

# 生存圏アジアリサーチノード活動報告

## Humanosphere Asia Research Node Activity Report

ARN / HSS / ISSH 2018



生存圏アジアリサーチノード  
Humanosphere Asia Research Node



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# 1. Preface



Director of RISH  
Takashi Watanabe

The environment surrounding humans is changing rapidly with complicated interlinkages, threatening sustainable development and healthy living. There has been an increasing demand for reliable future projections based on an accurate understanding of current conditions of Humanosphere, and for the presentation of measures for solving the problems. To establish the Sustainable Humanosphere, international collaboration and expansion of Humanosphere Science on a global scale is essential.

In 2016, RISH launched a new program called the Humanosphere Asia Research Node (ARN) to strengthen its function as a hub for international collaborative research and foster innovation in the field of humanosphere science, with the ultimate goal of delivering solutions to global-scale problems. ARN's activities in the past include the following: 1) an ARN joint laboratory was founded in Indonesian Institute of Sciences (LIPI) jointly with Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) project; 2)

the 1st ARN Symposium on Humanosphere Science was held in Penang, Malaysia in collaboration with Universiti Sains Malaysia (USM); 3) the 2nd ARN Symposium on Humanosphere Science was held in Uji, Japan; 4) a number of RISH Open Seminars were delivered and broadcasted live to selected foreign research organizations via web conferencing service; 5) a server mirroring system of "Humanosphere Science Database" was installed in Indonesia; 6) and a lecture and practical training course on atmospheric science were offered. ARN also served as a co-organizer for the International Workshop on Bioresources and Biodiversity at Uji, Kyoto (with the JASTIP), and "Humanosphere Science School 2016/2017" in Indonesia.

In September 25-27, 2018, RISH and National Chung Hsing University (NCHU) jointly held the 3rd Asia Research Node Symposium on Humanosphere Science at NCHU in Taichung, Taiwan. ARN supported 11 master course students and 7 Ph.D. course students to join the symposium from RISH. Researchers from India, Indonesia, Thailand, Malaysia and Vietnam were invited in addition to the participants from Japan and Taiwan. A total of 201 participants, including 140 students, attended the symposium. In October 18-19, 2018, RISH and LIPI jointly held the Humanosphere Science School (HSS) together with the satellite meetings, the International Symposium for Sustainable Humanosphere (ISSH), at Medan, Indonesia, in collaboration with University of North Sumatra. Through all these ARN's activities, RISH pursues the integration of different research disciplines, and seeks to promote the internationalization of humanosphere science.

This booklet is a report of ARN, HSS, and ISSH meetings at Taichung/Medan in 2018 with brief summary of ARN activities in 2018. Research abstracts of the 3rd ARN symposium and impression by the graduate students are included. We will continue to actively expand on educational and research activities in collaboration with the Humanosphere Science community with an effort to scientifically demonstrate the landmarks in mankind's path toward the construction of a sustainable Humanosphere. We look forward to your valuable assistance, support and participation.

Director of RISH, Kyoto University  
Takashi Watanabe



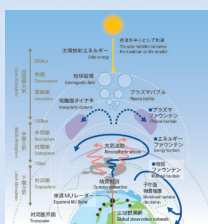
## 2. Humanosphere Asia Research Node



# Humanosphere Asia Research Node



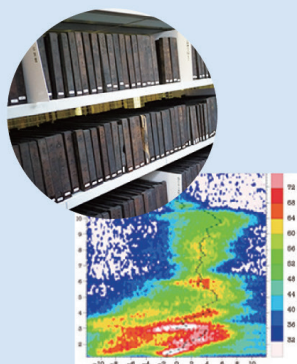
### Cooperative Study of the “Equatorial Fountain”



### Cooperative Research on the Sustainable Production and Utilization of Tropical Biomass in Relation to Environmental Conservation

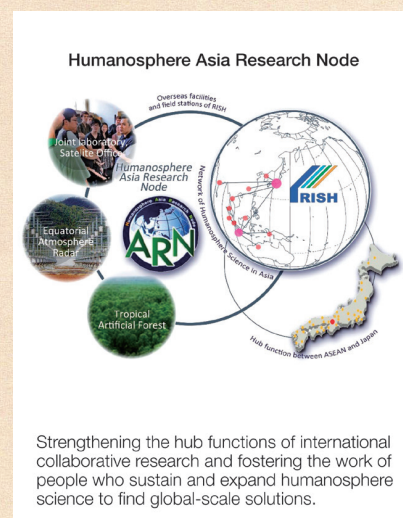


### International Cooperative Studies Using the Database for Humanosphere Science





In 2016, RISH initiated a new program named “Humanosphere Asia Research Node (ARN)”, thereby strengthening the hub functions of international collaborative research and fostering innovation in Humanosphere Science with the ultimate goal of delivering solutions on a global scale. ARN’s achievements included the following: 1) an ARN joint laboratory at the Indonesian Institute of Sciences (LIPI) was founded jointly with the Japan-ASEAN Science, Technology and Innovation Platform (JASTIP) project; 2) a number of RISH Open Seminars were delivered and broadcast live via web conferencing to selected foreign research organizations; 3) a server mirroring system for the “Humanosphere Science Database” was installed in Indonesia; 4) and a lecture and practical training course on atmospheric science was offered. ARN also served as a co-organizer for the International Workshop on Bioresources and Biodiversity in Uji, Kyoto (with the JASTIP), and the “Humanosphere Science School” in Indonesia. ARN held the 1st Asia Research Node Symposium on Humanosphere Science in Penang, Malaysia in February 2017, and the 2nd Symposium in Uji, Kyoto in July 2017, at which more than 30 speakers from Japan and all over the world were invited. With these ARN activities, RISH is in a perfect position to pursue the integration of different research disciplines and to promote the internationalization of Humanosphere Science.



## ARN & JASTIP Joint Laboratory

ARN serves as a network hub that connects research between ASEAN and Japan through joint laboratories in Indonesia and also provides an opportunity for various research institutes in Japan to access ARN’s overseas facilities. In addition, ARN highly encourages overseas researchers to conduct collaborative research using domestic facilities under the joint usage platform it promotes.



## Capacity Building

ARN supports the career development of young researchers and engineers by offering opportunities for collaborative research and involvement in international schools in Indonesia and other Asian countries. With ARN’s support, these young scientists can grow into future leaders in various fields of Humanosphere Science.



Practical training on atmospheric science in Indonesia



The 1st ARN Symposium on Humanosphere Science (February 20-21, 2017/Penang, Malaysia)



The 2nd ARN Symposium on Humanosphere Science (July 19-21, 2017/Uji, Kyoto)



Humanosphere Science School 2017, The 7th International Symposium for Sustainable Humanosphere (November 1-2, 2017/Bogor, Indonesia)

URL

**Humanosphere Asia Research Node**

[http://www.rish.kyoto-u.ac.jp/asiaresearchnodes\\_e/](http://www.rish.kyoto-u.ac.jp/asiaresearchnodes_e/)

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### **3. 3rd ARN Symposium**

**(The 373rd Symposium on Sustainable Humanosphere)**  
**The 3rd Asia Research Node Symposium on Humanosphere Science**  
**- Present and Future of Humanosphere Science -**  
**September 25-27, 2018**  
**International Conference Hall, Agricultural and Environmental**  
**Science Building**  
**National Chung Hsing University (NCHU), Taichung, Taiwan**

## Greetings



RISH Chair  
Hiroyuki Hashiguchi



NCHU Chair  
Hwang Shaw-Yhi

The Humanosphere Asia Research Node (ARN) aims to strengthen its function as a hub for international collaborative research and foster innovation in the field of humanosphere science, with the ultimate goal of delivering solutions to global-scale problems. ARN integrates our various facilities and human networks in ASEAN region and Japan for consolidating the international collaborative research on “Sustainable Humanosphere”. To further strengthen the international network and to discuss “Present and Future of Humanosphere Science”, RISH and National Chung Hsing University (NCHU) held “The 3rd Asia Research Node Symposium on Humanosphere

Science” at NCHU in Taichung, Taiwan on September 25-27, 2018. The symposium aimed to share the concept and recent advances of Humanosphere Science, thereby fostering students and young researchers who will sustain and expand the new science. The symposium featured 35 oral and 58 poster presentations.

At the opening ceremony of the symposium, Prof. Takashi Watanabe, Director of RISH and Prof. Chou Chi-Chung, Dean of the Office of Research and Development, NCHU, gave the opening addresses. On the first day, sessions were divided into three topics: Atmospheric Observations with MST radars; Energy Transfer and Conversion in Geospace; and, Plants for Sustainable Humanosphere—Biomass and Bioactive Compounds. An elevator speech, in which poster summaries were orally presented within one minute, closed the first day. At a banquet at the Park City Hotel Central Taichung, all participants enjoyed a delicious Taiwanese meal.

On the second day, we began with a session: Integrated Vector Management: a Strategy for Sustainable Humanosphere. Then, the poster session was conducted and many students and young researchers discussed their research results. In the afternoon, we visited Muh Sheng Museum of Entomology and Sun Moon Lake as an excursion, during which friendships among participants deepened.

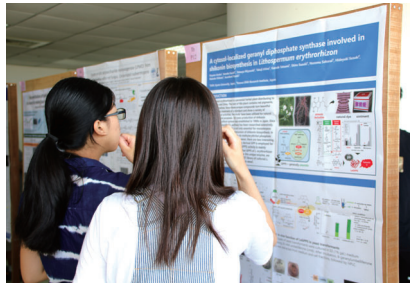
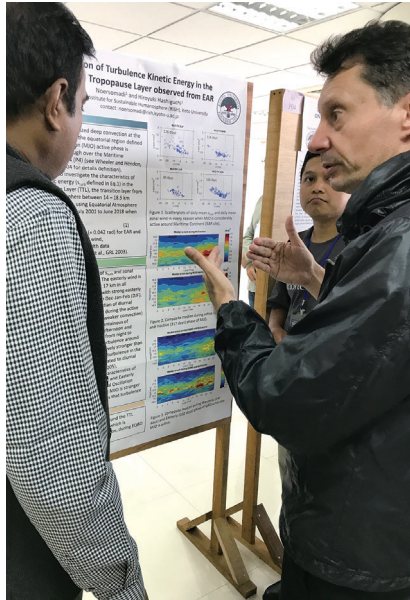
The last day of the symposium consisted of four sessions: Our Footprints on the Global Environment: Threats to Ecosystem Sustainability; Wireless Power Transfer for Sustainable Electronics; Water, Carbon, and Nutrient Cycling in Forest under Climate Change; and, Atmospheric and Ionospheric Studies with New Instruments and Technology. In the closing ceremony, best student poster awards were presented to six students. The closing address was given by Prof. Hwang Shaw-Yhi, Associate Dean of College of Agriculture and Natural Resources, NCHU.

A total of 201 participants, including 140 students, attended the symposium, which was deemed a great success. With sincere gratitude to all participants and organizers, we sincerely hope that our work can further our understanding of the differences and difficulties in the world, and accelerate the formation of a Sustainable Humanosphere.

