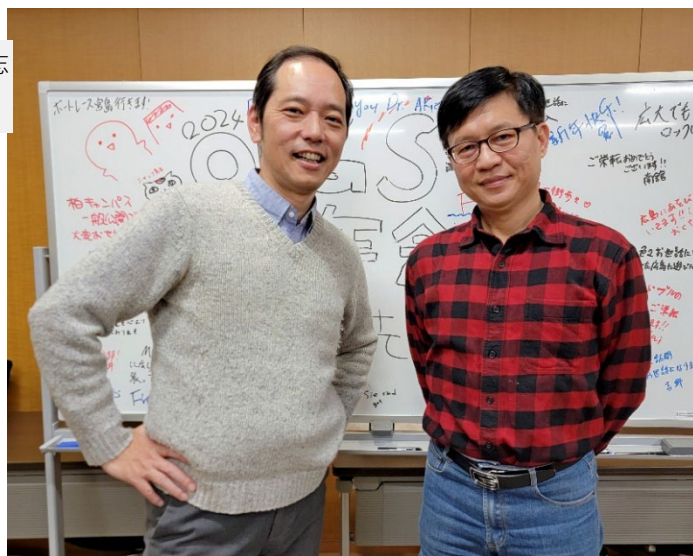


A group photo with colleagues during 2024 JpGU meeting.



A group photo with colleagues and students after a U-Th lecture.

A photo with Prof. Yusuke Yokoyama in the End-of-Year 忘年会 in the AORI on December 26, 2024.



## Prof. Chih-hao HSIEH

*Institute of Oceanography, National Taiwan University*

Latitudinal and longitudinal gradients of bacterioplankton diversity in the East China Sea

I really appreciate the warm support from the AORI and Prof. Hiroaki Saito for hosting my stay from May to Sep 2024. During my visit, Hiroaki and I analyzed the bacterioplankton diversity indices in the East China Sea at three water depth layers, including the surface layer (5 m depth), the deep chlorophyll maximum (DCM) layer, and the bottom layer, based on 16S amplicon sequencing. We broadly categorized the sampling area into inshore and offshore regions based on bottom depth and distance from the coastline. We analyzed the latitudinal and longitudinal diversity gradient for each depth and region. Overall, bacterial richness and diversity increased with both latitude and longitude. This could be attributed to factors such as variations in environmental conditions, including temperature, productivity, and oceanographic circulation patterns, which are known to influence microbial diversity. Bacterial richness exhibited a negative correlation with temperature. However, no clear relationship was found between chlorophyll-a concentration and richness, likely due to the low variability in chlorophyll-a levels (except for a few productive stations). The East China Sea (ECS) is a complex system influenced by multiple water masses and river inputs, with the boundaries of these water masses often acting as hotspots of diversity. Therefore, further investigation into circulation patterns is needed to understand better the mechanisms driving the latitudinal and longitudinal diversity gradient.

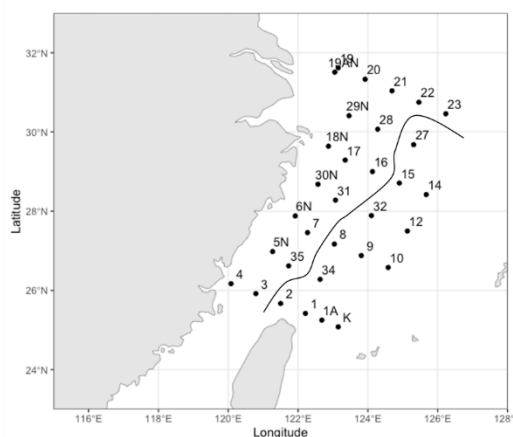


Figure 1. Map illustrating the sampling sites.

