

WESTPAC 9th International Scientific Symposium

Shuhei Nishida

Professor, Center for International Collaboration

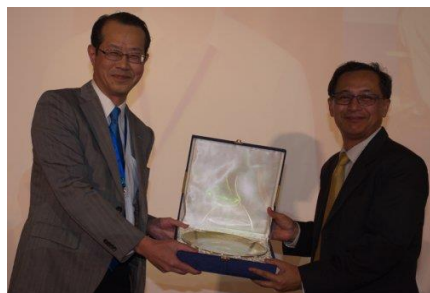
This symposium is among the largest scientific meetings in the field of oceanography in the Asian region, held every three years as a major WESTPAC activity. The 9th symposium was entitled “A Healthy Ocean for Prosperity in the Western Pacific: Science Challenges and Possible Solutions” and took place from April 22-25, 2014, at NhaTrang Sheraton Hotel in NhaTrang, Vietnam. It was hosted by the Vietnam Academy of Science and Technology (VAST) and IOC Sub-Commission for the Western Pacific (WESTPAC). The Asian CORE project joined the symposium as a co-sponsor and provided travel support for Japanese participants.

The symposium was attended by 550 participants from 21 countries, including researchers, research organization managers, regulators/policy makers, and project coordinators on coastal oceanography from all over the world. In the opening session, on the first day, Prof. Tomohiko Kawamura (International Coastal Research Center, AORI), gave a keynote presentation on the “Impacts of the 2011 mega-earthquake and tsunami on marine coastal ecosystems in the Pacific coast of Northeast Japan”. The opening session was followed by 450 presentations (oral and poster), distributed in 14 sessions under three sub-themes: “Understanding Ocean Processes in the Indo-Pacific Region”, “Ensuring Marine Biodiversity, Food Safety and Security”, and “Maintenance of Ocean Health”. The results of the Asian CORE project were presented by 70 members participating in the symposium. Workshops on eight projects related to the WESTPAC were also held during the symposium, such as the workshop “Ocean Remote Sensing for Coastal Habitat Mapping”, chaired by Prof. Teruhisa Komatsu (Dept. of Marine Bioscience, AORI), and the “Asian CORE” workshop, chaired by Prof. Shuhei Nishida (Center for International Collaboration: CIC, AORI).

Finally, during the symposium, Prof. Yutaka Michida (CIC, AORI) was honored for his long-term dedication to regional marine science development and cooperation with the WESTPAC Outstanding Scientist Award.



WESTPAC 9th International Scientific Symposium



Prof. Michida awarded as a WESTPAC outstanding scientist



Scenery of plenary session

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Completion of external evaluation of AORI

Mitsuo Uematsu

Professor and Director, Center for International Collaboration

From March 5-7, 2014, three foreign honorable experts were invited to convene with three distinguished local experts, in order to perform an external evaluation of AORI. The evaluation committee members all have significant achievements in atmospheric and oceanic sciences, as well as ample experience in managing research and education institutes. The committee

was chaired by Emeritus Professor Bob Duce, Texas A & M University.

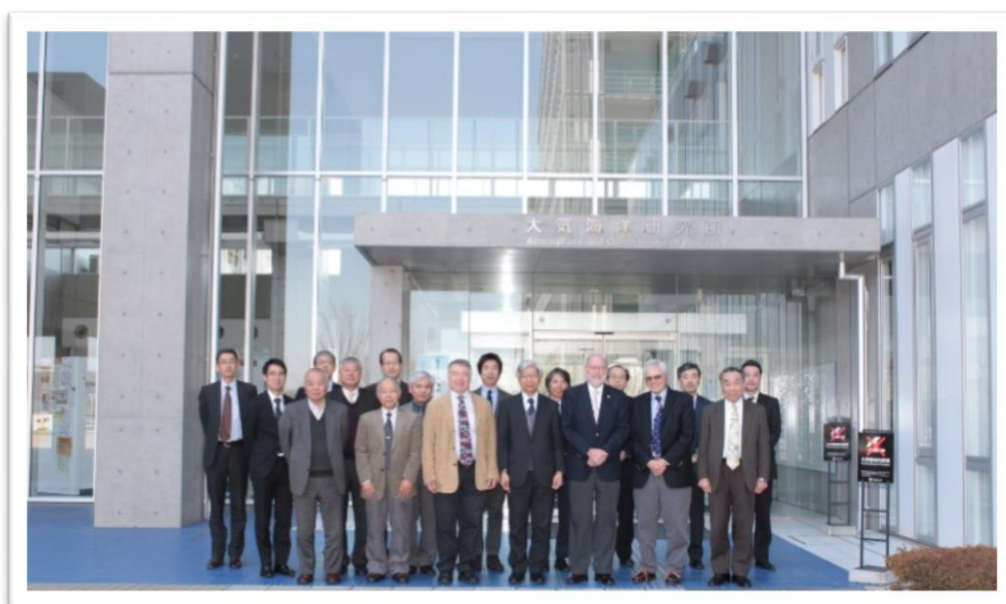
The committee evaluated the 2007-2012 activities, including those of the former Ocean Research Institute and the Center for Climate System Research, the current status and the future initiatives, presented by the director and faculty members. After a discussion session and a facilities tour, the evaluation