Acknowledgements: Organizing committee of the ARN symposium is deeply grateful to NCHU for allowing the use of conference facilities for the symposium. We also thank the Ministry of Science and Technology of Taiwan, Kyoto University, and Research Institute for Sustainable Humanosphere of Kyoto University for providing funds for travel support etc. for the symposium.

3rd ARN Symposium Organizing Committee









# The 373rd Symposium on Sustainable Humanosphere

## The 3rd ASIA RESEARCH NODE SYMPOSIUM ON HUMANOSPHERE SCIENCE

25 - 27 September 2018

**National Chung Hsing University, Taichung, Taiwan**  
Agricultural & Environmental Science Building  
10th Floor International Conference Hall

Date	Time	Title & Speaker	Date	Time	Title
Sep 25 (Tue)	1030-1210	<b>Atmospheric Observations with MST radars</b> Recent Progress of Chung-Li VHF Radar Group in Lower and Upper Atmospheric Researches Yen-Hsyang Chu (National Central University, Taiwan) 25 years of Indian MST radar at NARL, Gadank Thota N. Rao (National Atmospheric Research Laboratory, India) An overview of results from SHUREX campaigns (2015-2017) at Shigaraki WU Observatory Hubert Luce (Mediterranean Institute of Oceanography, France) Status of Equatorial MU Radar project in 2018 Mamoru Yamamoto (Kyoto University, Japan)	Sep 27 (Thu)	0830-1010	<b>Our Footprints on Global Environment: Threats to Ecosystem Sustainability</b> Globalization and invasive ants: polydomy as an enigmatic characteristics Kazuki Tsuji (University of the Ryukyus, Japan) The importance of urban pest management on the sustainable future of urban ecosystem Chow-Yang Lee (Universiti Sains Malaysia, Malaysia) How sublethal neonicotinoid insecticides weaken honey bee colonies? En-Cheng Yang (National Taiwan University, Taiwan) How will climate change affect a crop system that includes soybeans (crop), aphids (pest), and ladybugs (biocontrol agent)? Chuan-Kai Ho (National Taiwan University, Taiwan)
	1310-1450	<b>Energy Transfer and Conversion in Geospace</b> Auroras and precipitating particles above the high-latitude boreal forests Jih-Hong Shue (National Central University, Taiwan) Geospace Exploration by the ERG/Arae satellite: collaborations on spacephysics between Japan and Taiwan Yoshizumi Miyoshi (Nagoya University, Japan) Parameters of magnetospheric locations associated with occurrences of aurora and comparison with their ionospheric counterparts Sunny W. Y. Tam (National Cheng Kung University, Taiwan) Energy flow from the solar wind to the Earth during substorm: Simulation results Yusuke Ebihara (Kyoto University, Japan) Magnetic explosion in the Sun-Earth system: Magnetic reconnection Seiji Zenitani (Kyoto University, Japan)	1030-1210		<b>Wireless Power Transfer for Sustainable Electronics</b> Wirelessly-Powered CMOS Electrochemical Sensing Interface Design Yu-Te Liao (National Chiao Tung University, Taiwan) Some preliminary theoretical and experimental research results of WPT system between two points using Microwave power beam at 2.45 GHz Dao Khac An (Vietnam Academy of Science and Technology, Vietnam) Design of a 13.56-MHz Active Rectifier with Digital Offset Compensation for Implantable Medical Devices Po-Hung Chen (National Chiao Tung University, Taiwan) Signal Communication in Wireless Power Transfer For Internet of Things Heng-Ming Hsu (National Chung Hsing University, Taiwan) Recent Research of Wireless Power Transfer at RISH for a Smart, Happy, and Resilient Society Naoki Shinohara (Kyoto University, Japan)
	1520-1700	<b>Plants for Sustainable Humanosphere –Biomass and Bioactive Compounds– (Tentative)</b> Genetics and Genomic Analysis of the Heartwood Traits in Taiwanian cryptomerioides Ying-Hsuan Sun (National Chung Hsing University, Taiwan) Reciprocal cross-regulation of VND and SND multigene TF families for wood formation in Populus trichocarpa Ying-Chung Jimmy Lin (National Taiwan University, Taiwan) Biosynthesis of Heartwood and Antitumor Lignans Toshiaki Umezawa (Kyoto University, Japan) Dynamics and functions of plant bioactive compounds in the rhizosphere Akifumi Sugiyama (Kyoto University, Japan)			<b>1310-1450</b> <b>Water, carbon, and nutrient cycling in forest under climate change</b> Are the evapotranspiration and canopy photosynthesis of Asian tropical rainforests affected by climate change? Yoshiko Kosugi (Kyoto University, Japan) Effects of inter-annual climate difference on hydrologic and biogeochemical controls on methane dynamics in forest ecosystems Masayuki Itoh (University of Hyogo, Japan) T.B.D. Shih-Chieh Chang (National Dong Hwa University, Taiwan) The linkage between fine root dynamics and community structure in subtropical evergreen forest Jyh-Min Chiang (Tungshai University)
Sep 26 (Wed)	0830-1010	<b>Integrated Vector Management: a Strategy for Sustainable Humanosphere</b> Establishment of an early warning system for malaria in Southern Africa, incorporating climate predictions-the iDEWS project Noboru Minakawa (Nagasaki University, Japan) Plant-based repellents to control mosquitoes Theerapap Chareonviriyaphap (Kasetsart University, Thailand) Dengue Vector Control and Aedes aegypti resistance to insecticides from Indonesia Intan Ahmad (Bandung Institute of Technology, Indonesia) Dengue Prevention: Alternative Approaches in Managing Aedes Mosquitoes Wan Fatma Zuharah (Universiti Sains Malaysia, Malaysia) Mosquito reproduction control and the effects of mosquito host factors to dengue virus replication Shin-Hong Shiao (National Taiwan University, Taiwan)	1520-1700		<b>Atmospheric and Ionospheric studies with new instruments and technology</b> Lessons Learned from the Ongoing Development of the Ionospheric Dynamics Explorer and Altitude Subsystem Satellite (IDEASSat) Loren Chang (National Central University, Taiwan) Convective-scale assimilation with the GPS-zenith total delay and radar data and its impact on heavy rainfall prediction in Taiwan Shu-Chih Yang (National Central University, Taiwan) Equatorial Plasma Bubble for Space Weather Monitoring in Malaysia Suhaila M Buhari (Universiti Teknologi Malaysia, Malaysia) The development of data assimilation in the ionospheric space weather Chia-Hung Chen (National Cheng Kung University, Taiwan)

## **4. HSS 2018/8th ISSH**

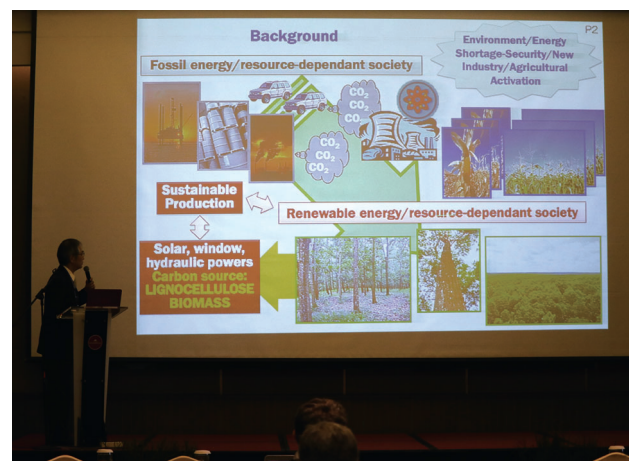


# **(The 384th Symposium on Sustainable Humanosphere) Humanosphere Science School 2018 The 8th International Symposium for Sustainable Humanosphere October 18-19, 2018 Hotel Grandhika, Medan, Indonesia**

Indonesian Institute of Sciences (LIPI) and RISH jointly held the Humanosphere Science School 2018 (HSS 2018) together with University of Sumatra Utara. HSS 2018 provides learning experience by sharing knowledge, science, and technology delivered by experts specializing in subjects related topics. HSS 2018 also held a forum for interdisciplinary researchers, practitioners and professionals to share their knowledge or results of scientific research in the 8th International Symposium for Sustainable Humanosphere (8th ISSH). It was supported by the JST-supported JASTIP (Japan-ASEAN Science, Technology and Innovation Platform), the JICA/JST-supported SATREPS (Science and Technology Research Partnership for Sustainable Development) projects, the RISH-supported ARN (Humanosphere Asia Research Node), Kyoto University-supported RUDGS (Research Unit for Development of Global Sustainability), and National Institute of Aeronautics and Space (LAPAN). The main theme for this year conference was “Sustainable Humanosphere: On the verge of global challenges and human security. HSS/ISSH was held for 2 days on October 18-19, 2018, in Hotel Grandhika, Medan, Indonesia. The program of the conference included keynote addresses (lectures), plenary sessions, oral and poster presentations. The invited lectures were 15 expertise from Japan, France, Malaysia and Indonesia. The seminar covered Forest science, Bioscience, Earth science, Community-based development and socioeconomic science and Applied science and technology. A total of 130 participants, including 16 students, attended the symposium, which was deemed a great success. The symposium contributed to scientific development of humanosphere science in Asia and other area.









## Humanosphere Science School 2018

### The 8<sup>th</sup> International Symposium for Sustainable Humanosphere

*"Sustainable Humanosphere : On the Verge of Global Challenges and Human Security"*



HOTEL GRANDHIKA  
MEDAN INDONESIA

October, 18-19 201

Authors are kindly invited to submit an abstract related to the topic of the symposium. The seminar covers following topics but not limited to:

- A. Forest science
- B. Bioscience
- C. Earth science
- D. Community-based development and socioeconomic Science
- E. Applied science and technology

#### Registration Fee :

Participant	Presenter Non-Index Publication	Presenter Index Publication	Non Presenter
Local Student	Rp. 1.000.000,-		Rp. 500.000,-
Local Professional	Rp. 2.000.000,-		Rp. 750.000,-
Student		Rp. 1.500.000,-	
Professional		Rp. 2.500.000,-	

Payment could be paid by transfer to:  
Account Name : Siti Miat  
Account Number : 1798 01 000168 53 9  
Bank Name : BRI KCP. CSC-Cibinong Bogor

#### Important Date :

Open registration up to	: October 1, 2018
Abstract submission deadline	: September 1, 2018
Full paper submission deadline	: October 1, 2018

Accepted papers will be published in:

1. IOP conference series: Earth and Environmental Science
2. Journal of Lignocellulose Technology (ISSN: 2548-8503; e-ISSN: 2548-8929)
3. Proceeding of 8<sup>th</sup> International Symposium for Sustainable Humanosphere (e-ISSN: 2579-5554)

#### Speakers :



Prof. Dr. Takashi Watanabe  
(RISH, Kyoto University)



Dr. Yusuke Ebihara  
(RISH, Kyoto University)



