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Center for International Collaboration
Atmosphere and Ocean Research Institute
The University of Tokyo

PICES-2018 Annual Meeting

Hiroaki SAITO
Professor, Center for International Collaboration

The city of Yokohama was the first port opened for foreign countries in 1859 after 220 years of Japan's seclusion from foreign influence. Scientific knowledge and goods were transported into Japan through the port, which contributed to establishing Japan as a modern state. The North Pacific Marine Science Organization (PICES) held its 26th Annual Meeting in Japan's leading maritime city October 25–November 4, 2018. PICES is an intergovernmental scientific organization promoting and coordinating marine research in the North Pacific and adjacent sea. Its members are Canada, Japan, China, Korea, Russia, and the USA. The theme of the meeting was "Towards integrated understanding of ecosystem variability in the North Pacific." More than 550 scientists, including 140 early career scientists, attended from 16 countries. Representatives of 22 international/regional organizations and programs also attended.

During the opening ceremony, Professor Hiroaki Saito—the chair of the PICES Science Board—summarized the organization's annual activities, including publications, collaborations with international organizations/projects, and capacity development activities. During the meeting, more than 440 papers were presented. Many studies focused on the recent acceleration of the impact of human activities on the North Pacific ecosystems; these include the marine heat wave, microplastic contamination, and the influence of fisheries on food web structure. Additionally, new techniques for monitoring the status of ecosystems and ocean management for sustainable ecosystem services were introduced. To cope with the increasing impact of human activities, the establishment of two expert groups was approved by the Governing Council, thus responding to recommendations from the Science Board. One is the Study Group on Impacts of Mariculture on Coastal Ecosystems; the other is the Working Group on Marine Microplastics. The next annual meeting will be held in Victoria, Canada, October 16–27, 2019. The theme of the meeting will be "Connecting Science and Communities in a Changing North Pacific."

Professor Saito (left) celebrated the 2018 Wooster Award winner, Dr. Vyacheslav B. Lobanov(right), during the opening ceremony.

Various types of sake were served during the poster session.

Contents

51st Session of the Executive Council of the Intergovernmental Oceanographic Commission (IOCEC-51)

Yutaka MICHIDA
Professor, Center for International Collaboration

Japanese delegation at the 51st Session of the Executive Council of the IOC. On the front row, Professor Saito (second left) and Professor Michida (third left), the head of the delegation.

The 51st Session of the Executive Council of the Intergovernmental Oceanographic Commission (IOC) was held on July 3–6, 2018, at UNESCO's headquarters in Paris. Professor Yutaka Michida, the director of Center for International Collaboration (CIC) of AORI, participated as the head of the Japanese delegation. Professor Hiroaki Saito also attended the meeting as a delegation member. The session adopted various decisions to prioritize programs of the IOC. Of significant impact in terms of the entirety of the IOC activities for the next decade was a resolution adopted by the Executive Council to establish an Executive Planning Group to take the lead in preparing the implementation plan for the UN Decade of Ocean Science for Sustainable Development (2021–2030). The resolution followed the proclamation by the United Nations General Assembly (UNGA) at the 72nd session in December 2017 and recalled the UNGA's invitation to the IOC to prepare an implementation plan for the Decade. The period 2018–2020 is considered to be the preparatory stage for the Decade; a draft and final plan that encompasses a scientific strategy and an engagement plan for a wide range of stakeholders, including international ocean-related organizations, will be developed. Heads of such organizations and institutions were invited to the session to provide statements regarding their contributions and commitments to the Decade. Representatives of more than 30 Member States among 40 Executive Council members took the floor, and almost all of them expressed their strong support for the Decade, and some of them clearly stated their commitment to the Decade in its preparatory stage and beyond. Japan also expressed its support and stated that it has a plan to host one of the regional planning workshops in the Asia-Pacific region that should be organized during the period 2019–2020. Dr. Mitsuo Uematsu, Professor Emeritus of the University of Tokyo and the former director of the CIC, has been selected as one of the 18 members of the Executive Planning Group for the Decade. The CIC will also be involved in the preparation processes for the Decade, cooperating closely with Dr. Uematsu and the Japanese government.

Another decision related to strategic matters of the IOC was the proposed reform of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). JCOMM, established in 1999 by parallel resolutions taken by the World Meteorological Congress (WMO) and IOC Assembly, has been a very successful framework for closer collaboration between WMO and the IOC for the last 20 years in scientific research and services of oceanography and marine meteorology through its joint expert teams and projects. WMO has decided its reform aiming at becoming a more flexible and integrated organization with stronger partnerships to meet emerging societal needs and challenges of global climate, water, and weather. The reform will also impact partner organizations, particularly the IOC (the closest cooperative body). The Executive Council of IOC decided to establish jointly with WMO a consultation group on the reform of JCOMM, emphasizing the importance of continued and enhanced cooperation between oceanography and meteorology, namely between the IOC and WMO. It is necessary to have careful and constructive discussions but not lose the existing and successful technical cooperation within JCOMM. Professor Michida has been selected as a member of the consultation group in his capacity as the co-chair of the International Oceanographic Data and Information Exchange (IODE) of IOC.