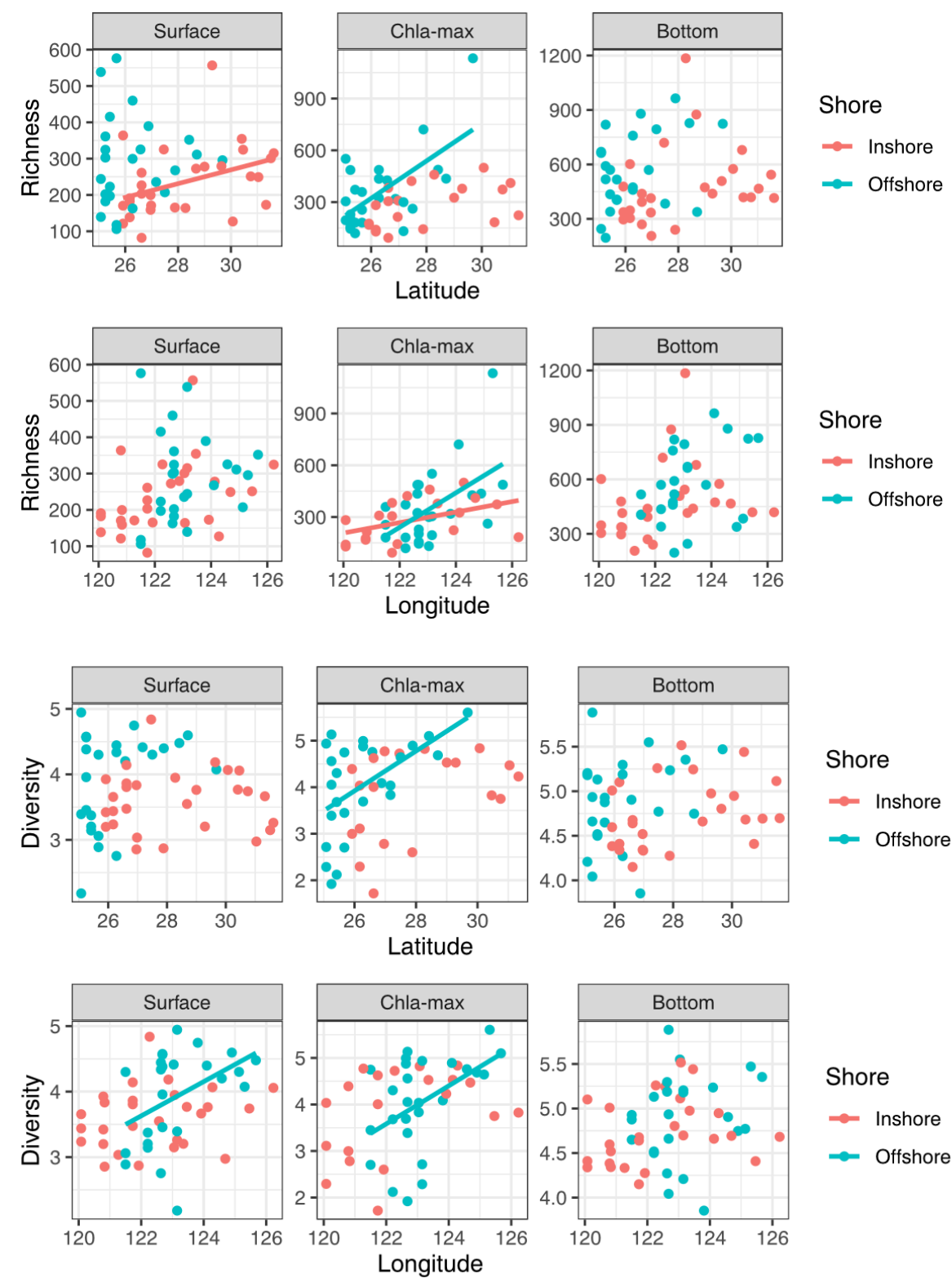


Figure 2. Diversity patterns along latitudes and longitudes.