Dr. Hubert Luce  
(MIO, Toulon University)



Dr. Akihisa Kitamori  
(RISH, Kyoto University)



Dr. Aya Yanagawa  
(RISH, Kyoto University)



Prof. Dr. Toshiaki Umezawa  
(RISH, Kyoto University)



Dr. Masaru Kobayashi  
(GSA, Kyoto University)



Dr. Takuji Miyamoto  
(RISH, Kyoto University)



Dr. Kenji Umemura  
(RISH, Kyoto University)



Dr. Masahiro Sakamoto  
(GSA, Kyoto University)



Dr. Veera Singham  
(Universiti Sains Malaysia-USM)



Dr. Khoirul Himmi Setiawan  
(LIPI)



Dr. Dede Heri Yuli Yanto  
(LIPI)



Dr. Halimurrahman  
(LAPAN)



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#### Registration & Submission :

<http://situs.opi.lipi.go.id/hss2018>

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Dr. Soejat Harto  
(University of Sumatera Utara - USU)

## **5. 3rd ARN Symposium Reports from RISH Students**

### ARN in Taichung, and Humanosphere Studies

(Laboratory of Atmospheric Sensing and Diagnosis, RISH, Kyoto University)

Nor Azlan bin Mohd Aris

#### 1. Experiences in 3rd ARN Symposium

The environment surrounding humans is changing rapidly, threatening sustainable development and healthy living. The occurrence of natural disasters such as heavy rain, typhoon and flood are unavoidable, but it could be predicted through the understanding of their characteristics and behaviors so that thorough preparation could be carried out. These early preparation and prevention are really required especially for the affected societies such as civilians, farmers, government agencies and other related industries in reducing the losses and damages due to the extreme weather. Activities to comprehensively understand the current situation in the “humanosphere” are continued, which leads to the establishment of science and technology indispensable for sustainable development and contributing to the betterment of society. In 2016, RISH launched Asia Research Node (ARN) program as a hub for international collaboration research in the field of humanosphere science. This time from 25<sup>th</sup> September until 27<sup>th</sup> September 2018, the 3<sup>rd</sup> Asia Research Node (ARN) has been held at National Chung Hsing University in Taiwan, which purposely to gather researchers, academicians, professionals and public in sharing knowledge, disseminating research finding, exchanging success stories, and expanding both national and international collaboration.

On the first day, a list of lectures started with the field topic of “Atmospheric Observations with MST Radars” in which I participated into. It is a very fruitful and informative session because a lot of update on recent studies and projects were shared. After that, we learned about energy transfer and conversion in Geospace which contributed significantly to the occurrence of natural phenomena such as aurora in our atmosphere. The day ended with biomass and bioactive research presentation and short elevator speech for poster presentation participants. After the session completed, we had a banquet at the Park City Hotel where all participants enjoyed the delicious food together.

The second day was quite informative as well wherein topics regarding vector control were shared and discussed and after that, we had the poster session. During the poster session, I got the opportunity to share the significant of my research and to explain about the current progress. Some participants and students were quite interested to understand about the processing of radar signal and how the USRP works which I was glad to share. Furthermore, I got few suggestions to improve my research work especially on how Full Correlation Analysis is carried out. The opportunity to discuss about my research progress could improve my overall research work onwards. In the afternoon, we were brought to visit Muh Sheng Museum of Entomology. Various insects and bugs from all around the world are displayed. It is quite interesting that I never encountered most of the species being displayed that made me realized how big the world we live in. After that, we visited Sun Moon Lake and got the opportunity to ride a cruise around the lake. Such experience was really refreshing and made me appreciate the nature more than ever.

Topics on the third day sessions were also quite intriguing. From the morning session, we were presented with the topic of how our own footprints (or might as well mentioned as invasion) threaten the ecosystem sustainability. Migration of different species of insects could significantly affect the occurrence of diseases among local society. It then followed by the topic about wireless power transfer and climate change effect towards water, carbon and nutrient cycling in forest. Finally, the research topic regarding atmospheric and ionospheric studies were presented. In conclusion, the presentations in ARN symposium gave an insight on a very wide view about humanosphere and a good experience for me to explore and get a better understanding. These also change my view of the world and its components in a whole new perspective. Such opportunity given to join this kind of visit is just invaluable at least for me.



### 2. Presentation summary

#### Development of Software-Defined Multi-Channel Receiver System for the Equatorial Atmosphere Radar (EAR)

Nor Azlan bin Mohd Aris<sup>1,2</sup>, Hiroyuki Hashiguchi<sup>1</sup>, and Mamoru Yamamoto<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

<sup>2</sup>Universiti Teknikal Malaysia Melaka (UTeM)

Equatorial Atmosphere Radar (EAR) was established in June 2001 by the collaboration between Research Institute for Sustainable Humanosphere (RISH), Kyoto University and Indonesian National Institute of Aeronautics and Space (LAPAN). EAR is a VHF Doppler radar operated at 47 MHz with an active phased-array antenna system and located at the equator at Kototabang, West Sumatra, Indonesia (0.20oS, 100.32°E, 865 m above sea level) [1]. Established with a single receiving channel, here we present the development of multi-channel receiver system for the EAR using the combination of Universal Software Radio Peripheral X300 (USRP X300) series and GNU Radio.



Figure 1. EAR antenna array

Two USRP X300 devices corresponding to four receiving channels are synchronized using 10 MHz reference clock and 1 pulse per second (PPS) signal. Received signals are collected by the existing EAR antennas and fed to the USRPs for digital conversion and then stored in Hard Disk Drive (HDD). Offline signal processing is carried out to obtain the Doppler spectra and Full Correlation Analysis from Spaced Antenna method is carried out for the measurement of zonal and meridional wind speed.

### References

- [1] S. Fukao *et al.*, “Equatorial atmosphere radar (EAR): System description and first results,” *Radio Sci.*, vol. 38, no. 3, 2003.
- [2] M. K. Yamamoto *et al.*, “Development of a digital receiver for range imaging atmospheric radar,” *J. Atmos. Solar-Terrestrial Phys.*, vol. 118, pp. 35–44, 2014.
- [3] Briggs, B. H. (1984), The analysis of spaced sensor records by correlation techniques, in ‘Handbook for the Middle Atmosphere Program’, Vol. 13, SCOSTEP Secretariat, University of Illinois, pp. 166–186.

### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Atmospheric Sensing and Diagnosis, RISH, Kyoto University)

Noersomadi

#### 1. Experiences in 3rd ARN Symposium

The Asia Research Node (ARN) symposium is one of the important activities for bridging ideas and knowledge among various backgrounds. ARN has connected interdisciplinary science and engineering such as the Informatics and Electrical Engineering, the Earth and Planetary Sciences (in particular Space and Atmosphere Science) and the Agriculture Science. The 3<sup>rd</sup> ARN symposium involved both oral and poster presentations and visiting the Museum of Entomology. This is the 3<sup>rd</sup> event of ARN symposium, but it is my first time to participate as the poster presenter. My research subject is the dynamics in the tropical tropopause layer (TTL), the layer at range 12-19 km above mean sea level.

The atmospheric dynamics in TTL can be observed by Equatorial Atmosphere Radar (EAR) measurement. EAR is one of the big wind profiler radars in the world that is installed at Kototabang, Sumatera, Indonesia as the result of collaborative research between Kyoto University and LAPAN. EAR provides the long-term atmospheric observation since 2001 till the present day. I am interested to utilize the uniqueness of this dataset with high resolution in time interval because I am curious about the climatological behavior around TTL, particularly over Indonesian region which is the most convective active region. Convective activity over Indonesian region has the major role in the atmospheric dynamics. It can generate the turbulence in TTL.

It is a great experience to present the preliminary analysis about turbulence kinetic energy from EAR observation at the poster session of this symposium. Attending the ARN symposium allows me to discuss with senior and young researchers, particularly those who have similar background. I would like to be grateful to Prof. Hiroyuki Hashiguchi who provided this opportunity. I would like to thank to Dr. T. N. Rao and Dr. Hubert Luce for the fruitful discussion on my research topic. I have received much valuable comments from them to improve the analysis about turbulence kinetic energy. I also obtained much information in scientific and engineering development from many experts in their research fields.

### 2. Presentation summary

#### Variation of Turbulence Kinetic Energy in the Tropical Tropopause from Long-term Observation Equatorial Atmosphere Radar

Noersomadi<sup>1,2</sup> and Hiroyuki Hashiguchi<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

<sup>2</sup>National Institute of Aeronautics and Space (LAPAN), Indonesia

We investigated the turbulence kinetic energy ( $s_{\text{turb}}$ ) near the tropical tropopause using long-term dataset of Equatorial Atmosphere Radar (EAR) version 02.0212 from July 2001 to June 2018.  $s_{\text{turb}}$  is estimated from the observed spectral width data in the northward beam to reduce the effect of strong zonal wind shear. We analyzed the variation of  $s_{\text{turb}}$  and the mean zonal wind ( $U$ ) at 17 km, which is considered as the mean height of the tropical tropopause, as well as the phase propagation of Madden Julian Oscillation (MJO) from the Real-time Multivariate MJO index (RMM). We discuss the relationship between  $s_{\text{turb}}$  and  $U$  in the active period of MJO (defined when the amplitude RMM is  $\geq 1$ ) at Phase 4 (P4). MJO P4 can be expected as the period of the occurrence of strong convective activity over the Maritime Continent. The preliminary result shows that during MJO P4,  $s_{\text{turb}}$  is found larger up to 0.6-0.8 (m/s)<sup>2</sup> associated with strong westward wind than with eastward wind (about 0.2 (m/s)<sup>2</sup>). The seasonal variation of  $s_{\text{turb}}$  and  $U$  during MJO P4 indicates contrast between December-January-February (DJF) and June-July-August (JJA). Our analysis describes large turbulence occurred associated with strong westward wind especially during the active period of MJO.

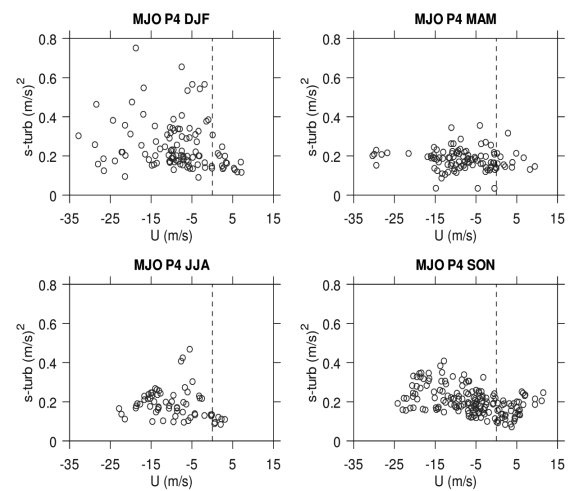


Figure 1. Scatter diagram between  $s_{\text{turb}}$  and  $U$  in the different season during the active period MJO at P4.