Professor Michida, reporting the outcome of the Resolutions Committee (a sessional committee established under the beginning agenda item) on the podium at the 51st Session of the Executive Council of the IOC

During the Executive Council session, Professor Michida was appointed as the chairperson of the Resolutions Committee to review the draft resolutions and report results back to the plenary.

RENSEA Seminar on Coastal Ecosystems in Southeast Asia

Hiroaki SAITO
Professor, Center for International Collaboration

Southeast Asia is a hotspot of marine biological diversity. However, the richness of biological diversity and marine ecosystem services in Southeast Asia are in crisis because of increasing human activity and the demand for marine ecosystem services. Unfortunately, our knowledge of the structure and dynamics of these important marine ecosystems is seriously limited. Building an international network to proceed with marine ecosystem studies in this region is an emergent issue.

To enhance multilateral collaboration for research and education regarding coastal ecosystems among five Southeast Asian countries (i.e., Indonesia, Malaysia, Philippines, Thailand, and Vietnam) and Japan, a science project known as "Research and Education Network on coastal ecosystems in Southeast Asia" (RENSEA) was initiated in April 2016; it is supported by the Core-to-Core Program of the Japan Society for the Promotion of Science (JSPS). There are three research groups in RENSEA focused on physical processes, biodiversity, and environmental pollution, respectively.

The second RENSEA seminar was held at the University of the Philippines Visayas (UPV), Iloilo City, from February 27 to March 1, 2018. In Session 1, highlights of recent research regarding various ecosystems, such as seagrass beds, coral reefs, coastal physical processes, biodiversity, and pollution, were presented. Session 2 was an educational forum; UPV students presented their ongoing studies, and attendees offered suggestions and comments. After the group discussion during Session 3, attendees shared best practices for applying scientific knowledge for the sustainable use of marine ecosystem services and exchanged ideas to proceed with RENSEA scientific investigations and collaborations over the next year. The next phase of the Core-to-Core Program (from 2019) was also planned. The third RENSEA seminar will be held at Chulalongkorn University, Bangkok, February 20–22, 2019.

Emeritus Professor Shuhei Nishida was acknowledged for his long-term contributions to JSPS collaboration projects in Southeast Asia from RENSEA's national leaders.

Group photo of seminar attendees

High Level Scientific Conference "From COP 21 towards the United Nations Decade of Ocean Science for Sustainable Development" and the in-person meeting of the Ocean KAN Development Team in Paris

Mitsuo UEMATSU
Emeritus Professor, AORI, the University of Tokyo

In view of the launching of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030) - hereafter, "the Decade" - , the Intergovernmental Oceanographic Commission of UNESCO and Ocean and Climate Platform were held at the High Level Scientific Conference, September 10–11, 2018, at the UNESCO Headquarters in Paris.

Two hundred and eighty people from more than 30 countries participated, but only one Japanese from Asian countries. The importance of scientific oceanographic observation was emphasized in relation to such issues as the

The High Level Scientific Conference was held in Room X, UNESCO Headquarters, in Paris

Members of the Ocean KAN Development Team on the campus of University Paris VI

sea level rise resulting from global warming, acidification, oxygen deficiency, and microplastic contamination. We also concluded that Intergovernmental Panel on Climate Change (IPCC) and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) should collaborate and reflect on the scientific facts obtained for the decision making by policy makers. Finally, Professor Haugan, the IOC chair, summarized the importance of marine science in polar and deep sea regions, collaboration with climate science, expectations and efforts for female researchers' success, the natural science and social science network, ocean literacy, collaboration with industry, science-based communication, and policy planning. The Decade is comprehended as a plan that actually got the timing to start.

The second in-person meeting of the Ocean Knowledge-Action Network (KAN) Development Team (DT), co-chaired by Anna Zivian and Mitsuo Uematsu, was held and supported by SCOR at the French National Center for Scientific Research (CNRS) in Paris, September 12–13, 2018, immediately following the High Level Scientific Conference. Fifteen members from nine countries attended the meeting and discussed the progress of the various working groups (i.e., Learning Networks, Knowledge Mobilization, Transboundary Fisheries Crime, Coastal Risk, and Ocean Governance) in addition to the Early Career Network. We must endeavor to raise interest in Asia as well.

