World Premier International Research Center Initiative (WPI)

FY2024 WPI Project Progress Report

Host Institution1	Tohoku University	Host Institution Head1	Teiji Tominaga
Host Institution2	Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Host Institution Head2	Hiroyuki Yamato
Research Center	Advanced Institute for Marine Ecosystem Change (WPI-AIMEC)		
Center Director	Toshio Suga	Administrative Director	Kentaro Ando

Common instructions:
* Unless otherwise specified, prepare this report based on the current (31 March 2025) situation of your WPI center.
* So as to execute this fiscal year's follow-up review on the "last" center project plan, prepare this report based on it.
* Use yen (\) when writing monetary amounts in the report. If an exchange rate is used to calculate the yen amount, give the rate.
- Prepare this report within 10-20 pages (excluding the appendices, and including Summary of State of WPI Center Project Progress (within 2 pages)).

Summary of State of WPI Center Project Progress (write within **2 pages**)

The Advanced Institute for Marine Ecosystem Change (WPI-AIMEC, AIMEC) aims to elucidate the response and adaptation mechanisms of marine ecosystems to Earth system dynamics and to achieve systematic prediction of marine ecosystem change through an integrated approach of marine physics, ecology, and mathematical data science. This section describes the main scientific activities in the fiscal year 2024, followed by measures to promote fusion research. We also report on the progress of the research center concept implemented in the second year.

Advancing world-class research

The total number of publications including "WPI-related" in FY2024 is now more than 200. By the Scopus analysis as of April 10, 2025, the top 10% citation percentiles are 13.2%, indicating that about 26 papers are within the top 10% papers and well referred. Among the 10 research Units described in Section 1-1 in detail, a wide variety of marine scientific research has been conducted. Among many studies, Sugimoto et al. (2025) discovered the most significant sea surface temperature (SST) increase in the world's oceans off the coast of Sanriku, Japan. This rise has become more pronounced since 2023, reaching about 6°C higher than average. The main cause of the SST increase was the anomalous course of the Kuroshio Extension. The abnormal rise in water temperature has significantly increased air temperature, with effects extending up to approximately 2,000 meters above sea level. In addition, reconstruction and future prediction data on climate and carbon cycles are obtained using the system under development and submitted to the Global Carbon Project. This resulted in a consecutive contribution to the Global Carbon Budget (GCB), a widely used dataset on the global carbon cycle since last year. The data analysis showed that the variability of air-sea CO_2 fluxes, especially in the tropical Pacific region, can be predicted several years in advance. The GCB2023 paper (Friedlingstein et al., 2023) was considered a key input for the Global Stocktake (GST) 2023 in the UNFCCC. It has been seen as one of the critical foundations for the statement in the first GST decision document "Recognizing that significant reductions in GHGs of 43% by 2030 and 60% by 2035 compared to 2019 levels are needed to achieve the 1.5 degrees target". Only five groups submitted Earth System Model (ESM) data to the GCB2024 (Friedlingstein et al., 2025). Considering that about 30 groups have participated in CMIP6, an internationally coordinated experiment for climate change projection, our contribution to GCB demonstrates the advancement of our model development.

Generating fused disciplines

At the beginning of the fiscal year, we invited proposals for fusion science projects to promote collaborative research across Units. These proposals were reviewed by the Director, Vice Director, and others, and fusion science activity (FSA) projects, as outlined in Section 1-2, were subsequently launched. In parallel, discussions were held regarding comprehensively formulating the Grand Challenges (GCs) to promote integrative research under WPI-AIMEC. The current tentative titles for GC1 through GC5 are as follows: GC1: Adaptability and vulnerability of marine ecosystems to multiple environmental drivers; GC2: Climate-ocean-ecosystem connectivity and spatiotemporal variability; GC3: Changes in surface marine ecosystems and the impacts on biogeochemical cycles; GC4: Changes in coastal marine ecosystems and the impact of human activities; GC5: Projection of marine ecosystem changes and planetary stewardship.

These GCs were further discussed during the WPI-AIMEC All-Hands Meeting (General Assembly) held at Japan Agency for Marine-Earth Science and Technology (JAMSTEC) on March 17–18, 2025. In fiscal year 2025, we plan to compile the GCs into a single document for publication. At the same time, we will revise and implement the initially proposed FSA projects to align with the GCs, ensuring a cohesive and effective research strategy.

Global research environment and institutional reform international research environment

AIMEC organized 5 international symposia and meetings, including workshops and related events. In addition, 31 AIMEC Science Salons were held in FY2024, regularly on Tuesday evenings, and conducted exclusively in English. Of these, 15 were lectures delivered by invited researchers who are internationally recognized leaders in AIMEC-related research fields. A total of 5 AIMEC Colloquiums were also held, providing opportunities for intensive, face-to-face discussions, mainly focused on the future scientific direction of AIMEC such as the GCs. A total of 41 invited researchers participated in the above international meetings and in-house seminars, representing the United States, France, Germany, the Republic of Korea, Russia, China, Indonesia, Thailand, Australia, Brazil, and Poland. In recognition of the importance of establishing an overseas satellite center to enhance the international research environment, AIMEC launched the international satellite center at the International Pacific Research Center (IPRC) of the University of Hawaii. Furthermore, to make it easier for foreign researchers to conduct research in Japan, we increased the annual salary by 1 million yen to 6.6 million yen from the previous 5.6 million yen.

Organizational reform

Since this WPI center was established as a multi-host type, it was inevitable that one host institution would need to adapt to the system of the other to operate AIMEC under a unified framework. This required significant reforms in various organizational aspects. Through the continuous discussion, we decided that Tohoku University and JAMSTEC would share this “one roof” principle as a fundamental approach. Accordingly, AIMEC established its self-operating regulations, based on JAMSTEC’s standard organizational framework, to ensure compatibility with both JAMSTEC’s existing system and Tohoku University’s AIMEC system. Since the last fiscal year, AIMEC has operated under this framework while sequentially developing the necessary rules and regulations for its operations. It is important to note that further regulations are being prepared as needed, and organizational reforms are an ongoing process that all AIMEC members are part of.

Values for the future creation and dissemination of social value of basic research

In our outreach activities, AIMEC aims to return the results of its research to society, improve the academic and social significance of its research, and strengthen science education, leading to advancement in universities and other institutions. On the internet, both host institutions’ content and the latest news have been widely disseminated to the social and academic classes through websites and social media. Face-to-face, we have held academic sessions at various conferences and events, including the Japan Geoscience Union (JpGU), one of the largest academic conferences in the field, and booth exhibitions targeting high school and university students. In addition, as an opportunity for science and society to generate knowledge, we collaborated with Tohoku University’s Tohoku Forum for Creativity (TFC) to hold a workshop. In this workshop, experts from industry and the humanities and social sciences, as well as the general public, mainly students, engaged in a collaborative process to generate ideas to solve social issues in coastal areas. Research introduction activities and meetings aimed at collaboration were held for stakeholders in specific fields, such as industry, foundation, corporation, and aquarium.

Human resource development, higher education, career development

The decision to expand the Graduate Program for International Joint Degrees (Graduate Program in Earth and Environmental Sciences; GP-EES) was made as a commitment by Tohoku University, and the selection of GP-EES graduate students began in the middle of FY2024. GP-EES is now to be expanded to support more than 10 students. This expansion is being implemented as a university-level commitment, representing a direct allocation from Tohoku University to AIMEC. This support makes it easier for Tohoku University graduate students to visit the University of Hawaii and other overseas partner institutions.

Sustainable center

Tohoku University, in collaboration with the University for International Research Excellence (UREX) initiative, is moving forward with a new building project at the Aobayama Campus. The building’s concept and architecture are currently underway, with the first floor set to be a shared open-facility for the promotion of knowledge sharing and co-creation with stakeholders. AIMEC will occupy the second and third floors, while the fourth and fifth floors will house UREX research activities. In line with the UREX initiative, the AIMEC is developing a long-term human resource strategy, including an eight-year and beyond staffing plan. This strategy envisions a sustainable research center of approximately 20 core faculty members by tenure and tenure-track positions, providing a sustainable fusion research environment after the decadal WPI support. Over the coming year, AIMEC aims to hire at least one person for a tenure position and one for a tenure-track position under the UREX initiative, reinforcing Tohoku University’s commitment to long-term growth and excellence of this WPI center.

* Describe clearly and concisely the progress being made by the WPI center project from the following viewpoints.

1. World-Leading Scientific Excellence and Recognition

1-1. Advancing Research of the Highest Global Level

* Among the research results achieved by the center, concretely describe those that are at the world's highest level. In Appendix 1, list the center's research papers published in 2024.

WPI-AIMEC currently consists of 10 research Units, promoting FSAs among the Units based on ocean observation and experimental data. Here we outline the activities and research progress of each Unit in FY2024.

■ **Marine Environment Integrative Analysis Unit (Unit Leader: Sayaka Yasunaka)**

To detect environmental and biological changes from coast to world ocean, seasonal to 10,000-year scale, we ran observational and modeling projects and led integrative analyses. A recent study published in *Nature* showed that the two domains, the well-lit surface water and the twilight zone below, are coupled in a way that strongly alters the response of surface ecosystems to climate change (Rodgers et al., 2024). This coupling is provided by "thermocline renewal" whereby the relatively warm upper ocean waters spanning the upper 300-500 meters are renewed by passing through the surface ocean over decades. This study could help us understand how habitats, important to marine resources such as fisheries, can be impacted by climate change. The overall trend is that gradual de-oxygenation and warming of the ocean may ultimately make it more difficult for fish to live. It is important to create models that accurately project marine ecosystems and fish habitats in a changing climate. Sugimoto et al. (2025) discovered the most significant SST increase in the world's oceans off the coast of Sanriku, Japan. This rise has become more pronounced since 2023, reaching about 6°C higher than average. The main cause of the rise in water temperature was the anomalous course of the Kuroshio Extension. The abnormal rise in water temperature has significantly increased air temperature, with effects extending up to approximately 2,000 meters above sea level. "Hot water treatment" is carried out yearly from August to September in some oyster farms along the Sanriku coast to remove attached organisms, increase oyster production, improve oyster quality, and protect the seabed environment (Hatakeyama et al. 2024). Hot water treatment increases the intake rate of organic matter, such as phytoplankton, which serves as food for the fish, and increases the high-value-added components. It prevents the accumulation of excrement and remains of attached organisms on the seabed, thereby contributing to the conservation of the marine environment. Hot water treatment is a good example of how it is possible to harmonize the flow of materials within an ecosystem with production activities based on the experience of fishermen, thereby improving productivity and reducing the environmental burden.

■ **Ecological Complexity Research Unit (Unit Leader: Michio Kondoh)**

We managed the environmental DNA (eDNA) observation network ANEMONE, a project that has made significant progress and is poised for further success. In fact, ANEMONE is promoting public engagement, international collaboration, and basic research and technological development. It is a nationwide eDNA-based biodiversity monitoring system operated in collaboration with stakeholders from academia, government, industry, and civil society. This year, with NPO Earth Watch Japan, we conducted a coastal survey at over 200 sites across Japan. Offshore eDNA surveys were carried out with commercial shipping companies, such as NYK Line, Kinkai Yusen, and Ogasawara Kaiun. We launched "ANEMONE Global" with scientists from 11 countries, aiming to establish a global eDNA monitoring network. Within the OceanShot program (OPRI, Sasakawa Foundation), the project "Holistic Genomic Approach to Asia-Pacific Marine Biodiversity," completed its first year. The project aims to collect and publicly release genomic data of major marine species in Japanese coastal waters using the MIG-seq method developed by Suyama of this Unit. We have collected over 14,000 samples from 700 species and obtained genomic data for 254 species. Our goal is to analyze 1,500 species by 2026, and we are well on our way to achieving it. We engaged in research and social collaboration toward realizing "Nature Positive" an emerging international environmental goal. The COI-NEXT program "Nature Positive Sustainable Development Hub" completed its first full-scale year. In partnership with 9 academic institutions, 15 companies and organizations, and 2 local governments, the project carried out wide-ranging initiatives to promote a science-based transition toward a nature-positive society. These included visualizing natural capital, developing financial mechanisms to support ecosystem restoration, and building capacity to support nature-positive transformation.

■ **Coastal Ecosystem Services Research Unit (Unit Leader: Takeshi Obayashi)**

Our three key challenges 1) elucidation of the response mechanisms of coastal ecosystems to changes in

the marine physical and chemical environment 2) elucidation of the response mechanisms of ecosystem services to human activities in coastal areas 3) development of evaluation and analysis methods for marine ecosystems utilizing functional genomics and related approaches. 2024 activities include *1) Enhancing Long-Term Coastal Ecosystem Monitoring by New Measurement Instruments.* Building on existing efforts at the Onagawa Field Center, we introduced long-read meta-epigenomics. The new PlanDyO (Plankton Dynamics in Onagawa) project aims to analyze all genetic material in seawater samples, capturing both the presence and physiological status of individual species across time and location. In 2024, we collaboratively established an analysis workflow encompassing coastal sampling, DNA sequencing using a Nanopore sequencer, phenotypic analysis via both flow cytometry and image-based flow cytometry, and microplastic analysis. The highly productive and ecologically diverse benthic zone is closely linked to the pelagic zone. While PlanDyO analysis focuses on the pelagic zone, high-resolution technologies for monitoring the benthic zone are needed. Fujii introduced an underwater observation system, Edokko-1 developed by SIP/JAMSTEC, which will be deployed in FY2025. *2) Monitoring and Co-Creation for Seagrass Bed Ecosystems.* Ikeda and Hamabata advanced the understanding and conservation of seagrass bed ecosystems through field surveys and interdisciplinary engagement. The monthly monitoring of juvenile fish in a small Oshika Peninsula fishing port (2023–2024) revealed that 72 species use the seagrass bed as a nursery, based on morphological and DNA-based identifications. These data highlight the ecological significance of even small seagrass habitats. Hamabata initiated interdisciplinary research on green sea turtles and seagrass beds to inform environmental policy and promote coexistence. She has fostered dialogue between science and society through her international workshops and citizen symposia. *3) Developing Computational Systems for Gene Network Analysis.* Obayashi developed a system to identify environmental conditions under which gene pairs function together, enabling network-level analysis of gene expression in response to environmental changes. This system, released as part of the ATTED-II database version 12.0 [https://atted.jp], provides a foundation for summarizing epigenomic data for the PlanDyO project.

■ **Ocean-Solid Earth Dynamics Research Unit (Unit Leader: Yusaku Ohta)**

We accelerated discussions on using geophysical observation data from the deep ocean floor for the solid earth and applied ocean physics models to solid earth analysis. We analyzed ocean bottom temperature (OBT) data in the Kuril Trench, collected over nearly two years by three moored seafloor geodetic sensors. Results show low-frequency OBT fluctuations with a period longer than 1 month. The 60-day low-passed OBT anomaly aligns with the 60-day low-passed sea level anomaly (SLA) from the gridded altimetry products (Fig. 1). Significant positive OBT anomalies occur when anticyclonic mesoscale eddy stays near the sites. A long-lived eddy may induce downwelling via isopycnal depression, as preliminarily evidenced by the “A-line” CTD observations across the eddy. Lag correlation between band-passed OBT and SLA with a period of 30-60 days increases when the eddy center approaches the observational sites. OBT fluctuations in this band are likely caused by topographic Rossby waves, triggered by the interaction between the anticyclonic eddy and the continental slope west of the Kuril Trench (Wang et al., in prep). Global Navigation Satellite System-Acoustic (GNSS-A) positioning enables three-dimensional seafloor deformation measurements. Accuracy of GNSS-A vertical components is low compared to horizontal ones due to the uncertainty of the reference sound speed profile (SSP) employed in GNSS-A positioning. Using direct oceanographic measurement data, we addressed uncertainties in both cases, where the reference SSP was taken from direct measurement and the oceanographic data assimilation model (JCOPE2M). We examined vertical GNSS-A positioning errors in both cases using the Monte Carlo method: ~2 and ~6 cm in the former and latter cases respectively. We optimized vertical GNSS-A positioning errors by considering the uncertainty of reference SSP and other error sources. Optimized vertical GNSS-A positioning errors successfully explain offsets of the campaign solutions deviated from a long-term displacement trend compared with conventional error evaluations (Tomita et al., MGR, 2025). With the Marine Biogeochemical Dynamics Research Unit, we simultaneously conducted GNSS-A and XCTD observations to obtain spatiotemporally dense oceanographic data for modeling sub-mesoscale phenomena. In October 2024, a field observation campaign occurred in the off-

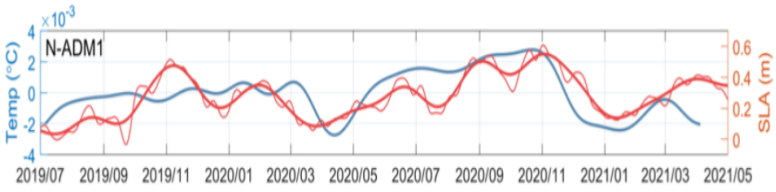


Figure 1: The 60-day low passed bottom temperature anomalies in the deep seafloor of 7,000m and SLA.

Sanriku region. The expected delay of sound waves based on the XCTD and the estimated GNSS-A observation results agree well, but GNSS-A observations showed shorter wavelength variations.

■ **Marine Biology Integrative Research Unit (Unit Leader: Cheryl Ames)**

Figure 2: NSF-AIMEC Joint Workshop (Onagawa Field Center & Tohoku University). Group photo.

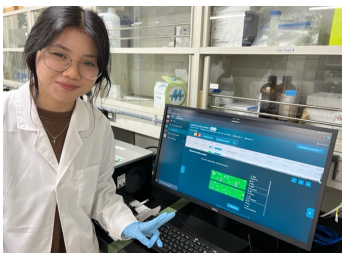


Figure 3: NSF-AIMEC Joint Workshop. A student demonstrating how to use the Nanopre GridION machine.

A FSA project permitted the integration of various research Units to establish a centralized specimen voucher repository (Tohoku University Museum). Initial efforts focused on specimen collection and data standardization with notable collaborations. The second year will emphasize specimen collection, physical data acquisition, *in situ* imaging, and DNA sequencing. Additionally, funding will support new hires and initiatives to enhance biodiversity understanding through public data integration and bioinformatics improvements. We logged 53 travel events (e.g., Japan, USA, Hawaii, Spain, Indonesia); borrowed lab space in Agriculture graduate school, 10 major oral presentations, developed QR code system for equipment use and maintenance, successful JSPS inspection; contributed to (Diversity, Equity, and Inclusion: DEI) task force and GC4. We developed fusion science relationships with four JAMSTEC Units. AIMEC-sponsored workshops (Figs. 2 & 3) include; Nanopore workshop in Onagawa had 27 participants, with 22% females and 52% students, representing 11 countries and covering 2 AIMEC Units. Imaging workshop at Tohoku University and JAMSTEC had 18 participants, with 56% females and 33% students, representing 10 countries and covering 2 AIMEC Units. R Studio workshop at Aobayama had 16 participants, with 44% females and 69% students, representing 10 countries and covering 3 AIMEC Units.

■ **Marine Microbial Ecology Research Unit (Unit Leader: Tatsuhiko Hoshino)**

Our research on the ecological characteristics and metabolic functions of marine microorganisms is poised to significantly impact our understanding of biogeochemical processes and material cycling in the ocean. We have been developing a framework for individual particle analysis with support from the FSA. We optimized protocols for cell digestion and DNA amplification from individual particles excised using laser microdissection. Using the optimized protocol, we revealed differences in microbial community composition and metabolic functions among various types of marine particles, despite similar sizes. These findings are a step toward a mechanistic understanding of the biological carbon pump and have the potential to refine current biogeochemical models. We are investigating the mechanisms underlying autumn bloom formation in the Pacific Arctic region, which has been occurring more frequently and significantly impacts the development of the much larger spring bloom (Fig. 4). Our study concluded that nutrients and resting spores released from resuspended sediments, driven by bottom currents induced by surface winds, serve as a seed source for autumn phytoplankton blooms (Fukai et al., 2025). These results underscore the ecological and biogeochemical significance of diatom resting spores and their critical role in the oceanic carbon cycle. A novel RNA editing system was discovered in *Ascetosporea*, a little-studied group of parasitic protists, for which we successfully established the first cell culture. Extensive RNA editing in the mitochondria was observed at an unprecedented level. The primarily nonsynonymous edits alter amino acid sequences in proteins, potentially restoring the function of otherwise mutated genes (Yabuki et al., 2025). These findings expand our understanding of mitochondrial RNA editing and open new avenues for exploring the evolution and significance of these

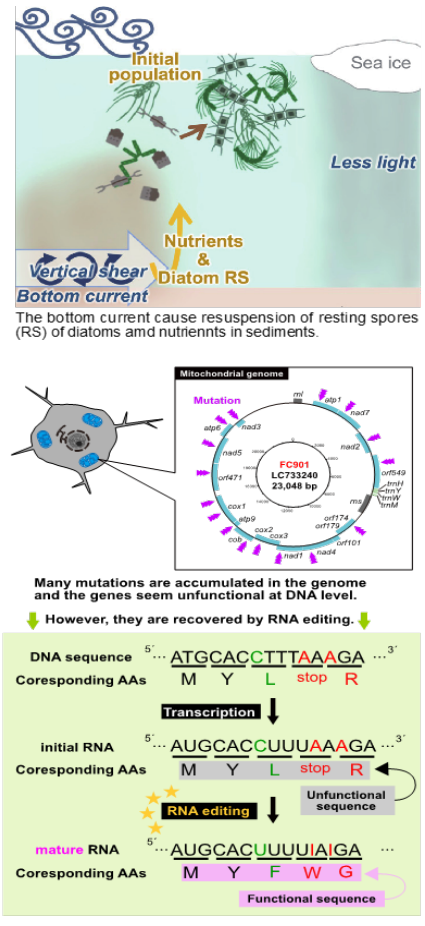


Figure 4

processes in eukaryotic biology (Fig. 4).

■ **Marine-Earth System Analytics Unit (Unit Leader: Michio Kawamiya)**

An Earth system model is a simulation tool for reproducing global climate and carbon cycle variability. We are developing a climate and carbon cycle prediction system that integrates our ESM with an initialization system. Initialization is a procedure for synchronizing the phase of internal variability in a model with observations by assimilating observed data into the model. Running the ESM while assimilating observations, we can consistently reconstruct the variability of the climate and carbon cycle. The obtained carbon cycle balance is closed on the global scale, which is important for analyzing atmospheric CO_2 concentration variations. In such an initialization process, initial values for future prediction are obtained together with the reconstructed data. Reconstruction and future prediction data on climate and carbon cycles are obtained using the system under development and submitted to the Global Carbon Project (GCB). This resulted in a consecutive contribution to the GCB, a widely used dataset on the global carbon cycle, since last year. Analysis of the obtained data showed that the variability of air-sea CO_2 fluxes, especially in the tropical Pacific region, can be predicted several years ahead. The GCB2023 paper (Friedlingstein et al., 2023) was considered a key input for the Global Stocktake 2023 in the UNFCCC. It has been seen as one of the critical foundations for the statement in the first GST decision document "Recognizing that significant reductions in GHGs of 43% by 2030 and 60% by 2035 compared to 2019 levels are needed to achieve the 1.5 degrees target". Only five groups submitted ESM data to the GCB2024 (Friedlingstein et al., 2025). Considering that about 30 groups have participated in CMIP6, an internationally coordinated experiment for climate change projection, our ESM data submission was a significant contribution to the GCB, demonstrating the advancement of our model development.

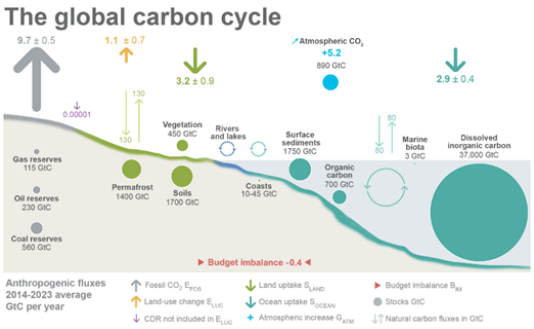


Figure 5: Global carbon cycle as compiled by Global Carbon Budget 2024 (Friedlingstein et al., 2025).

■ **Marine Biogeochemical Dynamics Research Unit (Unit Leader: Shinya Koketsu)**

Our contribution to biogeochemical (BGC) Argo float deployment and high-accuracy ship-based observation projects under the global ship observation network (GO-SHIP) are paving the way for future applications, including basin-scale microbial observations through GO-SHIP surveys and the development of data assimilation methods to estimate BGC cycles as inversions. We aim to expand global observations to elucidate large-scale BGC cycles, uncover how material distribution affects microorganisms, and how biological activities impact material distribution. We seek to evaluate the role of biological pumps and global changes, providing crucial insights. In 2024, we continued our contributions to BGC Argo float deployment and joined new float development projects in Japan's nearby seas (Hosoda; CREST and Grants-in-Aid for Scientific Research). Reliable data were provided through *in situ* calibration of oxygen sensor-equipped Argo floats, contributing to future research (by Sato et al.). The global 3D distribution of DOC (Dissolved Organic Carbon) was estimated via GO-SHIP-based research. This study lays the groundwork for connecting advanced ecological and circulation variations by combining DOC composition estimates with enhanced FDOM (Fluorescent Dissolved Organic Matter) measurements (i.e., FSA project). As a foundation for examining material cycles and their relation to ecosystems, microbial measurement data conducted in the past, including GO-SHIP observations, were organized (Yokokawa). This data organization forms an essential database for integration with DOC compositional distributions. Alongside efforts to estimate material cycles, organize data, and achieve breakthroughs via new observational items targeted within the FSA, we performed estimations of community production at the surface layer using relatively abundant dissolved oxygen observations (Koketsu; Yamaguchi et al., 2024). This method estimates the oxygen balance in the surface mixed layer and euphotic layer by combining physical circulation fields inferred from observations (geostrophic flows, eddy transports, and turbulent mixings) with monthly dissolved oxygen distributions and atmospheric flux estimates. The residual from this balance is taken as community production. The uncertainty inferred from observations was narrower than the spread observed in CMIP6 models, successfully providing a benchmark for modern models. This marked the first phase of research results for this Unit, which focuses on the role of biological pumps, utilizing global observations and data assimilation to advance studies. AIMEC researcher Jonathan Derot joined in FY2024 and is building collaborations with French institutes targeting phenomena such as harmful algal

blooms (HABs) in coastal and inland waters. Causal analysis through machine learning and estimating vertical profiles from limited data will be attempted. These methodologies are planned to be applied to future global observation networks, with anticipation for the potential impact.