### **Transparent Polymer Nanocomposites Reinforced with Immiscible Nanocelluloses Fabricated via a Water-Based Pathway**

**(Laboratory of Active Bio-based Materials, RISH, Kyoto University)**

Subir Kumar Biswas

#### **1. Experiences in 3rd ARN Symposium**

The Research Institute for Sustainable Humanosphere (RISH) is a highly multidisciplinary research institute at Kyoto University with labs studying everything from insects to phenomena in the upper atmosphere. The Humanosphere Asia Research Node (ARN), materialized in 2016, has its focus beyond Japan, pursuing the objectives of RISH on a scale that encapsulates particularly the Asia and perhaps beyond. From rhizosphere to exosphere, where the human interacts – the humanosphere, the 3rd ARN Symposium in Taiwan covered the full spectrum of the themes related to present and future of the humanosphere science.

One of the most unique things about ARN symposium is that it gives the opportunity to interact with researchers of vibrant fields and to be knowledgeable of their researches that might be out of the scope of one's research area. This unique multidisciplinary symposium might give the opportunity to create new solutions and technologies for future sustainable humanosphere. The 3rd ARN Symposium was no exception with topics covered from the rhizosphere in the soil to the distant exosphere where the man-made satellites orbit the earth.

Apart from the scientific presentations on humanosphere science, the recreational tours to Muh Sheng Museum of Entomology and Sun Moon Lake were highly enjoyable. Especially, Muh Sheng Museum of Entomology was very interesting owing to its diverse collection of insects and the beautiful butterfly park. Thanks to Dr. Chin-Cheng Yang (Associate Professor, RISH) for his guidance and explanation about the insects in the museum.

Finally, I would like to thank all the members of the organizing committee to give me opportunity to be a part of this excellent symposium. I wish to participate in the future ARN programs to gather more knowhow on the humanosphere science.



Dr. Yang explaining about the beetle.



An image from the Butterfly Park.



## 2. Presentation summary

### Transparent Polymer Nanocomposites Reinforced with Immiscible Nanocelluloses Fabricated via a Water-Based Pathway

Subir Kumar Biswas<sup>1</sup>, and Hiroyuki Yano<sup>1</sup>

<sup>1</sup>RISH, Kyoto University, Japan

Nanocelluloses, such as cellulose nanofiber (CNF), cellulose nanocrystal (CNC), cellulose whisker etc., have gained a recent enormous attention as the “green” reinforcing fillers for polymers to enhance their mechanical and thermal performances. Furthermore, nanocelluloses in a transparent polymer matrix do not scatter the visible light much.<sup>1</sup> However, the processing of nanocellulose-reinforced composites suffers from the difficulty of dispersing native hydrophilic nanocelluloses in a hydrophobic resin matrix (most commercial resins are hydrophobic). A uniform dispersion of nanofillers defines the good properties of a nanocomposite.

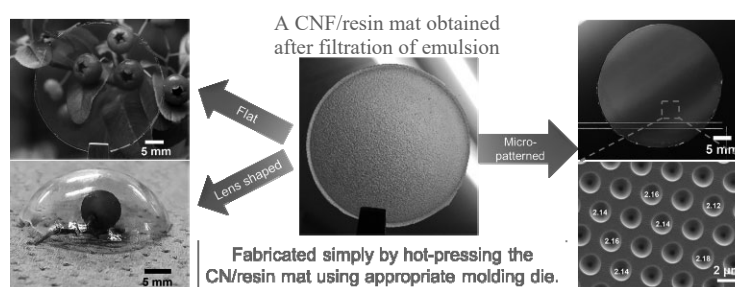


Fig. 1: Diverse transparent materials from CNF/resin emulsion.

To defeat this difficulty, previously, we have reported a water-based Pickering emulsification approach to prepare a CNF-reinforced strong, tough, flexible and transparent hierarchical nanocomposite.<sup>2</sup> Interestingly, unlike other methods such as the resin impregnation in a dehydrated CNF-network, the Pickering emulsification approach allowed the composite to be easily molded into a 3D-curved transparent material for next-gen applications (Fig. 1). The CNFs played a dual-role both as the resin-in-water emulsion stabilizer and the resin reinforcing element.

In this work, we report a Pickering-emulsification-assisted fabrication of transparent nanocomposites reinforced with cellulosic nanorods (CNs) of various lengths. Here, the term “cellulosic nanorods” is used to define both the long CNFs and the short CNCs. The effect of the length of nanocelluloses on the optical, mechanical and dynamic-thermo-mechanical properties of the composites is discussed (Fig. 2). The nanocomposites feature a unique biomimetic hierarchical structure and an ultrahigh thermo-mechanical, -dimensional, and -optical stability.

#### References

- [1] H. Yano et al., *Adv. Mater.*, 2005, 17, 153.
- [2] S.K. Biswas et al., *ACS Appl. Mater. Interfaces*, 2017, 9, 30177.

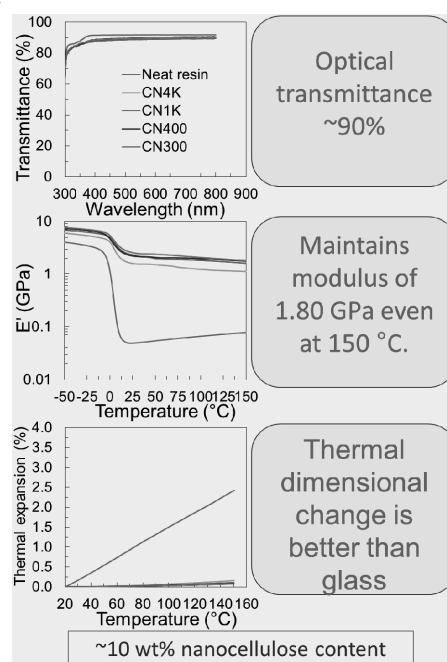


Fig. 2: Material properties of the nanocomposites. Note: CN4K, CN1K, CN400, and CN300 refers to the CN length of ~4000 nm, ~1000 nm, ~400 nm, and ~300 nm, respectively.

### Activities report of 3rd ARN symposium in Taiwan (Laboratory of Biomass Conversion, RISH, Kyoto University)

Yuki Tokunaga

#### 1. Experiences in 3rd ARN Symposium

The 3<sup>rd</sup> ARN symposium in Taiwan was a very satisfactory symposium covering a wide variety of research fields such as atmosphere, biomass resources, integrated vector management, ecosystems and wireless energy transfer. A number of presentations were given at the symposium, and the researchers discussed each other actively throughout the meeting. I am a Ph.D. student studying biomass conversion for the next generations, and not a specialist in most of the research fields given by the oral and poster presentations at the symposium. However, most of all the presentations in the 3<sup>rd</sup> ARN were attractive for me. From these presentations, I found two significant roles in ARN activities, (1) interactions between different fields of studies, and (2) interaction between different cultures.

##### 1-(1). Interaction between different fields of studies

Exchange of information and ideas across the various scientific fields at the 3<sup>rd</sup> ARN symposium was significantly meaningful to understand the humanosphere science. I exemplify the importance by introducing my own study. I have been analyzing binding mechanism of cellulase to lignocelluloses for the sake of utilization of lignocellulosic biomass as a sustainable resource producing biofuels, chemicals and materials. Although the industrial utilization of lignocellulose affects a local ecosystem including water and carbon cycling, biodiversity and soil conditions, I proceed my study without deep consideration of these ecological backgrounds and potential effects. Thus, at the symposium, I have learned the roles of my target, lignocelluloses in water, carbon and nutrient cycling (Session 1-c), with a wider insight into ecology and deeper interest. After the session, I have recognized the ecological background of lignocelluloses as well as their potentials as sustainable materials. As in the study on cellulase, most of researches are directed to solve the problems evoked in each field, and in most cases, these studies don't lay a strong emphasis on interactions between their study and research area outside of their fields. However, humanosphere includes human habitant, forest, ocean, atmosphere, space and other spheres surrounding humans, and importantly, these spheres are interacting each other. Thus, we cannot evaluate each sphere independently. To understand humanosphere science more deeply, we should recognize positioning of our study and its relationship with other fields in the humanosphere consisting of several spheres interacting each other. For this reason, interaction between various fields of studies is essential activity in the ARN symposium.

##### 1-(2). Interaction between different cultures

We had good opportunities for cross-cultural communication with researchers from different countries. We also enjoyed Taiwanese nature and culture during the 3<sup>rd</sup> ARN symposium. As a matter of course, different countries have different nature and culture. Thus, objectives and materials of study differ among the countries because most of the studies are focusing on local problems such as climate, resources, diseases, economy and other factors. For instance, pest management and invasive insects are good examples for the local problems (Session I-d). Integrated vector management defending dengue, malaria, zika and other fevers are also the essential local efforts (Session II-b). In my country, we have only a limited part of such problems and backgrounds, therefore, strategies necessary to solve these problems were unclear for me until I attended the ARN symposium. However, as mentioned above, humanosphere includes wide fields involving several countries as well as local regions. Thus, information of culture and nature in other countries is necessary to understand humanosphere science comprehensively.

### 2. Presentation summary

#### **NMR analysis of Non-productive Binding of Carbohydrate Binding Module of Cellobiohydrolase with Lignin**

Yuki Tokunaga<sup>1</sup>, Takashi Nagata<sup>2</sup>, Keiko Kondo<sup>2</sup>, Masato Katahira<sup>2</sup>, and Takashi Watanabe<sup>1</sup>

<sup>1</sup> RISH, Kyoto University, Japan

<sup>2</sup> IAE Kyoto University, Japan

#### **Abstract**

Enzymatic saccharification is an essential process for sustainable production of chemicals from lignocellulose. Industrially, a cellulolytic system including cellobiohydrolase I (Cel7A) from *Trichoderma reesei* has been widely used due to its high productivity and activity toward cellulosic substrates. Cel7A consists of catalytic domain and carbohydrate binding module 1 (*TrCBM1*) connected with highly glycosylated linker. *TrCBM1* plays a role to enhance activity of Cel7A by bringing the catalytic domain in close proximity to the cellulose. However, *TrCBM1* has affinity to lignin, in addition to cellulose, and the resultant non-productive binding to lignin decreases efficiency of the saccharification. To date, the interaction mechanism between *TrCBM1* and lignin has not been clearly understood. In this study, we analyzed interaction site of *TrCBM1* with lignin at a molecular level using NMR. <sup>15</sup>N-labeled *TrCBM1* was expressed and purified peptide with correct folding. Binding site of *TrCBM1* was analyzed by <sup>1</sup>H-<sup>15</sup>N HSQC NMR with incremental titration of cellobiose and milled wood lignin (MWL) from Japanese cedar and *Eucalyptus globulus*. The amino acid residues involving interaction with the titrants were mapped on the proposed structural model of *TrCBM1* based on chemical shift perturbation. From these NMR analysis and adsorption experiments, mechanism of the non-productive binding was discussed.