For the Surface Ocean Lower Atmosphere Study (SOLAS) Open Science Conference in Sapporo in April 2019, the discussion session regarding "What is Ocean KAN?" was proposed. At the Integrated Marine Biosphere Research (IMBeR) project Open Science Conference in June 2019, a session for Ocean Governance will be organized. The DT has been holding a Web meeting monthly, and we are considering holding an in-person meeting outside the US next year. The final report will be compiled at the DT meeting. We confirmed the roadmap for Ocean KAN on December 2019 as well.

ANU-UTokyo joint activities

Yusuke YOKOYAMA
Professor, Analytical Center for Environmental Study

Continuous active exchanges were conducted during 2018 between the University of Tokyo (UTokyo) and Australian National University (ANU) under their strategic partnership program. The Atmosphere and Ocean Research Institute (AORI) has been playing an important role as the leading institute for the UTokyo side of exchanges between the universities (based on the memorandum of understanding [MOU]). This report highlights several events in which AORI played a pivotal role during the year.

1) Dr. Anthony Purcell's visit (April–June 2018)

Dr. Purcell is a key researcher in the field of geophysics; presently, he is affiliated with the Research School of Earth Sciences (RSES). Furthermore, ANU has a world-leading laboratory for sea level studies. Dr. Purcell's group has developed a comprehensive global sea level model, and it is one of the three best models used for predicting past and future sea level changes. Dr. Purcell has been heavily involved in a project aimed at improving the model and has been playing a pivotal role because of his strong mathematical and computational skills.

Dr. Anthony Purcell (right) and AORI PhD student (K. Yagasaki)

Dr. Purcell visited AORI for three months as a visiting associate professor and gave several presentations at institutional seminars and a scientific conference. He interacted with various scholars and students during his stay, and several collaborative studies have been submitted for publication in scientific journals. These articles point to the success of his visit to AORI this year.

2) UTokyo-ANU student field excursion (September 2018)

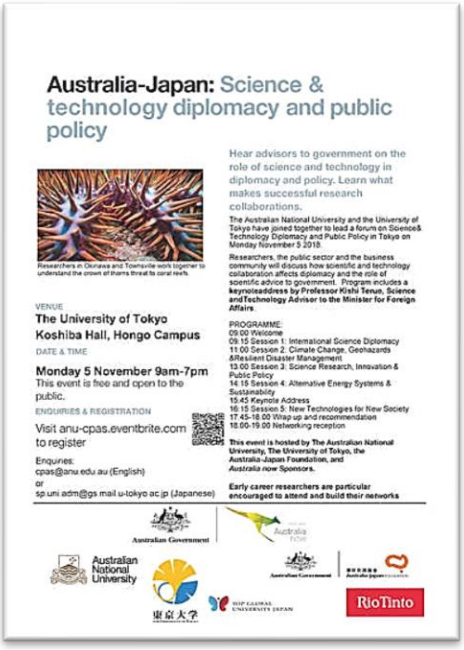
We also welcomed 20 ANU students and two staff members from ANU in September for two weeks for joint instruction at AORI and various other sites in Japan. More than 15 students from different schools in UTokyo also attended the course and work intensively for two weeks from morning to night. They collaborated effectively with ANU students and made lifetime friends. While students attended classes at AORI, Director/Professor Tsuda, as well as Professors Hyodo, Nagata, and Shinzato, as well as other members of AORI helped organize the program. A summary of this year's activities can be found via Twitter (#GeohazardsNCP2018) and YouTube (https://www.youtube.com/watch?v=gCeZ6_1a-4E&app=desktop), as well as the website of the Analytical Center for Environmental Study (http://lams-yokoyama.blogspot.com/search/label/Diary). This exchange programs will also be conducted in 2019 and include UTokyo students visiting Australia in March.

Tsunami boulders in Tohoku

Visiting an elementary school to hear stories of tsunami survivors

Group photo at the Hoei crater

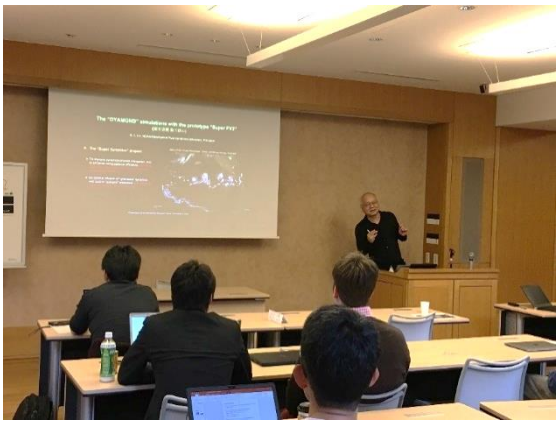
3) Science & Technology Diplomacy and Public Policy Forum (November 5, 2018)