■ **Marine Ecosystem Modeling Research Unit (Unit Leader: Sherwood Lan Smith)**

Two AIMEC postdoctoral researchers were hired: Wakamatsu in March 2025 and Luang-on will join in May 2025. They study HABs using satellite-based remote sensing and *in situ* observations. A third postdoctoral researcher is being recruited, who will join later in 2025. Siswanto and Luang-on enhanced the ability to detect various HABs from satellite observations (Fig. 6). Using 250-m-spatial-resolution ocean color products from Second-Generation Global Imager (SGLI), Global Change Observation Mission-Climate (GCOM-C) platform, they developed a new algorithm that accurately identified red tides caused by green *Noctiluca*, diatoms, and dinoflagellate blooms, consistent with observations in the upper Gulf of Thailand (Luang-on et al., 2024). Barbieri, working with researchers from the Biogeochemistry Group at JAMSTEC, has developed unprecedented reconstructions of ecological networks spanning 4 trophic levels, based on compound-specific stable isotope measurements of amino acids (Fig. 7; Barbieri et al., in submission). Barbieri received funding from the International Union of Theoretical and Applied Mechanics to run a workshop on sea ice dynamics in 2025.

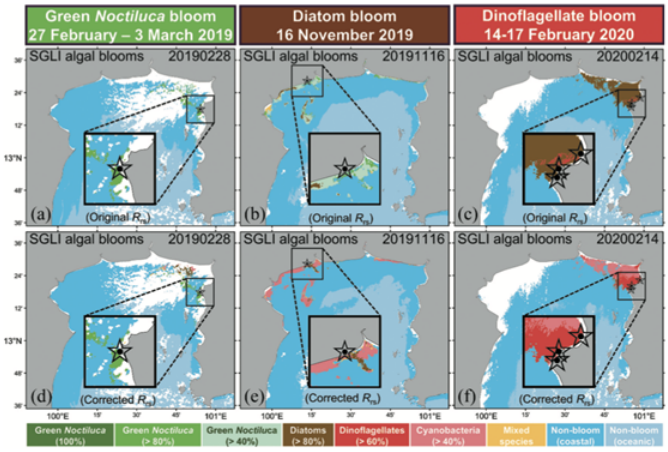


Figure 6: Comparison of GCOM-C/SGLI chl-a before (a–c), and after correction (d–f) during red tides caused by green *Noctiluca* blooms (a, d), diatoms (b, e), and dinoflagellates (c, f) as reported by the Department of Marine and Coastal Resources, Thailand. Stars mark locations of reported red tides.

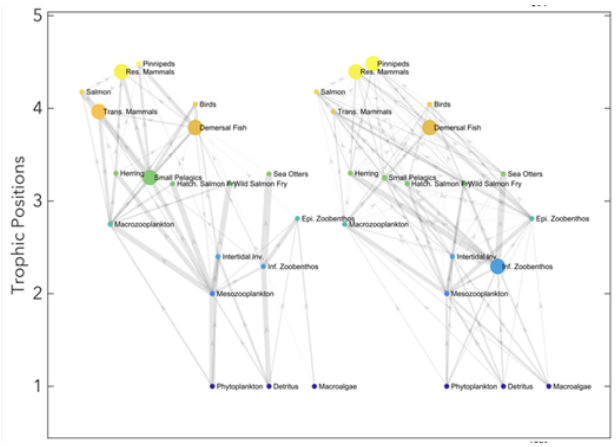


Figure 7: Reconstructed food webs (Prince William Sound, Alaska) from a previous study (EcoBase, left), and herein (right) based on Trophic Position, assuming connectance = 0.3. Line thickness is proportional to diet coefficients. Large nodes denote the four keynote species identified by each study, respectively (two were common to both).

■ **East-West North Pacific Marine Ecosystem Research (Unit Leader: Niklas Schneider)**

We focus on the North Pacific Subtropical Gyre (NPSG) and leverage existing model simulations and direct observations that leveraged the Hawaii Ocean Time-series (HOT). We explored physical processes that underlie the distribution of surface wind divergence over the sharp sea surface temperature fronts of western boundary current regions, with convergence over the warm and divergence over the cool flanks of the current. This feature is found over the Kuroshio and, most prominently, over the Gulf Stream. We analyzed satellite observations over the Gulf Stream and show the average surface wind divergence result from the combination of the atmospheric boundary layer response to the western boundary sea surface temperature fronts and the transient winds of the mid-latitude storm track. The study employs a unique analysis technique, impulse response functions, and, for the first time, reconciles the boundary layer responses to the ocean SST in the presence of the storm track. The study area will be extended to the Northwest Pacific and will investigate the atmospheric response to the recent warming and changes of the Kuroshio Large Meander and poleward shift of the Kuroshio Extension. We began an exploration of plankton abundance and optical properties within the NPSG. Small and abundant cyanobacteria, *Prochlorococcus* and *Synechococcus*, dominate these low-nutrient waters in terms of photosynthetic biomass and primary productivity. While there is a relatively good understanding of how the abundance of these organisms' change in time and space, less is known about how their size and cellular properties vary. This information is key to understanding niche differentiation and potential adaptation to alterations in the flux of energy and nutrients. We mined the database of the HOT to present changes in the

fluorescence and scattering properties per cell in the dominant picocyanobacterial genera *Prochlorococcus* and *Synechococcus*. This work aims to reveal how phytoplankton alter their cell size, carbon content and light absorption potential over time and space. This is a step towards synthesis of decades of phytoplankton distributions in the NPSG. Additional data from imaging flow cytometry, video plankton recorder, and an underwater vision profiler are being compiled and will be shared with our AIMEC colleagues. Tasks this year include a) participation AIMEC's All-Hands Meeting b) initial collaborations with Unit Leader (UL) Smith via a FSA project to explore models of photo-acclimation and phytoplankton resource allocation and c) initial collaboration with UL Cheryl Ames to share code and protocols for towed operation of a video plankton recorder.

1-2. Generating Fused Disciplines

* Describe the content of measures taken by the center to advance research by fusing disciplines. For example, measures that facilitate doing joint research by researchers in differing fields. If any, describe the interdisciplinary research/fused discipline that have resulted from your efforts to generate fused disciplines. You may refer to the research results described concretely in "1-1. Advancing Research of the Highest Global Level."

This session will report on the progress of FSA in FY2025, which consists of the fusion of different Units/specialties.

- **Combining observations and models to better understand the adaptive capacity of phytoplankton communities in the subtropical ocean (FSA Leader: Sharwood Lan Smith)**

In FY2024, White at the University of Hawaii (UH; Hawaii Ocean Time-series (HOT) Leader), her students and colleagues were invited to visit JAMSTEC, but due to oceanic observation and conference obligations, their visit was delayed. FSA Leader/UL Smith and AIMEC researcher Barbieri visited UH for the AIMEC March 4-5, 2025, workshop and met with White and AIMEC postdoctoral researcher Andrew Hirzel. March 6-11 FSA Leader/UL Smith and AIMEC postdoctoral researcher Lael Wakamatsu visited White and her colleagues at UH. Plans were made to use the Framework for Aquatic Biogeochemical Modeling (FABM) for 0D and 1D model development and hypothesis testing (by Barbieri). As well as plans to test hypotheses explaining the enigmatic long-term (30 years) observed increase in sub-surface primary production (e.g., in terms of physiological acclimation vs. adaptation). FSA Leader/UL Smith and Wakamatsu met with David Karl, the former leader of HOT and the Director of C-MORE, who advised focusing on the enigmatic source of nutrients that sustain primary production in the near-surface subtropical North Pacific Gyre, and mechanisms underlying sporadic fluctuations of primary production in the near-surface waters. FSA Leader/UL Smith conducted a preliminary investigation of modeled and observed patterns of primary production and chlorophyll concentrations (Fig. 8), which differ depending on the degree of environmental variability (between sites, and for the near-surface and sub-surface, respectively).

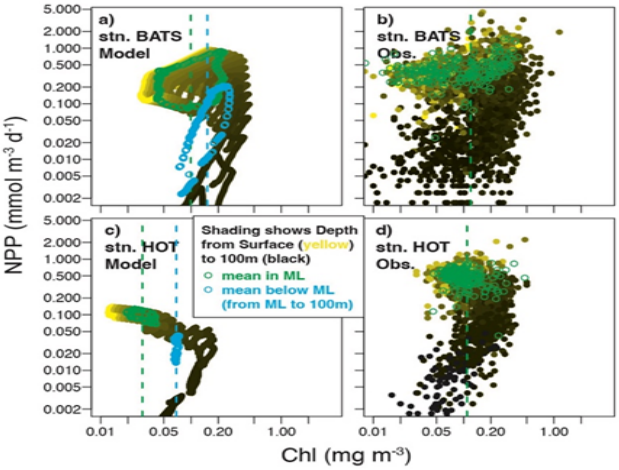


Figure 8: Modelled (a and c) and observed (b and d) rates of Net Primary Production (NPP) and Chlorophyll concentrations (Chl) from (a and c) Bermuda Atlantic Time Series (BATS) and (b and d) Hawaii Ocean Time-series (HOT). Modeled values are from the FlexPFT-3D model developed at JAMSTEC.

- **Responses of coral reefs and coral reef ecosystems to Quaternary climate changes (FSA Leader: Yasufumi Iryu)**

During the Quaternary, coral reefs and their ecosystems underwent repeated sea-level and temperature changes caused by glacial and interglacial cycles. Systematic analysis is limited, glacial coral reef deposits are submerged below sea level and are hard to access except in tectonically uplifted areas. The Ryukyu Islands expose interglacial reef to off-reef facies from high to low elevations on land, allowing 3D observations of coral reef responses to sea-level changes. Using this, we will compare glacial and interglacial coral assemblages (0.7–0.5 Ma) from Okinoerabu Jima and Tokunoshima, delineate responses of coral reefs and ecosystems to Quaternary climate changes, and make a numerical model to reproduce

paleoceanographic conditions constrained by geological and paleontological data. We quantitatively investigated coral assemblages at 12 outcrops on Okinoerabu Jima, showing no taxonomic composition differences between glacial and interglacial coral (Fig. 9). Taxonomic composition was analogous to the modern Central Ryukyus. Data suggests the Pleistocene coral assemblages held stable taxonomic composition and diversity despite paleoceanographic perturbations caused by glacial and interglacial changes. To investigate the ice age marine environment and the contribution of the Kuroshio, we use a global high-resolution ocean simulation model with a 0.1° horizontal resolution. Fig. 10 shows model results with boundary conditions and topography corresponding to the present climate and the Last Glacial Maximum (LGM).

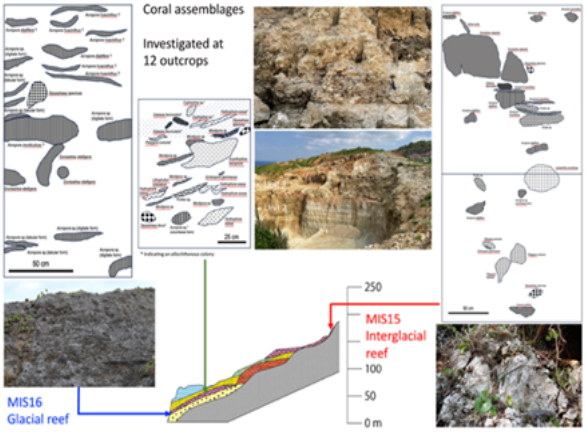


Figure 9: Glacial and interglacial coral assemblages on Okinoerabu Jima, central Ryukyu Islands.

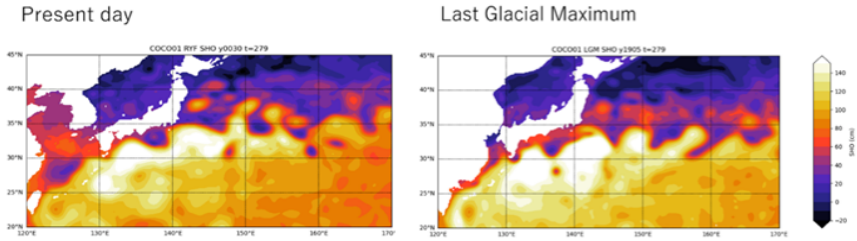


Figure 10: Sea level height distributions in the ocean model driven under the present climate (left) and the Last Glacial Maximum (right) conditions.

■ **Reconstruction of monthly-resolved time-series variations in the atmosphere and ocean for the past 500 years: a fusion of reanalyzed $\delta^{18}O$ proxy data, $\delta^{18}O$-based proxy data assimilation, and ocean modeling (FSA Leader: Hideko Takayanagi)**

Long-term observations of carbon flux and biogeochemical model studies have shown that carbon remineralization and sequestration processes are intricate due to multiple carbon mechanisms. How heterogeneous biogeochemical processes respond to ocean environmental changes is largely unknown, mainly due to the limitation of long-term data with high spatiotemporal resolution. We aim to reconstruct monthly- and high-spatial-resolved atmospheric and oceanographic time-series data from the northwestern Pacific over the past 500 years by integrating reanalyzed oxygen isotope ($\delta^{18}O$) proxy records, $\delta^{18}O$-based proxy data assimilation, and ocean modeling. In FY2024, we established a high-resolution time interpolation using giant clam (Tridacna) shells by improving Dynamic Time Warping (DTW), compiled long-term coral $\delta^{18}O$ data from previous studies, and generated monthly resolved reanalyzed coral-based $\delta^{18}O$ data using the listed data by applying the new temporal interpolation technique. Reliability of the DTW interpolation was verified by analyzing daily growth bands and $\delta^{18}O$ values of two giant clams (*Hippopus hippopus*) collected from the Sekisei Reef Lagoon. The shells possessed distinct daily growth bands, allowing direct comparison between the time determined by the daily growth bands and that obtained by the new time-series interpolation. Results indicated that DTW-based times were consistent with those obtained from the growth-line analysis, indicating that the DTW time-series interpolation is suitable for establishing the monthly resolved $\delta^{18}O$ proxy data from geological samples. In FY2025, we will reconstruct the atmospheric field every month basis by assimilating reanalyzed $\delta^{18}O$ data and reconstructing temporal changes in ocean circulation and temperature distribution by combining them with an ocean model. We will investigate long-term meandering and northward extension of the Kuroshio Current to Sanriku-oki over the past 500 years.

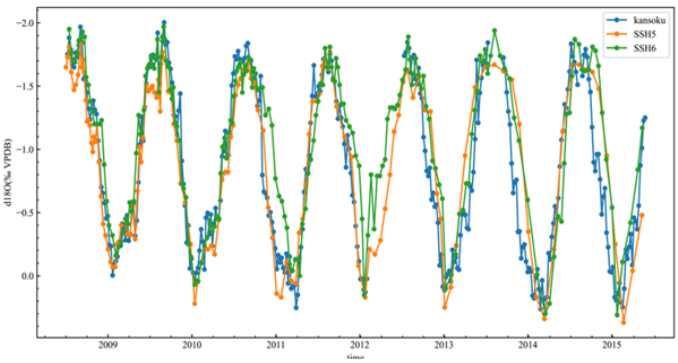


Figure 11: Comparisons of time-series $\delta^{18}O$ data of two *H. hipoppus* shells (orange, green) interpolated by new DTW and $\delta^{18}O$ values of the equilibrium aragonite (blue) based on observed oceanic data.

■ **Estimate of the Arctic Ocean CO_2 uptake (FSA Leader: Sayaka Yasunaka)**

The Arctic Ocean acts as a sink for atmospheric CO_2 due to the high solubility of CO_2 in low-temperature waters and extensive primary production during summer. Melting sea ice will increase open water areas and boost CO_2 uptake potential. Other processes may suppress uptake, e.g., rising seawater temperatures, reduced buffer capacity, and increased vertical mixing. CO_2 measurements are sparse, and existing Arctic air–sea CO_2 flux estimates are poorly constrained. We aim to estimate Arctic Ocean CO_2 uptake and reduce uncertainty by understanding Chlorophyll-a (Chl-a) distribution. Standard Chl-a products are unsuitable due to the optical properties of Arctic Ocean waters differing from those of lower-latitude waters. We must calculate Chl-a concentration from raw remote sensing reflectance by using the Arctic algorithm. Siswanto, an expert in satellite retrieval, will calculate Chl-a concentration. FSA Leader/UL Yasunaka, who estimated air-sea CO_2 flux in the Arctic Ocean 1992-2017, will extend the estimates with Chl-a concentration. In FY2024, Chl-a calculation was extended until June, and several test trials to estimate Arctic CO_2 parameters were conducted. This project has been selected for the Earth Observation Research Program by the Earth Observation Research Center, Japan Aerospace Exploration Agency (JAXA) for FY2025-2027. An AIMEC-JAXA joint workshop will be held July 7-9, 2025, in Tohoku University with 46 principal investigators (PIs) from the JAXA Program. The event expects to foster synergy among remote-sensing scientists and AIMEC including ocean biology, *in situ* ocean observation system and numerical modeling.

■ **Subsurface chlorophyll maximum in northern edge of the Western Pacific Warm Pool (FSA Leader: Masahito Shigemitsu)**

Chl-a serves as a proxy for measuring phytoplankton biomass and primary productivity. Chl-a absorbs shortwave radiation, leading to ocean warming, followed by a modified thermal structure and ocean dynamics. Modeling studies indicate that interannual variation in Chl-a concentrations is key for accurate El Niño simulations. Satellite data can elucidate Chl-a concentration at the ocean surface whereas distribution has not been thoroughly examined in the subsurface layer, despite often exhibiting a maximum value in the subsurface layer because of limited observational data. The western tropical Pacific warm pool, with the highest SST, acts as a heat reservoir for global atmospheric circulation. Warm temperatures at the surface inhibit nutrient supply from the subsurface, and Chl-a concentration shows subsurface maximum. SST in that region shows considerable interannual variation related to ENSO variability, with notable zonal shifts of the eastern edge and meridional shifts of the northern SST front. Subsurface Chl-a maximum is expected to vary with the warm pool shift. To clarify the spatio-temporal variation of subsurface Chl-a distribution and its relation to light intensity, we deployed a BGC-Argo float at the eastern edge of the warm pool in January 2025. We plan another deployment at the northern edge in April 2025. AIMEC researcher Hosoda and Sato implement data management. UL Koketsu oversees a deployment as the Chief Scientist of the *RV Mirai* research cruise in April 2025. FSA Leader Shigemitsu conducts *in situ* measurements during the cruise to calibrate the BGC sensors on float. UL Yasunaka and her student analyze BGC-Argo data with other *in situ* data. AIMEC researcher Fujiki gives advice based on his BGC-Argo float deployment experience. Collaborative researchers in JAMSTEC will run model experiments to examine the impact of Chl-a on ENSO prediction. In FY2024, we purchased a BGC-Argo float with temperature, salinity, pressure, Chl-a, CDOM, light and backscatter sensors. The float was loaded onto RV *Mirai* at Shimizu Port. It will be deployed mid-April at 10°N 135°E, measuring temperature, salinity, pressure, Chl-a, CDOM, light and backscatter from 1000 dbar to surface twice a day. Observed data will be sent via satellite (Argos System) to a server for quality control in JAMSTEC. Water samples will be collected for calibration before deployment.

■ **Realization of an understanding of hydrographic structures through collaboration between seafloor geodesy and physical oceanography (FSA Leader: Yusaku Ohta)**

With the Marine Biogeochemical Dynamics Research Unit, we conducted GNSS-A and XCTD observations to obtain spatiotemporally dense oceanographic data and model sub-mesoscale ocean phenomena. October 2024, we conducted a field observation campaign in G04 sites in the off-Sanriku region. The G04 site consists of six seafloor transponders (Fig. 12). We ran acoustic ranging once per minute and collected ~35 hours of GNSS-A data. XCTD measurements were conducted 26 times at x-marked locations, sound speed profiles were obtained from each XCTD cast. The average profile was used as a reference sound speed profile for GNSS-A observations. To compare GNSS-A's travel time data with XCTD data, we calculated travel time delays in the nadir direction from the XCTD's sound speed

profiles. We calculated the difference between each XCTD sound speed profile and the mean profile to compute the inverse “delta slowness”. Integrating delta slowness over depth allowed estimation of the nadir total delay (NTD), representing the travel time delay in the nadir direction from the ship. Although the expected delay of sound waves based on XCTD and GNSS-A observation-based results agree well, shorter wavelength variations were seen in the GNSS-A observations (Fig. 13). Travel time delays reflect spatiotemporal variations in sound speed structure, influenced by temperature fluctuation. While acoustic travel times do not provide depth-dependent information on temperature fluctuations, they can provide one-minute interval high sampling information. GNSS-A data may complement XCTD observations in reconstructing spatiotemporally high-resolution sound speed or temperature fields. Using inverted echo sounders, we aim to use the obtained observational datasets to model submesoscale ocean structures.

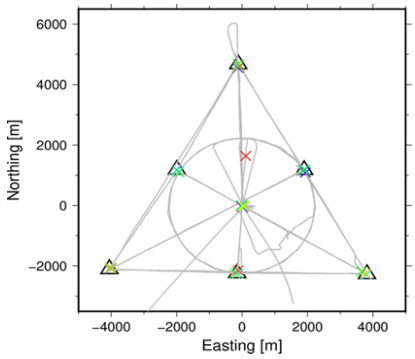


Figure 12: GNSS-A transponders location and ship track map in the G04 site. Colored crosses denoted the location of the XCTD observation.

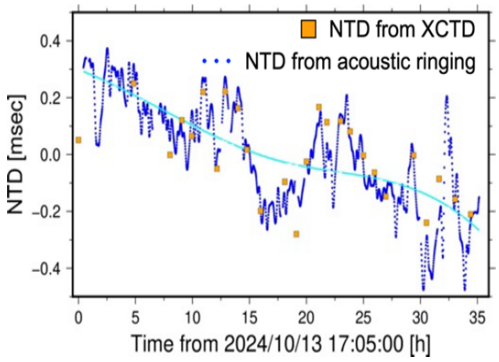


Figure 13: Estimated Nadir total delay (NTD) by the GNSS-A observations and the NTD values deduced from the *in situ* XCTD observations.

■ **Integrative research on effects of surface ocean changes in circulation and biological activity on dissolved organic matter distributions in deep layers (FSA Leader: Shinya Koketsu)**

Figure 14: Size exclusion chromatography with total carbon analyzer

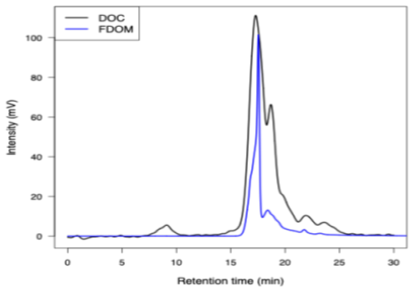


Figure 15: Test measurement for a water sample near Yokosuka

We aim to understand the dynamics of Dissolved Organic Matter (DOM) using new measurement techniques, analytical methods, physical oceanography, chemical oceanography, and marine microbiology. The project integrates a new tool “Size exclusion chromatography with total carbon analyzer (SEC-TOC; Fig. 14)” to link FDOM (Fluorescent DOM) values to molecular size of DOC, revealing DOM characteristics and its links to environmental factors like circulation, particulate matter states, and microbial utilization. This year, we acquired, installed and tested the SEC-TOC system. This instrument separates DOC by size while measuring DOC and FDOM. Initial tests using seawater samples from Yokosuka showed distinct size-related DOC and FDOM peaks (Fig. 15), suggesting this method can provide insights into DOC composition links to environmental factors. Complementary experiments were conducted using Matrix-Assisted Laser Desorption/Ionization-Time of Flight Mass Spectrometry to connect molecular numbers and sizes for more detailed DOC composition analysis. In 2025, these analyses will be applied to seawater samples from the GO-SHIP P4W expedition in the North Pacific. Observation preparations, led by UL/FSA Leader Koketsu, include seawater analyses (nutrients, salinity, dissolved inorganic carbon) and microbial observation casts (organized by Yokokawa). This year, we also organized past microbial observation datasets. The expedition will involve FDOM 3D spectral measurements (Shigemitsu) and deploy Argo floats equipped with CDOM sensors (Yasunaka, Fujiki, Hosoda, and Sato) for comprehensive data collection. To explore relationships between DOM and particulate matter, the team developed focused observation plans.