#### **Acknowledgements**

The authors grateful to Dr. Rie Takada, Dr. Satoshi Oshiro, Takashi Suetomi, Mai Murakami (RISH, Kyoto university, Japan), and Prof. Syuichi Karita (Mie university, Japan).

### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Plant Gene Expression, RISH, Kyoto University)

Tomohisa Shimasaki

#### 1. Experiences in 3rd ARN Symposium

This 3rd ARN Symposium was the first time for me to participate in the international conference. Because there were many researches in different fields, it was difficult to understand the contents in the oral session. To understand the research in a wider field, I thought that English is necessary.

It also gave me the opportunity to think about social problems throughout Asia such as population explosion, global warming, exhaustion of resources, environmental pollution. I felt that the approach to solve those problem is different from country to country even for similar problems due to differences in the environment, situation and culture of individual countries. In order to understand the circumstances of each country and derive new solutions, I thought it is important to share information through international symposium like ARN.

My study is focusing on the rhizosphere, which is the area close to the root of plants. A wide variety of microorganisms are inhabited in the rhizosphere, and there are symbiotic microorganisms that promote plant growth. My goal is to contribute to sustainable crop production that reduces the use of chemical fertilizer by making effective use of these symbiotic microorganisms. However, I participated in the ARN Symposium and realized again that various factors such as the atmosphere, the forest environment, and the economic situation of each country are involved in crop production. I felt it was important to see my own research from a broad perspective of the survival area.

The experience gained through participation in ARN this time is very valuable to me. I would also like to participate if there is such opportunity.

### 2. Presentation summary

#### **Analysis of santopine, an Amadori compound, in the rhizosphere**

Tomohisa SHIMASAKI, Takashi KAWASAKI, Kazufumi YAZAKI and Akifumi SUGIYAMA

RISH, Kyoto University, Japan

Rhizosphere is a small region around roots where millions of microbes inhabit and interact with host plants. These plant-microbe interactions in the rhizosphere are important for plant health and growth. Thus, rhizosphere microbes have a great potential to develop sustainable agriculture. Root exudates, such as amino acid, organic acid and secondary metabolites, secreted from plant roots are the key factor of plant-microbe interactions. Plants secrete those metabolites and construct microbial community structure. However, the fate and function of roots exudates in the rhizosphere have not well been understood, because of the complex composition of root exudates and the difficulty to quantify the specific compounds from the rhizosphere soil. Santopine, an Amadori compound, synthesized by the conjugation of glucose and glutamine, can be found in crown gall tumor induced by infection of agrobacteria. Agrobacteria exclusively utilizes santopine as energy source and keeps their population in crown gall tumor. Interestingly, it has been reported that santopine is secreted to rhizosphere and several bacterial species, besides agrobacteria, can utilize santopine, suggesting various role of santopine in plant-microbe interactions. To elucidate the fate and function of santopine in the rhizosphere, we synthesized santopine and the degradation as well as the distribution in the rhizosphere are to be analyzed.



### **First experience of poster presentation in foreign country** **(Laboratory of Plant Gene Expression, RISH, Kyoto University)**

Hayato Ueoka

#### **1. Experiences in 3rd ARN Symposium**

Research Institute for Sustainable Humanosphere (RISH) is promoting cross-sectional research towards the creation of a recycling-oriented society through effective utilization of materials, resources, and energy. The realization of a sustainable society is not limited to Japan alone, it is now a problem to be addressed on a global scale. International collaborative research is indispensable for that purpose. Asia Research Node (ARN) is an international symposium integrating various research fields such as space science, atmospheric science and biosphere science and aims to solve the above-mentioned issues through developing human resources to promote the Humanosphere Science. Many experts and students with diverse backgrounds participate in it. In ARN, not only individual research will be introduced but also enthusiastic discussions will be held toward establishing a high-quality Humanosphere.

Through this ARN, I was given an opportunity to make a poster presentation in foreign country for the first time. I am studying a medicinal plant, *Lithospermum erythrorhizon*, called “Murasaki” in Japanese. The root of this plant contains shikonin derivatives which exhibit a characteristic red color. Shikonin derivatives are used not only as natural dyes but also for medicine because of their various medicinal effects. After explaining such a background, I faced numerous problems when trying to introduce about a certain enzyme, my research target. It was very difficult to explain technical subjects such as how to select the gene of interest, how to measure enzyme activity, what is gene expression, what is intracellular localization, etc. to those who are not majoring in biology. I think that I could not explain my research simply because of my poor understanding of it. Poster presentation at ARN was a good opportunity to reflect on my attitude towards academics.

Meanwhile, through the introduction of each expert's research, I was able to learn about macro science such as space science and atmospheric science for the first time. While listening to stories that are not familiar on a daily basis, such as how the aurora can be made and how to observe the weather, I could feel the significance of science that directly contributes to human life. At the same time, I felt charm again in the Humanosphere Science. Contrary to these studies, my current research does not directly affect human life. Through this ARN, I thought that I needed to further develop my research and make it meaningful from the perspective of Humanosphere Science.

Participating in ARN was very meaningful for me as I was able to realize the need for a deeper understanding of my special field and the need to develop my own research as a Humanosphere Science. I would like to express my sincere appreciation to those who gave me this opportunity and organized ARN.

### 2. Presentation summary

#### **A cytosol-localized geranyl diphosphate synthase in *Lithospermum erythrorhizon* involved in shikonin biosynthesis**

Hayato Ueoka<sup>1</sup>, Kanako Sasaki<sup>1</sup>, Tatsuya Miyawaki<sup>1</sup>, Takuji Ichino<sup>1</sup>, Nozomu Sakurai<sup>2</sup>, Hideyuki Suzuki<sup>2</sup>, Daisuke Shibata<sup>2</sup>, and Kazufumi Yazaki<sup>1</sup>

<sup>1</sup> RISH, Kyoto University, Japan, <sup>2</sup> Kazusa DNA Research Institute, Japan

Terpenoids are the largest class of plant specialized metabolites representing flavors, phytoalexins and natural rubber. Among terpenoids, monoterpenes (C<sub>10</sub>) provide major components of flower fragrances and essential oils of herbs. These compounds are biosynthesized in plastids via methyl erythritol phosphate (MEP) pathway from the common precursor geranyl diphosphate (GPP), which is an allylic C<sub>10</sub> compound having two phosphate groups. In general, GPP is synthesized by isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP) from plastidial MEP pathway. However, cytosol-localized GPP synthase that employs cytosolic mevalonate pathway has been reported in a medicinal plant *Lithospermum erythrorhizon* that produces GPP-derived meroterpenoid compounds, shikonin derivatives, while this unique GPP synthase (LeGPPS) has not been identified so far. To uncover this cytosolic GPP synthase, we searched for a candidate gene of LeGPPS in an EST library constructed from cultured *L. erythrorhizon* cells. The target gene and the gene product have been analyzed in detail, i.e. its enzymatic function using recombinant protein, the expression pattern, and the subcellular localization. These characterizations have drawn a conclusion that the candidate gene is indeed coding for LeGPPS.

### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Biomass Conversion, RISH, Kyoto University)

Yu Iseki

#### 1. Experiences in 3rd ARN Symposium

I express my appreciation for giving me the opportunity to attend the 3<sup>rd</sup> ARN symposium in Taiwan. A variety of foreign people joined the symposium. It is important to know the problems in each country. When we discuss about the same topics, different idea and opinions may arise. In some occasions we may not be able to understand what they said. We may have higher or lower evaluations. I think that understanding of the background of each subject is important to solve the common problems such as global warming, natural disaster and pestilence.

When I joined Humanosphere Science School (HSS) 2017, some Indonesian participants studied natural disaster. In the 3<sup>rd</sup> ARN, some Taiwanese studied economic impacts of forest ecotourism and exploitation. Other researchers from tropical countries studied mosquito to prevent dengue and zika fevers. My research subject is lytic polysaccharide monooxygenase (LPMO) which cleaves cellulose and boosts degradation of cellulose with cellulolytic hydrolases. Cellulose is the most abundant renewable resource on the earth and it can be converted to biofuels and chemicals. Biochemistry usually focus on invisible small world. In the 3<sup>rd</sup> ARN symposium, some researchers studied big science such as living organisms and universe. I felt that I should expand horizon of my research because I have been conducting my research only at the molecular level. I could not recognize connections of my study with other sciences because of the broadness of humanosphere science. In the future, I would like to know the discussions about the same research areas from the view points of various scientific fields including social, political and other sciences.

In the 3<sup>rd</sup> ARN symposium, I had good experience to talk with foreign researchers in English. Sometimes, I was unable to listen English because of their pronunciation affected by their mother tongue. However, this experience improved my English skill. I was so nervous at the Elevator Speech within 1 minute. The Elevator Speech in English was my first experience and I realized the difficulties of oral presentations in English. I could not understand the research presentation so well as for the studies far from my research field. However, I could understand some research subjects presented clearly even if the subjects were far from my field. This fact reminds me that I should try to make simple presentation at the conference covering various research fields and subjects. Finally, I studied many things in the symposium and I hope that humanosphere science will continue and expand.



### 2. Presentation summary

#### **Studies on lytic polysaccharide monooxygenase (LPMO) from the selective white rot fungus, *Ceriporiopsis subvermispora***

Yu Iseki<sup>1</sup>, Satoshi Oshiro<sup>1</sup>, Takashi Nagata<sup>2</sup>, Keiko Kondo<sup>2</sup>,  
Masato Katahira<sup>2</sup>, and Takashi Watanabe<sup>1</sup>

<sup>1</sup>RISH, Kyoto University, Japan

<sup>2</sup>IAE, Kyoto University, Japan

Sustainable production of energy source and chemicals from woody biomass plays a critical role in our society due to reduction of fossil resource consumption, activation of forest resource recycling and non-competing with food supply. However, the recalcitrance of wood cell wall structure prevents conversion of woody biomass components. A selective white rot fungus, *Ceriporiopsis subvermispora* is known as a wood rotting basidiomycete decomposing preferentially lignin without significant damage to cellulose. The selectivity for lignin degradation depends on culture conditions, and simultaneous degradation of cellulose and lignin has been observed during the wood decay by the fungus. *C. subvermispora* secretes cellulolytic enzymes, cellobiohydrolase, endoglucanase and  $\beta$ -glucosidase. In addition to the hydrolases, the fungus possesses the genes encoding lytic polysaccharide monooxygenases (LPMOs) which are known to accelerate the saccharification by cellulolytic enzymes. LPMOs are copper metalloenzymes that oxidatively cleave  $\beta$ -1,4-glycoside bond at the C1 or C4 position, or at the both positions of terminal sugar. Typical LPMOs require an electron donor such as ascorbic acid, cellobiose dehydrogenase and phenols. Recent studies suggested that lignin can serve as electron donor for LPMOs but the redox mechanism is not well understood. In this study, LPMO from *C. subvermispora* was expressed in *Pichia pastoris*, purified and characterized by focusing its cellulolytic activities in the presence and absence of electron donor and interaction with lignin.