The workshop was organized as a collaboration between ANU and UTokyo. It was planned as a cooperative activity with the Australian Embassy and the outreach called "Australia now" (https://australianow2018.com/program/australia-japan-science-diplomacy-and-public-policy-forums). Planning was initiated in 2017 by Professor Jennifer Corbett with the Crawford School of Public Policy and Professor Joan Leach of the ANU Centre for the Public Awareness of Science. The program was wide-ranging and multidisciplinary. (https://cpas.anu.edu.au/news-events/events/australia-japan-science-diplomacy-and-public-policy) The workshop was extremely interesting and educational because of the many different perspectives on the mechanisms of interdisciplinary research collaborations and their contributions to formal and informal diplomacy. It was also informative for explaining how scientific and technological evidence can be made accessible and brought to bear on policymaking and why we should all be thinking responsibly about the societal and environmental impacts of the research that we conduct. The discussions shed light on points wherein Japan and Australia differ. However, it also shows that we can make important discoveries and innovations when we work together. The workshop was a great success, and students and postdocs who attended enjoyed the active discussions.

Although the MOU between the universities will be ending in February 2019, we will renew it to conduct continuous active exchanges; hence, further developments on strategic partnerships will be seen in the coming year. Continuous support from AORI as well as from UTokyo is appreciated and will be an important component for the success of the partnership.

Professor Corbett(left) and Professor Leach(center), who organized the Science & Technology Diplomacy and Public Policy forum with Professor Yokoyama(right)



Workshop in the Seminar Room, Ito International Research Center (November 3, 2018)

Workshop on the Intercomparison of Global Cloud Resolving Models and Related Studies, November 13, 2018

Masaki SATOH
Professor, Division of Ocean-Earth System Science

This referenced workshop was held in the Seminar Room, Ito International Research Center, The University of Tokyo to intensively discuss preliminary results of the project DYAMOND and related studies regarding global/regional high-resolution atmospheric simulations. The project DYAMOND describes a framework for the intercomparison of an emerging class of weather and climate models that, through their resolution of the major modes of atmospheric heat transport, endeavor to represent the most important scales of the full three-dimensional fluid dynamics of the atmospheric circulation. Simulations will be performed for a 40-day period with the goals of (i) identifying similarities and differences that emerge on storm-resolving scales (1–5 km) as compared to traditional (hydrostatic scale) representations of the atmospheric circulation and (ii) defining the frameworks and protocols for subsequent—and scientifically more ambitious—phases. Phase zero of the project DYAMOND has resulted in simulations from nine groups in the world at the time the workshop was held.

Members of four groups of the project DYAMOND—that is, Japan (NICAM), the Max Plank Institute of Meteorology (MPI-M, Germany; ICON), two groups in the United States (global-SAM and FV3)—have participated in the workshop and communicated with each other regarding recent results of project activities. Dr. Ryosuke Shibuya (JAMSTEC) showed results of "The DYAMOND simulations with NICAM" as the activity involving the Japanese global cloud-resolving model and collaboration with AORI. Professor Marat Khairoutdinov (Stony Brook University) introduced "Preliminary results from Global SAM". Dr. Shian-Jiann Lin (GFDL) talked on "The DYAMOND simulations with a prototype of super FB3", and Dr. Christopher Moseley (MPI-M) presented "The DYAMOND activities with ICON at MPI-M". Two talks on large eddy simulation (LES) studies were also invited to interact with DYAMOND studies. Dr. Takanobu Yamaguchi (NOAA) gave a talk entitled the "Perspective of shallow clouds as an integral component of the atmospheric circulation system", and Dr. Junshi Ito (AORI) introduced studies regarding "Whole typhoon LES". At the beginning of the workshop, Professor David Randall (Colorado State University) was invited to give an introductory talk entitled "Convective aggregation on the sphere with and without rotation".

This workshop was supported by the Center for Earth Surface System Dynamics (CESD), AORI. The agenda of the workshop was announced at http://cesd.aori.u-tokyo.ac.jp/info/20181023.html. Following this workshop, the 5th International Workshop on Nonhydrostatic Models (NHM2018) was held at the Japan Meteorological Agency, November 14–16, 2018, and all members who participated in the present "Workshop on the Intercomparison of Global Cloud Resolving Models and Related" have continued the discussions at NHM2018. The International Workshop on Nonhydrostatic Models is held regularly every two years. Global nonhydrostatic model studies by NICAM have been presented at International Workshops on Nonhydrostatic Models since the first workshop was held 10 years ago. This year, as described above, more international groups have begun global nonhydrostatic model simulations. Thus, it was a good idea to hold the workshop on the intercomparison of global cloud-resolving models. We are grateful for the support from AORI and assistance from Ms. Hidemi Hibino and Ms. Yoko Obayashi.