■ **Establishing an epigenomics research platform for marine plankton: From individual species analyses to ecological modeling (FSA Leader: Takeshi Obayashi)**

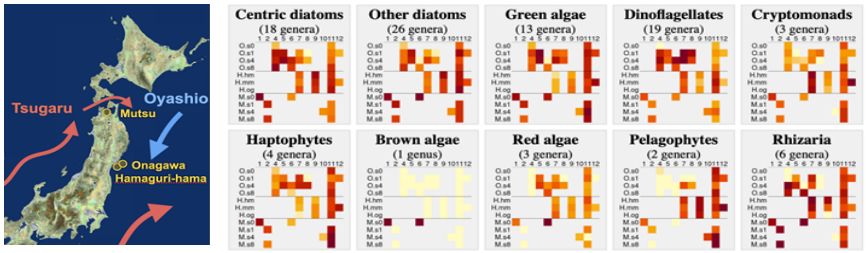


Figure 16: occurrence profiles of major taxonomic groups within Protozoa in the PlanDyO database. Yellow-to-red heatmaps indicate presence of each taxonomic group across sampling months and stations, gray denotes missing data. To date, we have detected approximately 500 genera, about half of which are eukaryotic.

We aim to establish a new marine metagenomics platform based on Nanopore sequencing technology, enabling long-read sequencing and detection of epigenomic nucleotide modifications. Our four main milestones: 1) construction of draft genomes based on metagenomic data, 2) generation of occurrence profiles for individual genomes, 3) analysis of epigenomic status of genes and individual cells in each sample, 4) prediction of gene functions with a focus on adaptation mechanisms to global environmental change. In 2024, based on the procedure developed by the Coastal Ecosystem Services Research Unit, we expanded our monitoring efforts to the Hamaguri-hama area and Mutsu Bay. These areas differ in connectivity with the Kuroshio, Oyashio, and Tsugaru warm currents, making them key sites for monitoring coastal plankton dynamics influenced by open-ocean processes (Fig. 16). We established a workflow including CTD profiling, sequencing, and image analyses of seawater samples. We developed a prototype of the PlanDyO database, originally standing for Plankton Dynamics in Onagawa, and expanded to represent Plankton Dynamics in the Ocean. In addition to occurrence profiles, we obtained preliminary results identifying contigs that contain differentially methylated regions across samples. These will be further analyzed to infer the physiological status of organisms, such as reproductive, growth, or resting stages. Observed genomic and epigenomic diversity trends will provide a foundation for predicting gene functions. Occurrence and status data will be used for ecosystem modeling and identifying species associations, such as parasitic relationships. Some sampling stations are shared with the ANEMONE database—another eDNA resource within AIMEC. The integration of PlanDyO and ANEMONE enables leveraging the high taxonomic resolution of PlanDyO alongside the high spatial and temporal resolution of ANEMONE.

■ **Biological imagery and vouchers: Advancing research by fusing disciplines (FSA Leader: Cheryl Ames)**

This project fuses three units: Marine Environment Integrative Analysis Unit, Coastal Ecosystem Services Research Unit and Ecological Complexity Research Unit. We identified, gathered, and organized existing marine specimens and reference materials for accession and sequencing in a centralized AIMEC specimen voucher repository. To model best practices for curation training and data standards we consulted with curators at Tohoku University Museum and Smithsonian National Museum of Natural History. Specimen vouchers are maintained at Tohoku University Museum (holotype material for a new species of jellyfish) or in the lab of origin (Onagawa Field Center larval fish collection; Asamushi Field Center zooplankton vouchers) with associated museum numbers and data as reference material. Accessioned specimen vouchers and associated data types connected by a unique identifier permit the AIMEC community to conduct analytical applications. Equipment for molecular sample analyses, live and preserved voucher imaging, frozen sample biorepository, and histological slide preparation has been installed and research is underway. We hired a postdoctoral researcher, an office administrator, and graduate students to conduct work as AA or RA covered by AIMEC funding. April 2025-March 2026, we will leverage funds for AIMEC fusion science 2025-2026 and Ocean Shot 2025-2028, objectives are to a) collect specimens and eDNA samples (boat/ship, shore), conduct physical transects on and offshore b) collect physical data including acoustics c) image marine organisms with *in situ* imaging technology d) sequence DNA barcode references (Sanger), and eDNA (meta-genome skimming), and whole genomes with Gridion (Nanopore 3rd generation technology), gene expression libraries e) assign taxonomic IDs and accession metadata into AIMEC reference database f) refine bioinformatics pipelines for phylogenetic analysis, visualize baseline biodiversity, and model distribution and interactions g) accession all DNA/RNA molecular barcodes into public databases (NCBI). With our Sasakawa Peace Foundation Ocean Shot award (April 2025-March 2028) we will synergize the process towards linking the unique voucher numbers

to OBIS.org (Ocean Biodiversity Information System) and migrating metadata to the public data repository (JAMSTEC DIAS Data Integration and Analysis System) for indefinite use. To accomplish this, we will hire a new AIMEC postdoctoral researcher, OceanShot Bioinformatics postdoctoral researcher, two technicians (molecular and data manager) and an office administrator.

■ **Development of an advanced analytical scheme for understanding the biological processes of organic matter degradation in marine particles (FSA Leader: Tatsuhiko Hoshino)**

We aim to understand the nature and extent of biogeochemical processes governed by microorganisms in marine particles and their contribution to the oceanic carbon pump. We will use this knowledge for carbon cycle models to improve their accuracy and predictive power. We focus on characterizing the properties of rarely studied individual particles with varying physical and chemical characteristics. Using filtrated marine particles onto membrane filters, we observed and took pictures under microscope followed by excision of individual marine particles by lase microdissection (Fig. 17). The excised particles were digested or destroyed using an alkaline solution or DMSO, the resulting lysate was used directly as a template for PCR or MDA (Multiple Displacement Amplification), for amplicon sequencing and shotgun metagenomic sequencing, respectively. Amplicon sequencing revealed that the phyla Bacteroidota and Firmicutes, known as particle-associated bacteria, were more dominant in marine particles than in the free-living bacterial communities. The similarity of bacterial communities among individual marine particles does not clearly correlate with particle size or density. However, clustering patterns of microbial communities show some association with particle morphology, suggesting that particles of similar size can harbor distinct microbial communities depending on their type. This study is the first to reveal the coexistence of aerobic pathways, such as ammonium oxidation, and anaerobic pathways, including sulfate reduction and methane generation, within individual marine particles as small as 10 μm in diameter. These findings show that geochemical processes occurring within individual particles are crucial to a mechanistic understanding of the oceanic carbon pump, complementing conventional size-fractionated analyses of marine particles. We have been attempting to visualize the fine-scale distribution of organic compounds at the submicron level, including DNA, amino acids, and proteins, using synchrotron-based scanning transmission X-ray microscopy (STXM) at Tohoku University's NanoTerasu. This year, we conducted preliminary measurements and plan to make improvements in the coming year.

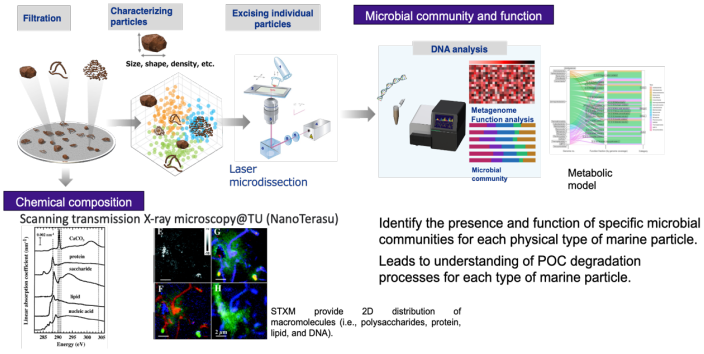


Figure 17: Identifying the presence and function of specific microbial communities for each physical type of marine particles. Leading to understanding of POC degradation processes for each type of marine particle.

■ **Community-based, nation-wide eDNA monitoring to reveal the response of coastal biodiversity to marine environmental change (FSA Leader: Michio Kondoh)**

We aim to capture changes in the fish fauna along Japan's coastline by a community science approach. With support from NPO Earth Watch Japan and in collaboration with Hokkaido University, Kyushu University, and Kyoto University, we conducted eDNA sampling at 205 coastal sites from July 1 to August 31, 2023. The collected eDNA samples were analyzed at the Kazusa DNA Research Institute, and the obtained sequence data were processed using the Claident pipeline. Our efforts led to the successful detection of 692 fish species, and the development of an online tool "UODAS" to share the results of the eDNA surveys. This platform allows participants to access data in a user-friendly and visualized format, showcasing the fish biodiversity across Japan. Two online sessions were held to provide educational outreach on marine environmental changes

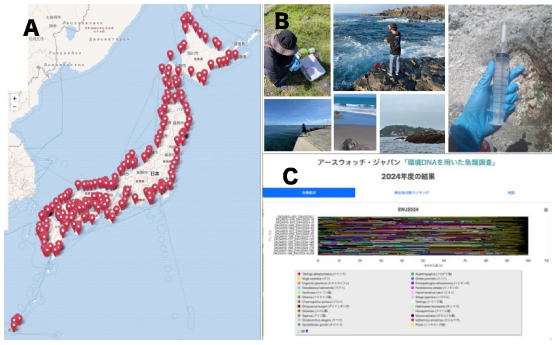


Figure 18 A. 200 survey sites were selected from 2017 nationwide survey. B. Photos submitted by participants showing scenes from the field survey. C. UODAS portal allows users to easily visualize species composition and fish distributions at selected locations.

and the importance of biodiversity. We plan to compare the citizen-led survey data with the results of a nationwide eDNA survey conducted by scientists in 2017. This comparison will allow us to identify biodiversity changes that have occurred along Japan's coasts from 2017 to 2024.

2. Global Research Environment and System Reform

2-1. Realizing an International Research Environment

* Describe what's been accomplished in the efforts to raise the center's recognition as a genuine globally visible research institute, along with innovative efforts proactively being taken in accordance with the development stage of the center, including the following points, for example:
- Efforts being developed based on the analysis of number and state of world-leading, frontline researchers (in Appendix 2); exchanges with overseas entities (in Appendix 4); number and state of visiting researchers (in Appendix 5)
- Proactive efforts to raise the level of the center's international recognition and to obtain diversity within the center.
- Efforts to make the center into one that attracts excellent young researchers from around the world (such as efforts fostering young researchers and contributing to advancing their career paths)

To foster an international research environment, AIMEC organized five international symposia and meetings (including workshops and related events). In addition, 31 Science Salons were held in FY2024, primarily on Tuesday evenings and conducted exclusively in English. Of these, 15 were lectures delivered by invited researchers who are internationally recognized leaders in AIMEC's research fields. Five colloquia were also held, providing opportunities for intensive, face-to-face discussions, mainly focused on the future scientific direction of AIMEC. A total of 41 invited researchers participated, representing the United States, France, Germany, the Republic of Korea, Russia, China, Indonesia, Thailand, Australia, Brazil, and Poland.

This year, the concept of "Grand Challenges" was explored through internal calls for proposals, aiming to integrate a broad range of marine research fields through fusion research initiatives. These initiatives were planned, executed, and discussed primarily by internationally active researchers affiliated with the center.

As noted in last year's report, Director Suga is a member of the Steering Committee of the Argo Program, which is supported by UNESCO's Intergovernmental Oceanographic Commission (IOC) and involves over 30 countries. He has also contributed to the work of the Intergovernmental Panel on Climate Change (IPCC) and the UN Decade of Ocean Science for Sustainable Development (2021–2030) (UNDOS) (https://forum.oceandecade.org). Vice Director Inagaki serves as an advisor to CIFAR's Earth 4D: Subsurface Science & Exploration Program. Among AIMEC's 17 PIs are researchers who contributed to the IPCC report, such as UL Kawamiya and international PI Xie. Other Tohoku University's AIMEC researchers, such as ULs Kondoh and Obayashi, who are conducting international studies on ecosystem dynamics using eDNA and its sequence data, are also actively involved. AIMEC PI Rodgers has carried out research applying hierarchical modeling to better understand processes that control marine ecosystems.

In recognition of the importance of establishing an overseas satellite center to enhance the international research environment, AIMEC prepared to launch such a center at the University of Hawaii's International Pacific Research Center (IPRC). This initiative builds on previous collaborations between Tohoku University and the University of Hawaii/IPRC, as well as between JAMSTEC and the University of Hawaii/IPRC. Following six months of discussions, a new overseas satellite center was officially established at the University of Hawaii/IPRC on October 1, 2024, through a Collaborative Research Agreement (CRA) between AIMEC and IPRC under the Memorandum of Understanding (MoU) between Tohoku University and the University of Hawaii. In March 2025, Director Suga, Vice Director Inagaki, and several members visited the University of Hawaii to discuss future research activities at this overseas center. The number of affiliated researchers is expected to gradually increase in the next fiscal year and beyond.

Building an international research environment also requires promoting global brain circulation. In FY2024, AIMEC launched an open recruitment initiative to attract top-tier early-career researchers worldwide, offering the highest salary levels ever provided under JAMSTEC or Tohoku University's postdoctoral fellowship programs. The initial salary was set at 5.6 million yen per year, but was later raised to 6.6 million yen to remain competitive amid rising global wages for postdoctoral researchers. In addition, salaries for other researcher positions were also set at higher levels.

In the first round of recruitment, AIMEC received 98 applications. After document screening and interviews, 9 postdoctoral fellows and 7 researchers were hired. In the second round, 104 applications were received, and 8 postdoctoral fellows and 4 research fellows were selected through the same process. During the selection process, five candidates declined the offers due to concerns over fixed-term contracts or other

reasons. To further enhance the international research environment, continued efforts will be necessary, particularly in improving compensation and establishing tenure-track opportunities.

2-2. Making Organizational Reforms

* Describe the system reforms made to the center's research operation and administrative organization, along with their background and results.
* Describe the measures taken and results achieved in implementing the center's gender-balance plan.
* If innovated system reforms generated by the center have had a ripple effect on other departments of the host institutions or on other research institutions, clearly describe in what ways.
* Describe the establishment of an integrated management system for the center, including an effective decision-making scheme and risk management, carried out in cooperation with the host institutions.
* Describe the center's operation and the host institutions' commitment to the system reforms. (Include measures taken made by the host institution to provide a support system and to work toward improving the environment for achieving gender balance.)

Since WPI-AIMEC was established as a multi-host type, it was inevitable that one host institution would need to adapt to the system of the other to operate AIMEC under a unified framework. This required significant reforms in various organizational aspects. As described in last year's report, the initial changes were made at Tohoku University on January 1, 2024, using the Advanced Institute for Materials Research (AIMR) as a model and placing AIMEC under the Advanced Research Organization of Tohoku University. During these discussions, strategies to realize the "under-one-roof" concept were considered. It was decided that Tohoku University and JAMSTEC would share this concept as a fundamental approach, and that JAMSTEC's organizational structure would be aligned with that of Tohoku University as much as possible. Accordingly, AIMEC established its self-operating regulations, based on JAMSTEC's standard organizational framework, to ensure compatibility with both JAMSTEC's existing system and Tohoku University's AIMEC system. This process implemented an integrated decision-making structure at the beginning of FY2024. Since then, AIMEC has operated under this framework while sequentially developing the necessary rules and regulations for its operations. Further regulations are being prepared as needed, and organizational reforms are ongoing.

For the administrative department, including the URA (University Research Administrator) division, we utilized existing systems at each host institution with minor adjustments to accommodate AIMEC's specific needs. These adjustments will streamline our processes and improve efficiency. In the research division, efforts are being made to standardize systems between the two institutions, including aligning compensation structures and reviewing the Target & Feedback (T&F)-based evaluation system that has been in place at JAMSTEC. This system is being refined to make it most suitable for AIMEC.

The decision to expand the GP-EES was made as a commitment by Tohoku University, and the selection of graduate students began in the middle of FY2024. Until now, GP-EES had supported five students, but with the new policy to expand the program in alignment with AIMEC's goals, we can now support more than 10 graduate students. This expansion is being implemented as a university-level commitment, without drawing from AIMEC's grant funding—in other words, it represents a direct allocation from Tohoku University to AIMEC. This support makes it easier for Tohoku University graduate students to visit the University of Hawaii and other overseas partner institutions, and it is expected to invigorate the GP-EES program further (see also Section 3-2).

Regarding office and research space, AIMEC has secured a relatively large area on the Aobayama Campus at Tohoku University, where the administrative office is already operational and newly appointed postdoctoral fellows and researchers are based. Similarly, the AIMEC's office space at the Yokohama Institute for Earth Science of JAMSTEC is being utilized primarily for administrative functions and for accommodating newly hired researchers. These arrangements are supported by commitments from the respective host institutions, highlighting the synergistic nature of the WPI center development.

3. Values for the Future

3-1. Creating and Disseminating the Societal Value of Basic Research

* Describe the content of measures taken by the center to widely disseminate the results of its basic research to the general public.
* Describe what was accomplished in the center's outreach and other activities last year and how they have contributed to creating the Societal Value of Basic Research. In Appendix 6, describe concretely the contents of these outreach activities. In Appendix 7, describe media reports or coverage, if any, of the activities.

The AIMEC website (https://wpi-aimec.jp/en/about/) is continuously improved to provide up-to-date and easy-to-understand information. Organized into various categories, the site is regularly updated with activity reports, media appearances, press releases, and other content, including records of dialogue with society. In addition, researcher profile pages have been enhanced to publicly share the interests and research themes of individual members, thereby strengthening both internal and external collaboration.

Original content—such as interviews, videos, and columns—provides further insight into the work and lives of AIMEC members. Along with the website, X (formerly Twitter) has also been used to share research findings, activity updates, and related content. Since June 2024, these posts have been published in coordination with the website, targeting researchers and audiences with a strong interest in science. Efforts are ongoing to increase engagement, including growing the follower base (267 as of April 7, 2025), while sharing meaningful content continuously.

For on-site outreach activities, AIMEC hosted its own session and exhibition at the JpGU meeting in May 2024. During the session, AIMEC's ULs, PIs, and other members presented AIMEC's missions and research themes, providing a forum for interdisciplinary discussion. At the exhibition, AIMEC engaged in interactive dialogue with a wide range of participants, including high school students and early-career researchers, on marine science topics and career opportunities. In February 2025, AIMEC co-hosted a workshop and public event titled *"Creating a Future Coastal Community Where People and the Ocean Coexist"* in collaboration with the Tohoku Forum for Creativity (TFC) at Tohoku University. Students and other participants engaged in dialogue with AIMEC researchers and experts from diverse fields such as cultural anthropology, fisheries, and economics. These discussions generated new ideas and insights for addressing the complex challenges coastal communities face in the Tohoku region.

In addition to these efforts, discussions are underway to collaborate with a marine research network being established by the Uehiro Foundation on Ethics and Education (https://www.rinri.or.jp/) and the Toyota Konpon Research Institute (https://konpon.toyota/) to make AIMEC's research outcomes more accessible to society. As part of outreach efforts, AIMEC visited the Sendai Umino-Mori Aquarium (https://www.uminomori.jp/umino/index.html) to increase interest in marine research among younger generations. This initiative will continue into the next fiscal year as part of ongoing efforts to communicate the appeal and importance of marine science. Additionally, the Director and Vice Director have delivered lectures at several high-profile venues, including the JAMSTEC Partners Symposium (https://www.jamstec.go.jp/partners/), the STS Forum (https://www.stsforum.org/), and the Essence Forum (https://esse-sense.com/forum2024). AIMEC has also maintained ongoing discussions with CIFAR (https://cifar.ca/#topskipToContent). CIFAR has submitted a budget request (equivalent to 200,000 Japanese yen) to the Canadian government for a workshop focused on marine ecosystem change in alignment with AIMEC's goals. The outcome of this request is currently pending.

3-2. Human Resource Building: Higher Education and Career Development

* Describe the content of measures taken by the center to foster young researchers, including doctoral students, through their participation in a research system that creates new interdisciplinary domains within a rich international environment.
* Describe measures taken for fostering researchers with a view to achieving gender plans, and measures taken for domestic and international promotion activities to attract female researchers to the center.

The strategy based on the GP-EES—an international joint graduate program led by Tohoku University in collaboration with the University of Hawaii—has been expanded to include additional departments within the university. These now include the Graduate School of Science and the Graduate Schools of Agriculture, Life Sciences, Information Sciences, and Engineering, intending to utilize AIMEC funds for broader educational initiatives. In October 2024, a research Unit was established within the University of Hawaii as part of its international satellite center (see also Section 2-2). This Unit, comprising five faculty members and postdoctoral fellows from the University of Hawaii, serves as a base for supervising GP-EES doctoral students. These students will receive jointly supervised degrees upon completion of their programs. In parallel, a cross-appointment system was implemented to allow JAMSTEC PIs and researchers to be appointed as professors at Tohoku University. Currently, eight JAMSTEC researchers are contributing to graduate education at the university. This system has created an enriched academic environment, offering a broader range of educational opportunities than Tohoku University could provide on its own.

The expansion of GP-EES, the establishment of the East-West North Pacific Marine Ecosystem Research Unit, and the involvement of JAMSTEC researchers through cross-appointments collectively contribute to more comprehensive and diverse graduate education. These initiatives further advance AIMEC's mission of promoting integrated marine ecosystem research.

In October 2024, several international postdoctoral fellows and researchers began working at AIMEC. In late November, AIMEC held listening sessions to hear their experiences. Some researchers faced urgent challenges in adjusting to life in Japan. In response, AIMEC took proactive steps and established a Diversity, Equity, and Inclusion Promotion Committee in December 2024. This committee, which includes at least 30% women as AIMEC's internal regulations, is addressing gender and other DEI-related issues. The DEI committee is also working to compile a transparent system for supporting diversity at the host institutions, which will be published on AIMEC's internal portal. AIMEC's proactive approach to these

challenges demonstrates our commitment to diversity and inclusion, and we will continue to work towards a more inclusive environment.

3-3. Self-sufficient and Sustainable Center Development

* Describe the state of implementation of the Alliance's host institutions' mid-to-long term measures based on robust collaboration among host institutions participating in the Alliance for supporting the center toward becoming self-sufficient and sustainable after the 10-year funding period ends, such as reforming the host institutions' organizations, providing personnel with priority allocation of tenured posts to the center, providing fundamental financial support, and material support including land and buildings.

AIMEC is positioned under Tohoku University's Advanced Research Organizations. To ensure the long-term sustainability of AIMEC, Tohoku University has decided to construct a new building in collaboration with the UREX. The building's concept and architecture are currently underway, with the first floor set to be a shared open-facility for the promotion of knowledge sharing and co-creation with stakeholders. AIMEC will occupy the second and third floors, while the fourth and fifth floors will house UREX research activities. In the meantime, the Chemistry Building (expanded to 1,384 m²) has been designated as AIMEC's temporary operational space, thanks to the cooperation of the Faculty of Science. Moreover, a parallel system has been introduced with support from relevant faculties to allow each AIMEC Unit to operate within its respective home faculty. Nevertheless, as space shortages were anticipated, a newly constructed research facility in the Katahira campus and the Onagawa Field Center—shared with the Faculty of Agriculture—have also been secured as additional operational spaces, the latter serving as an oceanfront experimental site.

As Tohoku University has been designated a UREX project institution, AIMEC expects to secure both tenure and tenure-track positions through this initiative. AIMEC is developing a long-term human resource strategy, including an eight-year staffing plan that envisions a sustainable research center of approximately 20 members, including eight tenure and eight tenure-track positions. In FY2025, AIMEC aims to hire at least a few tenure and tenure-track researchers under the UREX initiative.

The need for tenure-track positions at JAMSTEC, with a view toward the next 10 years, is an issue commonly recognized among the current department heads within JAMSTEC. The experimental environment is also provided by the host institutions. With the consent of the host institutions, each Unit conducts its activities on the respective campuses where their ULs are employed as primary staff members.

Based on the experiences of the past 1.5 years of this project, it has become clear that directly allocating research funds—such as grants—*to AIMEC itself*, rather than to the departments to which AIMEC members primarily belong, is essential. Therefore, in the future, requests will be made to the respective host institutions to allocate the necessary amount of research funding accordingly.

4. Others

* In addition to the above 1-3 points, if there is anything else that deserves mention regarding the center project's progress, please note it.

At the end of 2023, in response to the *roadmap 2023* issued by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) (www.mext.go.jp/content/20231222-mxt_gakkikan-000033259_1.pdf), Director Suga's proposal for OneArgo was adopted, and AIMEC's Tohoku University Office was designated to oversee the budget request. Accordingly, for FY2024, a preliminary budget request for FY2025 was submitted to the MEXT through Tohoku University. A separate request was also submitted to the university headquarters in preparation for the FY2026 budget.

To enhance international visibility and leadership, the "*Marine Ecosystem Change for the North Pacific (MECNP)"* program was launched to promote international marine research activities in the North Pacific, centered on AIMEC's initiatives. This program was aligned with the goals of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030).

To officially register MECNP as a UN Decade Action Program, it was proposed as a WESTPAC initiative at the 15th Intergovernmental Session of WESTPAC (a regional commission of the IOC) and was approved by the member countries. As a result, the WESTPAC-MECNP program will be officially registered as part of the UN Decade Action Program in 2025, with new proposals to be developed by experts from participating countries, aiming to elevate it into a fully recognized UN ocean research program.

5. Center's Response to Results of Last Year's Follow-up

* Transcribe the item from the "Actions required and recommendations" section in the site visit report and the Follow-up report, then note how the center has responded to them.
* If you have already provided this information, please indicate where in the report.

a. Develop GCs immediately. Use the GCs to re-codesign a limited number of Fusion Science Activities that have clear integration across the units. In this process it is important not to neglect interfaces between AIMEC's work and other areas of earth systems and climate change modeling.