committee finalized the report. This evaluation report serves as an excellent guide for future development of the Atmosphere and Ocean Research Institute.

The final review report, comprising the external review and other material from the external evaluation, is now available in both Japanese and English, as a hard copy and PDF files on the AORI website.



Snap shots during the external evaluation committee meeting



International Training Workshop

“Marine Zooplankton Biodiversity and Taxonomy”

Shuhe Nishida

Professor, Center for International Collaboration

Among the major activities of the Asian CORE Program of the Japan Society for the Promotion of Science, the international training workshop “Marine Zooplankton Biodiversity and Taxonomy”, was held at the Institute of Bioscience, Universiti Putra Malaysia (UPM), from August 26–29, 2014. The workshop aimed at enhancing Malaysia’s capacity in the areas of marine zooplankton identification and ecology. This workshop, sponsored by the Ministry of Education (Malaysia) and the Asian CORE Program, was convened by

Prof. Fatimah M.D. Yusoff (UPM) and Prof. Shuhe Nishida (AORI). The total of 32 participants included university teachers, graduate students, and researchers from other institutions and companies conducting environmental research in different regions of Malaysia. The sessions on the first day and in the morning of the second day included lectures on the marine biodiversity in Southeast Asia, the importance of zooplankton in marine ecosystems, the ecology and taxonomy of major zooplankton groups, and application of molecular genetics tools in

zooplankton research. The afternoon of the second day, third, and fourth days were devoted to two parallel sessions on laboratory sorting practices and the practical identification of four zooplankton groups (copepods, mysids, chaetognaths, and gelatinous plankton). The workshop was concluded with a final session late in the afternoon of the fourth day. This workshop succeeded in enhancing zooplankton research in Malaysia and was a good starting point for our future collaboration, both in research and education.



Lecture on Mysids



Practice of copepod identification

The 13th Regional Spectral Model Workshop

Kei Yoshimura

Associate Professor, Division of Climate System Research

The 13th Regional Spectral Model Workshop (RSM-WS) was held in Yokohama Institute of Earth Science (YES) in JAMSTEC, from November 25-29, 2014. The RSM-WS has been held almost every year since 1999. Its purpose is to discuss the development and applications of the RSM, which was originally developed at the National Centers for Environmental Prediction (NCEP). RSM has been used extensively in regional downscaling of coarse resolution forecasts, analyses, and simulations; one of the hottest topics in atmospheric modeling. There were four scientific sessions, namely “Dynamical Downscaling for Climate”, “Model Development and Process Studies”, “Model Development and Application Studies”, and “Tropical Cyclones”, with a total of 38 presentations. There were more than 50 attendees from 13 different countries, including emerging ones like Kenya, Senegal,



Participants of the 13th Regional Spectral Model Workshop (photo taken on 2014/11/27 at Yokohama Institute of Earth Science, JAMSTEC)

Bangladesh, Vietnam, etc. In the afternoons of November 27 and 28, practical sessions were held on the regional atmosphere-ocean coupled model (RSM-ROMS), during which the participants were divided into six groups and tried to install and run the model for their preferred domains, and all of them could make their runs.

Agreement on Scientific Cooperation between AORI and Rajdhani College, University of Delhi