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**Prof. Patricia REGLERO**  
*Spanish Institute of Oceanography (IEO-CSIC)*

I am deeply grateful for the opportunity to receive a scholarship that allowed me to spend the month of March 2025 at AORI. It has been both an honor and a true privilege to work with Professor Dr. Hiroaki Saito, whose generosity with his time, dedication, and ideas has made this experience especially meaningful.

During this stay, I was also accompanied by my husband, who joined through a research visit supported by a project funded by the Spanish Ministry. Sharing this experience together made our time in Japan even more enjoyable, both personally and scientifically.

Throughout the month, we explored a fascinating question: how is it that the Kuroshio region and the Balearic Islands in the Mediterranean Sea, two of the most oligotrophic areas on the planet, can nevertheless sustain such remarkable tuna production? As we worked side by side, we began to suspect that these regions may be driven by "secret mechanisms," processes not yet fully considered, that enrich their ecosystems far more than their low nutrient levels would suggest.

We would also like to express our warm thanks to Dr. Saito's team and to everyone who accompanied and supported us during our time in Kashiwa. With Dr. Saito, we learned not only about the mysteries hidden beneath the ocean's surface, but also about Japan's fascinating culture and extraordinary gastronomy. From scientific discussions to culinary discoveries, every day brought something new!

Time passed fast! In just a few weeks, we moved from snowy mornings to the breathtaking beauty of cherry blossoms and sunny days. We are certain that this stay marks the beginning of a new line of research and collaboration, one that opens exciting horizons for understanding the functioning of the Mediterranean Sea. I left AORI with deep gratitude, inspiration, and confidence in the possibilities of all that lies ahead.



**Prof. Kevin HAMILTON**  
*International Pacific Research Center, University of Hawaii*

I was fortunate to visit Prof. Masaki Satoh's lab during October and November 2024. This was my third appointment as a guest professor at AORI (following earlier terms in 2015 and 2017) and I very much appreciated the chance to visit once more.

Exciting new developments over the last few years in the field of atmospheric normal modes provided a key motivation for my visit. The new research results have very largely come from Japanese scientists and so I was delighted to participate in a "mini workshop" in Kashiwa organized by Prof. Satoh to review recent progress in atmospheric normal modes. The workshop was held on October 24 and brought together more than a dozen researchers from the University of Tokyo, Kyoto University, Kyushu University and JAMSTEC. The subjects covered included observational analyses that have identified dozens of distinct global modes with periods ranging from ~a few hours to ~2 weeks, observations of the related effects on tropical convection, analysis of the observations of the pressure pulses emerging from the 2022 Hunga Tonga eruption, refinements in the linear theory of global modes including treatments with mean state zonal winds and meridional temperature gradients, related ocean effects including the possibility of "meteotsunamis", and even the possible role of resonant modes in the Martian atmosphere. The discussion identified outstanding issues notably in understanding the internal excitation of the modes as part of the normal flow patterns in the atmosphere.



Group dinner after the normal modes workshop

**Professor Yuqing WANG**  
*University of Hawai'i at Manoa*



I visited the Atmosphere and Ocean Research Institute (AORI), The University of Tokyo, from July 1 to August 31, 2024. My visit was hosted by Professor Masaki Satoh and supported by the AORI's visiting scholar fellowship. This was my second long-term visit to The University of Tokyo when I was on sabbatical. My last three-month visit was fourteen years ago, from March 1 to June 30, 2010; which was also hosted by Prof. Satoh, supported by CCSR (Climate Change Research Center, now part of the AORI). During my last long-term visit, I gave a lecture course on "Tropical Cyclone Dynamics". I am so glad to see that some of the students who joined my lecture have now become very active in tropical cyclone research in Japan. I am also impressed by the tropical cyclone (TC) research activities in Prof. Satoh's lab. During this visit, in collaboration with Prof. Satoh, I focused on a review on understanding how the global TC activity may change in response to global warming sea surface temperature (SST) patterns. We particularly focused on the possible patterns in the tropical Pacific, such as El Nino-like or La Nino-like SST warming patterns, and the modulation by the warming in the tropical Atlantic and Indian Ocean. Based on the literature review, we planned to propose strategies to address the dependence of global TC activity change in response to global warming on the SST patterns in the coming IPCC. This will result