The 3rd AIMEC Colloquium was held at the Onagawa Field Center, Tohoku University, on November 25–26, 2024, to discuss the GCs of WPI-AIMEC. The currently envisioned titles for GC1 to GC5 are:

- GC1: Adaptability and vulnerability of marine ecosystems to multiple environmental drivers
- GC2: Climate-ocean-ecosystem connectivity and spatiotemporal variability
- GC3: Changes in surface marine ecosystems and the impacts on biogeochemical cycles
- GC4: Changes in coastal marine ecosystems and the impact of human activities
- GC5: Projection of marine ecosystem changes and planetary stewardship

These GCs were further discussed at the AIMEC All-Hands Meeting held at JAMSTEC on March 17–18, 2025, where all WPI-AIMEC members, including overseas PIs, gathered to engage in focused discussions on each GC. We are preparing to release a consolidated document that will comprehensively outline the GCs during FY2025. Additionally, we plan to (re)establish the FSAs essential for achieving the GCs, while ensuring a shared understanding of their importance across AIMEC.

b. Identify knowledge gaps and barriers that may impede AIMEC's short-term goals and develop strategies to address them.

In establishing the aforementioned GCs, we intend to identify the context (C), scientific questions (Q), hypotheses (H), and approaches (A) necessary for addressing each GC, and to construct a comprehensive and clear logical framework (C-QHA). We will draft an executive summary covering all the GCs compiled into a single white paper (Perspective/Opinion Paper), which will present the C-QHA framework, followed by the title and summary of each GC.

c. Expand the use of generative AI language models for knowledge synthesis and global leadership, including recruiting AI-related scientists.

As of FY2024, only one researcher is primarily focused on AI research within AIMEC. However, AI/machine learning applications have gained increasing relevance in Science Salons and across various research domains. At JAMSTEC, the upcoming mid-to-long-term strategy (beginning FY2026) emphasizes the development of the "Digital Twin for Ocean (DTO)," and discussions with AIMEC are underway to align DTO research with studies on marine ecosystem changes. AIMEC is conducting AI-driven research on regime shifts, short-term ecosystem forecasting in complex coastal areas, and developing indicators for marine ecosystem vulnerability and resilience. These indicators will eventually be integrated into generative AI/LLM frameworks.

To accelerate R&D in this area, we will restructure relevant Units (particularly at JAMSTEC), recruit PI-level AI researchers, and actively promote international hiring of postdoctoral researchers with AI/machine learning expertise.

d. Strengthen AIMEC's international leadership in marine ecosystem and climate research.

Emphasize the pivotal role of AIMEC in addressing GCs in collaboration with other leading frontier science institutions. This not only involves pursuing further international cooperation but also enhancing the visibility of the roles and activities of overseas PIs affiliated with AIMEC, underscoring the importance of their involvement.

Through its contributions to the UNDOS, AIMEC plans to strengthen its collaborations with other top-tier universities, research institutes, and related programs, thereby enhancing its international presence.

First, Director Suga led the development of a proposal to position a UN Decade Action Programme as a strategic plan to achieve highly accurate predictions of marine ecosystem changes in the Northwest Pacific. This will be realized through integrated modeling based on physical, chemical, and biological observations. The proposal was reviewed and approved at the 15th Intergovernmental Session of the IOC/WESTPAC. It is now set to become one of the official IOC/WESTPAC programs and will be registered as a UN Decade Action Programme once the registration documentation is finalized.

In addition, UL Kondoh led a successful proposal to the UN Decade Action Project for the "ANEMONE GLOBAL Project." This initiative aims to expand the current eDNA observation database "ANEMONE" from

Japan's coastal areas to the broader Pacific and Indian Oceans. The project was officially announced as accepted in April 2025.

e. Develop a communication strategy and a comprehensive public engagement strategy, including engagement with stakeholder communities.

With regard to communication strategies that include stakeholders, we are referencing the activities of other WPI research centers and have begun to take steps in this direction through collaboration with URAs, under the leadership of the Director Suga and Vice Director Inagaki. The importance of a communication strategy—including the Science-Society-Policy Interface (SSPI)—was emphasized during a discussion with the Toyota Component Research Institute, held on January 10, 2025, at AIMEC, Tohoku University. This topic will continue to be discussed on an ongoing basis, demonstrating our commitment to the knowledge sharing and co-creation with stakeholders.

In addition to the timely and accessible dissemination of information via the website (in both Japanese and English) and social media, we plan to establish regular communication events with the general public using the commons space in the new building. Furthermore, we aim to collaborate with media organizations and aquariums, utilize citizen-participatory initiatives such as Citizen Science, which has already been implemented in the ANEMONE project, and apply new frameworks for industry-academia collaboration, such as Tohoku University's Sustainability Open Knowledge-Action Platform (SOKAP). Effective outreach and communication strategies will be considered and implemented to the extent the available budget and human resource permit. Activities conducted in line with these strategies are outlined in Section 3-1.

Discussions on the "Comprehensive Social Contribution Strategy" will be promoted under one of the GCs, titled "Projections of marine ecosystem change and planetary stewardship (GC5)." Specifically, we aim to build a knowledge and action platform that serves as a SSPI, utilizing scientific knowledge from GC1 to GC4, and data derived from marine ecosystem change models and forecasts. In particular, in forecasting marine ecosystem change, we will work in partnership with the "OneArgo" and other international observation and data-sharing networks to improve marine ecosystem's forecasting accuracy. The results will be disseminated to various stakeholders—including private companies, local governments, the United Nations, the IPCC, UNESCO/IOC, the International Science Council (ISC), and others—to promote informed decision-making and action related to climate and ocean change, marine environmental conservation, and marine-related industries.

These efforts will also contribute to developing international policies and norms in the abovementioned areas. Establishing this framework will be carried out as part of the roles and responsibilities associated with the UN Decade Action Programme and should be further strengthened in alignment with the launch of the Japan OneArgo Center and the completion of the new AIMEC building.

f. Make continuous efforts to promote in-person communication, particularly for students and young researchers located at different sites within Tohoku University and JAMSTEC. Encourage them to routinely engage in opportunities to consult beyond their own scientific groups and disciplines.

Currently, AIMEC conducts an online Science Salon, a relatively informal seminar and discussion session held in English, in principle every Tuesday from 16:00 to 17:00. As of the end of March 2025, a total of 31 sessions have been held, and we are in the process of archiving all the seminar recordings. The Science Salon is a platform for practicing facilitation, presentation, and discussion in English, offering a valuable opportunity for researchers from different fields to understand each other better and to collaborate towards addressing grand challenges. In addition, AIMEC Colloquia have been held five times this fiscal year as a forum for face-to-face discussions among AIMEC members. These events have taken place at various locations, including Tohoku University's Aobayama Commons, the Onagawa Field Center, the Asamushi Center for Marine Biology Education and Research, the Tohoku University Tokyo Branch, and JAMSTEC's Yokosuka Headquarters. These gatherings have provided valuable opportunities for discussing the formulation of GCs, conducting facility tours, and fostering the engagement of young researchers.

Furthermore, all AIMEC members, including overseas PIs, are invited to attend the annual AIMEC All-Hands Meeting in person. This meeting offers an excellent opportunity for members to connect across geographic locations and academic disciplines, and graduate students are also welcome to attend.

These exchange activities will continue to be held regularly and will be managed efficiently and effectively.

Since its inception, AIMEC has held a hybrid “management meeting” every two weeks to discuss administrative matters. Starting in the middle of the fiscal year, these meetings have also functioned as a forum for information sharing with ULs. In addition, every Friday morning, a “Tea Time” communication session is hosted in McDonough’s space at Tohoku University, offering a relaxed environment for informal conversation.

We plan to organize similar “AIMEC Café” gatherings in various formats. We also intend to leverage digital transformation (DX) technologies to create interactive communication opportunities—including for students—in relaxed settings, while continuing to improve based on feedback and experience.

g. Advance diversity and promote female scientists.

Take proactive steps and provide training to address unconscious bias and support the advancement of female scientists. Initiatives such as unconscious bias training programs, mentorship opportunities for both male and female researchers, and inclusive recruitment strategies should be implemented to foster an inclusive and equitable research environment. These efforts aim to establish AIMEC as a leader in promoting diversity in marine science.

AIMEC’s human resource strategy has prioritized awareness of the need to increase the representation of both international and female researchers since before the center's official establishment. At the same time, we remain constantly mindful of the potential influence of unconscious bias, which may compromise actual impartiality. To mitigate this, AIMEC has implemented a system that incorporates the perspectives of multiple members in the review process for open positions. In other words, the objective of recruitment is not merely to increase the proportion of international or female researchers, but to secure individuals essential to achieving AIMEC’s scientific objectives and addressing its GCs. This system places value not only on past research experience and accomplishments, but also on a candidate’s potential, willingness to engage in interdisciplinary collaboration, and capacity for international communication. These evaluations align with the essential principles of DEI, aiming for a balanced employment ratio of international and female researchers.

During the 3rd AIMEC Colloquium, held in November 2024 at the Onagawa Field Center of Tohoku University, discussions with newly hired international and female researchers revealed a number of issues that need to be addressed. These include challenges related to cultural differences encountered after their assignment, as well as practical concerns in daily life, such as childcare. In response to these challenges, AIMEC has taken a proactive approach by convening the first meeting of the “DEI Promotion Committee,” chaired by Director Suga. This committee, with its proactive stance, will deliberate on the future direction of DEI efforts at this WPI center. Current action items from the DEI Promotion Committee include conducting a questionnaire survey of newly appointed researchers and compiling information on DEI-related initiatives already in place on campus. Moving forward, the DEI Promotion Committee will continue to meet three to four times per year to discuss training on DEI-related topics, including unconscious bias, to establish mechanisms for gathering feedback on DEI matters, and to set key performance indicators (KPIs) for DEI. The committee will also conduct regular evaluations and formulate improvement measures for these initiatives, while fully using the systems provided by both host institutions.

Appendix 1 FY 2024 List of Center's Research Results and Main Awards

1. Refereed Papers

- List only the Center's papers published in 2024. (Note: The list should be for the calendar year, not the fiscal year.)

(1) Divide the papers into two categories, A and B.

A. WPI papers
List papers whose author(s) can be identified as affiliated with the WPI program (e.g., that state "WPI" and the name of the WPI center (WPI-center name)). (Not including papers in which the names of persons affiliated with the WPI program are contained only in acknowledgements.)

B. WPI-related papers
List papers related to the WPI program but whose authors are not noted in the institutional affiliations as WPI affiliated. (Including papers whose acknowledgements contain the names of researchers affiliated with the WPI program.)

Note: On 14 December 2011, the Basic Research Promotion Division (the Basic and Generic Research Division at present) in MEXT's Research Promotion Bureau circulated an instruction requiring paper authors to include the name or abbreviation of their WPI center among their institutional affiliations. From 2012, the authors' affiliations must be clearly noted.

(2) Method of listing paper

- List only refereed papers. Divide them into categories (e.g., original articles, reviews, proceedings).
- For each, write the author name(s); year of publication; journal name, volume, page(s) (or DOI number), and article title. Any listing order may be used as long as format is consistent. (The names of the center researchers do not need to be underlined.)
- If a paper has many authors (say, more than 10), all of their names do not need to be listed.
- Assign a serial number to each paper to be used to identify it throughout the report.
- If the papers are written in languages other than English, underline their serial numbers.
- Order of Listing

A. WPI papers

1. Original articles

(1) To S.-W., Acevedo-Trejos E., Smith S.L., Chakraborty S., Merico A. Ecological and environmental factors influencing exclusion patterns of phytoplankton size classes in lake systems. Ecological Complexity 2025;61. https://doi.org/10.1016/j.ecocom.2024.101115.

(2) Tomita F. Enhanced GNSS-acoustic positioning method implementing with constraints on underwater sound speed structure. Earth, Planets and Space 2024;76(1). https://doi.org/10.1186/s40623-024-02120-6.

(3) Deser C., Kim W.M., Wills R.C.J., Simpson I.R., Yeager S., Danabasoglu G., Rodgers K., Rosenbloom N. Effects of macro vs. micro initialization and ocean initial-condition memory on the evolution of ensemble spread in the CESM2 large ensemble. Climate Dynamics 2025;63(1). https://doi.org/10.1007/s00382-024-07553-z.

(4) Sugimoto S. Marine heatwave off Tokai, Japan, attributed to the Kuroshio large meander path, and an associated increase in summer rainfall over Japan. Journal of Oceanography 2024. https://doi.org/10.1007/s10872-024-00741-9.

(5) Huang L., Woolway R.I., Timmermann A., Rodgers K.B. Projected phenological shifts in stratification and overturning of ice-covered Northern Hemisphere lakes. Communications Earth and Environment 2024;5(1). https://doi.org/10.1038/s43247-024-01953-z.

(6) Falk J., et al. Emerging threats from climate change on our oceans demand proactive action. Sustainability Science 2024. https://doi.org/10.1007/s11625-024-01605-3.

(7) Silvy Y., et al. AERA-MIP: Emission pathways, remaining budgets, and carbon cycle dynamics compatible with 1.5 and 2 °C global warming stabilization. Earth System Dynamics 2024;15(6):1591-1628. https://doi.org/10.5194/esd-15-1591-2024.

(8) Yamaguchi R., Kouketsu S., Kosugi N., Ishii M. Global upper ocean dissolved oxygen budget for constraining the biological carbon pump. Communications Earth and Environment 2024;5(1). https://doi.org/10.1038/s43247-024-01886-7.

(9) Friedlingstein P., Artaxo P., Gallego-Sala A.V., Jia G., Jones C.D., Kawamiya M., Loisel J., Loutre M.-F., Rehfeld K., Rovere A., Smith C., Séférian R., van der Wel N., Ziegler E. Earth system responses to different levels of greenhouse gas emissions mitigation. Frontiers in Climate 2024;6. https://doi.org/10.3389/fclim.2024.1480208.

(10) Min-Khant-Kyaw, Kato A., Adachi K., Iryu Y., Baba M. Coralline red algal species diversity at a shallow rhodolith bed in warm-temperate Japan, including two new species of Roseolithon (Hapalidiales, Corallinophycidae). Phycologia 2024. https://doi.org/10.1080/00318884.2024.2421269.

(11) Adiwira H., Suga T., Richards K.J. The relationship between Indian Ocean subtropical mode water variability and ocean temperature structure. Journal of Geophysical Research: Oceans 2024;129(11). https://doi.org/10.1029/2024JC021226.

(12) Nishihira G., Sugimoto S. Record-breaking marine heatwave over the Central North Pacific in 2021 summer: Its formation associated with loss of Central Mode Water. Journal of Physical Oceanography 2024;54(11):2361-2372. https://doi.org/10.1175/JPO-D-24-0021.1.

(13) Ohno K., Ohta Y., Takamatsu N., Munekane H., Iguchi M. Real-time modeling of transient crustal deformation through the quantification of uncertainty deduced from GNSS data. Earth, Planets and Space 2024;76(1). https://doi.org/10.1186/s40623-024-02068-7.

(14) Kurihara H., Ikeda M. Genetic population structure and demographic history of the sailfin sandfish Arctoscopus japonicus associated with sea level changes during the Last Glacial Maximum. Marine Ecology Progress Series 2024;747:133-149. https://doi.org/10.3354/meps14701.

(15) Wu B., Gan J. Long-term variation of the eddy kinetic energy in the Northeastern South China Sea. Progress in Oceanography 2024;229. https://doi.org/10.1016/j.pocean.2024.103366.

(16) Rhode S., Preusse P., Ungermann J., Polichtchouk I., Sato K., Watanabe S., Ern M., Nogai K., Sinnhuber B.-M., Riese M. Global-scale gravity wave analysis methodology for the ESA Earth Explorer 11 candidate CAIRT. Atmospheric Measurement Techniques 2024;17(19):5785-5819. https://doi.org/10.5194/amt-17-5785-2024.

(17) Sugiura N., Kouketsu S., Osafune S. Ocean data assimilation focusing on integral quantities characterizing observation profiles. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1398901.
(18) Luang-on J., Siswanto E., Ogata K., Toratani M., Buranapratheprat A., Leenawarat D., Ishizaka J. Enhancing the reliability of GCOM-C/SGLI data for red tide detection in the upper Gulf of Thailand. Remote Sensing Letters 2024;15(10):1096-1106. https://doi.org/10.1080/2150704X.2024.2406032.
(19) Kim I.-W., Timmermann A., Kim J.-E., Rodgers K.B., Lee S.-S., Lee H., Wieder W.R. Abrupt increase in Arctic-Subarctic wildfires caused by future permafrost thaw. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-51471-x.
(20) Kawai Y., Oka E., Sato K., Hosoda S., Kido S. Marine heatwave in the Oyashio region in 2022/23 and its impact on subsurface dissolved oxygen. Journal of Oceanography 2024. https://doi.org/10.1007/s10872-024-00731-x.
(21) Yamagami Y., Suzuki T., Tatebe H. Intraseasonal variations and extreme occurrence in the local sea level along the western coast of India remotely controlled by a basin-scale climate variability. Geophysical Research Letters 2024;51(17). https://doi.org/10.1029/2024GL108737.
(22) Hatakeyama Y., Fujibayashi M., Maruo C., Nishimura O., Sakamaki T. Dual benefits of biofouling reduction in non-fed aquaculture: On-site heat treatment enhances oyster production and mitigates local environmental impacts. Journal of Cleaner Production 2024;472. https://doi.org/10.1016/j.jclepro.2024.143502.
(23) Nagano Y., Abdel-Wahab M.A., Nakajima R., Yabuki A. Oceanitis abyssalis sp. nov., a new deep-sea fungus from sunken wood collected at the depth of 5707 m in the Northwest Pacific Ocean. Phytotaxa 2024;663(4):171-183. https://doi.org/10.11646/phytotaxa.663.4.1.
(24) Rodgers K.B., Aumont O., Toyama K., Resplandy L., Ishii M., Nakano T., Sasano D., Bianchi D., Yamaguchi R. Low-latitude mesopelagic nutrient recycling controls productivity and export. Nature 2024;632(8026):802-807. https://doi.org/10.1038/s41586-024-07779-1.
(25) Wang Z., Akimoto T., Yue T., Hatakeyama Y., Maruo C., Pascual G., Fujibayashi M., Sakamaki T. Testing combined effects of environmental trace metals/arsenic and marine trophic status on the bioaccumulation in Pacific oysters: Insights from 22-site field samplings. Marine Pollution Bulletin 2024;207. https://doi.org/10.1016/j.marpolbul.2024.116827.
(26) Huang L., Woolway R.I., Timmermann A., Lee S.-S., Rodgers K.B., Yamaguchi R. Emergence of lake conditions that exceed natural temperature variability. Nature Geoscience 2024;17(8):763-769. https://doi.org/10.1038/s41561-024-01491-5.
(27) Shyu J.B.H., Liao J.-H., Chen C.-Y., Tsutsumi H., Iryu Y. Assessing the relative activity of faulting along both flanks of the Ou Backbone Range, Tohoku Region, Japan, from fluvial geomorphic analyses. Progress in Earth and Planetary Science 2024;11(1). https://doi.org/10.1186/s40645-024-00644-9.
(28) Bassi D., Iryu Y., Pignatti J., Fujita K., Renema W. Biogeographical patterns of the porcelaneous larger foraminifer Alveolinella quoyi through the integration of fossil data. Geobios 2024;85:1-9. https://doi.org/10.1016/j.geobios.2024.05.002.
(29) Suzuki S., Ishii S., Chadwick G.L., Tanaka Y., Kouzuma A., Watanabe K., Inagaki F., Albertsen M., Nielsen P.H., Nealson K.H. A non-methanogenic archaeon within the order Methanocellales. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-48185-5.
(30) Bassi D., Braga J.C., Asami R., Goto K., Szidat S., Takayanagi H., Iryu Y. Paleoenvironmental significance of growth story of long-living deep-water acervulinid macroids from Kikai-jima shelf, Central Ryukyu Islands, Japan. Palaeogeography, Palaeoclimatology, Palaeoecology 2024;647. https://doi.org/10.1016/j.palaeo.2024.112254.
(31) Barbieri E., Bilotti E., Liu Y., Grimaldi C. Pyroresistive response of percolating conductive polymer composites. Physical Review Materials 2024;8(4). https://doi.org/10.1103/PhysRevMaterials.8.045602.
(32) Hoshino T., Inagaki F. Distribution of eukaryotic environmental DNA in global subseafloor sediments. Progress in Earth and Planetary Science 2024;11(1). https://doi.org/10.1186/s40645-024-00621-2.
(33) Ichimura S., Takayanagi H., Iryu Y., Takahashi S., Oji T. Shallow-water temperature seasonality in the middle Cretaceous mid-latitude northwestern Pacific. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1324436.
(34) Tei M., Soma F., Barbieri E., Uga Y., Kawahito Y. Non-destructive real-time monitoring of underground root development with distributed fiber optic sensing. Plant Methods 2024;20(1). https://doi.org/10.1186/s13007-024-01160-z.
(35) Sasaki Y., Yasuda I., Katsumata K., Kouketsu S., Uchida H. Turbulence across the Antarctic Circumpolar Current in the Indian Southern Ocean: Micro-temperature measurements and finescale parameterizations. Journal of Geophysical Research: Oceans 2024;129(2). https://doi.org/10.1029/2023JC019847.
(36) Jitsuno K., et al. Comparative single-cell genomics of Atribacterota JS1 in the Japan Trench hadal sedimentary biosphere. mSphere 2024;9(1). https://doi.org/10.1128/msphere.00337-23.

2. Review articles
(37) Stockhause M., et al. Implementing FAIR data principles in the IPCC seventh assessment cycle: Lessons learned and future prospects. PLOS Climate 2024;3(12). https://doi.org/10.1371/journal.pclm.0000533.
(38) Oikawa K., Abe O., Iryu Y. Recent efforts to improve the accuracy and precision of carbonate clumped-isotope analysis. Island Arc 2024;33(1). https://doi.org/10.1111/iar.12537.

3. Proceedings N/A

4. Other English articles
(39) Nasuno T., Kikuchi K., Nakano M. Boreal summer intraseasonal oscillation. Atmospheric Oscillations: Sources of Subseasonal-to-Seasonal Variability and Predictability 2024:33-68. https://doi.org/10.1016/B978-0-443-15638-0.00003-4.
(40) Sugiyama M., Asayama S., Kosugi T., Ishii A., Watanabe S. Correction to: Public attitude toward solar radiation modification: Results of a two-scenario online survey on perception in four Asia–Pacific countries (Sustainability Science, (2024), 10.1007/s11625-024-01520-7). Sustainability Science 2024. https://doi.org/10.1007/s11625-024-01544-z.
(41) Hoshino T., Inagaki F. Correction to: Distribution of eukaryotic environmental DNA in global subseafloor sediments (Progress in Earth and Planetary Science, (2024), 11, 1, (19), 10.1186/s40645-024-00621-2). Progress in Earth and Planetary Science 2024;11(1). https://doi.org/10.1186/s40645-024-00628-9.
(42) Sylvan J.B., Tully B.J., Morono Y., Alt J.C., Grim S.L., Inagaki F., Koppers A.A.P., Edwards K.J. Bacterial abundance and diversity in 64–74 Ma subseafloor igneous basement from the Louisville Seamount Chain. mLife 2024;3(4):578-583. https://doi.org/10.1002/mlf2.12148.
(43) Yabuki A., Hoshino T., Nakamura T., Mizuno K. The copy number of the eukaryotic rRNA gene can be counted comprehensively. MicrobiologyOpen 2024;13(2). https://doi.org/10.1002/mbo3.1399.

B. WPI-related papers

1. Original articles

(1) Luo F., Xie S.-P., Ying J., Geng Y.-F., Chen D. Impacts of Antarctic Sea ice change on global warming pattern inferred from CMIP6 intermodel spread. Geophysical Research Letters 2025;52(1). https://doi.org/10.1029/2024GL112323.

(2) Li T., García-Artola A., Shaw T.A., Peng D., Walker J.S., Cearreta A., Horton B.P. Vertical land motion is underestimated in sea-level projections from the Oka estuary, northern Spain. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-82692-1.

(3) Nathan Y., Chua S., Chong A., Chan N., Morgan K., Switzer A.D., Friess D.A., Horton B.P. Rapid mangrove sediment accretion in late-Holocene paleochannels of Singapore. Holocene 2024. https://doi.org/10.1177/09596836241297646.

(4) Liu Z., Liu Y., Zhang C., Sakamaki T., Li X. Preparation and anti-fouling behavior of conductive and hydrophilic polypyrrole modified PVDF composite membrane. Journal of Polymer Engineering 2024. https://doi.org/10.1515/polyeng-2024-0153.

(5) Abe H., Ueno S., Matsuo A., Hirota S.K., Miura H., Su M.-H., Shen Y.-G., Tsumura Y., Suyama Y., Wang Z.-L. Evolutionary histories of Camellia japonica and Camellia rusticana. Ecology and Evolution 2024;14(12). https://doi.org/10.1002/ece3.70721.

(6) Plata-Martinez R., Iinuma T., Tomita F., Nakamura Y., Nishimura T., Hori T. Revisiting slip deficit rates and its insights into large and slow earthquakes at the Nankai subduction zone. Journal of Geophysical Research: Solid Earth 2024;129(12). https://doi.org/10.1029/2023JB027942.

(7) Mayumi D., Tamaki H., Kato S., Igarashi K., Lalk E., Nishikawa Y., Minagawa H., Sato T., Ono S., Kamagata Y., Sakata S. Hydrogenotrophic methanogens overwrite isotope signals of subsurface methane. Science (New York, N.Y.) 2024;386(6728):1372-1376. https://doi.org/10.1126/science.ado0126.

(8) Nishikawa S., Sugiyama T., Kurogi M., Tsujino H., Nakano H., Ishikawa Y. Development of a high-resolution ocean ensemble future projection dataset for the North Pacific incorporating simple biogeochemical processes. Progress in Earth and Planetary Science 2024;11(1). https://doi.org/10.1186/s40645-024-00669-0.