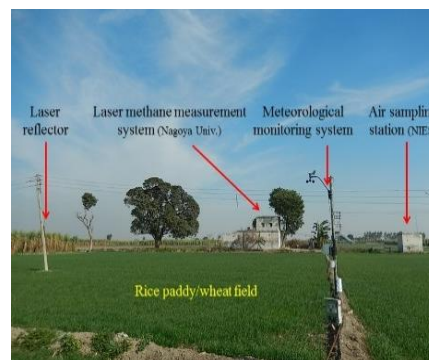
Ryoichi Imasu

Associate Professor, Division of Climate System Research

Most anthropogenic emission sources of atmospheric methane, an important greenhouse gas, are related to agricultural activities, particularly rice cultivation in paddy fields. To examine the methane emission processes taking place in Indian paddies, AORI and Rajdhani College of the University of Delhi, the largest university in India, made an agreement on 12 December 2014. Based on that agreement, we set up a monitoring station at the central part of one of the rice districts in Sonapat/Haryana, India. Methane concentration can be measured continuously using an open-path laser measurement system developed by a research group of Nagoya University as well as other monitoring parameters such as soil moisture and meteorological conditions. These activities have been supported by the Green Network of Excellence Environmental Information (GRENE) program of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. The National Institute for Environmental Studies (NIES) has also used the station for air sampling, supported by their own funding. Most monitoring and sampling systems have been operated and maintained by members of Rajdhani College, led by Dr. S. K. Dhaka. The data are used both for studies and for the education of young students of the universities. This station is expected to be extremely important, not only as an observation site in India for methane monitoring, but also as a foundation for further cooperative activities between Japanese and Indian universities.



Signing ceremony with Dr. V. L. Pandit, Principal of Rajdhani College (right), Dr. S. K. Dhaka (left), and Dr. R. Imasu (center) at University of Delhi



Monitoring station in Sonapat /Haryana, India

Agreement on Academic Exchanges between AORI and LDEO (Columbia University)

Jin-Oh PARK

Associate Professor, Division of Ocean-Earth System Science

Doctors Hiroshi NIINO (Director of the Atmosphere and Ocean Research Institute, University of Tokyo, Japan) and Sean C. Solomon (Director of the Lamont-Doherty Earth Observatory, Columbia University, United States of America) have signed an agreement on academic exchanges between the two institutes in July 2014. This was the third consecutive agreement since 1999. More than 120 Ph.D. level researchers work and teach at LDEO, founded in 1949 and currently a core component of the Earth Institute, Columbia University. LDEO operates a federally funded research ship, the Marcus G. Langseth, which uses seismic data to

map the sub-seafloor, highlighting hidden faults and other earthquake hazards. In the last five years, AORI scientists have collaborated with LDEO scientists in various geoscience fields, for example the IODP (Integrated Ocean Drilling Program) expedition for the Nankai Trough Seismogenic Zone Experiment and the seismic reflection imaging of the Sumatra subduction zone off Indonesia.

The two institutes agreed to implement exchanges and other mutually interesting academic research activities through the following actions: (1) exchange of faculty and researchers, (2) conducting collaborative research, (3) holding joint lectures and



Birdview of LDEO campus

symposia, and (4) exchange of academic information and materials. It is expected that academic exchanges between the two institutes will promote academic research and educational activities in the future.

Bilateral Joint Research Program with Indonesia

Koji Inoue

Professor, Department of Marine Bioscience and Center for International Collaboration

A three-year collaboration research project (FY2013-2015) with Indonesia entitled “Development of the Technique to Detect Environmental Pollution Utilizing Gene Response of Aquatic Organisms” is in progress under the Bilateral Joint Research Program of the Japan Society for the Promotion of Science. In FY2014, two researchers from the Indonesian Institute of Sciences (LIPI), Ms. Khozanah Munawir and Mr. Onny

Nurrahman Marwayana, were invited to Japan to analyze organotin compounds in Java sediment samples and to identify the DNA sequences of local medaka fish used for pollution assay, respectively. Dr. Irma Andriani, a scientist from the Universitas Hasanuddin (UnHas) was also invited to learn new experimental techniques using medaka fishes, with the aim to establish a “Medaka Research Centre” in UnHas. From Japan, I was invited to the First International

Conference of Science held in Makassar, where I presented a keynote lecture entitled “*Oryzias* Fishes: Important Scientific Resources in Sulawesi”. We are also planning to hold a workshop in Indonesia to introduce new techniques using medaka fishes. We hope that research cooperation between the two countries will be strengthened in the future through our project.

Transformation from IGBP to Future Earth

Mitsuo Uematsu

Professor and Director, Center for International Collaboration

The 29th meeting of the Scientific Committee (SC) of the International Geosphere-Biosphere Programme (IGBP) was held in Bangalore, India, from April 8-10, 2014. Dr. Mitsuo Uematsu, Director of Center for International Collaboration (CIC) attended the meeting as an IGBP Science Committee member. IGBP activities were synthesized through (a) The Anthropocene synthesis: a high impact paper exploring the concept of Anthropocene in conjunction with IHDP, (b) The Earth-system synthesis: an overview paper mapping the development of Earth System science throughout the IGBP, and (c) Individual synthesis topics: a series of core projects syntheses and future vision articles on the road-map for the evolution of science to address sustainability issues. IGBP will be terminated by the end of 2015.