In addition to the above topic, I also joined Prof. Satoh's lab meetings/discussions and provided comments and suggestions to his graduate students, postdoctoral associates in his lab. Most of them focused on TC research, including understanding the historical extreme typhoon events affecting Japan, island topographic effects on the evolution of TC characteristics, the possible impact of inner-core asymmetries on TC rapid intensification, and the possible artificial modification on TC intensity of the TyphoonShot project. On July 18, I had a meeting with Prof. Hironari Fudeyasu of the Yokohama National University (YNU) to comment on the research progress of the TyphoonShot project that he has been in charge as a project leader.

During my visit, I also gave an AORI seminar on July 4 with the title "*A New Time-Dependent Theory of Tropical Cyclone Intensification and Its applications: Current Status and Future Directions*". On August 23, a special workshop at the Yokohama National University for my visit to Japan was organized by Prof. Satoh of the AORI and Prof. Fudeyasu of the YNU. I delivered a lecture in the morning session on "*Recent understanding on the duration of concentric eyewall structure and the associated intensity change in tropical cyclones*". In the afternoon session, I commented on all presentations from members participated the TyphoonShot project. At the end of the day, I gave a Typhoon Science and Technology Research Center (TRC) seminar, which was open to relevant Japanese communities online with the title "*Lapsed impact of El Niño on North Atlantic and western North Pacific tropical cyclone activity in 2023 and beyond*".

Apart from academic exchanges, I enjoyed my stay, especially the Japanese foods, such as sashimi, sushi, Tempura, wagyu, and more. Japanese foods are delicious and healthy. This may explain why the Japanese people have the longest life on average in the world. I also enjoyed my visit to The Sumida Hokusai Museum on August 25 and learned the cultural connection in arts between Japan and China in the history.

In conclusion, my visit to AORI at the University of Tokyo was fruitful and enjoyable. I appreciated the hospitality of the Japanese people, especially my host Prof. Satoh and the staff in the International Lodge of the Kashiwa Campus. Although the time was limited for my visit, our exchange and collaboration will continue. Finally, I would thank the AORI for providing the fellowship for my visit.



Prof. Satoh's group photo taken after a semester in AORI, left to Prof. Satoh is Prof. Wang.-----



## **Prof. Antonio CARACAUSI**

***National Institute of Geophysics and Volcanology (INGV), Italy, and University of Salamanca, Spain***

I visited Professors Shirai Kotaro and Naoto Takahata at the Atmosphere and Ocean Research Institute (AORI), the University of Tokyo during June-July 2024. I have known Professor Yuji Sano, currently emeritus professor in AORI, for more than ten years having the privilege to collaborate with him and he introduced me in AORI years ago.