5th International Workshop on Nonhydrostatic Models (NHM2018), November 14–16, 2018, held at the Japan Meteorological Agency

Visiting Professors

Name / Affiliation	Nationality	Length of stay	Subject for study
LEICHTER, James Scripps Institution of Oceanography University of California, San Diego Professor	USA	2017/9/27-12/24	International research network for elucidating trophic, geochemical, and population connectivity of coral reef ecosystems
CALIL, Paulo H. R. Instituto de Oceanografia, Universidade Federal do Rio Grande Associate Professor	Brazil	2017/5/15-8/14	Multiple temporal and spatial scales of variability in WBC systems and their biogeochemical consequence: a comparison between the Brazil-Malvinas and Kuroshio-Oyashio Current systems
ZHANG, Hui Institute of Oceanology, Chinese Academy of Sciences (IOCAS) Associate Professor	China	2017/4/1-2018/1/31	Ecology of ichthyoplankton assemblage and early life history of fishes in the Yangtze River Estuary
WEINBAUER, Markus G. Laboratoire d'Oceanographie de Villefranche (LOV), Sorbonne Universités, UPMC Researcher	Austria	2017/9/18-12/17	Animal-prokaryote association and its contribution to biogeochemical cycles in the ocean
WILLIAMS, Suzanne Natural History Museum, London Research Leader	Australia/UK	2017/5/25-6/30	The genetic architecture of colour in marine invertebrates and adaptive evolution of deep-sea gastropods
CHIVAS, Allan R. The School of Earth and Environmental Sciences, University of Wollongong, Australia Professor	Australia	2017/10/23-12/1	Paleoenvironment reconstruction using biogenic carbonate trace element
HAMILTON, Kevin International Pacific Research Center, University of Hawaii retired professor and Director	USA	2017/4/1-5/31	Simplified Representations of the Stratospheric Quasibiennial Oscillation (QBO)
STRUNIN, Alexandr M. CAO/ROSHYDROMET Researcher	Russia	2017/4/1-6/25	Studies on the atmospheric environment over West-Siberia and Arctic region using Russian airplane

Visiting professors' reports

WILLIAMS, Suzanne

Research Leader, Natural History Museum, London

I was delighted to have the opportunity to visit AORI in May and June 2017 to visit Japan for the first time and to continue collaborating with Prof. Yasunori Kano. I first met Prof. Kano in London in 2007 when he visited the Natural History Museum. A few years ago, we collaborated on a paper where we published the first molecular phylogeny for a group of deep-sea gastropods belonging to the family Solariellidae.

During my time at AORI, Prof. Kano and I have been working on two more papers about solariellids. One is a small monograph of the genera, which will provide a taxonomic framework for the family and the other is investigating reproductive behavior in a genus that broods young snails in the umbilicus of its shell. The monograph is nearly finished and we hope to submit it soon.

A key activity during my visit was giving a one-credit graduate course at the Kashiwa Campus "Special lectures of Aquatic Science", which was attended by approximately 40 people. My seminar was entitled '*Colourful shells: Investigating the evolution of shell colour in molluscs*'**.** It was a review of the function of colour and pattern in the phylum Mollusca and then an introduction to some research that I have undertaken in this field. Afterwards we had a small party where I was able to talk further with several professors and students.

One of the highlights of my trip was meeting Prof. Kano's team of students and post-docs and Prof. Kojima. They were all very friendly and helpful and we shared many meals together. Another highlight of my visit to AORI was the fieldwork I was able to undertake in Okinawa. I went to the beautiful islands of Okinawa and Ishigaki from 20-28 June with Prof. Kano, and five of his students and post-docs and we met up with three Spanish colleagues. During our fieldwork I collected samples of the starfish, *Linckia laevigata*, for molecular and ecological studies on the evolution of colour in this colourful species, and strombid gastropod samples for molecular and morphological studies, in order to learn more about their vision. The analysis of these samples will take place back in London at the Natural History Museum, and Yasunori and I will work on papers that result from this fieldwork.

My visit has been an extremely rewarding time, both personally and scientifically. I have very much enjoyed my visit to Japan and I would like to thank Prof. Kano for his kindness and generosity as my host. He and his team have been unfailingly kind and helpful at all times and I am very grateful to all of them.

CHIVAS, Allan R.

Emeritus Professor, School of Earth and Environmental Sciences, University of Wollongong, Australia

I visited AORI during October and November 2017 and resided in Professor Yusuke Yokoyama' s group, namely the Analytical Center for Environmental Study (ACES). We have known each other since the time of his PhD studies at the Australian National University, starting in 1995, and it is always a pleasure to continue our scientific collaboration.

A key aspect of my visit was our discussions of a joint project concerning past air temperatures during the Last Glacial Maximum, about 20,000 years ago, in New Zealand. This involves several isotopic techniques applied to carbonate nodules and rhizomorphs (plant roots replaced by soil carbonate minerals). A fundamental part of this investigation requires being able to date small amounts of these carbonate minerals using radiocarbon. To this end, the unique capabilities of the YSAMS single-stage Accelerator Mass Spectrometer (AMS) at AORI has been critical as there are few other laboratories world-wide with such capability. Indeed, this equipment and the associated graphite-target preparation procedure are quite special and unique for small samples.