A series of events has been planned to take place at the 2015 American Geophysical Union (AGU) fall meeting in December 2015, to mark the achievements of IGBP and its core projects over nearly 30 years, and the transition to Future Earth. The organizing committee of the landmark synthesis event ensures that the list of speakers, presenters, and panelists is as diverse as possible.

The Scientific Committee on Oceanic Research (SCOR), which co-sponsors IMBER and SOLAS, emphasized its desire to continue supporting bottom-up research projects on current issues in ocean sciences. A summary of the IGBP core project transitional status to Future Earth is presented in Table 1.

Five globally distributed headquarters of Future Earth have been established in Boulder (USA), Montreal (Canada), Paris (France), Stockholm (Sweden), and Tokyo (Japan). The Integrated Research System for Sustainability Science (IR3S), at the University of Tokyo, is in charge of the Tokyo office, and the Research Institute of Humanity and Nature (RIHN) will be leading the activities of Asia as a regional office of Future Earth.

The ocean community of Japan is strongly encouraged to exchange information that will aid in the smooth transition of the core projects related to marine sciences, such as AIMES, IMBER, LOICZ, PAGES, and SOLAS, to Future Earth, which is focused on research on global sustainability. The committee for the promotion of Future Earth in Japan is chaired by Dr. Tetsuzo Yasunari (RIHN) and was established under the Science Council of Japan in July 2013. Dr. Toshio Yamagata (Japanese Agency for Marine-Earth Science and Technology: JAMSTEC) and Dr. Uematsu serve as committee members, from the ocean community. We believe that experts from social sciences (e.g., marine policy, marine economics), and a collaboration with the IOC/WESTPAC community are further needed to promote Future Ocean under Future Earth in Japan, in the Asia-Pacific region and internationally. To this end, the WESTPAC region ocean community, including Japan, is intent upon establishing a program on the “Sustainability Initiative for the Marginal Seas of South and East Asia (SIMSEA)”, based on the principles of Future Earth. SIMSEA is a new platform for international research being developed by the International Council of Science (ICSU) and Future Earth. JAMSTEC and CIC/ AORI are trying to organize the national committee of SIMSEA, under the Science Council of Japan (SCJ).

Table 1. IGBP Core Project status

Brief update on core and joint projects (March 2014)			
Project	IPO funding secure until	Transition to Future Earth	Comments
AIMES	No IPO	Positive about playing an important role in Future Earth	NSF proposal submitted for IPO at Arizona State University
IGAC	June 2015	Planning to move to Future Earth once IGBP ends (end 2015). Closer ties with iLEAPS and SPARC/WCRP.	Co-sponsored by iCACGP. IPO funding subject to renewal by US funding agencies every 3 years.
iLEAPS	End 2014	Plans to move to Future Earth, bringing in more social science. Forging closer ties with GLP, IGAC and AIMES.	IPO to move location with transition anticipated during 2014 and full move January 2015.
GLP	End 2015 (however, some uncertainty with Brazilian funding)	Transition to Future Earth (dual parentage with IGBP anticipated June 2014). OSC in Mar 2014 will help shape new science plan.	Co-sponsored by IHDP (which ends in June 2014). Significant IPO staff changes in early 2014. Recruitment ongoing.
IMBER	April 2017	Draft plan to be developed at OSC in June for completion in late 2014.	Co-sponsored by SCOR. Science plan extension to be submitted to SCOR in late 2014.
PAGES	(Ongoing)	Plans to seek sponsorship of Future Earth as well as to forge closer ties with WCRP. Revising science plan.	Has applied for renewal of Swiss NSF and US NSF funding. Ongoing in-kind support from the University of Bern.
SOLAS	End 2015	Draft plan in preparation. Due for completion mid-2014.	Co-sponsored by SCOR, WCRP and iCACGP. Science plan extension to be submitted to SCOR in 2014.
LOICZ	End 2014	Planning to move to Future Earth. Developing a new plan based on collaboration with stakeholders from various regions.	Co-sponsored by IHDP (which ends in June 2014). Part time IPO interim director appointed Oct 2013. Seeking new IPO host from end of 2014.
GCP	Ongoing	Planning to join Future Earth. Timeframe unclear.	Two IPO offices: Australia and Japan. Canberra office has reduced funding and no administrative capacity.
GWSP	End 2014	Planning to join Future Earth as Sustainable Water Future Project in Jan. 2015 (dependent upon BMBF funding) with co-sponsorship by IGBP until IGBP ends.	Pre-proposal submitted to BMBF for funding that would start Jan. 2015.