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## 3rd ARN Symposium Report

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### The 3rd ARN symposium in Taiwan

(Laboratory of Biomass Conversion, RISH, Kyoto University)

Chihiro Kimura

#### 1. Experiences in 3rd ARN Symposium

The 3rd ARN symposium provided me three great experiences. Firstly, all poster presenters were required to give a short presentation on the stage of elevator speech session. I explained our research within a minute toward a large number of audiences who study in various scientific fields. I've never had such opportunity to give an elevator speech before I joined this symposium. Therefore, I learned the difficulty to attract audience's attention within a short time. From other presenter's speeches, I realized that relax and dignified speaking as well as concise contents and emphasis points are necessary for the attractive speech. More practices are need, but I have had a good opportunity to improve my presentation skills. Secondly, I stayed with an Indonesian student at the same room. We spent our time by watching TV shows with conversations. When Sakamoto Ryoma appeared in a TV program, my roommate asked me what Mr. Sakamoto achieved and how he contributed to Japan. However, I could not reply the question due to lack of my knowledge about Japanese history. We also talked about Japanese language especially differences among words, but I could not answer him clearly. I really enjoyed the stay with him, but I learned that I should be more interested in Japanese culture to promote friendship with foreign friends from the experience. Thirdly, I learned Taiwanese culture from the differences between Japan and Taiwan. The most impressive thing is that all dogs walking in the city were unconnected by lead and cross roads freely. And there were many birds, fishes and turtles in National Chung Hsing University. I found that Taiwanese are good at living together with animals compared with Japanese. In night, Taichung city is darker than Japanese city due to less lights, but the city is enough safe for walking of foreigners. During the walking in night around our hotel, I thought that Japan is too light to reduce electric power and to conserve environment of other lives. Taiwanese culture tough me that we have to reconsider our Japanese life style.

Thanks to the 3rd ARN symposium, I listened to many lectures which covers wide range fields from molecules to space, and discussed our research with many researchers who work at similar or different fields. In ordinary academic meeting, I may only discuss with specialists who work at similar scientific field, so ARN symposium provides great opportunity to evaluate our research from the point of view of other fields. Now, we are facing big challenges for conservation of the earth and establishment of sustainable society. One scientific discipline cannot solve this problem, so interdisciplinary collaborations are essential. Therefore, Humanosphere science play a very important role. I will continue my own research with considering Humanosphere science. Finally, I would like to appreciate for giving me an opportunity for the great experience.

### 2. Presentation summary

#### **Production of Antiviral Compounds from Sugarcane Bagasse by Microwave Reactions**

Chihiro Kimura<sup>1</sup>, Ryota Ouda<sup>1,2</sup>, Ruibo Li<sup>1</sup>, Hiroshi Nishimura<sup>1</sup>, Takashi Fujita<sup>2</sup>, and Takashi Watanabe<sup>1</sup>

<sup>1</sup>RISH, Kyoto University, Japan

<sup>2</sup>IFLMS, Kyoto University, Japan

There is an enormous concern to establish sustainable society by replacing fossil resources to renewable bioresources. Biomass is the only one renewable carbon source and exist in huge quantity. Thus, the process of converting lignocellulosic biomass into platform chemicals and other value-added products as well as energy is strongly required for sustainable development. Sugarcane bagasse is one of the most abundant lignocellulosic agricultural residue, and has been studied as a raw materials for biofuels and chemicals. In the present study, we focused on production of antiviral compounds from sugarcane bagasse. Bagasse was decomposed by microwave catalytic reactions in polar solvents, and the degradation products were fractionated by extraction with organic solvents. Antiviral activities of each fraction were evaluated against encephalomyocarditis virus (EMCV), a nonenveloped single-strand RNA virus belonging to the family Picornaviridae. Strong antiviral activity against EMCV was found in the MeOH extract after acidic aqueous glycerolysis. The fraction was further fractionated, and then the weight average and number average molecular weight were determined by gel permeation chromatography. The cross peaks for *p*-etherified benzoate and xylan were observed by <sup>1</sup>H-<sup>13</sup>C heteronuclear single quantum coherence correlation NMR. These results suggested that antiviral fraction is composed of lignin and polysaccharide.



### **My experiments in 3rd ARN symposium**

**(Laboratory of Biomass Conversion, RISH, Kyoto University)**

Saho Kashima

#### **1. Experiences in 3rd ARN Symposium**

Firstly, I would like to express my thanks to professors and researchers who are supporting my research. It was the first time for me to attend a symposium and present my research by poster. I couldn't get ready for the ARN symposium without their helps. I really appreciate them for giving me the great opportunity to present my study because my study still needs a period to obtain experimental results. Because presentation at this symposium was highly challenging for me, I was relieved after finishing my presentation without problems. I had wonderful time for 3 days. Thank you so much.

Through this international symposium, I had many experiences which make me grew up. Especially the poster session was really happy for me because many participants came to my poster to know details of my study. However, sometimes I was unable to answer their questions. I felt that this was regrettable but at the same time, I could have the positive thinking that I recognized lack of knowledge through the questions. I want to make use of this experience to grow up as an independent researcher. I also recognized that English-speaking skills are essential to make research globally. My enthusiasm to learn English was stimulated by foreign student attendees who are not a native speaker but speak English fluently.

In the oral session, with a fresh feeling I listen the presentations about the research different from my own field. Especially, I was impressed to listen a lecture about malaria and dengue fever. I was surprised to know that occurrence of these fevers is related to the amount of rain. Because dengue fever occurred in Japan a few years ago, I felt familiar with the lecture. I hope patients suffering from the infectious fevers will be saved by extending this research.

I visited an insect museum as an excursion and I saw many kinds of insects in subtropical and tropical regions. Because museum guides explained us about the ecology of insect and hand touching was admitted, I was able to understand the insect better than when I was in Japan. I was very surprised because touching insects was not admitted in most of Japanese museums. Through this experience, I thought that touching is the best way to understand the insects and this system should be introduced in Japan.

As I wrote above, I really had wonderful experiences in each session. Thank you so much for three days.

### 2. Presentation summary

#### **Fractionation and analysis of lignin-carbohydrate complex in wood cell wall**

Saho Kashima<sup>1</sup>, Hiroshi Nishimura<sup>1</sup>, Shizuka Sakon<sup>1</sup>, Misato Yamada<sup>1</sup>, Yukari Ohta<sup>2</sup>, Keiko Kondo<sup>3</sup>, Yudai Yamaoki<sup>3</sup>, Takashi Nagata<sup>3</sup>, Masato Katahira<sup>3</sup>, and Takashi Watanabe<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

<sup>2</sup>Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan

<sup>3</sup>Institute of Advanced Energy, Kyoto University, Japan

Building a sustainable society is essential for the future. We use a huge amount of petroleum now, but petroleum is a limited resource and CO<sub>2</sub> generated by petroleum influences the global warming. As an alternative source of petroleum, utilization of biomass has been focused. Wood is composed of cellulose, lignin and hemicelluloses. Lignin is composed of aromatics and has a potential to use as energy, chemicals, and materials. Lignin associates with hemicelluloses in plant cell walls. This complex is called Lignin-Carbohydrate Complex (LCC). Our aim in this study is to obtain a better understanding of LCCs at a molecular level to develop an effective conversion system of woody biomass. Enzymatic digestions of both polysaccharides and lignin is effective to fractionate and concentrate the LCCs. We are now fractionating LCCs extracted from wood and analyzing them by 2D-NMR and LC-MS.

### Activity Report: The 3rd Asia Research Node Symposium on Humanosphere Science

(Laboratory of Innovative Humano-habitability, RISH, Kyoto University)

Bramantyo Wikantyo

#### 1. Experiences in 3rd ARN Symposium

The 3<sup>rd</sup> ARN Symposium was conducted on 25-27 of September, 2018. We had a flight on 24 September 2018 on and arrived on the same day. We took a bus to the Park City Hotel after the arrival and prepared for the Symposium on the next day.

I had a chance to meet many researchers in many scientific areas. I found that this symposium provided many pieces of information in regards to humanosphere science. Furthermore, had a chance to visit Taiwan was a great moment since Taiwan is beautiful islands with noteworthy bioresources. From this symposium, I understand that the development of a sustainable human environment must not be ruled out. Much anthropogenic activities have lead to many environmental degradations. For example, the global warming impact to the climate changes is obviously considered. The developed industrial activities are not only affecting the weather but also the dispersion of many pest or disease from one country to another. The efforts of public society to solve the impact of climate change also need to be supervised by expertise. Since popular green building which engages much vegetation to be planted inside the building, it would have been leading to not only greener community but may end up in another problem such as insect pest and disease by any vectors. These several issues are waiting to be resolved by humanosphere scientific meeting which will come up with a thorough discussion.

I presented a poster entitled “A Case Report of Termite Attack on Mango Fruit: Flexibility of Feeding Habit Underlining *Coptotermes gestroi* Status as Potential Urban Pest in Indonesia”. This study was conducted in Research Center of Biomaterials LIPI, Indonesia and Lab. Innovative Humano-habitability, RISH, Kyoto University, Japan. The presented study is likely to contribute to the revision of economical important termites in Indonesia. The Poster award went to 6 participants namely Ms. Pei Hua Lia from National Chung Hsing University, (My self) Mr. Bramantyo Wikantyo from RISH Kyoto University, Mr. Takuya Ikeda from RISH Kyoto University, Mr. Tatsumasa Hagiwara from RISH Kyoto University, Ms. Amonrat Panthawong from Kasetsart University, and Mr. Ting-Han Lin from National Central University. We went back to Japan on Friday 28 September 2018 and arrived safely at Kansai Airport.



### 2. Presentation Summary

#### A Case Report of Termite Attack on Mango Fruit: Flexibility of Feeding Habit Underlining *Coptotermes gestroi* Status as Potential Urban Pest in Indonesia

Bramantyo Wikantyo<sup>1,2</sup>, S. Khoirul Himmi<sup>2</sup>, Sulaeman Yusuf<sup>2</sup>, and Tsuyoshi Yoshimura<sup>1</sup>

<sup>1</sup>Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Kyoto, Japan

<sup>2</sup>Research Center for Biomaterials, Indonesian Institute of Sciences (LIPI), Bogor, Indonesia

Termites are generally regarded as wood attacking insects. The attack incidence of a genus *Coptotermes* on plantation has been quite common across Southeast Asian countries. Nevertheless, little is known about the incidence of fruits. We report the first case of *Coptotermes gestroi* attack on a mango (*Mangifera indica* “Harum Manis”) fruit at home-based storage in Jakarta. Description of soldier caste was done thoroughly by morphological characters as evidence together with a taxonomical understanding of related species.