(9) Grandey B.S., Dauwels J., Koh Z.Y., Horton B.P., Chew L.Y. Fusion of probabilistic projections of sea-level rise. Earth's Future 2024;12(12). https://doi.org/10.1029/2024EF005295.

(10) Shahenda A.A.E., Kondoh M., Hori M., Nagasawa A., Nakamura K., Elsayed W.M. Feeding categorisation of some Caeliferan and Ensiferan species (Insecta: Orthoptera) collected from selected grasslands in Sendai City, Japan. Entomologia Hellenica 2024;33(2):90-109. https://ejournals.epublishing.ekt.gr/index.php/entsoc/article/view/37715/29253.

(11) Miyamoto A., Xie S.-P. Low cloud–SST variability over the summertime subtropical Northeast Pacific: Role of extratropical atmospheric modes. Journal of Climate 2025;38(1):165-180. https://doi.org/10.1175/JCLI-D-24-0015.1.

(12) Nishikawa H., Matsuoka D., Nishimori Y., Yamaguchi T., Ito M., Watanabe Y., Sugiyama D., Kuwatani T., Ishikawa Y. Estimation of the fish number in farming cage from the fish finder echo images via machine learning. Aquacultural Engineering 2025;109. https://doi.org/10.1016/j.aquaeng.2024.102505.

(13) Shang Y., Kasada M., Kondoh M. Rescue or murder? The effect of prey adaptation to the predator subjected to fisheries. Ecology and Evolution 2024;14(12). https://doi.org/10.1002/ece3.70336.

(14) Suzuki H., Ichiyanagi H., Kass J.M., Urabe J. Differences in factors determining taxon-based and trait-based community structures: A field test using zooplankton. Limnology and Oceanography 2024. https://doi.org/10.1002/lno.12744.

(15) Hynes A.M., Winter J., Berthiaume C.T., Shimabukuro E., Cain K., White A., Armbrust E.V., Ribalet F. High-frequency sampling captures variability in phytoplankton population-specific periodicity, growth, and productivity. Limnology and Oceanography 2024. https://doi.org/10.1002/lno.12683.

(16) Murata A., Kouketsu S., Sasaoka K., Arulananthan K. Modulation of surface seawater CO2 system at 80°E: Impacts of the positive IOD in 2019. Journal of Geophysical Research: Oceans 2024;129(12). https://doi.org/10.1029/2024JC021177.

(17) Munkhbat D., Battulga B., Oyuntsetseg B., Kawahigashi M. Dynamics of plastic debris and its density change between river compartments in the Tuul River system, Mongolia. Environmental Science and Pollution Research 2024;31(57):65548-65558. https://doi.org/10.1007/s11356-024-35584-w.

(18) Koh Z.Y., Grandey B.S., Samanta D., Switzer A.D., Horton B.P., Dauwels J., Chew L.Y. Tide-surge interaction observed at Singapore and the east coast of Peninsular Malaysia using a semi-empirical model. Ocean Science 2024;20(6):1495-1511. https://doi.org/10.5194/os-20-1495-2024.

(19) Kass J.M., et al. Achieving higher standards in species distribution modeling by leveraging the diversity of available software. Ecography 2024. https://doi.org/10.1111/ecog.07346.

(20) Ma W., Hibino K., Yamamoto K., Kachi M., Oki R., Yoshikawa H., Yoshimura K. A new generation of hydrological condition simulator employing physical models and satellite-based meteorological data. Earth and Space Science 2024;11(11). https://doi.org/10.1029/2023EA003228.

(21) Islam J., Ohtani N., Shimizu Y., Tanimizu M., Goto Y., Sato M., Makino E., Shimada T., Ueda C., Matsuo A., Suyama Y., Sakai Y., Karrow N.A., Yoneyama H., Hirakawa R., Furukawa M., Tanaka H., Nochi T. Freeze-dried fecal microorganisms as an effective biomaterial for the treatment of calves suffering from diarrhea. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-79267-5.

(22) He S., Yu P., Shao Y., Gao X., Sakamaki T., Li X. Enhanced activity of mixed-culture electroactive biofilms and sulfamethoxazole removal efficiency by adding N-acyl-homoserine lactones in bio-electrochemical system. Environmental Technology (United Kingdom) 2024. https://doi.org/10.1080/09593330.2024.2428441.

(23) Ishii S., Sahashi N., Ebihara A., Hirota S.K., Suyama Y., Watano Y. Reticulate evolution in Japanese Sceptridium (Ophioglossaceae), including diploid, tetraploid, and hexaploid species. Molecular Phylogenetics and Evolution 2025;202. https://doi.org/10.1016/j.ympev.2024.108244.

(24) Wang S., Guo X., Cao A., Tsutsumi E., Chen X. Parametric subharmonic instability of the M2 internal tides in the Tokara Strait. Journal of Geophysical Research: Oceans 2024;129(11). https://doi.org/10.1029/2022JC019622.

(25) Kano M., Ohta Y., Tanaka Y., Matsumoto S. Report on 2024 Summer School on Geodesy. Journal of the Geodetic Society of Japan 2024;70:96-104. https://doi.org/10.11366/sokuchi.70.96, EID: 2-s2.0-85209127955.

(26) Hata C., Endo C., Tanaka H., Hiruma M., Kumamoto M., Takenaka I., Makino T., Niinaka K., Suyama Y., Hirota S.K., Yamasaki M., Isagi Y. Conservation units and the origin of planted individuals of an endangered endemic species Lobelia boninensis in the Ogasawara Islands. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-78452-w.

(27) Hou Y., Xie S.-P., Johnson N.C., Wang C., Yoo C., Deng K., Sun W., Li X. Unveiling the Indian Ocean forcing on winter eastern warming – western cooling pattern over North America. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-53921-y.

(28) Liefer J.D., et al. Latitudinal patterns in ocean C:N:P reflect phytoplankton acclimation and macromolecular composition. Proceedings of the National Academy of Sciences of the United States of America 2024;121(46). https://doi.org/10.1073/pnas.2404460121.

(29) Park I.-H., Yeh S.-W., Min S.-K., An S.-I., Xie S.-P., Shin J. Irreversible changes in the sea surface temperature threshold for tropical convection to CO2 forcing. Communications Earth and Environment 2024;5(1). https://doi.org/10.1038/s43247-024-01751-7.
(30) Andrade-Silva J., Baccaro F.B., Prado L.P., Guénard B., Kass J.M., Warren D.L., Economo E.P., Silva R.R. Common ant species dominate morphospace: Unraveling the morphological diversity in the Brazilian Amazon Basin. Ecography 2024;2024(11). https://doi.org/10.1111/ecog.07121.
(31) Yang K., Zhang C., Zhang H., Jiang X., Hu J., Sakamaki T., Li X. Enhancing electron utilization and sulfamethoxazole degradation in microbial electrochemical systems using MnCo2O4 modified electrodes. Journal of Environmental Engineering (United States) 2025;151(1). https://doi.org/10.1061/JOEEDU.EEENG-7697.
(32) Su X., Shiogama H., Tanaka K., Tachiiri K., Hajima T., Watanabe M., Kawamiya M., Takahashi K., Yokohata T. Reductions in atmospheric levels of non-CO2 greenhouse gases explain about a quarter of the 1998-2012 warming slowdown. Communications Earth and Environment 2024;5(1). https://doi.org/10.1038/s43247-024-01723-x.
(33) Ebihara A., Fukuda H., Yamada Y., Yokokawa T., Miki T., Nagata T. Structuring of particle-associated bacterial communities along the extracellular polymeric substance gradient of sinking and suspended particles in an oligotrophic, subtropical region of the western North Pacific Ocean. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1462522.
(34) Zhang W., et al. Long-term carbon storage in shelf sea sediments reduced by intensive bottom trawling. Nature Geoscience 2024. https://doi.org/10.1038/s41561-024-01581-4.
(35) Satake A., et al. Somatic mutation rates scale with time not growth rate in long-lived tropical trees. eLife 2024;12. https://doi.org/10.7554/eLife.88456.
(36) Blair M.E., et al. Software codesign between end users and developers to enhance utility for biodiversity conservation. BioScience 2024;74(12):867-873. https://doi.org/10.1093/biosci/biae097.
(37) Onuma Y., Yoshimura K., Nitta T., Tatebe H., Watanabe M. Sensitivity of the Northern Hemisphere warming trend to snowpack variability. Journal of Climate 2024;37(22):5751-5768. https://doi.org/10.1175/JCLI-D-23-0496.1.
(38) Hagiwara T., Shiojiri K., Suyama Y., Matsuo A., Ishihara M.I. Volatile-mediated plant–plant communication in natural beech forests. Journal of Plant Interactions 2024;19(1). https://doi.org/10.1080/17429145.2024.2414103.
(39) Unland E., Miramontes E., Spiess V., Bozzano G., Kasten S., Schwenk T. Evolution of a buried moat–drift system in the Ewing Terrace uncovering highly dynamic bottom currents at the Argentine margin from the early Oligocene to middle Miocene. Journal of Sedimentary Research 2024;94(6):784-798. https://doi.org/10.2110/jsr.2024.030.
(40) Daly P., Nejad A.S., Domijan K., McCaughey J.W., Brassard C., Kathiravelu L., Marques M., Sarti D., Parnell A.C., Horton B. The socio-economic impacts of the COVID-19 mitigation measures and vulnerabilities in Singapore. Progress in Disaster Science 2024;24. https://doi.org/10.1016/j.pdisas.2024.100377.
(41) Suzuki H., Aoki T., Mitsuyuki C., Suyama Y., Agatsuma Y., Aoki M.N. Local versus regional patterns in zoospore dispersal of the kelp Eisenia bicyclis (Laminariales, Phaeophyceae). Phycological Research 2024;72(4):238-248. https://doi.org/10.1111/pre.12563.
(42) Liang Y., Xie S.-P., Zhang H. An intrinsic low-frequency atmospheric mode of the Indonesian-Australian summer monsoon. npj Climate and Atmospheric Science 2024;7(1). https://doi.org/10.1038/s41612-024-00792-1.
(43) Longo P.A.D.S., Azevedo-Silva M., Mansur K.F.R., Marinho T.A., Madeira A.G., de Souza A.P., Hirota S.K., Suyama Y., Mori G.M., Leite F.P.P. Towards the understanding of genetic and morphological variations of a highly abundant seaweed-associated marine invertebrate. Estuarine, Coastal and Shelf Science 2024;309. https://doi.org/10.1016/j.ecss.2024.108977.
(44) Battulga B., Nakanishi T., Atarashi-Andoh M., Otosaka S., Koarashi J. Biofilm-mediated interactions between plastics and radiocesium in coastal environments. Environmental Science and Pollution Research 2024;31(50):60080-60092. https://doi.org/10.1007/s11356-024-35164-y.
(45) Sakaguchi S., et al. Evaluating the potential of interpopulation outbreeding to rescue plant populations facing reproductive failures. Ecological Research 2024;39(5):694-704. https://doi.org/10.1111/1440-1703.12472.
(46) Melnikova I., Yokohata T., Ito A., Nishina K., Tachiiri K., Shiogama H. Emergent constraints on future Amazon climate change-induced carbon loss using past global warming trends. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-51474-8.
(47) dos Santos A.A., Nunes-Freitas A.F., Tompson C.M., Barbosa G., Takahashi D., Suyama Y., Lira C.F. Multidisciplinary assessment of a restored mangrove ecosystem in Guanabara Bay, Brazil: Linking science and conservation. Wetlands Ecology and Management 2024;32(6):1003-1025. https://doi.org/10.1007/s11273-024-10012-5.
(48) Katafuchi M., Narita S., Komaki Y., Nagano A.J., Yukawa T., Suyama Y., Hirota S.K., Yamasaki M., Isagi Y. Comprehensive genetic analysis reveals the genetic structure and diversity of Calanthe hoshii (Orchidaceae), an endemic species of the Ogasawara Islands: Implications for appropriate conservation of a critically endangered species. Plant Species Biology 2024;39(5):297-305. https://doi.org/10.1111/1442-1984.12479.
(49) Tsunamoto Y., Nishikawa Y., Shimamura T., Suyama Y., Matsuo A. Does decline and recovery process affect clonal and genetic diversity of a coastal plant population?. Restoration Ecology 2024. https://doi.org/10.1111/rec.14283.
(50) Buesseler K.O., et al. Next steps for assessing ocean iron fertilization for marine carbon dioxide removal. Frontiers in Climate 2024;6. https://doi.org/10.3389/fclim.2024.1430957.
(51) Zhang C., Hu J., Wang H., Cheng H., Cao X., Sakamaki T., Li X. Sulfamethoxazole degradation in tri-electrode microbial electrochemical systems: Metabolomic and Metagenomic insights into organic pollution effects. Journal of Environmental Management 2024;370. https://doi.org/10.1016/j.jenvman.2024.122410.
(52) Chonnaniyah, Siswanto E., As-syakur A.R., Osawa T. Surface manifestation characteristics of internal solitary waves observed by GCOM-C/SGLI imagery. Journal of Sea Research 2024;202. https://doi.org/10.1016/j.seares.2024.102541.
(53) Lott F., et al. Comparison between non-orographic gravity-wave parameterizations used in QBOi models and Strateole 2 constant-level balloons. Quarterly Journal of the Royal Meteorological Society 2024;150(763):3721-3736. https://doi.org/10.1002/qj.4793.
(54) Cao X., Khodseewong S., Jiang L., Yuan Y., Zhang S., Sakamaki T., Li X. Enhance the removal of pyrene by 3,4-ethylene dioxythiophene modified electrode in microbial electrochemical system. Journal of Environmental Chemical Engineering 2024;12(5). https://doi.org/10.1016/j.jece.2024.114057.
(55) Phua S.Z., Lee K.F., Tsai Y.-K., Ganguly S., Yan J., Mosbach S., Ng T., Moise A., Horton B.P., Kraft M. Urban vulnerability assessment of sea level rise in Singapore through the World Avatar. Applied Sciences (Switzerland) 2024;14(17). https://doi.org/10.3390/app14177815.
(56) Asakawa A., Murakami S., Horie S., Matsuo A., Suyama Y., Fujii S., Maki M. Genome-wide SNPs reveal clonality and population genetic structure of Nymphoides peltata in Japan (Menyanthaceae). Aquatic Botany 2024;190. https://doi.org/10.1016/j.aquabot.2023.103720.
(57) Nishida S., Takano A., Suyama Y., Kakishima S. Detection of reproductive interference between closely related Salvia species with small-scale separated distributions by multifaceted pollination and molecular analyses. Journal of Plant Research 2024;137(6):1033-1047. https://doi.org/10.1007/s10265-024-01577-6.

(58) Zhang P., Xie S.-P., Kosaka Y., Lutsko N.J., Okumura Y.M., Miyamoto A. Why East Asian monsoon anomalies are more robust in post El Niño than in post La Niña summers. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-51885-7.
(59) Takatsuka S., Miyamoto N., Sato H., Morino Y., Kurita Y., Yabuki A., Chen C., Kawagucci S. Millisecond-scale behaviours of plankton quantified in vitro and in situ using the Event-based Vision Sensor. Ecology and Evolution 2024;14(8). https://doi.org/10.1002/ece3.70150.
(60) Maitner B., et al. Code sharing in ecology and evolution increases citation rates but remains uncommon. Ecology and Evolution 2024;14(8). https://doi.org/10.1002/ece3.70030.
(61) Ikenoue T., Nakajima R., Osafune S., Siswanto E., Honda M.C. Vertical flux of microplastics in the deep subtropical Pacific Ocean: Moored sediment-trap observations within the Kuroshio extension recirculation gyre. Environmental Science and Technology 2024;58(36):16121-16130. https://doi.org/10.1021/acs.est.4c02212.
(62) Yoshida K., Takagi R., Fukushima Y., Ando R., Ohta Y., Hiramatsu Y. Role of a hidden fault in the early process of the 2024 Mw7.5 Noto Peninsula earthquake. Geophysical Research Letters 2024;51(16). https://doi.org/10.1029/2024GL110993.
(63) Kagawa O., Hirota S.K., Hirano T., Kimura K., Kobayashi G., Suyama Y., Chiba S., Yamazaki D. The population structure and demography of an intertidal gastropod Lunella correensis around the Japanese Archipelago affected by past environmental change. Marine Biology 2024;171(9). https://doi.org/10.1007/s00227-024-04497-0.
(64) Seelen E.A., Townsend E., Gleich S.J., Caron D.A., Dugenne M., White A.E., Karl D.M., John S.G. Pelagic ecosystem research incubators (PERIcosms): Optimized incubation tanks to investigate natural communities under long term, low nutrient, and low metal conditions. Limnology and Oceanography: Methods 2024;22(8):548-571. https://doi.org/10.1002/lom3.10628.
(65) Zhao J., Zhan R., Wang Y., Xie S.-P., Zhang L., Xu M. Lapsed El Niño impact on Atlantic and Northwest Pacific tropical cyclone activity in 2023. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-51241-9.
(66) Mizuki M., Kaneko Y., Yukie Y., Suyama Y., Hirota S.K., Sawa S., Kubo M., Yamawo A., Sasabe M., Ikeda H. Evolution of secondary metabolites, morphological structures and associated gene expression patterns in galls induced by four closely related aphid species on a host plant species. Molecular Ecology 2024;33(16). https://doi.org/10.1111/mec.17466.
(67) Konaka S., Hirota S.K., Sato Y., Matsumoto N., Suyama Y., Tsumura Y. Secondary contact zone and genetic introgression in closely related haplodiploid social spider mites. Heredity 2024;133(4):227-237. https://doi.org/10.1038/s41437-024-00708-y.
(68) Deen A., Kitajima S., Sato-Okoshi W., Fujii T. Seasonal variability in the influence of coastal aquaculture operation on benthic–pelagic coupling processes in shallow aquatic ecosystems. Journal of Marine Science and Engineering 2024;12(8). https://doi.org/10.3390/jmse12081293.
(69) Nishikawa H., Tsujino H., Nishikawa S., Nakayama S.-I., Nakano H., Sugiyama T., Ishikawa Y. Long-term comparison between the Japanese sardine Sardinops melanostictus stock level and simulated zooplankton density around the Kuroshio region. Marine Ecology Progress Series 2024;741:271-287. https://doi.org/10.3354/meps14622.
(70) Streuff K.T., Lešić N.-M., Kuhn G., Römer M., Kasten S., Bohrmann G. Glacial history of the King Haakon trough system, sub-Antarctic South Georgia. Quaternary Science Reviews 2024;338. https://doi.org/10.1016/j.quascirev.2024.108749.
(71) Chen L., et al. A machine learning model that outperforms conventional global subseasonal forecast models. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-50714-1.
(72) Zhang C., Jiang X., Zhang S., Cao X., Wang H., Sakamaki T., Li X. Degradation of pyrene at high concentrations in sediment and the implications for the microbiome in microbial electrochemical systems. Chemical Engineering Journal 2024;496. https://doi.org/10.1016/j.cej.2024.154324.
(73) Suetsugu K., Hirota S.K., Suyama Y. A new natural hybrid Goodyera ×kazumae (Orchidaceae) from Tomakomai City, Hokkaido Prefecture, Japan. Taiwania 2024;69(3):309-316. https://doi.org/10.6165/tai.2024.69.309.
(74) Cunningham J., Lämmle A., Sakamaki T., Filgueira R. Predicting eastern oyster (Crassostrea virginica) settlement using growing degree days along the north shore of Nova Scotia, Canada. Aquaculture 2025;594. https://doi.org/10.1016/j.aquaculture.2024.741377.
(75) Mimura M., Takeuchi M., Kobayashi T., Hirota S.K., Suyama Y., Yamaguchi H., Tabuchi T. Genetic diversity in the traditional cultivars and wild ancestor of near-threatened Japanese iris (Iris ensata Thunb.). Conservation Genetics 2024;25(5):1079-1086. https://doi.org/10.1007/s10592-024-01625-7.
(76) Mori M., Tokinaga H., Kosaka Y., Nakamura H., Taguchi B., Tatebe H. The influence of extratropical ocean on the PNA teleconnection: Role of atmosphere-ocean coupling. Geophysical Research Letters 2024;51(14). https://doi.org/10.1029/2024GL110234.
(77) Mikimasa J.O.H., Katayama S., Takashima T., Murakami O. Development of an age-determination method using otolith-thin sections and the relationship between age and body length of pointhead flounder in the Pacific Ocean off western Hokkaido Island, Japan. Nippon Suisan Gakkaishi (Japanese Edition) 2024;90(4):313-322. https://doi.org/10.2331/suisan.23-00060, EID: 2-s2.0-85199399997.
(78) Joyse K.M., Walker J.S., Godfrey L., Christie M.A., Shaw T.A., Corbett D.R., Kopp R.E., Horton B.P. The preservation of storm events in the geologic record of New Jersey, USA. Journal of Quaternary Science 2024;39(5):801-815. https://doi.org/10.1002/jqs.3622.
(79) Wang R., Kass J.M., Chaudhary C., Economo E.P., Guénard B. Global biogeographic regions for ants have complex relationships with those for plants and tetrapods. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-49918-2.
(80) Ishihara T., Kamezaki N., Hirai S., Matsuzawa Y., Hamabata T., Ishizaki A., Dutton P.H. Genetic characteristics of loggerhead turtles in the coastal corridor of the North West Pacific, around the Cape Muroto, Japan. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1303553.
(81) Murakami S., Ito T., Uemachi T., Fujii S., Matsuo A., Suyama Y., Maki M. Phylogenetic relationships and divergence time of Hydrangea sect. Macrophyllae (Hydrangeaceae) revealed by genome-wide SNPs. Plant Systematics and Evolution 2024;310(4). https://doi.org/10.1007/s00606-024-01902-5.
(82) Garner A.J., Samanta D., Weaver M.M., Horton B.P. Changes to tropical cyclone trajectories in Southeast Asia under a warming climate. npj Climate and Atmospheric Science 2024;7(1). https://doi.org/10.1038/s41612-024-00707-0.
(83) Peng Q., Xie S.-P., Deser C. Collapsed upwelling projected to weaken ENSO under sustained warming beyond the twenty-first century. Nature Climate Change 2024;14(8):815-822. https://doi.org/10.1038/s41558-024-02061-8.
(84) Suárez-Atilano M., Pacheco-Sierra G., Vázquez-Domínguez E., Kass J.M., Paz A., Pérez-Alquicira J. Genomic and environmental insights and conservation challenges for two hybridizing iconic crocodile species across Mexico: Crocodylus acutus and C. moreletii. Animal Conservation 2024;27(3):308-323. https://doi.org/10.1111/acv.12907.
(85) Sugiyama M., Asayama S., Kosugi T., Ishii A., Watanabe S. Public attitude toward solar radiation modification: Results of a two-scenario online survey on perception in four Asia–Pacific countries. Sustainability Science 2024. https://doi.org/10.1007/s11625-024-01520-7.
(86) Cabrini M., Lira C., Suyama Y., Takahashi D., Ishikawa N., Paglia I., Trovó M. Genomic and morphological data