Report on the Sabbatical Leave: Visit to the Institute for Geophysics, University of Texas

Jin-Oh PARK

Associate Professor, Division of Ocean-Earth System Science

I have spent my sabbatical leave at the University of Texas, in Austin, Institute for Geophysics (UTIG), from October 2013 to September 2014, kindly hosted by Dr. Nathan Bangs. UTIG was founded in 1972 and is part of the Jackson School of Geosciences, University of Texas, Austin. Its research areas cover marine geology and geophysics, tectonics, terrestrial and lunar seismology, quantitative and exploration geophysics, and geophysical studies of ices and climate. Several AORI scientists, including myself, have been collaborating with UTIG scientists since the 1990s. We have been working on 3-D seismic reflection imaging of the Nankai subduction zone in terms of the ODP (Ocean Drilling Program) and IODP (Integrated Ocean Drilling Program) expeditions.

During my stay at UTIG, I attended the 2013 AGU (American Geophysical Union) Fall Meeting and discussed with US scientists the possibility of establishing a Japan-US collaborative research program on 3-D VSP (Vertical Seismic Profiling) in the Nankai subduction zone off Kumano, Kii Peninsula, in southwest Japan. I presented a seminar entitled “Along-strike variations in the Nankai shallow décollement properties and their implications for tsunami earthquake generation” in February 2014, in cooperation with Dr. Nathan Bangs. We have successfully published a paper on this subject in the journal “Geophysical Research Letters”, published by the AGU in 2014. Rupture of slow tsunami earthquakes at subduction zones propagates along a shallow plate-boundary fault (i.e., décollement) nearly all the way to the trench. Seismic reflection profiles reveal that shallow décollements have variable reflection characteristics in the Nankai subduction zone, allowing us to divide the subduction zone into impedance-decreasing (inferred to be fluid-rich) and impedance-increasing (fluid-poor) décollement regions. The fluid-rich décollement regions with reverse-polarity reflections may play a role as conditionally-stable patches because of elevated fluid pressures. In contrast, the fluid-poor décollement (i.e., Figure 1) regions with normal-polarity reflections could be unstable seismogenic patches with no unusual fluid pressures. We propose that when megathrust earthquakes nucleate at shallow depth, the small unstable fluid-poor patches are prone to slip. They may also accelerate (velocity-weakening) adjacent, large, conditionally stable patches generating large shallow slip and large tsunamis. As a result, along-strike contrast of fault properties can involve large tsunami earthquakes along the Nankai shallow megathrust fault. Several Japanese mass media such as Kyodo News and Nihon Keizai Shimbun have reported the research result in light of its social impact in November 2014.

This was my fourth visit to Austin, Texas; the earliest one took place in October 2000, immediately after a Japan-US collaborative research project on 3-D seismic reflection imaging of the Nankai subduction zone off Muroto, Shikoku Island, in southwest Japan. This sabbatical leave was very productive and enjoyable, even though it was still unbearably hot in Texas.

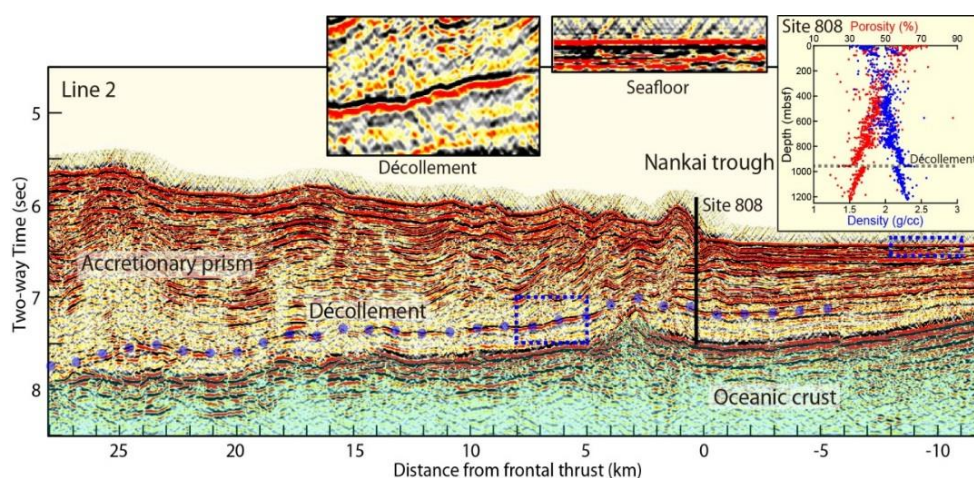


Figure 1. Time-migrated seismic reflection profile of line 2 showing the fluid-rich décollement. Vertical exaggeration about 5:1 at the seafloor. Subducting oceanic crust of the Philippine Sea Plate is shaded in light cyan. Blue shaded dots mark the décollement. An ODP Site 808 is positioned. Inset: Enlarged sections of seafloor and décollement are shown. Note reverse polarity reflection of the décollement (black-red-black), compared with seafloor (red-black-red). Porosity (red dot) and density (blue dot) measurements at Site 808 are plotted. We observe significant contrasts of the porosity and density measurements around the décollement level.