I was fortunate enough to be able to participate in and present a talk concerning clumped-isotope palaeothermometry at the symposium organised at AORI to mark the retirement of Professor Masao Nakada, a University of Tokyo scholar now at the

University of Kyushu. This was an event that paid tribute to his many important scientific achievements. For me, it was particularly pleasing in that, in the early 1980s we were both working at the Research School of Earth Sciences at the Australian National University.

Another aspect of my visit that is always a highlight is the interaction that I so enjoy with graduate students and other post-doctoral visitors in ACES. There is much scientific endeavour being pursued and across a range of important research topics. This is a strong and cohesive team. I was pleased to provide a talk to the group about Quaternary stratigraphy and the possibility that the part of the official global geological timescale may be formally named "Chibanian" after the prefecture in which we reside. During my time here, I was also able to complete revisions to several manuscripts in an encouraging and conducively peaceful environment. I thank Professor Yokoyama and assistant Tomoko Shibatsuji for smoothing the way for a most enjoyable sojourn.

WEINBAUER, Markus G.

Researcher, Laboratoire d'Oceanographie de Villefranche (LOV), Sorbonne Universités, UPMC

I was invited by Prof. Koji Hamasaki at AORI as guest professor. I have a long lasting collaboration with this institute (former ORI). A former ORI student who also worked at my institute during her PhD studies, worked later with me as postdoc on pelagic microorganisms at my institute (Laboratoire d'Océanographie de Villlefranche, France). We are reassuming
work that we have proposed 10 areas ago, i.e. to compare so-called free-living microorganisms with attached organisms (bound to organic aggregates or living within metazoans, i.e. copepods and fish). Now we have the funding to actually start this research and Prof. Hamasaki was my care-taking host. The main idea of my stay was to compile data for a potential conceptual paper on this topic. However, some ideas for more detailed projects raised and we will try to get that funded (the initial part will be covered by a French University). Indeed, the first DNA samples for microbial metagenome sequencing of the gut microbiome of some bristlemouth fish species, the most abundant group of fish in the world, have been obtained. Additionally, I gave a seminar at the institute and for the GFS students on the neglected role of the effects of volcano ash and soot for the diversity and activity of microorganisms in the ocean.

According to the allowances of the University of Tokyo, I could visit the Noto Marine Station. Parts of this peninsula look like the pre-alpine area of my home country (Austria) especially now in fall but then you drive around a corner and there is the sea… .I could even help Prof. Hamasaki in a sampling exercice.

I had also the chance to visit Kochi University and JAMSTEC. The technological facilities associated to deep subsurface drilling at this institute are amazing. This visit was organized by Prof. Keizo Nagasaki, a colleague from postdoc times when we worked on viruses.

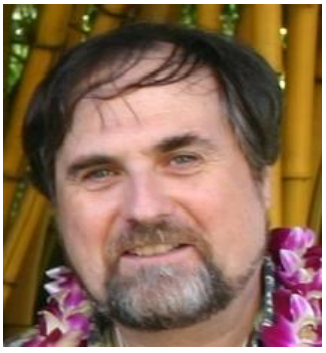
In addition, I could visit the Hakuho-Maro when unloading after a long cruise and attend the symposium in Tsukuba in honor to Prof. Rita Colewell (University of Maryland) who won the 33rd International Prize for Biology (Japanese Society for the Promotion of Science).

The time here at AORI and general in Japan was wonderful. The leaves changed the color in the period from late summer to late fall when I lived here. This was a very pleasing experience. Also, I will never forget all the cheerful lunches and dinners with colleagues and friends. I am deeply grateful to the administration, students and postdocs, who helped whenever they could i(not only with science related issues). And I am particularly grateful to Prof. Hamasaki for his hospitality and for his pertinent help. They all made my stay at AORI a real pleasure!

HAMILTON, Kevin

retired professor and Director, International Pacific Research Center, University of Hawaii

I am just about to complete my second extended (April-May) visit to CCSR/AORI (my previous visit was in spring 2015). I am pleased to have the chance to report on my activities. In April I presented a seminar on recent work quantifying the effect of atmospheric tides on the daily cycle of rainfall in the tropics and was pleased by the discussions with AORI scientists that this seminar stimulated. During my earlier 2015 visit I presented a series of lectures (in English) at the Hongo campus as a 1-credit graduate course, and later reflected on the barriers many Japanese students had dealing with my lectures and generally in operating professionally in English. Back in Hawaii this experience led me to some informal online research into available advice for writing papers in English. Armed with this background, in this April I had an extended presentation-interaction session with the CCSR/AORI students and younger



researchers on ways to improve the standard of English in scientific manuscripts and presentations. I enjoyed this interaction and I hope this may have been helpful for these young climate scientists.