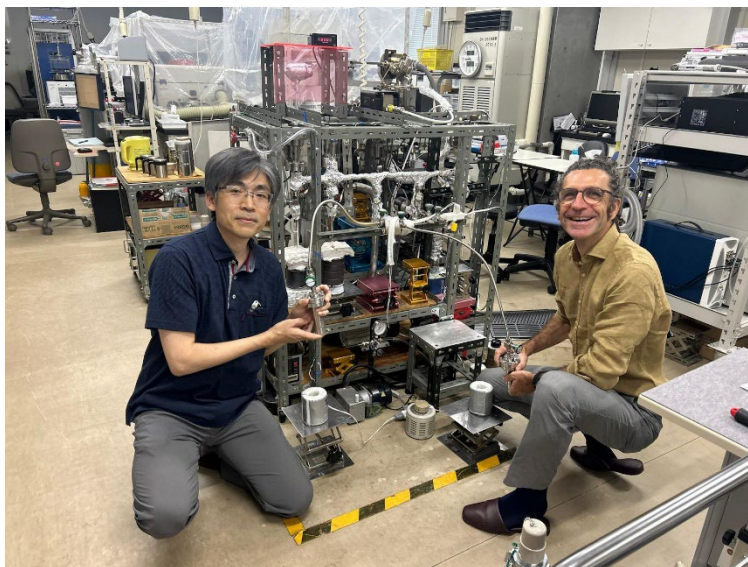


As an Invited Professor at the University of Tokyo, I engaged in a dynamic academic environment that permitted me to have interesting scientific discussions with professors and post docs. I had also the privilege to have a seminar and introduce the community to my recent research about the origin of fluids in the mantle below Antarctica. My scientific research at AORI focused on a detailed geochemical study of mantle-derived fluids from Italy. This study was crucial to optimizing the characterization of mantle volatiles, serving as a control parameter for further comparisons with surface-emitted fluids from active volcanoes. Collaborating with Prof. Takahata Naoto, I conducted the first measurements of helium (He), argon (Ar), carbon (C), nitrogen (N<sub>2</sub>), and water (H<sub>2</sub>O), along with isotopic compositions of CO<sub>2</sub> and N<sub>2</sub> in mineral-trapped volatiles. Additionally, my colleagues and students at INGV in Palermo analyzed noble gases (He-Ne-Ar) in the same samples, ensuring a comprehensive dataset to characterize the mantle beneath Italy. The AORI laboratory, under Prof. Takahata's coordination, is among the few in the world capable of performing C-N isotope analyses in fluid inclusions within minerals. Together, we developed a new step-crushing methodology to extract volatiles from minerals, allowing for the measurement of multiple gas fractions per sample and providing deeper insights into isotopic variability. Our research revealed significant variability in C and N isotopic compositions in mantle-derived volatiles. These findings opened new avenues for understanding mantle evolution, including melting, fertilization, and metasomatic processes.

My collaboration with professors at AORI laid the groundwork for future research on Mid-Ocean Ridge Basalts (MORB) to further investigate mantle geochemistry. Preliminary MORB analyses confirmed isotopic variability, prompting the need for additional studies on samples from different oceanic regions. I plan to continue this research at AORI in June 2025 and also in 2026 under a JSPS fellowship, while simultaneously expanding noble gas analyses at INGV in Palermo.

I had also the opportunity to collaborate with Prof. Norikatsu Akizawa in the study of the mantle in Sea of Japan and in particular to investigate the mantle rock from the Oki-Dogo islands. I participate to the field trip to collect the samples, that will be analyzed for the geochemistry of volatiles in the laboratories of INGV and AORI.

Beyond research, my time at the University of Tokyo offered valuable exposure to Japanese academic culture, characterized by precision, rigor, and innovation. This tenure was a significant professional and personal milestone. The collaborations and research initiated during this period will foster future projects and academic exchanges, strengthening ties with the University of Tokyo and its researchers.

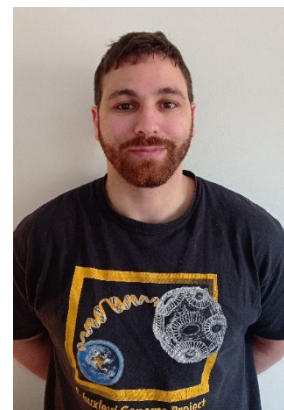


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## Prof. El Mahdi BENDIF

*Institut des sciences de la mer, Université du Québec à Rimouski*

I had the honour to visit Professor Shin-Ichi Ito and his laboratory at the Atmosphere and Ocean Research Institute (AORI) from July to August 2024. I was especially thrilled to forge a new collaboration with Professor Ito, whose integrative research in oceanography provides fresh insights into how marine ecosystems function. This partnership stems from the new links being established between AORI and ISMER, uniting our complementary expertise to drive research at the forefront of Marine sciences. AORI is a premier oceanographic research institute in Asia, and it was a privilege to work alongside Professor Ito and other accomplished scientists in this extraordinary setting.