International feasibility study workshop towards the establishment of an IOC Regional Training and Research Center in Japan

Teruhisa Komatsu

Associate Professor, Department of Marine Bioscience

The “International Feasibility Study Workshop towards the Establishment of an IOC Regional Training and Research Center in Japan” took place at the Atmosphere and Ocean Research Institute (AORI), The University of Tokyo, from 18 to 19 November 2014. The workshop was organized by CIC in close cooperation with the Intergovernmental Oceanographic Commission (IOC), Sub-commission for the Western Pacific (WESTPAC), with financial support from the Ministry of Education, Culture, Sports, Science and Technology of Japan. This workshop aimed to: (i) update the present status of and challenges for the establishment and/or operation of IOC Regional Training and Research Centers (RTRC) among Member States; who have been hosting or have expressed the interest to host such Centers, (ii) identify the regional capacity and the development needs; including Small Island Developing States’ (SIDS), and (iii) assist in the identification of the most

appropriate focus for the newly proposed RTRC of Japan that is the main subject of this workshop. The list of invited experts included Prof. Fangli Qiao from China; Dr. Zainar Arifin from Indonesia; Mr. Masashi Akiba; Profs. Yasuwo Fukuyo, Tetsuo Yanagi, Mitsunori Iwataki, and Kazumi Iwataki, and Dr. Ken Ando from Japan; Profs. Mohd Lokman bin Husain, Lim Poo Teen, and Chui Pin Leaw from Malaysia; Dr. Yimnang Golbuu from Palau; Prof. Marie Antonette Juinio-Meñez from Philippines; Dr. Jae Ryoung Oh from the Republic of Korea; Dr. Sandric Chee Yew Leong from Singapore; Dr. Somikait Khokiattiwongk from Thailand; Drs. Vo Si Tuan and Dao Viet Ha from Vietnam; Dr. Peter Pissiersens from the International Ocean Data Exchange project office; and Mr. Wenxi Zhu and Ms. Nachapa Saransuth from the WESTPAC Office. A total of twenty-eight participants attended the workshop. Profs. Hiroshi Niino, Mitsuo Uematsu, Shuhei Nishida, and Teruhisa Komatsu, as well as Drs.

Shingo Sakamoto, Yasushi Narita, and Shuji Sasa were present at the workshop from AORI.

The workshop was opened by Prof. Hiroshi Niino, Director of AORI; Mr. Masashi Akiba, Executive Secretary of Japanese National Commission for UNESCO; and Dr. Somkiat Khokiattiwongk, Chair of WESTPAC. They stressed the need to establish one RTRC in Japan, in order to contribute to the collective efforts in this region towards building a sustainable society, and they further invited all experts to come up with their suggestions on the most appropriate domain the RTRC in Japan shall focus on. The workshop recognized the pressing need for sustainability science in the region to put into practice integrated approaches to marine scientific research for sustainable development. It further suggested that Japan should host one RTRC on Coastal and Marine Sustainability Science, which will conduct relevant research and implement case studies in the field of sustainability science.



Participants of International feasibility study workshop towards the establishment of an IOC Regional Training and Research Center in Japan

Activities in 2014 related to the IOC

Yutaka Michida

Professor, Center for International Collaboration



Prof. Michida (center) was leading the discussion on the podium of 47th Session of IOC Executive Council as the responsible officer for tsunami programmes of the IOC



Discussion at the International Workshop on Mega Earthquakes and Tsunamis in Subduction Zones in Rhodes, Greece, in October 2014

The 47th Session of the Executive Council of the Intergovernmental Oceanographic Commission (IOC) was held from July 1-4, 2014, at the UNESCO headquarters in Paris. Prof. Mitsuo Uematsu, Director of the Center for International Collaboration of AORI (CIC), participated as the head of the Japanese delegation. Prof. Yutaka Michida and Associate Prof. Teruhisa Komatsu also participated in the meeting as members of the delegation. The session adopted various decisions to prioritize the programs in response to the 22% cut in IOC's budget. The decisions included those on the strategic implementation plans of the IOC's tsunami programme, the processes for the IOC governance audit, and



Japanese delegation led by the head of delegation, Prof. Uematsu (center), and members Prof. Komatsu, Prof. Michida and Dr. Kawano, at the 47th Session of the IOC Executive Council in June, 2014

other policy issues. The Japanese delegation actively contributed to the discussions during the whole session.