The overall subject of my research activities here was the variability of the stratospheric quasi-biennial oscillation (QBO), a subject I introduced in a seminar at AORI I gave during a brief visit in September last year. The QBO dominates the equatorial stratospheric circulation where prevailing winds are observed to undergo a remarkable alternation between strong easterlies and strong westerlies in a cycle with period averaging ~27 months. Unlike the completely predictable, astronomically-forced, seasonal or tidal cycles, the QBO emerges spontaneously from the internal fluid dynamics of the atmosphere, and so - while it has behaved fairly regularly in most of the observed record - there is interest in understanding the variability of the QBO from cycle-to-cycle. This issue became even more interesting after 2016 which saw a very anomalous QBO cycle – one that is unprecedented since at least 1953 when regular balloon observations allowed careful monitoring of the QBO state.

I am involved now in several research projects with Japanese colleagues relating to different aspects of the QBO variability, and my stay I Japan has enabled me to interact with my collaborators on these projects and provide my comments and input. At JAMSTEC I am assisting Yoshio Kawatani in his investigation of the systematic effects of ENSO on the QBO behavior. Notably Yoshio has been able to reproduce in his atmospheric GCM the observed tendency for the QBO phase to progress faster in El Nino vs La Nina conditions. We are now considering further analysis of the GCM results. Once again at JAMSTEC, Shingo Watanabe is leading an effort to examine the predictability of the 2016 QBO disruption using a very high vertical resolution GCM. Initial results are promising and may represent the first time any comprehensive simulation model has been able to reproduce the basic features of the observed 2016 disruption. I am consulting with Shingo and his colleagues on how to proceed from these exciting initial results.

In addition to these collaborations on sophisticated model analysis, I also collaborated with Takatoshi Sakazaki (now at U Hawaii on a JSPS postdoctoral fellowship) on a very simple observational study which we were actually able to complete during my CCSR/AORI visit. In light of the increasing interest in QBO variability, it would very useful to extend the observed QBO time series back to the pre-1953 era when no regular daily balloon observations of the wind in the equatorial stratosphere are available. One data point in the distant past has been known for some time, namely that in there was a strong equatorially-centered easterly jet in the stratosphere in the period immediately after the Krakatau eruption in August 1883. The existence of these "Krakatau easterlies" was inferred from the motion of the stratospheric aerosol cloud injected by the major eruption. The aerosols produced very spectacular optical effects, including very long twilight periods and colorful sunsets. By tracking the first time the presence of these optical effects was reported, the spread of the stratospheric aerosol cloud around the equator could be tracked (see top panel of the Figure). In our new study we were able to find reports of typical post-eruption optical effects after major eruptions in early May 1902 on Caribbean islands, and are able to infer the QBO phase at that time (see bottom panel of the Figure). We also identified several other major low-latitude eruptions during 1800-1952 for which there might be useful data to infer equatorial winds. Working with Takatoshi, I completed last month a small manuscript on this historical study that has just been accepted for publication in the British journal *Weather*.

My stay in Japan was very enjoyable and I was pleased to have a chance to do some sightseeing both around the Tokyo area and further afield. I would like to express my gratitude to AORI/CCSR for the chance to make this extended visit. I especially would like to thank Masaki Satoh for the invitation to come to AORI/CCSR and for his kindness as my host, as well as Midori Kubota for her efficient and friendly assistance beginning months before I actually arrived. They made it a real pleasure for me to stay at the Kashiwa campus!