During my stay at AORI, I had the opportunity to explore the wide-ranging research of Prof. Ito by meeting his entire team, whose work spans physics, fish eDNA, and microplastics, with future plans for research on nature-based solutions for carbon dioxide removal. Observing how these diverse endeavours intersect provided me with a unique insight into the holistic approach Prof. Ito takes to marine science, underscoring the importance of integrating multiple research disciplines to tackle the complex challenges facing our oceans. We are now planning to build a strong collaboration by integrating eDNA methodologies with ongoing studies in primary production, sharing data and expertise to collectively advance our understanding of marine ecosystem function and resilience. Furthermore, I presented a seminar on the genomics of the elusive yet widely common and ecologically significant coccolithophore *Gephyrocapsa huxleyi*. This presentation sparked productive discussions and provided valuable feedback from the research team.

Another highlight of my time at AORI was meeting Professor Hiroaki Saito, who generously hosted me in one of his offices. I am deeply thankful for his unwavering support. Sharing the space with another visiting professor, Professor Chih-hao Hsieh (Zac; Institute of Oceanography and Institute of Ecology and Evolutionary Biology, National Taiwan University), enriched my experience. During our discussions, we met Professor Haruka Takagi, whose research on planktonic foraminifera and their relation to photosymbiosis sparked significant interest. The common features between our expertise and related evolutionary questions led to engaging conversations and potential research collaborations. Additionally, discussing with Professor Takahashi Irie on marine calcification provided me with valuable insights that complemented my research interests. I also had the opportunity to briefly meet with Professor Takuhei Shiozaki, whose work on diazotrophic bacteria and the nitrogen cycle offered new perspectives relevant to research I was planning to conduct in Canada. The support from all these professors provided me with valuable networking opportunities. Outside of Kashiwa, I had the opportunity to visit Professor Masanobu Kawachi at Tsukuba University, where I toured the NIES facility—the major culture collection of microalgae in Japan and one of the most advanced in the world. This visit allowed us to revive a long-term collaboration on the evolutionary genetics of coccolithophores. Additionally, I met and brainstormed with Dr. Yoshiyuki Ishitani from JAMSTEC, an old acquaintance from my time as a PhD student in France. Dr. Ishitani guided me in Tokyo during some weekends, assisting with translation and helping me to rediscover and learn more about the richness and diversity of Japanese culture.

My trip to Shikoku Island was also a wonderful opportunity to meet with Dr. Kyoko Hagino (Marine Core Research Institute (MCRI), Kochi University), with whom I share a deep passion for coccolithophores, as evidenced by the pictures taken by her during my stay in Kochi. These pictures feature commonly found coccolithophores along the Japanese coast near the Kuroshio Current (*Gephyrocapsa huxleyi* on the left, *Baraardosphaera bigelowii* on the right). This collaboration is by far the longest standing among all my partnerships. Additionally, I reconnected with Professor Yurika Ujiie at MCRI, who has developed a strong research program on planktonic foraminifera biology at the Kochi University. She invited me to present my work through a seminar to other members of her lab and the whole institute who all contributed in providing valuable feedback. Looking ahead, we plan to expand our collaboration to further investigate the evolutionary ecology of microcalcifiers in the Pacific and Atlantic Oceans, inclusive of AORI's expertise. In conclusion, my visit to Prof. Ito at AORI was both productive and enjoyable. It provided an excellent platform to collaborate with leading researchers, share my work, and gain invaluable insights from their expertise. Additionally, this experience provided me with amazing memories that I will cherish, thanks to the warm welcome from Professor Ito, his team, and all members of AORI whom I had the chance to meet. I need to add also that Osakana-club Hama added a delightful culinary dimension to my visit, making it even more memorable.