reveal a critically endangered new species from the Atlantic Forest, Paepalanthus salimenae (Eriocaulaceae). Phytotaxa 2024;655(2):173-186. https://doi.org/10.11646/phytotaxa.655.2.5.
(87) Wu H., Yamada Y., Chuang P.-S., Ishikawa K., Mitarai S. Effects of flows on transparent exopolymer particles released from branching Acropora coral colonies. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1404526.
(88) Yamamoto Y., Takanashi A., Yokosawa Y., Ikeda M. Implication of homoplasy in hypervariable region (HVR) of mitochondrial DNA in a population of marbled flounder Pseudopleuronectes yokohamae: Consideration for conducting population genetic analyses using the HVR. Fisheries Science 2024;90(5):701-712. https://doi.org/10.1007/s12562-024-01792-z.
(89) Zhang C., Yang K., Yuan Y., Cao X., Wang H., Sakamaki T., Li X. Material modification of electrodes in microbial electrochemical system to enhance electrons utilization on the electrode and its impact on microorganisms. Journal of Hazardous Materials 2024;475. https://doi.org/10.1016/j.jhazmat.2024.134908.
(90) Zhou W., Leung L.R., Xie S.-P., Lu J. An analytic theory for the degree of Arctic Amplification. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-48469-w.
(91) Tan F., et al. Late Holocene relative sea-level records from coral microatolls in Singapore. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-62937-9.
(92) Jiang X., Gao X., Yang K., Hu J., Cao X., Sakamaki T., Li X. Promotion and mechanism of defective hematite on the power generation and phenanthrene degradation of soil microbial fuel cells. Environmental Engineering Research 2025;30(1). https://doi.org/10.4491/eer.2024.135.
(93) Tozawa M., Nomura D., Matsuura M., Hatta M., Fujiwara A., Yasunaka S., Murata A. Quantitative assessment of factors contributing to variations in sea surface pCO2 in the Pacific sector of the Arctic Ocean. Journal of Geophysical Research: Oceans 2024;129(6). https://doi.org/10.1029/2024JC021012.
(94) Suetsugu K., Hirota S.K., Yagame T., Yukawa T., Suyama Y. Taxonomic revision of the formerly monotypic orchid genus Dactylostalix. Phytotaxa 2024;652(2):83-99. https://doi.org/10.11646/phytotaxa.652.2.1.
(95) Yuhara T., Ohtsuki H., Hirota S.K., Suyama Y., Urabe J. Contrasting population genetic structure of three semi-terrestrial brachyuran crabs on the coast of the Japanese archipelago. Ecology and Evolution 2024;14(6). https://doi.org/10.1002/ece3.11484.
(96) Takahashi D., Suyama Y., Fukushima K., Setoguchi H., Sakaguchi S. Deer grazing drove an assemblage-level evolution of plant dwarfism in an insular system. Journal of Ecology 2024;112(6):1383-1396. https://doi.org/10.1111/1365-2745.14309.
(97) Nakayama T., Nomura M., Yabuki A., Shiba K., Inaba K., Inagaki Y. Convergent reductive evolution of cyanobacteria in symbiosis with Dinophysiales dinoflagellates. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-63502-0.
(98) Cao X., Li X., Wang H., Zhang S., Zhang H., Sakamaki T., Li X. The promotion of the polycyclic aromatic hydrocarbons degradation mechanism by humic acid as electron mediator in a sediment microbial electrochemical system. Bioresource Technology 2024;404. https://doi.org/10.1016/j.biortech.2024.130909.
(99) Setiawan R.Y., Susanto R.D., Horii T., Alifdini I., Siswanto E., Sari Q.W., Wirasatriya A., Aryudiawan C. The Fujiwhara effect on ocean biophysical variables in the southeastern tropical Indian Ocean region. Journal of Marine Systems 2024;245. https://doi.org/10.1016/j.jmarsys.2024.103990.
(100) Dutkiewicz S., et al. Multiple biotic interactions establish phytoplankton community structure across environmental gradients. Limnology and Oceanography 2024;69(5):1086-1100. https://doi.org/10.1002/lno.12555.
(101) Yamada Y., Ebihara A., Fukuda H., Otosaka S., Mitarai S., Nagata T. Functions of extracellular polymeric substances in partitioning suspended and sinking particles in the upper oceans of two open ocean systems. Limnology and Oceanography 2024;69(5):1101-1114. https://doi.org/10.1002/lno.12554.
(102) Kurihara H., Shirai S.M., Fujiwara K., Ikeda M. Indel variation in the mitochondrial ND5 region supports monophyly of the tribe Hippoglossoidini (sensu Vinnikov et al. 2018) within the family Pleuronectidae. Ichthyological Research 2024. https://doi.org/10.1007/s10228-024-00978-w.
(103) Okui H., Koshin D., Watanabe S., Sato K. Roles of gravity waves in preconditioning of a stratospheric sudden warming. Journal of Geophysical Research: Atmospheres 2024;129(10). https://doi.org/10.1029/2023JD039881.
(104) Song X., Xie X., Yan Y., Xie S.-P. Observed subdaily variations in air–sea turbulent heat fluxes under different marine atmospheric boundary layer stability conditions in the Gulf Stream. Monthly Weather Review 2024;152(5):1223-1238. https://doi.org/10.1175/MWR-D-24-0003.1.
(105) Alencar A.S., Suyama Y., Takahashi D., F. Mansano V., Lira C.F. Insights from genetic research: SNP analyses confirm white clover naturalization in Brazil. Genetic Resources and Crop Evolution 2024. https://doi.org/10.1007/s10722-024-02020-4.
(106) Suzuki S., Otomo Y., Dazai A., Abe T., Kondoh M. Assessing the impacts of aquaculture on local fish communities using environmental DNA metabarcoding analysis. Environmental DNA 2024;6(3). https://doi.org/10.1002/edn3.551.
(107) Gu Q., Gervais M., Danabasoglu G., Kim W.M., Castruccio F., Maroon E., Xie S.-P. Wide range of possible trajectories of North Atlantic climate in a warming world. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-48401-2.
(108) Komagata Y., Oe T., Sekine T., Kimura Y., Hirota S.K., Taguchi H., Suyama Y. Small-scale dispersal and gene flow of the agricultural pest two-spotted spider mite in apple orchards: Implication from landscape ecological and population genetic analyses. Ecological Research 2024;39(3):341-352. https://doi.org/10.1111/1440-1703.12463.
(109) Kurata S., Sakaguchi S., Hirota S.K., Kurashima O., Suyama Y., Ito M. Phylogeographic incongruence between two related Geranium species with divergent habitat preferences in East Asia. Ecological Research 2024;39(3):273-288. https://doi.org/10.1111/1440-1703.12458.
(110) Tanaka Y., Kano M., Nishimura T., Ohta Y., Yano K. Numerical experiment toward simultaneous estimation of the spatiotemporal evolution of interseismic fault slips and block motions in southwest Japan. Earth, Planets and Space 2024;76(1). https://doi.org/10.1186/s40623-024-02009-4.
(111) Zhao W., Gao J., Hall D., Andersson B.A., Bruxaux J., Tomlinson K.W., Drouzas A.D., Suyama Y., Wang X.-R. Evolutionary radiation of the Eurasian Pinus species under pervasive gene flow. New Phytologist 2024;242(5):2353-2368. https://doi.org/10.1111/nph.19694.
(112) Lawrence J.M., Speirs D.C., Heath M.R., Fujii T., Burns F., Fernandes P.G. Elevated fish densities extend kilometres from oil and gas platforms. PLoS ONE 2024;19(45417). https://doi.org/10.1371/journal.pone.0302738.
(113) Wang H., et al. Atmosphere teleconnections from abatement of China aerosol emissions exacerbate Northeast Pacific warm blob events. Proceedings of the National Academy of Sciences of the United States of America 2024;121(21). https://doi.org/10.1073/pnas.2313797121.
(114) Fu Z.-H., Zhou W., Xie S.-P., Zhang R., Wang X. Dynamic pathway linking Pakistan flooding to East Asian heatwaves. Science Advances 2024;10(17). https://doi.org/10.1126/sciadv.adk9250.
(115) Liu J.-W., Yang L., Xie S.-P. CALIPSO observed low clouds over the subtropical northeast Pacific: Summer climatology and interannual variability. Journal of Geophysical Research: Atmospheres 2024;129(8). https://doi.org/10.1029/2023JD039168.

(116) Lange N., et al. Synthesis Product for Ocean Time Series (SPOTS) - a ship-based biogeochemical pilot. Earth System Science Data 2024;16(4):1901-1931. https://doi.org/10.5194/essd-16-1901-2024.
(117) Kawai Y., Katsura S., Hosoda S. Spatiotemporal variations in upper-ocean salinity over the North Pacific in 2004–2021. Journal of Geophysical Research: Oceans 2024;129(4). https://doi.org/10.1029/2023JC020309.
(118) Kinoshita G., et al. Ice age land bridges to continental islands: Repeated migration of the forest-dwelling sable in northeastern Asia. Journal of Biogeography 2024;51(5):924-939. https://doi.org/10.1111/jbi.14797.
(119) Shigemitsu M., Sasaoka K., Wakita M., Yokokawa T., Hashioka T., Arulananthan K., Murata A. Controlling factors of latitudinal distribution of dissolved organic matter in the upper layers of the Indian Ocean. Progress in Earth and Planetary Science 2024;11(1). https://doi.org/10.1186/s40645-024-00623-0.
(120) Xie X., Hu J., Cao X., Zhang S., Sakamaki T., Li X. In situ utilization of electron-enhanced degradation of azo dyes in a constructed wetland–microbial fuel cell coupling system. Sustainability (Switzerland) 2024;16(8). https://doi.org/10.3390/su16083181.
(121) Visioni D., et al. G6-1.5K-SAI: A new Geoengineering Model Intercomparison Project (GeoMIP) experiment integrating recent advances in solar radiation modification studies. Geoscientific Model Development 2024;17(7):2583-2596. https://doi.org/10.5194/gmd-17-2583-2024.
(122) Sugimoto K., Kawai R., Koizumi T., Matsuo A., Suyama Y., Mizuki I. Fine-scale clonal structure of the lingonberry Vaccinium vitis-idaea under the nurse plant Pinus pumila vegetation in an alpine region, Mt. Norikura. Journal of Plant Research 2024;137(4):619-626. https://doi.org/10.1007/s10265-024-01537-0.
(123) Zhou Z., Waska H., Henkel S., Dittmar T., Kasten S., Holtappels M. Iron promotes the retention of terrigenous dissolved organic matter in subtidal permeable sediments. Environmental Science and Technology 2024;58(14):6204-6214. https://doi.org/10.1021/acs.est.3c09531.
(124) Li X., Cao X., Wang H., Sun Y., Zhang S., Khodseewong S., Sakamaki T. The promotion of the atrazine degradation mechanism by humic acid in a soil microbial electrochemical system. Journal of Environmental Management 2024;357. https://doi.org/10.1016/j.jenvman.2024.120767.
(125) Lalk E., Velez A., Ono S. Methane clumped isotopologue variability from ebullition in a mid-latitude lake. ACS Earth and Space Chemistry 2024;8(4):689-701. https://doi.org/10.1021/acsearthspacechem.3c00282.
(126) Rezeau H., Jagoutz O., Beaudry P., Klein B.Z., Izon G., Ono S. Lower crustal assimilation revealed by sulfur isotope systematics of the Bear Valley Intrusive Suite, southern Sierra Nevada Batholith, California, USA. Contributions to Mineralogy and Petrology 2024;179(4). https://doi.org/10.1007/s00410-024-02123-2.
(127) Hamabata T., Kameda K., Hayashi R., Okuyama J., Kawazu I., Nishizawa H. Latest and comprehensive mitochondrial DNA haplotype data on green and hawksbill turtles collected in their habitats in Japan. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1328101.
(128) Stefánsson A., et al. Isotopic and kinetic constraints on methane origins in Icelandic hydrothermal fluids. Geochimica et Cosmochimica Acta 2024;373:84-97. https://doi.org/10.1016/j.gca.2024.03.015.
(129) Yim S.H.L., et al. Global health impacts of ambient fine particulate pollution associated with climate variability. Environment International 2024;186. https://doi.org/10.1016/j.envint.2024.108587.
(130) Tomita F., Kido M. A new GNSS-acoustic positioning software implementing multiple positioning functions considering nadir total delays. Earth, Planets and Space 2024;76(1). https://doi.org/10.1186/s40623-024-01987-9.
(131) Peng Q., Xie S.-P., Passalacqua G.A., Miyamoto A., Deser C. The 2023 extreme coastal El Niño: Atmospheric and air-sea coupling mechanisms. Science Advances 2024;10(12). https://doi.org/10.1126/sciadv.adk8646.
(132) Zhang H., Xie S.-P., Seager R., Zhao S. Dynamical constraint on precipitation biases over the Indo-Pacific region during boreal summer in AMIP6 models. Geophysical Research Letters 2024;51(6). https://doi.org/10.1029/2023GL107181.
(133) Fujita M., Sugiura N., Kouketsu S. Prediction of atmospheric profiles with machine learning using the signature method. Geophysical Research Letters 2024;51(6). https://doi.org/10.1029/2023GL106403.
(134) Xia M.-Q., Luo Y.-X., Suyama Y., Matsuo A., Sakaguchi S., Wang Y.-G., Li P. Genetic divergence and ecological adaptation of an eastern North American spring ephemeral Sanguinaria canadensis. Diversity and Distributions 2024;30(4). https://doi.org/10.1111/ddi.13813.
(135) Hu J., Cao X., Qu L., Khodseewong S., Zhang S., Sakamaki T., Li X. Study on the mechanism of mitigating membrane fouling in MFC-AnMBR coupling system treating sodium and magnesium ion-containing wastewater. Environmental Technology (United Kingdom) 2024. https://doi.org/10.1080/09593330.2024.2329916.
(136) Mori M., Kosaka Y., Taguchi B., Tokinaga H., Tatebe H., Nakamura H. Northern Hemisphere winter atmospheric teleconnections are intensified by extratropical ocean-atmosphere coupling. Communications Earth and Environment 2024;5(1). https://doi.org/10.1038/s43247-024-01282-1.
(137) Kawatani Y., Nakamura H., Watanabe S., Sato K. Effects of mid-latitude oceanic fronts on the middle atmosphere through upward propagating atmospheric waves. Geophysical Research Letters 2024;51(6). https://doi.org/10.1029/2024GL108262.
(138) Chen S., Chen W., Xie S.-P., Yu B., Wu R., Wang Z., Lan X., Graf H.-F. Strengthened impact of boreal winter North Pacific Oscillation on ENSO development in warming climate. npj Climate and Atmospheric Science 2024;7(1). https://doi.org/10.1038/s41612-024-00615-3.
(139) Kusuma Y.W.C., et al. Genetic diversity and structure of Hopea bilitonensis, an endemic Dipterocarp from Belitung Island, Indonesia. Journal of Asia-Pacific Biodiversity 2024;17(2):400-405. https://doi.org/10.1016/j.japb.2024.01.008.
(140) Chowdhury A., et al. Cold seep formation from salt diapir-controlled deep biosphere oases. Proceedings of the National Academy of Sciences of the United States of America 2024;121(12). https://doi.org/10.1073/pnas.2316878121.
(141) Beckett S.J., et al. Disentangling top-down drivers of mortality underlying diel population dynamics of Prochlorococcus in the North Pacific Subtropical Gyre. Nature Communications 2024;15(1). https://doi.org/10.1038/s41467-024-46165-3.
(142) Gutiérrez-Ortega J.S., Pérez-Farrera M.A., Sato M.P., Matsuo A., Suyama Y., Vovides A.P., Molina-Freaner F., Kajita T., Watano Y. Evolutionary and ecological trends in the Neotropical cycad genus Dioon (Zamiaceae): An example of success of evolutionary stasis. Ecological Research 2024;39(2):131-158. https://doi.org/10.1111/1440-1703.12442.
(143) Samanta D., Vairagi V., Richter K., McDonagh E.L., Karnauskas K.B., Goodkin N.F., Chew L.Y., Horton B.P. The role of anthropogenic forcings on historical sea-level change in the Indo-Pacific warm pool region. Earth's Future 2024;12(3). https://doi.org/10.1029/2023EF003684.
(144) Luongo M.T., Brizuela N.G., Eisenman I., Xie S.-P. Retaining short-term variability reduces mean state biases in wind stress overriding simulations. Journal of Advances in Modeling Earth Systems 2024;16(2). https://doi.org/10.1029/2023MS003665.
(145) Masuda K., et al. Genetic consequences of Last Glacial–Holocene changes in snowfall regime in Arnica mallotopus populations: A plant confined to heavy-snow areas of Japan. American Journal of Botany 2024;111(2). https://doi.org/10.1002/ajb2.16275.
(146) Cai Q., Chen W., Chen S., Xie S.-P., Piao J., Ma T., Lan X. Recent pronounced warming on the Mongolian Plateau boosted by internal climate variability. Nature Geoscience 2024;17(3):181-188. https://doi.org/10.1038/s41561-024-

01377-6.
(147) Ren Y., Li Y., He Z., Qin Y., Sakamaki T., Li Y.-Y. System stability associated with different lipid contents during mesophilic anaerobic digestion of lipid-rich food waste. Journal of Cleaner Production 2024;443. https://doi.org/10.1016/j.jclepro.2024.141171.
(148) Takasuka D., et al. How can we improve the seamless representation of climatological statistics and weather toward reliable global k-scale climate simulations?. Journal of Advances in Modeling Earth Systems 2024;16(2). https://doi.org/10.1029/2023MS003701.
(149) Kawakami Y., et al. Future changes in marine heatwaves based on high-resolution ensemble projections for the northwestern Pacific Ocean. Journal of Oceanography 2024;80(3):177-195. https://doi.org/10.1007/s10872-024-00714-y.
(150) Wang M., Xie S.-P., Sasaki H., Nonaka M., Du Y. Intensification of Pacific tropical instability waves over the recent three decades. Nature Climate Change 2024;14(2):163-170. https://doi.org/10.1038/s41558-023-01915-x.
(151) Harada R., Hirakawa Y., Yabuki A., Kim E., Yazaki E., Kamikawa R., Nakano K., Eliáš M., Inagaki Y. Encyclopedia of family A DNA polymerases localized in organelles: Evolutionary contribution of bacteria including the proto-mitochondrion. Molecular Biology and Evolution 2024;41(2). https://doi.org/10.1093/molbev/msae014.
(152) Hwang Y.-T., Xie S.-P., Chen P.-J., Tseng H.-Y., Deser C. Contribution of anthropogenic aerosols to persistent La Niña-like conditions in the early 21st century. Proceedings of the National Academy of Sciences of the United States of America 2024;121(5). https://doi.org/10.1073/pnas.2315124121.
(153) Yoshikawa C., Shigemitsu M., Yamamoto A., Oka A., Ohkouchi N. A nitrogen isoscape of phytoplankton in the western North Pacific created with a marine nitrogen isotope model. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1294608.
(154) Kawase T., Kyogoku D., Kawatsu K., Katayama N., Miki T., Kondoh M. Time series analysis showing how different environmental conditions affect the interspecific interactions of Callosobruchus maculatus and Callosobruchus chinensis. Population Ecology 2024;66(1):6-21. https://doi.org/10.1002/1438-390X.12160.
(155) Siswanto E., Luang-on J., Ogata K., Higa H., Toratani M. Observations of water optical properties during red tide outbreaks off southeast Hokkaido by GCOM-C/SGLI: Implications for the development of red tide algorithms. Remote Sensing Letters 2024;15(2):121-132. https://doi.org/10.1080/2150704X.2024.2302948.
(156) Santos M.N.M., Wowor D., Ikeda M., Padilla P.I., Romana-Eguia M.R. Morphological and genetic diversity assessment of freshwater prawns (Macrobrachium spp.) in the Cairawan River, Antique Province, Panay Island, Philippines. Philippine Journal of Fisheries 2024;31(1):35-48. https://doi.org/10.31398/tpjf/31.1.2023-0009.
(157) Azami H., et al. Antifungal profile against Candida auris clinical isolates of tyroscherin and its new analog produced by the deep-sea-derived fungal strain Scedosporium apiospermum FKJ-0499. Journal of Antibiotics 2024;77(3):156-162. https://doi.org/10.1038/s41429-023-00696-x.
(158) Suetsugu K., Hirota S.K., Shitara T., Ishida K., Nakato N., Hayakawa H., Suyama Y. The absence of bumblebees on an oceanic island blurs the species boundary of two closely related orchids. New Phytologist 2024;241(3):1321-1333. https://doi.org/10.1111/nph.19325.
(159) Tsunenari K., et al. Double migration of the endangered Tricyrtis formosana (Liliaceae) in Japan. Scientific Reports 2024;14(1). https://doi.org/10.1038/s41598-024-51431-x.
(160) Ishikawa N.F., Takashima A., Maruoka H., Kondoh M. Integrated trophic position as a proxy for food-web complexity. Methods in Ecology and Evolution 2024;15(1):164-177. https://doi.org/10.1111/2041-210X.14256.
(161) Tsujino H., et al. Impact of increased horizontal resolution of an ocean model on carbon circulation in the North Pacific Ocean. Journal of Advances in Modeling Earth Systems 2024;16(1). https://doi.org/10.1029/2023MS003720.
(162) Sakata Y., Hirota S.K., Matsuo A., Kobayashi K., Nakahama N., Suyama Y. Contrasting patterns of genetic structure and population demography in two Dicraeus species feeding on bamboo flowers in Japan. Biological Journal of the Linnean Society 2024;143(2). https://doi.org/10.1093/biolinnean/blad171.
(163) Kurata S., Sakaguchi S., Kurashima O., Ogawa R., Suyama Y., Nishida S., Ito M. Refugia within refugium of Geranium yesoense varieties: A follow-up study using chloroplast genome sequencing data of specimens from Mt. Asama, Japan. Biological Journal of the Linnean Society 2024;142(1):1-7. https://doi.org/10.1093/biolinnean/blad121.

2. Review articles
(164) Stevens B., et al. Earth Virtualization Engines (EVE). Earth System Science Data 2024;16(4):2113-2122. https://doi.org/10.5194/essd-16-2113-2024.

3. Proceedings N/A

4. Other English articles
(165) Horton B.P., et al. There has never been a more crucial time for the Earth Observatory of Singapore. Perspectives of Two Island Nations: Singapore-New Zealand 2024:235-246. https://doi.org/10.1142/9789811287541_0018.
(166) Ishii S., et al. Future space-based coherent Doppler wind lidar for global wind profile observation. Springer Aerospace Technology 2024; Part F2592:37-46. https://doi.org/10.1007/978-3-031-53618-2_4.
(167) Lee J., Sushkov A., Fahey M.E., Yu A.W., Farcy B., McAdam A., Arevalo R.D., McDonough W.F. Solid state multi-wavelength laser development for planetary science laser mass spectrometer. Proceedings of SPIE - The International Society for Optical Engineering 2024;12864. https://doi.org/10.1117/12.3001087.
(168) Inoue T., Yokota Y., Ishikawa T., Kouno K., Nakamura Y., Watanabe S.-I., Nagae K., Ohta Y. Experimental GNSS data using the trimble antenna on the moving cart. Journal of the Geodetic Society of Japan 2024;70:1-12. https://doi.org/10.11366/sokuchi.70.1, EID: 2-s2.0-85196323497.
(169) Rajaram H., et al. Thank you to our 2023 peer reviewers. Geophysical Research Letters 2024;51(9). https://doi.org/10.1029/2024GL109626.
(170) Shigemitsu M., Duteil O., Ito T., Tjiputra J., Eddebbar Y. Editorial: Constraining uncertainties in hindcasts and future projections of marine deoxygenation. Frontiers in Marine Science 2023;10. https://doi.org/10.3389/fmars.2023.1355015.
(171) Nakajima S., Suzuki H., Nakatsugawa M., Matsuo A., Hirota S.K., Suyama Y., Nakamura F. Correction to: Inferring future changes in gene flow under climate change in riverscapes: A pilot case study in fluvial sculpin (Landscape Ecology, (2023), 38, 5, (1351-1362), 10.1007/s10980-023-01633-x). Landscape Ecology 2024;39(6). https://doi.org/10.1007/s10980-024-01904-1.
(172) Chowdhury A., et al. Reply to Jautzy et al.: Considerations on methane equilibrium—do not forget to add the pepper. Proceedings of the National Academy of Sciences of the United States of America 2024;121(37). https://doi.org/10.1073/pnas.2410194121.
(173) Tan F., Meltzner A.J., Li T., Majewski J.M., Khan N.S., Chutcharavan P.M., Horton B.P. Reply to: A commentary on Holocene relative sea-level histories of far-field islands in the mid-Pacific. Quaternary Science Reviews 2025;348. https://doi.org/10.1016/j.quascirev.2024.109097.
(174) Ikeda M., Hirase S., Kikuchi K. Population genomics in wild fisheries organisms. Nippon Suisan Gakkaishi (Japanese

Edition) 2024;90(2). https://doi.org/10.2331/suisan.WA3095-0, EID: 2-s2.0-85190942687.
(175) Yamamoto Y., Ikeda M. 3. Comparative population genomics of yellow striped flounder Pseudopleuronectes herzensteini and marbled flounder P. yokohamae with contrasting early life histories. Nippon Suisan Gakkaishi (Japanese Edition) 2024;90(2). https://doi.org/10.2331/suisan.WA3095-3, EID: 2-s2.0-85190270490.
(176) Kurihara H., Ikeda M. 2. Reconstructing the historical distribution of the sailfin sandfish: From constructing reference genome sequence to population demographic analysis. Nippon Suisan Gakkaishi (Japanese Edition) 2024;90(2). https://doi.org/10.2331/suisan.WA3095-2, EID: 2-s2.0-85190267039.
(177) Ng C.K.Y., Ishihara T., Hamabata T., Nishizawa H., Liu M., Song J.-H., Li T.H., Fong C.-L., Moon D.Y., Kim I.H. Overview of the population genetics and connectivity of sea turtles in the East Asia Region and their conservation implications. Frontiers in Marine Science 2024;11. https://doi.org/10.3389/fmars.2024.1325849.

(3) Submission of electronic data
- In addition to the above, provide a .csv file output from the Web of Science (e.g.) or other database giving the paper's raw data including Document ID. (Note: the Document ID is assigned by paper database.)
- The papers should be divided into A or B categories on separate sheets, not divided by paper categories.

(4) Use in assessments
- The lists of papers will be used in assessing the state of WPI project's progress.
- They will be used as reference in analyzing the trends and whole states of research in the said WPI center, not to evaluate individual researcher performance.
- The special characteristics of each research domain will be considered when conducting assessments.

(5) Additional documents
- After all documents, including these paper listings, showing the state of research progress have been submitted, additional documents may be requested.

2. Invited Lectures, Plenary Addresses (etc.) at International Conferences and International Research Meetings

- List up to 10 main presentations during FY 2024 in order from most recent.
- For each, write the date(s), lecturer/presenter's name, presentation title, and conference name.