Prof. Michida, vice-chair of the IOC since 2011, has played a leading role in the IOC tsunami programme, as chair of the Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS-WG). He has also participated in a series of international/intergovernmental meetings in 2014 as an IOC representative: the International Workshop on Mega Earthquakes and Tsunamis in Subduction Zones in Rhodes, Greece, in October; the Annual meeting of the North Pacific Marine Science Organization (PICES) in Yeosu, Korea, in October as well; the International Conference on Education for Sustainable Development (ESD) in Nagoya, in November; and the International

Conference to Commemorate the 10th Anniversary of the Indian Ocean Tsunami in Jakarta, Indonesia, in November. At the Conference in Jakarta, in particular, Prof. Michida moderated the panel discussion on "Strengthening international cooperation: the role of international organisations in tsunami warning". The panel concluded that IOC/UNESCO should continue to lead the coordination towards globally harmonized, practical, effective, and sustainable tsunami warning systems under closer cooperation with its partner organization, aiming at (i) ensuring the robust, efficient, and effective performance, and global coverage of interoperable warning systems for coastal hazards, (ii) enhancing the network of stake-holders, including EWS operators, scientists, policy-makers, and mass-media, and (iii) facilitating data and information exchange.

List of Visiting Professors

Name / Affiliation	Nationality	Length of stay	Subject for study
YANG, Tsan Yao <i>National Taiwan University, Professor</i>	Taiwan	2013/4/1-2013/7/31	Noble gas application to marine geochemistry
LUO, Zhengzhao <i>City University of New York, Associate Professor</i>	China	2013/6/25-2013/8/24	Cloud remote sensing and analysis
CHEN, Guanghua <i>Chinese Academy of Sciences, Institute of Atmospheric Physics, Center for Monsoon System Research, Associate Professor</i>	China	2013/8/1-2014/1/15	A Study on the influence of multi-scale tropical circulation on tropical cyclogenesis and TC precipitation
ALIBERT, Chantal Annie <i>The Australian National University, Research School of Earth Sciences, Visiting Fellow</i>	Australia	2013/10/1-2013/10/31	Trace element pathways from seawater to sediments
KINSLEY, Leslie <i>The Australian National University, Research School of Earth Sciences, Laboratory Chief Manager</i>	Australia	2013/10/1-2013/10/31	ICP-MS Instrumentation (both Quadrupole and Multi-collector) and Laser ablation sampling for ICPMS
LIU, Yuzhi <i>Lanzhou University, College of Atmospheric Sciences, Associate Professor</i>	China	2013/10/15-2014/3/31	A study of aerosol effects on the cloud field and the earth's radiation budget
LAI, Chun-ta <i>San Diego State University, Associate Professor</i>	USA	2013/12/17- 2014/3/2	Improving isotope parameterization on land in GCMs

Visiting professors' reports

Mr. Leslie KINSLEY

Laboratory manager for the ICP-MS facility in the Biogeochemistry research group at the Research School of Earth Sciences, The Australian National University



Having known Prof. Yusuke Yokoyama since his own student days at the Research School of Earth Sciences, it was a pleasure to see him again when he made a brief visit to RSES with a group of higher degree students, as part of their lightning visit to Australia in early 2013. It was at this time that he suggested the possibility of my visiting AORI to provide some assistance with the implementation of a new laser ablation capability for their Element XR high resolution ICPMS. While I had not previously used the Element XR instrument, I have been responsible for the ICPMS facilities at RSES since the

early 1990's, and the new AORI laser ablation instrument is closely related to the system which we had originally created at RSES.

I am immensely pleased that I accepted this invitation, as it gave me the opportunity to experience some of the culture of Japan and to make the acquaintance of many wonderful people within AORI.

The Element XR is a single collector, magnetic sector, mass spectrometer with an Argon plasma ionization source and is well known for its excellent sensitivity and high mass resolution capabilities. This instrument was already being successfully used for solution based analyses, particularly for Uranium-series dating measurements. The addition of a laser ablation front-end allowed the possibility of in-situ elemental analyses in solid samples, at the scale of tens to hundreds of microns, and it was anticipated that this would be used to analyse samples carrying potentially valuable past climate information such as corals, speleothems and tree ring sections.