Given the potential for feeding habit flexibility, *C. gestroi* has an important behavioral foundation to be considered as a potential pest in urban areas, particularly in Jakarta. By doing so they might be able to exploit and explore the possibility of any food sources around the colony as a survival attempt [2]. The fact that *C. curvignathus* has long been considered as the representation of Indonesian urban subterranean termite pest (*Standard Nasional Indonesia* 01-7207-2006), contrary to some references [1,3], needs to be comprehensively reviewed. The present observation is likely to contribute to the revision of economical important termites in Indonesia. Further research needs to be carried out on:

1. The possibility of water content and/or fructose content in mango and co-evolution factor among microorganism and host which may assist to this flexibility,
2. Reviewing the distribution of related species in Indonesia particularly in an urban area.

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3. Lee C-Y, Vongkaluang C, Lenz M (2007) Challenges to Subterranean Termite Management of Multi-Genera Faunas In Southeast Asia and Australia. Sociobiology 50(1):213-221

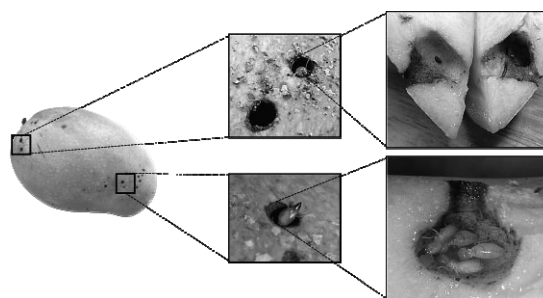


Figure 1. Dissection of mango *Mangifera indica* “Harum Manis” after 3 days of infestation. Both of the chambers had small openings at the exocarpium layer and widened at the mesocarpium layer. The first and second chamber’s dept and width roughly were 16x16 mm and 11x11 mm respectively. The sizes of the initial holes were around 2-4 mm.

### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Innovative Humano-habitability, RISH, Kyoto University)

Shu-Ping Tseng

#### 1. Experiences in 3rd ARN Symposium

I was a great opportunity and experience for me attending 3<sup>rd</sup> ARN Symposium. I fully enjoyed the symposium with so many interesting seminars and discussions on various topics. The 3<sup>rd</sup> ARN symposium comprised of eight sessions a broad range of topics, all relevant to Sustainable Humanosphere. Among these sessions, two sessions “Integrated Vector Management: a Strategy for Sustainable Humanosphere” and “Our Footprints on Global Environment: Threats to Ecosystem Sustainability” were most related to my study and I learned a lot from these two sessions. The session “Integrated Vector Management: a Strategy for Sustainable Humanosphere” featured new approaches to vector control. The bacteria *Wolbachia*, which is also my research topic, could be used as an effective method of reducing Aedes-borne diseases. Inspired by what I learned from this session, I feel that my study would have more practical value if I understand the mechanism of interspecies *Wolbachia* transfer. The session “Our Footprints on Global Environment: Threats to Ecosystem Sustainability” featured several anthropogenic threats to the sustainable future of ecosystem, including invasive species, climate change and insecticide overuse. I learned the characteristics of invasive pests, pest management and the potential problems of current control and study methods from this session, and what I learned would help me improve my research design.

Through discussions with other scientists during the poster presentation and during informal conversations at the symposium, I received valuable feedback on my study that I will incorporate as my project continues. For example, Prof. Tsuji told me he also found parasitoid mite infection on two ant species in Okinawa. This is a valuable information about the distribution of parasitoid mite, and I will carry out a comprehensive survey on ant parasites in Okinawa soon. Further, through these conversations, I was able to network with other researchers and it is very important for future cooperation. In conclusion, I have benefited very much from this symposium.

### 2. Presentation summary

#### Horizontal transfer of *Wolbachia* in longhorn crazy ant

Shu-Ping Tseng, Tsuyoshi Yoshimura, and Chin-Cheng Scotty Yang

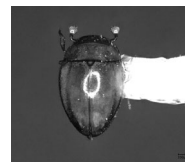
RISH, Kyoto University, Japan

The intracellular protobacteria *Wolbachia* is the most widespread endosymbionts in arthropods and nematodes. These bacteria are mainly vertically transmitted from mother to daughter through the egg cytoplasm, and horizontal transmission is generally assumed to be rare. One possible mechanism for interspecific horizontal transmission of *Wolbachia* is through the intimate contact between parasites and their hosts. In this study, we aim to examine the possible vectors of horizontal transmission of *Wolbachia* in longhorn crazy ant, *Paratrechina longicornis*, a worldwide spreading exotic ant. We characterized the *Wolbachia* wsp gene of the arthropods living inside ant nests, the so-called myrmecophiles in *P. longicornis* colonies. Among all the myrmecophiles, the host-specific ant cricket *Myrmecophilus americanus* was infected one *Wolbachia* variant identical to their ant host, *P. longicornis*, suggesting possible transfers of *Wolbachia* between this parasite and their hosts have occurred.

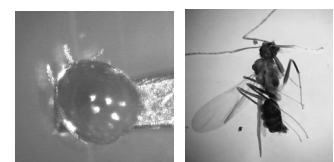
(A) Ant cricket



(B) Minute beetle



(C) Acaridae mite



(D) Parasitoid mite

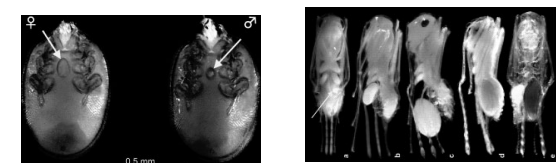


Figure 1. Ant guests in *P. longicornis*

(A) Ant cricket *Myrmecophilus* sp. (B) Minute beetle *Coluocera maderae* (C) Acaridae mite *Cosmoglyphus* sp. (D) Parasitoid mite *Macrodinychus multispinosus*. Picture of *M. multispinosus* was adapted from Lachaud *et al.* 2016

### Reference

[1] Lachaud, J. P., Klompen, H., & Pérez-Lachaud, G. (2016). *Macrodinychus* mites as parasitoids of invasive ants: an overlooked parasitic association. Scientific reports, 6, 29995.



### **My attending in 3rd ARN Symposium**

**(Laboratory of Computer Simulation for Humanospheric Sciences, RISH, Kyoto University)**

Takuya Ikeda

#### **1. Experiences in 3rd ARN Symposium**

I had been to Taiwan twice but had not been to Taichung yet. My first trip to Taichung became very grate memory. Taichung has very tasty food, beautiful scenery and kind people. I visited a night market near the hotel and Hokakuzi temple. In the night market, I bought many kinds of Chinese food. Hokakuzi temple has very huge great statue.

One of the most excited experiences is attendance in 3rd ARN Symposium. My experiences in 3rd ARN Symposium are much valuable. I talked with many foreigners who are from different Asian counties and I gained a lot of knowledge from them. All of them are expert in their study theme. Because an opportunity for obtaining accurate and deep knowledge of various fields is precious, the symposium is very important for me as a student. In addition to this, 3rd ARN Symposium is also an opportunity for being given and giving a presentation about research. Hearing many expert's presentation, I knew many things and learn good constitutions and approaches in giving presentation. Through my poster presentation, I exchanged opinions about my study theme with listeners who are experts and not experts in my theme. The advises for me from them make progress of my research.

The experiences are valuable for me. I got many valuable information in this symposium. I think that I want to attend 4th ARN Symposium.

### 2. Presentation summary

#### **Response of electrons in near-Earth space to solar wind, and possible region where electromagnetic waves are excited**

Takuya Ikeda<sup>1</sup>, Yusuke Ebihara<sup>1</sup>, Takashi Tanaka<sup>2</sup> and Fok Mei-ching<sup>3</sup>

<sup>1</sup>RISH, Kyoto University, Japan

<sup>2</sup>Kyushu University, Japan

<sup>3</sup>Nasa/GSFC, USA

The Earth is surrounded by energetic charged particles. The population of the energetic charged particles is called radiation belts. The growth and decay of the radiation belt are critical issues because these particles are hazardous to artificial satellites and human activities in space. To understand the growth and decay of the radiation belts, we need to understand two different processes. One is an *adiabatic process* in which adiabatic invariants of the particles are conserved. The other one is a *non-adiabatic process* in which the adiabatic invariants are violated. The non-adiabatic process is thought to occur when the particles interact with electromagnetic waves. The electromagnetic waves are excited when a certain condition of lower energy particles is set up by the adiabatic process. Toward the understanding of the radiation belts, we used the global magnetohydrodynamics (MHD) simulation together with the advection simulation called Comprehensive Inner Magnetosphere-Ionosphere (CIMI) model. In this presentation, we will show the adiabatic changes in the electrons with various energies, and show the possible region where the electromagnetic waves are excited in response to changes in the solar wind.

### Experience Report in 3rd ARN Symposium

(Laboratory of Space System and Astronautics, RISH, Kyoto University)

Tatsumasa Hagiwara

#### 1. Experiences in 3rd ARN Symposium

Through the presentation in the elevator speech and poster session as ARN symposium work, I found that I need not only the speaking ability of English but also the communication skills to attempt the mutual understanding. When I present my research to the researchers and students who are not familiar with my research field, I found that it is difficult to understand my presentation with a lot of technical terms for the listeners. Therefore, when I use the technical terms in not only Japanese but also English in my presentation, I realized that I have to explain the technical terms briefly.

By attending the presentation which is various kinds of study field, I could obtain the wide knowledge except my research field. Through the discussion on their current research and problems they face and focus on with researchers and students who come from other countries, I found what is the problem now in their research field and solutions they have. Moreover, given the advices from researchers who are not familiar with my research topics, we could find other solutions from another views, so it is very marvelous time to discuss.

Thorough this symposium, I think this symposium is connected to more improvement of technology by more deep collaboration between RISH and university or other research institutions. To achieve this, I felt that it is important to hold these symposiums regularly. Furthermore, nowadays, RISH is mainly collaborate with Asian countries, especially ASEAN countries. For the further development, I think we need to collaborate with not only the Asian countries but also America and Europe.

Lastly, my research topic is on the space propulsion system for the next generation spacecraft. The spacecraft has utilized for the exploration of the asteroids and the planets of the solar system such as Mars, Jupiter and Saturn. The problem of the current propulsion system is the low use efficiency of onboard fuel, basically low propulsion efficiency. Therefore, in our research, we proposed the new high efficiency system and aim to the short mission term. We are able to decrease the failure rate and explore in the short mission time. Space exploration could not only examine the origin of the Earth but also have a potential of the procurement of the resource from the other planets. The resource on the Earth is finite, so resource depletion is the serious problem now around the world. The immigration to the other planets and space exploration is important for thinking the humanosphere activity.