I am grateful for this opportunity and eagerly anticipate future collaborations and visits at AORI. I am very enthusiastic about the potential advancements our joint research will contribute to the global understanding of the marine ecosystem and how it will keep us connected across different parts of the world.

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**Prof. Surendra Kumar DHAKA**  
*University of Delhi Rajdhani College*

**Research Experience at Atmosphere and Ocean Research Institute (AORI),  
CCSR, The University of Tokyo during summer 2024**

I had the privilege of undertaking a research attachment at the Atmosphere and Ocean Research Institute (AORI), Center for Climate System Research (CCSR), The University of Tokyo, where I worked with Professor Imasu's research group from May 7, 2024, to August 3, 2024. This opportunity was made possible through the generous support of **Professor Imasu**, with whom I have maintained a long-standing academic association spanning over two decades.



During this period, my research focused on the study of small-scale agricultural burning using Sentinel-2 satellite data, with an emphasis on integrating advanced deep learning techniques for improved detection and analysis. This work built upon ongoing research in Professor Imasu's laboratory and aimed to evaluate the environmental impacts and detection capabilities of remote sensing technologies applied to agricultural burning. Through the use of artificial intelligence and machine learning algorithms, we sought to develop enhanced models for the classification and prediction of burn areas, contributing to sustainable agricultural practices and improved environmental monitoring.

Throughout the course of this collaboration, Professor Imasu's scientific guidance and mentorship were instrumental in shaping the research direction and methodology. His insights into the complexities of Earth observation systems and AI-based data modelling significantly strengthened the analytical framework of our study and enriched the research outcomes.

In addition to this work, we completed a preliminary investigation on the linkages between solar cycle variability and meteorological parameters—including wind speed, temperature, and surface pressure—over the Indian region, using a combination of MERRA-2 reanalysis data and sunspot records. The findings revealed a gradual decline in solar cycle intensity over the past four decades, corresponding with a reduction in wind speed across several metropolitan cities in India. These changes are likely to influence air quality deterioration due to reduced pollutant dispersion. The observed climatic patterns underscore the importance of continued investigation, and we plan to extend this study further as part of our collaborative work.

My stay at AORI also included participation in an academic field tour to Gunma Prefecture, organized by Professor Imasu's group. This visit provided valuable exposure to the practical applications of remote sensing in environmental studies. A highlight of the tour was the visit to the Gunma Astronomical Observatory, where I had the opportunity to observe the use of advanced telescopic systems and their role in exploring and interpreting celestial phenomena for scientific and educational purposes.

During mid-July, I also had the opportunity to visit Nagoya University and Kyoto University, where I met with Professor Y. Matsumi and Professor S. Yoden, respectively. These interactions fostered interdisciplinary academic discussions, broadening my understanding of the scientific context and potential applications of our collaborative research.

I am deeply grateful to Professor Imasu's research team, including Mr. Arthur (Li Ho Wang), Mr. Arai Yutaka, Ms. Xie Fengxin, Ms. Hasegawa Asaka, Mr. Hu Qiduo, Ms. Anand Anamika, Ms. Owada Hiromi, Mr. Miyauchi Oura, Ms. Yamada Anri, Mr. Wang Qiao, and Ms. Iwasaki Chisa, for their collegial support and intellectual engagement throughout my stay. I would also like to express my heartfelt appreciation to Ms. Asako Ando for her kind assistance with day-to-day matters at both the Kashiwa International Lodge and AORI, and to her colleagues for their warmth and hospitality.

My time at AORI was an enriching and transformative experience that significantly enhanced my technical competence, research acumen, and collaborative outlook. It provided a deeper appreciation of how remote sensing data and AI-driven analysis can be effectively employed to address pressing environmental challenges. I remain sincerely thankful to Professor Imasu and the entire AORI research community for their mentorship and support. The knowledge, skills, and collaborations developed during this period will continue to inform my future research pursuits and academic contributions.