Date(s)	Lecturer/Presenter's name	Presentation title	Conference name
Mar.14, 2025	Fumio Inagaki	Prospects for large-scale CO_2 storage and fixation technology utilizing oceanic island basalts (tentative translation)	Symposium of the CCUS Review Committee, 90th Annual Meeting of the Society of Chemical Engineers, Japan
Feb.19, 2025	Michio Kondoh	The multi-sector network for eDNA-based biodiversity monitoring: ANEMONE and its challenges	International Symposium on Environmental DNA for Conservation and Biomonitoring in Southeast Asia 2025
Feb.18, 2025	Yoshihisa Suyama	Genome-wide and environmental DNA analysis to assess the genetic diversity of forest tree	International Symposium on Environmental DNA for Conservation and Biomonitoring in Southeast Asia (eDNAConBio 2025)
Oct. 4, 2024	Tomoko Hamabata	Balancing marine life: towards managing green turtles and seagrass ecosystems in Okinawa, Japan	4th Annual Sea Turtle Workshop at Hawaii Pacific University
Aug.19, 2024	William F. McDonough	What is powering the Earth's engine?	Goldschmidt meeting, Chicago
Aug. 15, 2024	Cheryl Ames	What makes some box jellyfishes so venomous	GRC Venom Evolution, Function and Biomedical Applications. University of Southern Maine, U.S.A.
Jun. 13, 2024	Taichi Yokokawa	Community assembly patterns and environmental drivers shaping the vertical distribution of microbial communities in the pelagic ocean	Marine Microbes, Gordon Research Conference
Jun. 8, 2024	Fumio Inagaki	Exploring the Ocean–Earth Life Frontier and Sustainability (tentative translation)	Annual General Meeting and Lecture Meeting of the Japan Humboldt Association, German Cultural Center (FOAG Conference Room, hybrid format)

Apr. 25, 2024	Eko Siswanto	Harnessing Earth observations for assessing optical water quality in Asian coastal waters	2nd UN Ocean Decade Regional Conference & 11th WESTPAC International Marine Science Conference, Bangkok, Thailand
Apr. 24, 2024	Sherwood Lan Smith	Marine Ecosystem Modeling: How can it be useful to society?	2nd UN Ocean Decade Regional Conference & 11th WESTPAC International Marine Science Conference, Bangkok, Thailand

3. Major Awards

- List up to 10 main awards received during FY 2024 in order from the most recent.
- For each, write the date issued, the recipient's name, and the name of award.
- In case of multiple recipients, underline those affiliated with the center.

Date	Recipient's name	Name of award
Oct. 2024	Fumiaki Tomita	2024 Young Researcher's Award, Seismological Society of Japan
Jul. 2024	Fumio Inagaki	Hanse-Wissenschaftskolleg (HWK) Fellow
Jul. 2024	Kentaro Ando	Top Cited Paper Award for China
Apr. 2024	Yusaku Ohta	The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, Awards for Science and Technology, Research Category

Appendix 2　FY 2024 List of Principal Investigators

NOTE:

*Underline names of principal investigators who belong to an overseas research institution.

*Enter the host institution name and the center name in the footer.

		<Results at the end of FY2024>				**Principal Investigators Total:22**	
Name	Age	Affiliation (Position title, department, organization)	Academic degree, specialty	Effort (%)*	Starting date of project participation	Status of project participation (Describe in concrete terms)	Contributions by PIs from overseas research institutions
Toshio Suga	62	Professor, Department of Geophysics, Graduate School of Science, Tohoku University	Physical Oceanography	90	Ocrober 3rd, 2023	usually stays at the center	
Fumio Inagaki	53	Professor, Department of Earth Science, Graduate School of Science, Tohoku University	Geomicrobiology, Earth Life Engineering	80	Ocrober 3rd, 2023	usually stays at the center (JAMSTEC)	
Benjamin Horton	54	Director, Earth Observatory of Singapore, Nanyang Technological University	Oceanography	10	Ocrober 3rd, 2023	joins a video conference from another institution biweekly	planned to host early-career researchers from the WPI center
Sabine Kasten	61	Head, Section Marine Geochemistry, Alfred Wegener Institute	Sediment Geochemistry, Biogeochemistry	15	Ocrober 3rd, 2023	joins a video conference from another institution biweekly and stays at the center once a year	planned to host early-career researchers from the WPI center
Michio Kawamiya	55	Professor/Director, Research Center for Environmental Modeling and Application, JAMSTEC	Oceanography, Meteorology, Earth System Modeling	80	Ocrober 3rd, 2023	usually stays at the center (JAMSTEC)	
Michio Kondoh	51	Professor, Department of Ecological Developmental Adaptability, Graduate School of Life Sciences, Tohoku University	Theoretical Ecology	80	Ocrober 3rd, 2023	usually stays at the center	

Takeshi Obayashi	49	Professor, Department of System Information Sciences, Graduate School of Information Sciences, Tohoku University	Systems Genomics	80	Ocrober 3rd, 2023	usually stays at the center	
Yusaku Ohta	46	Professor, Research Center for Prediction of Earthquakes and Volcanic Eruptions, Graduate School of Science, Tohoku University	Solid State Geophysics	80	Ocrober 3rd, 2023	usually stays at the center	
Riko Oki	60	Director, Earth Observation Research Center, Japan Aerospace Exploration Agency	Atmospheric and Hydrospheric Science	30	Ocrober 3rd, 2023	joins a video conference from another institution biweekly	
Shuhei Ono	53	Professor, Department of Earth/ Atmospheric and Planetary Sciences, Massachusetts Institute of Technology	Isotope Geochemistry	25	Ocrober 3rd, 2023	joins a video conference from another institution biweekly	planned to host early-career researchers from the WPI center
Niklas Schneider	62	Director, Professor, International Pacific Research Center, Department of Oceanography, University of Hawaii at Manoa	Oceanography	40	Ocrober 3rd, 2023	usually stays at the oversea satellite center	planned to host early-career researchers from the WPI center
Angelicque White	50	Professor, Department of Oceanography, University of Hawaii at Manoa	Biological and Chemical Oceanography	30	Ocrober 3rd, 2023	usually stays at the oversea satellite center	planned to host early-career researchers from the WPI center
Shang-Ping Xie	61	Professor, SCRIPPS Institution of Oceanography, University of California, San Diego	Climatology, Physical Oceanography	30	Ocrober 3rd, 2023	joins a video conference from another institution biweekly	planned to host early-career researchers from the WPI center
Cheryl Lynn Ames	54	Professor, International Integrative Research & Instruction, Graduate School of Agricultural Science, Tohoku University	Molecular Biology	80	Ocrober 3rd, 2023	usually stays at the center	

Shinya Koketsu	48	Director, Professor, Global Ocean Observation Research Center, JAMSTEC	Atmospheric and Hydrospheric Science	80	Ocrober 3rd, 2023	usually stays at the center (JAMSTEC)	
Sherwood Lan Smith	54	Senior Researcher, Professor, Research Institute for Global Change, JAMSTEC	Marine Ecology	80	Ocrober 3rd, 2023	usually stays at the center (JAMSTEC)	
Sayaka Yasunaka	48	Professor, Center for Atmospheric and Oceanic Studies, Graduate School of Science, Tohoku University	Marine Environmental Sciences	80	Ocrober 3rd, 2023	usually stays at the center	
Keith Rodgers	61	Professor, Advanced Institute for Marine Ecosystem Change (WPI-AIMEC), Tohoku University	Oceanography	100	Apri 1stl, 2024	usually stays at the center	
William F. McDonough	70	Professor, Advanced Institute for Marine Ecosystem Change (WPI-AIMEC), Tohoku University	Geomicrobiology	67	Apri 1stl, 2024	usually stays at the center	
Shingo Watanabe	51	Director, Professor, Research Center for Environmental Modeling and Application, JAMSTEC	Meteorology, Earth System Modeling	10	Apri 1stl, 2024	usually stays at the center (JAMSTEC)	
Youichi Ishikawa	54	Director, Professor, VAiG, JAMSTEC	Oceanography, Modelling, AI Development	10	Apri 1stl, 2024	usually stays at the center (JAMSTEC)	
Tatsuhiko Hoshino	49	Senior Researcher, Professor, Kochi Institute for Core Sample Research, JAMSTEC	Chemical Engineering, Applied Chemistry	80	Apri 1stl, 2024	usually stays at the center (JAMSTEC)	

*Percentage of time that the principal investigator devotes to working for the center vis-à-vis his/her total working hours.

Principal investigators unable to participate in project in FY 2024

N/A

Name	Affiliation (Position title, department, organization)	Starting date of project participation	Reasons	Measures taken

Appendix 2a Biographical Sketch of a New Principal Investigator

(within 3 pages per person)

N/A

Name (Age)

Affiliation and position (Position title, department, organization, etc.)

Academic degree and specialty

Effort **%**

* Percentage of time that the principal investigator devote to working for the center vis-à-vis his/her total working hours.

Research and education history

Achievements and highlights of past research activities

Achievements

(1) International influence * Describe the kind of attributes listed below.

a) Recipient of international awards

b) Member of a scholarly academy in a major country

c) Guest speaker or chair of related international conference and/or director or honorary member of a major international academic society in the subject field

d) Editor of an international academic journal

e) Peer reviewer for an overseas competitive research program (etc.)

(2) Receipt of major large-scale competitive funds (over the past 5 years)

(3) Major publications (Titles of major publications, year of publication, journal name, number of citations)

(4) Others (Other achievements indicative of the PI's qualification as a top-world researcher, if any.)

Appendix 3-1 FY 2024 Records of Center Activities

1. Researchers and center staff, satellites, partner institutions

1-1. Number of researchers in the "core" established within the host institution

- Regarding the number of researchers at the Center, fill in the table in Appendix 3-1a.

Special mention

- Enter matters warranting special mention, such as concrete plans for achieving the Center's goals, established schedules for employing main researchers, particularly principal investigators.
- As background to how the Center is working on the global circulation of world's best brains, give good examples, if any, of how career paths are being established for the Center's researchers; that is, from which top-world research institutions do researchers come to the Center and to which research institutions do the Center's researchers go, and how long are their stays at those institutions.

To establish an overseas satellite hub, a Collaborative Research Agreement (CRA) was concluded with the University of Hawaii, and a unit was set up within the university.
To enhance the circulation of talented researchers, there are plans to hire a significant number of postdoctoral researchers. In fiscal year 2024, a hired postdoc transferred to a JST postdoctoral position. Another postdoc has been confirmed to assume an associate professor position in fiscal year 2025. At the hub, research equipment has been installed for use by overseas PIs, thereby promoting collaboration. Additionally, All-Hands meetings have been held, and young researchers have been dispatched to the institutions of overseas PIs to strengthen collaboration with them.

1-2. Satellites and partner institutions

- List the satellite and partner institutions in the table below.
- Indicate newly added and deleted institutions in the "Notes" column.
- If satellite institutions have been established overseas, describe by satellite the Center's achievements in coauthored papers and researcher exchanges in Appendix 4.

<Satellite institutions>

Institution name	Principal Investigator(s), if any	Notes
University of Hawaii at Manoa	Niklas Schneider, Angelicque White	Development of Collaborative Research Agreement

< Partner institutions>

Institution name	Principal Investigator(s), if any	Notes
Scripps Institute of Oceanography, University of California San Diego	Shang-Ping Xie	
Massachusetts Institute of Technology	Shuhei Ono	
Nanyang Technology University	Benjamin Horton	
Alfred Wegener Institute	Sabine Kasten	
JAXA Earth Observation Research Center	Riko Oki	Development of Collaborative Research Agreement

1-3. Postdoctoral Positions through Open International Solicitations

- In the columns "number of applications" and "number of selections," put the total number (upper) and the number and percentage of overseas researchers in the < > brackets (lower).

Fiscal year	Number of applications	Number of selections
FY 2024	98	16
	〈 80 , 81.6 %〉	〈 13 , 81.2 %〉

2. Holding international research meetings

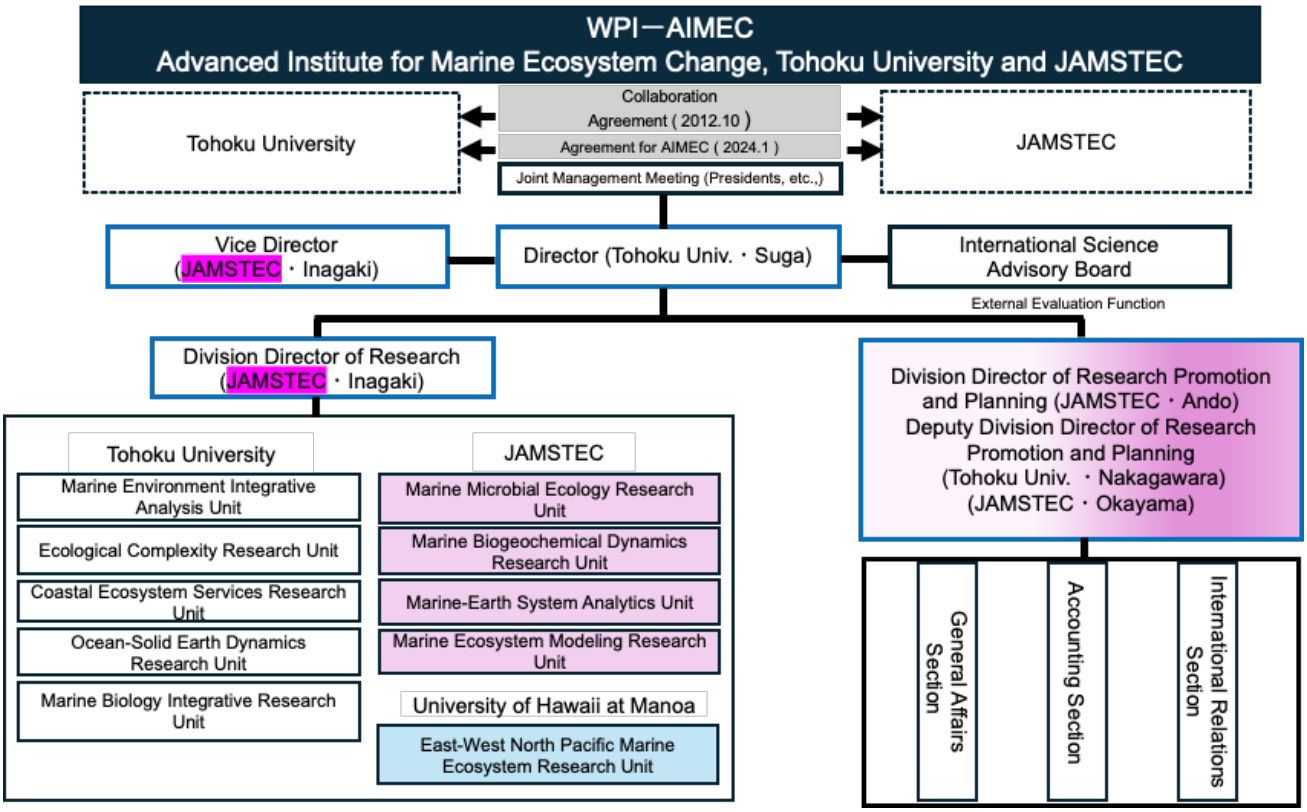
- Indicate the number of international research conferences or symposiums held in FY2024 and give up to three examples of the most representative ones using the table below.

FY 2024: 5 meetings

Major examples (meeting titles and places held)	Number of participants
WPI-AIMEC Workshop: Intro to RStudio for Reproducible Science 20-24 January 2025 Graduate School of Agricultural Science, Aobayama New Campus, Tohoku University	From domestic institutions: 16 From overseas institutions: 0
WPI-AIMEC Workshop on Biological Imaging & Voucher Curation 11-15 November 2024 Aobayama Campus, Tohoku University and Yokosuka Headquarters, JAMSTEC	From domestic institutions: 15 From overseas institutions: 3
Fifth Session of the CSK-2 International Steering Group (ISG-5) 15 November 2024 Espace, Katahira Campus, Tohoku University	From domestic institutions: 7 From overseas institutions: 18
Second International Scientific Symposium of CSK-2 13-14 November 2024 Tokyo Electron House of Creativity, Katahira Campus, Tohoku University	From domestic institutions: 51 From overseas institutions: 39
AIMEC-NSF Joint Workshop for the Model Species Cassiopea: Molecular Analysis with Gridion and Fluidic Dynamics 28 October-1 November 2024 Onagawa Field Center, Graduate School of Agricultural Science, Tohoku University	From domestic institutions: 22 From overseas institutions: 5

3. Diagram of management system

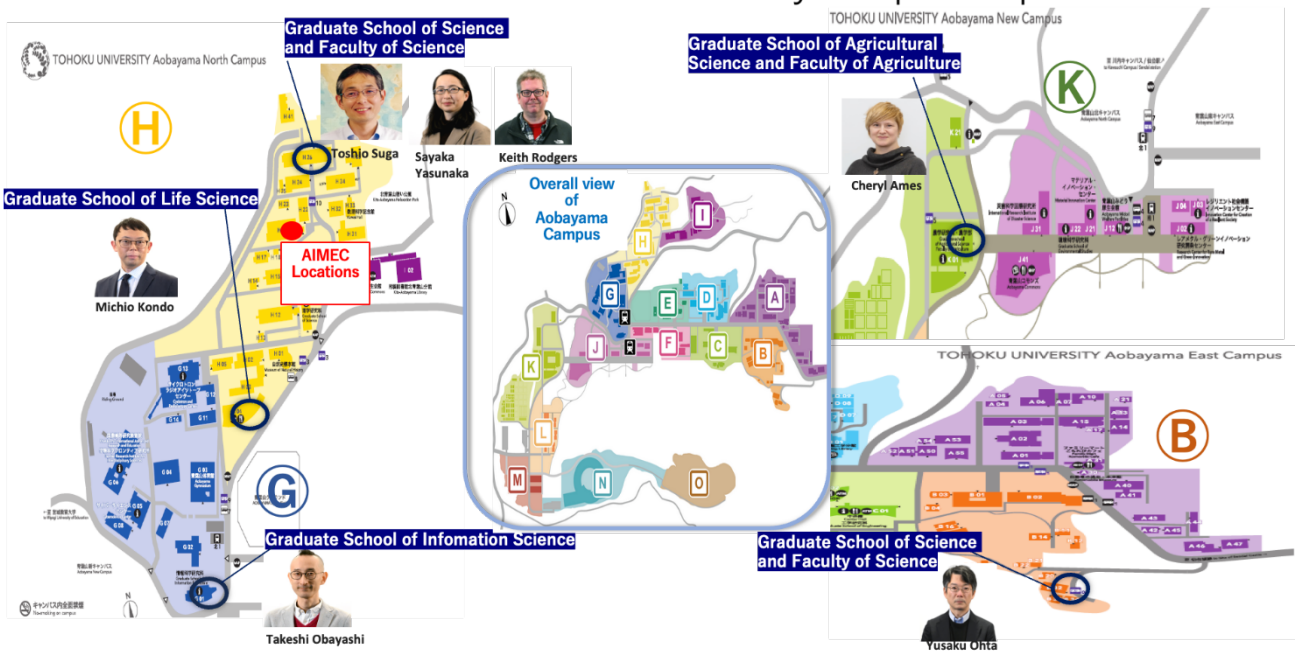
- Diagram the center's management system and its position within the host institution in an easily understood manner.
- If any new changes have been made in the management system from that in the latest "center project" last year, describe them. Especially describe any important changes made in such as the center director, administrative director, head of host institution, and officer(s) in charge at the host institution (e.g., executive vice president for research).

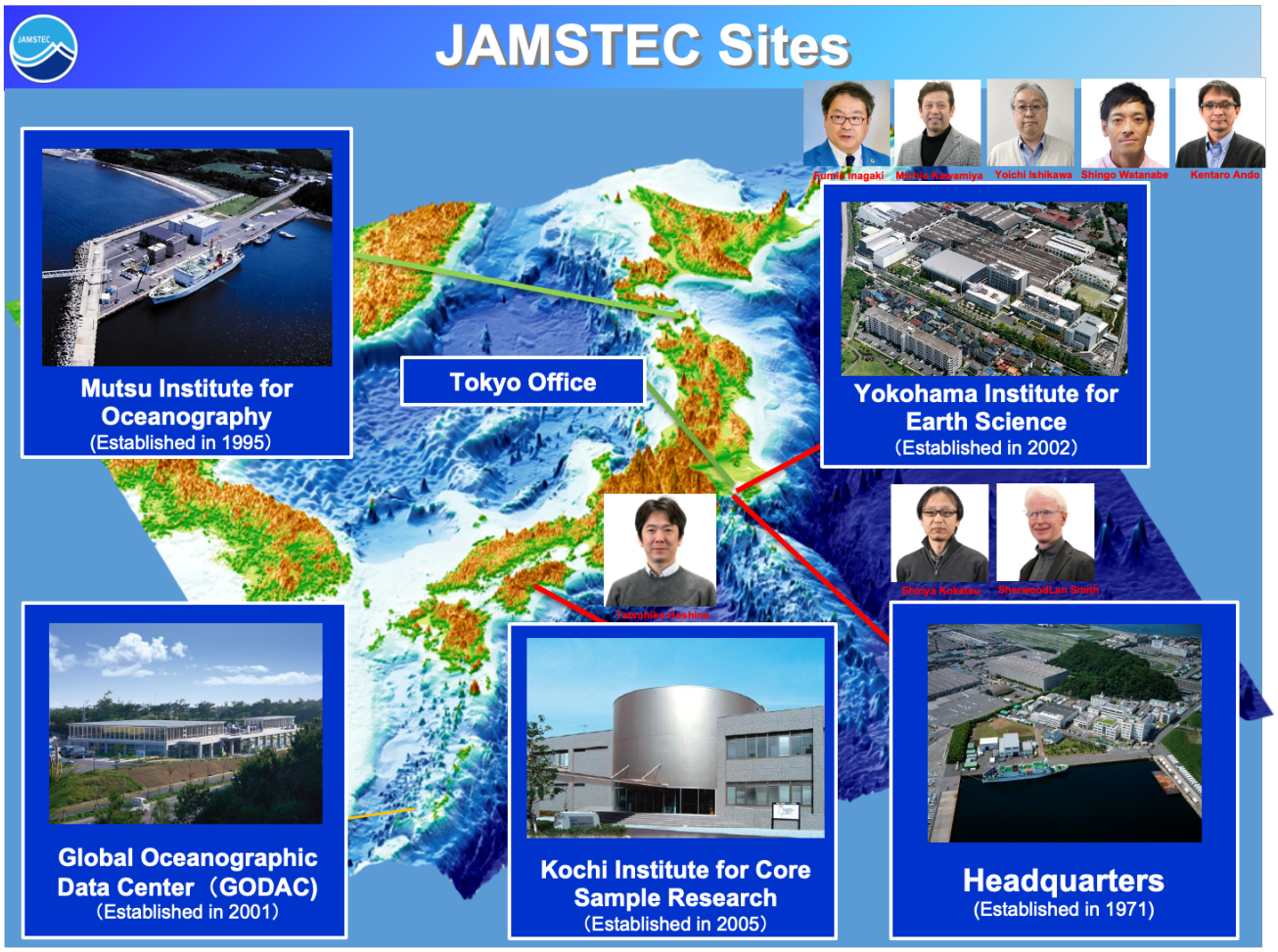


4. Campus Map

- Draw a simple map of the campus showing where the main office and principal investigator(s) are located.

location of AIMEC shown on Tohoku University campus map





5. Securing external research funding*

External research funding secured in FY2024

Total: 880,888,713 yen

- Describe external funding warranting special mention. Include the name and total amount of each grant.
* External research funding includes "KAKENHI," funding for "commissioned research projects," "joint research projects," and for others (donations, etc.) as listed under "Research projects" in Appendix 3-2, Project Expenditures.

Grants-in-Aid for Scientific Research	340,754,724 yen	Grant-in-Aid for Scientific Research (S) 9,950,000 yen Grant-in-Aid for Transformative Research Areas (A) 108,578,000 yen Grant-in-Aid for Scientific Research (B) 56,083,000 yen Grant-in-Aid for Challenging Research 13,450,000 yen
Commissioned research funding	495,502,805 yen	JST COI NEXT 21,000,000 yen JST CREST 31,250,000 yen MEXT-Program for the Advanced Studies of Climate Change Protection(SENTAN) 120,000,000 yen
Collaborative research funding	3,358,030 yen	
Other（e.g. Donation)	41,273,154 yen	

Appendix 3-1a FY 2024 Records of Center Activities

Researchers and other center staff

Number of researchers and other center staff

* Fill in the number of researchers and other center staff in the table blow.
* Describe the final goals for achieving these numbers and dates when they will be achieved described in the last "center project."

a) Principal Investigators

(full professors, associate professors or other researchers of comparable standing)

(number of persons)

	At the beginning of project	At the end of FY 2024	Final goal (Date: April, 2027)
Researchers from within the host institution	10	15	15
Researchers invited from overseas	6	6	8
Researchers invited from other Japanese institutions	1	1	4
Total principal investigators	17	22	27

b) Total members

		At the beginning of project		At the end of FY 2024		Final goal (Date: April, 2027)	
		Number of persons	%	Number of persons	%	Number of persons	%
Researchers		49		66		109	
	Overseas researchers	11	22	24	36	36	33
	Female researchers	11	22	19	29	46	42
	Principal investigators	17		22		27	
	Overseas PIs	8	47	10	45	10	37
	Female PIs	5	29	5	23	8	30
	Other researchers	32		37		52	
	Overseas researchers	3	9	9	24	16	31
	Female researchers	6	19	9	24	22	42
	Postdocs	0		7		30	
	Overseas postdocs	0	0	5	71	10	33
	Female postdocs	0	0	5	71	16	53
Research support staffs		0		7		7	
Administrative staffs		7		14		29	
Total number of people who form the "core" of the research center		56		87		145	

		At the beginning of project		At the end of FY 2024		Final goal (Date: April, 2027)	
		Number of persons	%	Number of persons	%	Number of persons	%
Doctoral students		0		20		81	
	Employed	0	-	13	65.0	33	40.7

※b) The number of doctoral students in the lower table can be duplicated in the upper table of overall composition.

Appendix 3-2 Project Expenditures

1) Overall project funding

* In the "Total costs" column, enter the total amount of funding required to implement the project, without dividing it into funding sources.

* In the "Amount covered by WPI funding" column, enter the amount covered by WPI within the total amount.

* In the "Personnel," "Project activities," "Travel," and "Equipment" blocks, the items of the "Details" column may be changed to coincide with the project's actual content.