It was encouraging to see the enthusiasm and growing confidence of the students as they became familiar with the methodology of laser ablation as a sampling technique and its adaptation to the characteristics of the Element XR. As it is a magnetic sector based instrument, it is rather more limited than a quadrupole ICPMS in the speed with which it can jump from one measurement mass to another. It does however have the advantage of significantly better peak shapes and potentially better measurement precision. For best results, it became necessary to scan samples more slowly under the focussed laser beam than is generally the case for

quadrupole ICPMS measurements. A further important consideration is that, unlike solution-based analyses, where the aerosol droplets introduced to the Argon plasma all have the same composition, the particulate material generated by laser ablation sampling have heterogeneous compositions due to the varying condensation temperatures of the elements from a hot gaseous phase. This requires tuning the Argon plasma conditions to a compromise state where one can be more confident that all the heterogeneous particulates are vaporised and ionized by the plasma, thereby maintaining the stoichiometry of the original sample. Such a compromise tuning however results in operating at less than maximum sensitivity, but is necessary also for quadrupole based ICPMS measurements.

As a check on the performance of the laser ablation system with the Element XR, PhD student Yuta Kawakubo spent some time reanalysing some coral samples which he had previously measured using the facilities at RSES. After appropriate configuration of the instrumental operating parameters, the results were not only comparable for the important Sr/Ca ratio but for other element ratios such as U/Ca and Mg/Ca, the results generated using the Element XR appeared to be significantly superior to the quadrupole based measurements. I am confident that valuable data will continue to be generated by the facilities within this laboratory.

It is very rewarding to me that my visit to AORI has been both highly enjoyable for myself, but also has been of value to Prof Yokoyama and his students. I look forward to crossing paths with such exceptional people again in the future.

Dr. Chantal Annie ALIBERT

*'Visiting Fellow' in the Biogeochemistry research group at the Research School of Earth Sciences,
The Australian National University*

This trip gave me the opportunity to follow up on some collaborative work with Pr YOKOYAMA and his PhD student Yuta KAWAKUBO, started in late 2009. The main subject of this collaboration is an exceptionally well-preserved long coral core (ca. 400 year old) from the central Ryukyu islands which has

been analysed in-situ at high-resolution by laser ablation ICPMS at RSES, and also at AORI, for elemental ratios such as Sr/Ca and U/Ca. These ratios are used as proxies for sea surface temperature and therefore allow to reconstruct past climate conditions. The acquisition of this coral record was challenging,

both analytically and because of the reduced formation of coral skeleton during the winter season. As coral calcification is biologically mediated, time-consuming, important steps of this research include the duplication of analyses. To appraise the validity of each year of reconstructed water temperatures, it is also necessary to monitor the coral growth banding, for example using X-ray images, and confirm the pristine state of the delicate aragonitic skeleton using scanning electron microscope. Some quality control criteria have to be set up before comparing the coral composition with instrumental temperature datasets, in particular when the record is calculated as annual mean temperatures of interest to the study of climate change at decadal and longer timescales.

I was particularly keen to understand which oceanographic and atmospheric processes drive the interannual to decadal variations of sea surface temperature (SST) observed in this region, east of the Ryukyu islands, which is part of the Kuroshio recirculation gyre. Historical/reconstructed temperature datasets from several sources were examined to assess the errors associated with these data, in particular prior to 1950 when the number of

SST observations is very limited. These data allow to estimate the respective roles of the Pacific Decadal Oscillation (PDO) and ENSO on sea surface temperatures in the region of southern Japan, including on the modulation of the strength of the winter monsoon. These relations are complex due to the relatively weak correlations between PDO/ENSO and SSTs in the Ryukyu island region, far from the 'center of action' of these modes of climate variability. This coral is recording exceptional events such as a protracted cooling during the Little Ice Age and anomalously cold winters during the negative phase of the Arctic Oscillation, for example the record cold event of 1962/63 that affected the entire Northern Hemisphere.

During my stay at AORI, I also had the pleasure to interact with the other students of Pr. YOKOYAMA, in particular those involved in coral and tree-ring research, and I have greatly appreciated the exceptionally friendly and constructive atmosphere of Pr. YOKOYAMA's research group. It has been a great pleasure and honour for me to visit AORI and, as a French native, I have loved the excellent Japanese cuisine available at walking distance from AORI.

CIC STAFF

Director of CIC Prof. Mitsuo UEMATSU
International Scientific Planning Prof. Yutaka MICHIDA
International Advanced Research Prof. Mitsuo UEMATSU
International Research Cooperation Prof. Shuhei NISHIDA

Assoc.Prof. Ryoichi IMASU
Assoc.Prof. Jin-Oh PARK
Prof. Koji INOUE

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

5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8564, Japan
Phone&Fax : +81-4-7136-6361
URL : <http://www.aori.u-tokyo.ac.jp/>