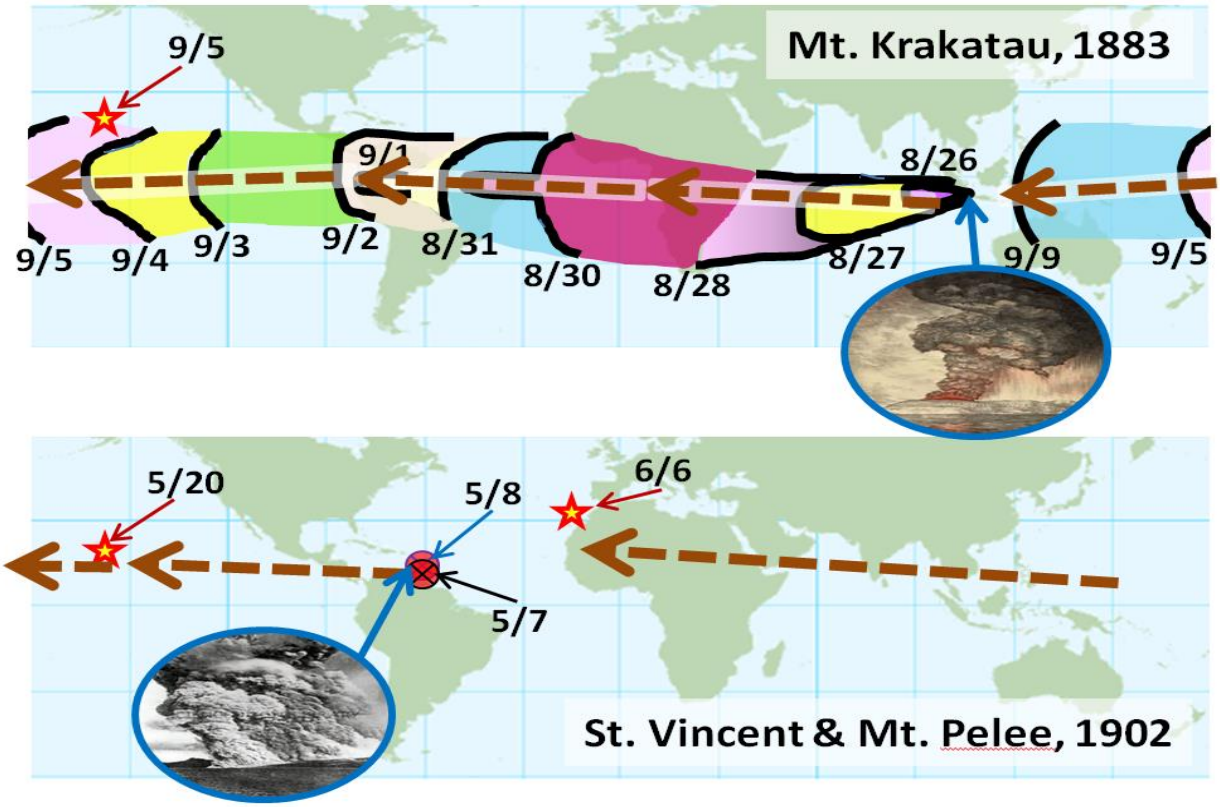


Figure Caption: Maps showing observations relevant to the stratospheric dispersal of the aerosol following major volcanic eruptions. Note that dates identifying individual features are given as "month of year"/"day of month". (top) Observed spread of the sunset optical phenomena in the two weeks following the Krakatau eruption. The black lines are redrafted from an earlier study and show the westward extent of the phenomena each day. (bottom) The red circles show locations of St. Vincent and Mt. Pelee which had explosive eruptions on 7 May and 8 May, 1902, respectively. The stars show the locations of Honolulu and Madiera where observations of twilight phenomena resulting from the aerosol cloud from the eruptions were first observed on 20 May and 6 June, respectively.

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I work as a researcher in Laboratory of Thermodynamic of Atmosphere, Department of Cloud Physics and Weather Modifications, Central Aerological Observatory, Russia. I am interested in investigations of thermodynamic and turbulence of atmosphere, especially turbulence in the clouds, atmospheric aerosols, mainly based on aircraft observations. I took part in creating new Russian aircraft-laboratory Yak-42D "Roshygromet" and now I work as onboard operator, responsible for the aircraft system for measuring flight navigation parameters and thermodynamic characteristics of atmosphere.

During my visit to Japan I worked at Atmosphere and Ocean Research Institute (AORI) of Tokyo University about three months from beginning of April, 2017 up to end of June, 2017. During my staying in AORI I had chance to attend the Japan Geosciences Union and American Geophysical Union joint meeting 2017 (JpGU-AGU). I also made a short visit to Dr. MACHIDA Toshinobu office (National Institute for Environmental Studies, NIES) where I leaned with Comprehensive Observation Network for Trace gases by Airliner (CONTRAIL) project. I also visited to Dr. KANAYA Yugo office

(Japan Agency for Marine-Earth Science and Technology, JAMSTEC).

The main goal of my staying in AORI was the finding a way for using aircraft-based data on atmospheric aerosols, thermodynamic parameters of atmosphere and precise aircraft navy data for validation of satellite data. Russian aircraft-laboratory Yak-42D "Roshydromet" fulfilled some research flights in Arctic, Moscow and St. Petersburg regions (in period from July, 2013 up to June 2017 82 research flights were made), and its tracks sometimes crossed with projection of trajectory of MODIS satellite (Aqua and Terra platforms) and Orbiting Carbon Observatory. This gave me possibility to compare concentrations of small and sub-micron particles, particles of black carbon with correspondent satellite data.

Beyond the research work in AORI, I also had chance to enjoy nice spring in Japan, including beautiful sakura (cherry) and other flowers blossoming. My family - my wife and daughter - accompanied me to Japan, it was their first visit to Japan and they much enjoyed staying here. We got great experience and many nice impressions during the visit.

I would like to take this opportunity to thank my host, Prof. Ryoichi Imasu for this chance to visit AORI and all laboratories' members for a welcome. I also hope for our further cooperation between our institutes.

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