(Million yens)

Cost items	Details (For Personnel - Equipment please fill in the breakdown of fiscal expenditure, and the income breakdown for Research projects.)	Total costs	Amount covered by WPI funding
Personnel	Center director and administrative director	39	32
	Principal investigators (no. of persons):11	78	29
	Other researchers (no. of persons):38	193	103
	Research support staff (no. of persons):7	24	23
	Administrative staff (no. of persons):33	127	119
	Subtotal	461	306
Project activities	Gratuities and honoraria paid to invited principal investigators	0	0
	(no. of persons):0	0	0
	Cost of dispatching scientists (no. of persons):0	0	0
	Research startup cost (no. of persons):42	483	483
	Cost of satellite organizations (no. of satellite organizations):1	30	30
	Cost of international symposiums (no. of symposiums):3	2	2
	Rental fees for facilities	17	11
	Cost of consumables	19	19
	Cost of utilities	1	1
	Other costs	32	27
	Subtotal	584	573
Travel	Domestic travel costs	34	34
	Overseas travel costs	43	43
	Travel and accommodations cost for invited scientists	0	0
	(no. of domestic scientists):0	0	0
	(no. of overseas scientists):11	7	7
	Travel cost for scientists on transfer	0	0
	(no. of domestic scientists):0	0	0
	(no. of overseas scientists):2	1	1
	Subtotal	85	85
Equipment	Depreciation of buildings	9	9
	Depreciation of equipment	17	17
	Subtotal	26	26
Research projects (Detail items must be fixed)	Project supported by other government subsidies, etc. *1	255	
	KAKENHI	147	
	Commissioned research projects, etc.	419	
	Joint research projects	6	
	Ohers (donations, etc.)	41	
	Subtotal	868	0
Total		2024	990

Costs (Million yens)

WPI grant in FY 2024	0
Costs of establishing and maintaining facilities	9
Floor Renovation：100 m²	2
Partition renovation: 50 m²	1
Repairing facilities (electricity):98㎡	2
Water supply and drainage:247m	1
Blind construction：100㎡	1
Air-conditioning：148㎡	1
Telephone construction	1
Costs of equipment procured	17
multifunctinal printer: unit	1
Office furniture	1
Online meeting tools	15

*1. Management Expenses Grants (including Management Enhancements Promotion Expenses (機能強化経費)), subsidies etc., indirect funding, and allocations from the university's own resources.
*2 When personnel, travel, equipment (etc.) expenses are covered by KAKENHI or under commissioned research projects or joint research projects, the amounts should be entered in the "Research projects" block.

*1
運営費交付金（機能強化経費を含む）、各種補助金、間接経費、その他大学独自の取組による学内リソースの配分等による財源
*2
科研費、受託研究費、共同研究費等によって人件費、旅費、設備備品等費を支出している場合も、その額は「研究プロジェクト費」として計上すること

2) Costs of satellites

(Million yens)

Cost items	Details	Total costs	Amount covered by WPI funding
Personnel	Principal investigators (no. of persons):0		
	Other researchers (no. of persons):1		
	Research support staff (no. of persons):0		
	Administrative staff (no. of persons):2		
	Subtotal	16	16
Project activities	Subtotal	1	1
Travel	Subtotal	2	2
Equipment	Subtotal	2	2
Research projects	Subtotal	9	9
Total		30	30

Appendix 4 FY 2024 Status of Collaboration with Overseas Satellites

1. Coauthored Papers

- List the refereed papers published in FY 2024 that were coauthored between the center's researcher(s) in domestic institution(s) (include satellite institutions) and overseas satellite institution(s). List them by overseas satellite institution in the below blocks.
- Transcribe data in same format as in Appendix 1. Italicize the names of authors affiliated with overseas satellite institutions.
- For reference write the Appendix 1 item number in parentheses after the item number in the blocks below. Let it free, if the paper is published in between Jan.-Mar. 2025 and not described in Appendix 1.

Overseas Satellite 1 University of Hawaii at Manoa (Total: 1 papers)

1) Adiwira H., Suga T., *Richards K.J.* The relationship between Indian Ocean subtropical mode water variability and ocean temperature structure. Journal of Geophysical Research: Oceans 2024; 129(11). https://doi.org/10.1029/2024JC021226.

Overseas Satellite 2

N/A

2. Status of Researcher Exchanges

- Using the below tables, indicate the number and length of researcher exchanges in FY 2024. Enter by institution and length of exchange.
- Write the number of principal investigator visits in the top of each space and the number of other researchers in the bottom.

Overseas Satellite 1: University of Hawaii at Manoa

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2024	7	0	0	0	0
	11	0	0	0	0

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2024	3	0	0	0	3
	0	1	2	0	3

Overseas Satellite 2:

N/A

<To satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2024					

<From satellite>

	Under 1 week	From 1 week to 1 month	From 1 month to 3 months	3 months or longer	Total
FY2024					

Appendix 5 FY 2024 Visit Records of Researchers from Abroad

* If researchers have visited/ stayed at the Center, provide information on them in the below table.
* Enter the host institution name and the center name in the footer.

Total: 41

	Name	Age	Affiliation		Academic degree, specialty	Record of research activities (Awards record, etc.)	Time, duration	Summary of activities during stay at center (e.g., participation as principal investigator; short-term stay for joint research; participation in symposium)
			Position title, department, organization	Country				
1	Angelicque White	49	Professor, SOEST, University of Hawaii	U.S.A.	Ph.D., Biological Oceanography	https://www.researchgate.net/profile/Angelicque-White	3 days	Presentation and Discussion at WPI-AIMEC All-Hands Meeting
2	Kelvin Richards		Professor, University of Hawaii	U.S.A.	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Kelvin-Richards	3 days	Presentation and Discussion at WPI-AIMEC All-Hands Meeting
3	Shang Ping Xie	61	Professor, University of California San Diego	U.S.A.	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Shang-Ping-Xie	3 days	Discussion with AIMEC Researchers, Presentation and Discussion at WPI-AIMEC All-Hands Meeting
4	Niklas Schneider	61	Professor, University of Hawaii	U.S.A.	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Niklas-Schneider	3 days	Presentation and Discussion at WPI-AIMEC All-Hands Meeting
5	Andrew Hirzel		Postdoctoral Researcher, SOEST, University of Hawaii	U.S.A.	Ph.D., Biological Oceanography	https://www.soest.hawaii.edu/soestwp/about/directory/andrew-hirzel/	3 days	Discussion at WPI-AIMEC All-Hands Meeting
6	Sabine Kasten	60	Professor, Alfred Wegener Institute	Geramany	Ph.D., Marine Geochemistry	https://www.researchgate.net/profile/Sabine-Kasten	14 days	Discussion with AIMEC Researchers, Presentation and Discussion at WPI-AIMEC All-Hands Meeting
7	Laurent Bopp	50	Senior Research Scientist, Deputy Director, IPSL, CNRS	France	Ph.D., Marine Biogeochemistry, Climate change	https://www.researchgate.net/profile/Laurent-Bopp	3 days	Deliver a Lecture and Discussion as an External Collaborator for AIMEC Research
8	Ono Shuhei	54	Professor, MIT	U.S.A.	Ph.D., Geochemistry	https://www.researchgate.net/profile/Shuhei-Ono/2	18 days	Meeting with Professors at Tohoku Univesrity and Researchers at JAMSTEC, and Hold a Seminar
9	Julia Graf	25	Graduate student, University of Cologne	Germany	M.Sc., Biological Sciences		46 days	Meeting with Professors at Tohoku Univesrity and Researchers at JAMSTEC
10	Kelvin Richards		Professor, University of Hawaii	U.S.A.	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Kelvin-Richards	9 days	Discuss Grand Challenge with AIMEC Researchers
11	Niklas Schneider	61	Professor, University of Hawaii	U.S.A.	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Niklas-Schneider	2 days	Attend AIMEC Workshop at Asamushi
12	Hanna Na	43	Associate Professor, Seoul National University	South Korean	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Hanna-Na-3	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting

13	Augy Syahailatua	63	Research Professor, National Research and Innovation Agency	Indonesian	Ph.D., Fishery Oceanography	https://www.researchgate.net/profile/Augy-Syahailatua-2	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
14	Lucas Cardoso Laurindo	41	Assistant Scientist, Univeristy of Miami	Brazil	Ph.D., Meteorology and Physical Oceanography	https://www.researchgate.net/profile/Lucas-Laurindo	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
15	Hyung-Ju Park	30	Ph.D. student, Seoul National University	South Korean	Ph.D. (cand), Physical Oceanography	https://www.researchgate.net/profile/Hyungju-Park-2	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
16	Mariia Lebedeva	24	Master student, Saint-Petersburg State University	Russia	B.C., Earth Sciences	https://www.researchgate.net/profile/Maria-Lebedeva-8	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
17	Yangyang Lu	35	Researcher, Second Institute of Oceanography	China	Ph.D., Marine Chemistry	https://www.researchgate.net/scientific-contributions/Yangyang-Lu-2129297325	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
18	Faisal Hamzah	42	Researcher, National Research and Innovation Agency	Indonesian	Ph.D., Marine Chemistry	https://scholar.google.com/citations?user=6xoyX7MAAAAJ&hl=en	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
19	Qicheng Meng	36	Research Associate, Second Institute of Oceanography	China	Ph.D., Fluid Mechanics	https://www.researchgate.net/profile/Qicheng-Meng	3 days	Presentation and Discussion at CSK-2 Symposium
20	Feng Zhou	46	Professor, Second Institute of Oceanography	China	Ph.D., Fluid Mechanics	https://www.researchgate.net/profile/Feng-Zhou-42	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
21	Jaehyoung Park	39	Assistant Professor, Pukyong National University	South Korea	Ph.D., Science	https://www.researchgate.net/profile/Jae-Hyoung-Park	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
22	Linlin Zhang	43	Professor, Institute of Oceanology, Chinese Academy of Sciences	China	Ph.D., Physical Oceanography	https://scholar.google.com/citations?user=WOtAPRYAAAAJ&hl=en	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
23	Donglian Yuan	58	Professor, First Institute of Oceanography	China	Ph.D., Oceanography	https://www.researchgate.net/profile/Dongliang-Yuan	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
24	Wenxi Zhu	53	Head of the Office, IOC/WESTPAC	China	M.S., Oceanography	https://www.unesco.org/en/author/wenxi-zhu	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
25	Xiaopei Lin	47	Professor, Ocean University of China	China	Ph.D., Physical Oceanography	https://www.researchgate.net/profile/Xiaopei-Lin	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
26	Jingsong Guo	47	Professor, First Institute of Oceanography	China	Ph.D., Physical Oceanography	https://www.researchgate.net/scientific-contributions/Jingsong-Guo-76179003	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting
27	Nachapa Saransuth	52	Senior Programme Assistant, IOC/WESTPAC	Thai	M.S., Oceanography	https://ioc-westpac.org/about-us/team/	3 days	Presentation and Discussion at CSK-2 Symposium and ISG Meeting

28	Karen Joyce Osborn	50	Professor, Curator & Zoologist, Smithsonian National Museum of Natural History; Monterey Bay Aquarium Research Institute	U.S.A.	Ph.D., Zoology	https://naturalhistory.si.edu/staff/karen-osborn	8 days	Participation in the Workshop
29	Jan Michael Hemmi	56	Asociate Professor, School of Biological Sciences, University of Western Australia Oceans Institute	Australia	Ph.D., Oceanography	https://research-repository.uwa.edu.au/en/persons/00079633	8 days	Participation in the Workshop
30	Kakani Katija	44	Principal Engineer & Bioengineer, Monterey Bay Aquarium Research Institute	U.S.A.	Ph.D., Bioengineering	https://www.mbari.org/person/kakani-katija/	5 days	Participation in the Workshop
31	Easton White	35	Professor, University of New Hampshire	U.S.A.	Ph.D., Environmental & Data Science	https://colsa.unh.edu/person/easton-white	8 days	Participation in the Workshop
32	Emily Malcolm-White	35	Professor, Middlebury College	U.S.A.	Ph.D., Mathematics and Statistics	https://www.middlebury.edu/college/people/emily-malcolm-white	8 days	Participation in the Workshop
33	Faith Frings	25	Ph.D. Student, University of New Hampshire	U.S.A.	Master, Marine Ecology	https://colsa.unh.edu/spotlight/faith-frings	7 days	Participation in the Workshop
34	Andrew Villeneuve	32	Ph.D. Student, University of New Hampshire	U.S.A.	Master, Marine Ecology and Heatwaves	https://colsa.unh.edu/spotlight/andrew-drew-villeneuve	7 days	Participation in the Workshop
35	Bastian Bentlage	44	Associate Professor, University of Guam	U.S.A.	Ph.D., Marine Ecology and Data Management	https://www.uog.edu/directory/bentlage-bastian.php	5 days	Participation in the Workshop
36	Aki Hammond Ohdera		Postdoctoral Fellow, University of Arizona	U.S.A.	Ph.D., Marine Ecology and Genomics	https://scholar.google.co.jp/citations?user=ZtxKYn0AAAAJ&hl=en	7 days	Participation in the Workshop
37	Andre Carrara Morandini	50	Professor, University of Sao Paulo	Brazil	Ph.D., Marine Biology & Systematics	https://bv.fapesp.br/en/pesquisador/30050/andre-carrara-morandini/	7 days	Participation in the Workshop
38	Gary Wessel	69	Professor, Brown University	U.S.A.	Ph.D., Molecular and Cell Biology	https://vivo.brown.edu/display/gwessel	13 days	Teaching an international marine biology course and conducting joint research at the Asamushi Field Center
39	Anna Jaźdżewska	44	Professor, University of Lodz	Poland	Ph.D., Biological Sciences	https://www.uni.lodz.pl/en/employee/anna-jazdzewska	14 days	Teaching an international marine biology course and conducting joint research at the Asamushi Field Center
40	Nagayasu Nakanishi	46	Professor, University of Arkansas at Fayetteville	U.S.A.	Ph.D., Evolutionary Development	https://biology.uark.edu/directory/faculty/uid/nnakanis/name/Nagayasu+Nakanishi/	30 days	Conducting collaborative research and mentoring a student for a joint research project
41	Julie Kim	40	Consultant, Deloitte USA	U.S.A.	Computer Science and AI		3 days	Participation in the Workshop

Appendix 6 FY2024 State of Outreach Activities

* Fill in the numbers of activities and times held during FY2024 by each activity.
* Describe the outreach activities in the "3-1. Societal Value of Basic Research" of Progress Report, including those stated below that warrant special mention.

Activities	FY2024 (number of activities, times held)
PR brochure, pamphlet	1; Brochure related to fundraising
Lectures, seminars for general public	1
Teaching, experiments, training for elementary, secondary and high school students	2; Hands-on science class and research guidance for junior high school students
Participating, exhibiting in events	2
Press releases	8; 1 in English, 7 in Japanese
Publications of the popular science books	2; Writing and supervising research-related content
Original Contents	3; 2 interview articles and 1 Video
Others (Workshop)	1; Interdisciplinary workshop in collaboration with experts including those from the humanities
Others (Outreach for Industry)	5; 1 Discussion with fishery stakeholders, 2 Related to JAMSTEC, 2 Others
Others (Guidance for prospective students)	1; Explanation of international graduate programs
Other (Social contribution activities)	1; Cooperation in ESD (Education for Sustainable Development) education
Other (Seminars and sessions for external experts)	1; AIMEC's own session at JpGU (The Japan Geoscience Union)

*If there are any rows on activities the center didn't implement, delete that (those) row(s). If you have any activities other than the items stated above, fill in the space between parentheses after "Others" on the bottom with the name of those activities and state the numbers of activities and times held in the space on the right. A row of "Others" can be added, if needed.

Outreach Activities and Their Results

List up to three of the Center's outreach activities carried out in FY2024 that have contributed to enhancing the brand or recognition of your Center and/or the brand of the overall WPI program, and describe its concrete contents and effect in narrative style. (Where possible, indicate the results in concrete numbers.)

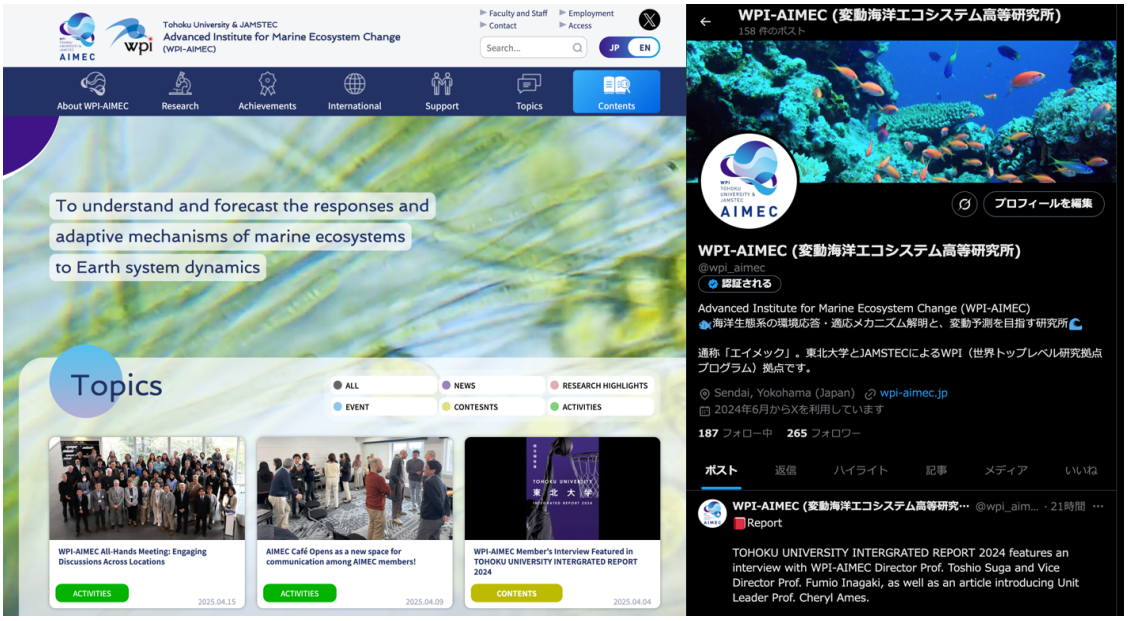
Examples:
- As a result of using a new OO press-release method, a OO% increase in media coverage was obtained over the previous year.
- By holding seminars for the public that include people from industry, requests for joint research were received from companies.
- We changed our public relations media. As a resulting of using OO to disseminate information, a OO% increase in inquiries from researchers was obtained over the previous year.
- As a result of vigorously carrying out OO outreach activity, \OO in external funding was acquired.

Website and Social Media

The website (https://wpi-aimec.jp/en/about/) is continuously improved to provide up-to-date information in an easy-to-understand manner. Divided into various genres, the website is promptly updated with activity reports, media appearances, press releases, etc., including dialogue activities with society. In addition, personal pages have been improved to better showcase the interests and research themes of individual researchers and strengthen internal and external collaborations.

Original content has also been developed, including two interviews, one video, and twice-monthly columns by advisors that highlight the activities and status of researchers. A group of junior high school students who viewed the website inquired about specific research topics, which led us to offer advice for their group activities.

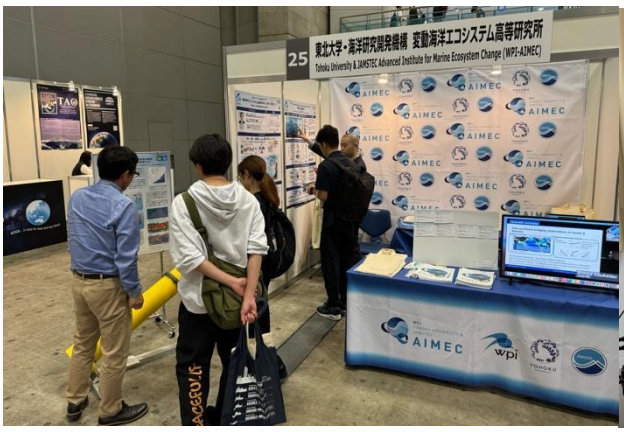
In June 2024, we linked our website to X (formerly Twitter, https://x.com/wpi_aimec). We disseminated in research results, activity reports, and other information as needed for researchers and high-science interest audiences (152 posts in FY2024). Furthermore, we are aiming to increase the number of followers (265 as of April 16, 2025) and provide continuous information. In addition, from April 2025, a Facebook account was launched to target a somewhat older and more engaged audience compared to X. Going forward, as we refine our outreach strategy, we will further clarify our audiences and objectives to optimize the content of our website and social media.

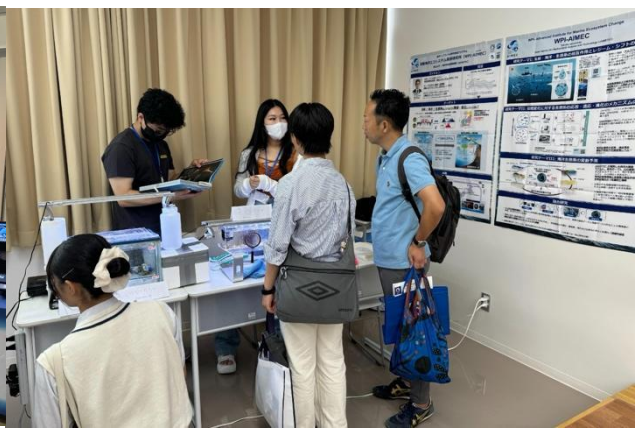


On-site (Face-to-Face) Communication

We prioritize face-to-face communication, including booth exhibitions, to facilitate two-way exchanges of opinions with various stakeholders. As part of these efforts, AIMEC held its own session and exhibition at the Japan Geoscience Union (JpGU) in May 2024. During the session, ULs and others gave presentations on AIMEC's mission and research themes, providing a forum for discussion that transcended academic disciplines. The exhibition at the JpGU meeting offered interactive dialogue with the marine science community, including high school students and young researchers, on research topics and job opportunities.

At the Tohoku University Open Campus, in collaboration with UL, we conducted activities that linked specific research content to the institute's mission for high school students, thereby encouraging them to pursue further education. After the event, we received a message from one participant expressing a strong interest in both academic advancement and scientific outreach activities. Going forward, we plan to increase face-to-face communication opportunities specifically for those with a high interest in marine science.





Co-creation of Knowledge and Problem-Solving with Diverse Stakeholders

In February 2025, AIMEC co-hosted a workshop and public event titled “Creating a Future Coastal Community Where People and the Ocean Coexist” with the Tohoku University Knowledge Forum. In addition to AIMEC researchers, experts from various fields—such as cultural anthropology, fisheries, and economics—together with participants primarily consisting of students, engaged in ongoing dialogue to generate ideas. This provided an opportunity for each participant to take home insights for addressing multifaceted issues in coastal communities. One indicator of the workshop’s outcome was the question: “Looking ahead, do you want to increase the opportunities to think about coexistence between people and the ocean in your work or daily life?” Of the 23 respondents, 19 selected “5 (Definitely want to increase),” suggesting a ripple effect on solving real-world social challenges.

Appendix 7 FY 2024 List of Project's Media Coverage

* List and describe media coverage (e.g., articles published, programs aired) in FY 2024.

* Enter the host institution name and the center name in the footer.

	Date	Types of Media (e.g., newspaper, magazine, television)	Description
1	Aug. 26, 2024	Newspaper	[Kochi Shimbun] (distributed by Kyodo News) Introduction about OneArgo by Toshio Suga
2	Oct. 31, 2024	WEB article	[TOHOKU University Researcher in Focus] Introduction about WPI-AIMEC's Mission and the recent result by Toshio Suga
3	Oct. 31, 2024	Book	[Tell Me! The Truth About Jellyfish: 100 Questions Answered (tentative translation); published by TSURUOKA CITY KAMO AQUARIUM] Introduction about Jellyfish by Cheryl Ames
4	Nov. 22, 2024	WEB article	[Tohoku University official website, MANABI NO MORI] Introduction about WPI-AIMEC's Mission and Research Activities by Toshio Suga and Takeshi Obayashi
5	Dec. 2, 2024	Magazine	[JAMSTEC Blue Earth] Introduction about Research Activities by Shinya Kouketsu, Masahito Shigemitsu, Shigeki Hosoda and Toshio Suga
6	Dec. 13, 2024	News Website	[Asahi Shogakusei Shimbun] Introduction about eDNA by Michio Kondoh
7	Dec. 20, 2024	WEB article	[JAMSTEC BASE] Report about UNFCCC by Michio Kawamiya
8	Dec. 26, 2024	TV	[OH! Bandesu (tentative translation) by Miyagi Television Broadcasting] Introduction about Blue Carbon by Michio Kondoh
9	Jan. 8, 2025	News Website	[The Kahoku Shimpo] Introduction about WPI-AIMEC's Mission and Research Activities by Toshio Suga, Michio Kondoh and Keith Rodgers
10	Jan. 15, 2025	Book	[Newton Special Edition: Weather and Meteorology (Revised Edition), Science Magazine Newton] Explanation of Marine Research by Shigeki Hosoda and Kentaro Ando
11	Jan. 16, 2025	Magezine	[milsil by National Museum of Nature and Science] Introduction about eDNA by Michio Kondoh
12	Jan. 21, 2025	TV	[Live News It! (tentative translation) Sendai Television Incorporated] Explanation of Oyster by Satoshi Katayama
13	Jan. 26, 2025	News Website	[Tokyo Shimbun Digital] Explanation of CCS (Carbon dioxide Capture and Storage) by Fumio Inagaki
14	Feb. 12, 2025	News Website	[Charge ! (tentative translation) by HIGASHI NIPPON BROADCASTING] Explanation of Rosy seabass of in Tohoku region by Satoshi Katayama

	Date	Types of Media (e.g., newspaper, magazine, television)	Description
15	Feb. 19, 2025	WEB article	[AMBI] Introduction about WPI-AIMEC's Mission and Job Opening by Yuichi Okayama