### 2. Presentation summary

#### **Performance Evaluation of Magneto Plasma Sail with Magnetic Nozzle by Using MPD Arcjet**

Tatsumasa Hagiwara<sup>1</sup>, Yoshihiro Kajimura<sup>2</sup>, Yuya Oshio<sup>3</sup>,  
Ikkoh Funaki<sup>4</sup> and Hiroshi Yamakawa<sup>4</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

<sup>2</sup>National Institute of Technology, Akashi College, Japan

<sup>3</sup>Tokyo University of Agriculture and Technology, Japan,

<sup>4</sup>Japan Aerospace Exploration Agency (JAXA), Japan

The development of new propulsion system for exploring the new residential area is necessary to achieve short mission term and large payload ratio. In recent years, magneto plasma sail(MPS), which generates its force by the interaction between solar wind and an inflated magnetic field via plasma injection, has been researched to attain above objectives. According to the previous study, however, it is difficult to launch and build because this system needs to huge coil to obtain thrust for the above mission. Therefore, we proposed the new system called magneto plasma sail(MPS) with magnetic nozzle. This proposed system combines two systems, MPS and magnetic nozzle. Magnetic nozzle is the system which generates thrust by converting the thermal energy of the thermal plasma injected into the nozzle magnetic field formed by radial magnetic field into the directed kinetic energy. The objective of our study is to substantiate the concept of thrust increase and evaluate the performance of the proposed system. This can lead to expand the residential area in other planets. We have been conducted the thrust measurement by using the vacuum chamber experimentally. We will present evaluation results of the proposed system.

#### **Acknowledgements**

This work was supported by JSPS KAKENHI Grant Number 24760669. The authors wish to express their sincere appreciation and acknowledgement to RISH, Kyoto University, and its financial support of mission-linked research.

### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Computer Simulation for Humanospheric Sciences, RISH, Kyoto University)

Tomohiro Sekine

#### 1. Experiences in 3rd ARN Symposium

I have had many new experiences at the 3rd ARN symposium. One of them is a presentation in English. Although I have had overseas presentation experience so far, the audience were people in the same field of expertise, so everyone understood without detailed explanation. However, in this presentation, since many of the listeners were experts on plants, insects, environment, etc., I felt how difficult it is to convey research contents to such people. Also, because my English skill was inadequate, there were many things that did not convey well even if I tried to explain easily. From the above experience, I found two issues. One is to understand the research deeply enough to explain to those who do not have expert knowledge. The other is to improve communication skills in English. As long as you do not actually face difficulties, motivation to get over it would not rise. In that sense, I feel that the presentation at this symposium was a good experience for me.

It was also a great harvest that I got useful advice from prominent professors of the same field of specialty and very good students. It has become a great motivation for research to receive positive words from those people such as interesting, exiting, and so on. Also, I got a lot of advice on research subjects. In that advice, I also felt it was necessary to accumulate more knowledge because there are things I still do not understand. In that advice, I also felt it was necessary to accumulate more knowledge because there are things I still do not understand.

### 2. Presentation summary

#### **Dynamics of energetic protons interacting with electromagnetic ion cyclotron waves**

Tomohiro Sekine<sup>1</sup>, Yoshiharu Omura<sup>1</sup>, Danny Summers<sup>1</sup>, and Yikai Hsieh<sup>1</sup>

<sup>1</sup>RISH, Kyoto University, Japan

We perform simulations of non-relativistic protons interacting with EMIC waves in the Earth's magnetic field. We find that the non-relativistic protons are trapped and accelerated by waves. We also perform simulations of the motion of relativistic protons in the Jovian magnetic field. We find highly efficient acceleration of the protons by the EMIC waves. The efficiency is greater than at the Earth. In this acceleration process, the direction of proton velocity along the magnetic field is reversed. We observe that this acceleration process is quite similar to the acceleration process of relativistic electrons by whistler-mode chorus waves, called Relativistic Turning Acceleration (RTA). We modify the nonlinear trapping theory for the relativistic proton case. We confirm that our results satisfy the theoretical conditions for RTA.



### Activities report of 3rd ARN symposium in Taiwan

(Laboratory of Computer Simulation for Humanospheric Sciences, RISH, Kyoto University)

Keita Takahashi

#### 1. Experiences in 3rd ARN Symposium

I gained various valuable experiences by participating in ARN this time.

First of all, I recognized of the importance of English. I joined a poster presentation program and I interacted with a number of people in English, but I still have a strong impression that I could not successfully communicate. The ARN Symposium is a valuable opportunity to interact with excellent participants. But this time I felt disappointed that I could not understand what other persons wanted to say and that I could not convey what I wanted to say firmly, because of my disadvantage of English. In order to make my research better, I realized again that English is essential to communicate with various people.

In addition, I learned what how other field research are being studied. Normally, opportunities to deeply touch other fields cannot be obtained easily. Therefore, by touching on various studies this time, I could deepen the importance and knowledge of the study of the survival area, I felt not only interesting but also appreciation for such opportunity.

Such an experience cannot be obtained unless it is an academic society such as ARN that various people from various fields gather. I would like to take advantage of this valuable experience in my own future.

### 2. Presentation summary

#### **Interaction between energetic electrons and whistler mode chorus waves in 1-D, 2-D and 3-D magnetic fields**

Keita Takahashi<sup>1</sup>, Yoshiharu Omura<sup>1</sup>, Danny Summers<sup>1</sup>, and Yikai Hsieh<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

To evaluate the validity of a 1-D and 2-D model magnetic fields, we perform test-particle simulations and monitor the resonant trapped electrons in both 1-D, 2-D and 3-D models. With respect to the adiabatic motions of electrons, the trajectories of electrons in the 1-D and 2-D motions show agreement with those in the 3-D models in terms of cyclotron and bounce motions. When simulations including the whistler mode waves are performed, we find that cyclotron resonance occurs with similar timing in each models. Though relativistic turning acceleration (RTA) is observed in each models, the energy that electrons acquire in the 1-D model is greater than those in the 2-D and 3-D models. It is confirmed that the 1-D model realizes the Earth's dipole magnetic field adequately only near the equator, which suggests that the results of simulations based on the 1-D model at high-latitude positions may be greatly different from those in 3-D model.

### ARN Symposium Report

(Laboratory of Computer Simulation for Humanospheric Sciences, RISH, Kyoto University)

Kazuki Kurisu

#### 1. Experiences in 3rd ARN Symposium

At ARN, I gave a poster presentation about geomagnetically induced current (GIC). GIC, which is briefly explained at my presentation summary too, is a phenomenon caused by solar activity and is known to result in terrible black out at high latitude. Recent research has revealed that large amplitude of GIC may occur at middle and low latitudes. However, the reason why GIC flows is not well known. I had great opportunity to discuss with many people from other countries and in different research fields. I hope that my presentation leads more people to feel a sense of danger to GIC and be interested in studying GIC.

There are many researchers from different fields in ARN. I study space weather, but I gained knowledge of forests, insects and observations with radars in ARN. I think there are not many places where researchers from different fields gather although I haven't been to conferences or symposiums much. ARN is a good symposium to expand our mind because we gain knowledge of not only our own fields but also wide knowledge of humanosphere.

This was the second time for me to give a presentation in foreign countries. By attending ARN, I got great motivation which can never been obtained in Japan. I would like to recommend other students to participate in international activities like ARN. My English skill may have improved through discussions or conversations with people from other countries.

In summary, I was able to have a good experience in ARN. I appreciate all the organizers who coordinated ARN and provided us comfortable venue.



### 2. Presentation summary

#### **Simulation study on the generation of geomagnetically induced current (GIC) in terms of ground-transmission line coupling**

Kazuki Kurisu<sup>1</sup>, Yusuke Ebihara<sup>1</sup>, and Satoko Nakamura<sup>1</sup>

<sup>1</sup>RISH, Kyoto University, Japan

GIC is a current flowing in the grid due to the influence of solar activity, which may cause a large power failure. Recent observation has revealed that extreme solar flares may occur in our Sun. If such an extreme solar event occurs, the impact on our life would be catastrophic. Under this circumstance, the need for GIC research is increasing for better understanding of the cause of the GIC.

Previously, many researches have calculated the GICs for given geomagnetically induced electric field (GIE) by assuming an equivalent electrical circuit. The GIE is often calculated by the temporal variation of the magnetic field, and is assumed to be independent of the existence of the transmission line. However, the existence of the transmission line may alter the ambient electric field including GIE because the conductance of the transmission line is extremely high in comparison with the ground conductivity. We calculated both the GIE and GIC simultaneously by using 3-D Finite-Difference Time-Domain (FDTD) method to investigate the interaction between the ground and the transmit line.

### Experience Report in 3rd ARN symposium

(Laboratory of Space Systems and Astronautics, RISH, Kyoto University)

Takuto Ueno

#### 1. Experiences in 3rd ARN Symposium

At first, I express gratitude for taking the opportunity to participate in the 3<sup>rd</sup> ARN symposium and making a valuable experience. At this ARN symposium, researchers from various fields from many countries participated, I was able to have a meaningful communication with them.

Through this ARN symposium, I realized again that the study on Humanosphere is a very important research field. We study the space debris, which are one of the task of the space exploration. Debris cause serial damages to space stations or satellites with collision. We think that efforts to eliminate debris are extremely important for human to have space as Humanosphere in the future. However, it is a matter of course, but in order to expand Humanosphere to space, at the moment, we need to study about the global environment that is the foundation. I have heard about problems such as unusual climate change, torrential rainfall, and diseases mediated by mosquitoes in news and others. I don't know the measures to these problems, so, by participating ARN symposium, I got to know measures, and became interested. Especially, I was greatly interested in combining with these measures and IoT technology.

At ARN symposium, I presented our study on a poster. Through this poster presentation, I felt that I need to devise the way to explain our study. I have experienced the poster presentation several times, but at these presentations, I explain our study to researchers, whose studies were electrical field and space engineering field, so I was easy to explain to them. However, at ARN, researchers with wide range of fields participated, so I felt it difficult to explain to these researches with easy to understand. I recognized that I have to try efforts of a descriptive explanation.

To conclude, through ARN symposium, I learned many things. I would like to make use of them in my own efforts.

## 2. Presentation summary

### Study on 3 D Simulation for Shape Estimation of Space Debris Using MU Radar

Takuto Ueno<sup>1</sup>, Hiroshi Yamakawa<sup>2</sup>, Hiroyuki Hashiguchi<sup>1</sup>, and Mamoru Yamamoto<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan, <sup>2</sup>Japan Aerospace Exploration Agency

#### Background

The total number of space debris are increasing year by year. In the year 2016, 20,000 debris are found in the orbit around the earth. Debris move at a speed of 3~7 kilometers a second. So, even debris about 1 mm will cause sufficient damage by colliding with artificial satellites and the space station. In 2009, the communication satellite and debris collided. Therefore, for remove debris, it is necessary to expand the observation network for debris and improve the accuracy of debris observation. In debris observation, we study the shape estimation of space debris method using the atmospheric radar on the ground. The use of atmospheric radar has advantages such as reduction of cost work by utilizing existing facilities and observation without the influence of weather. In this study, we use MU radar (Middle and Upper atmosphere radar) held by Kyoto University, RISH.

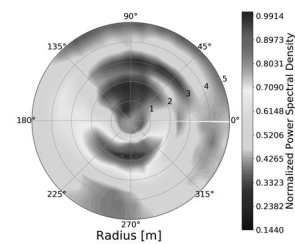


Figure 1. Estimated debris' rotation radius

Rotation radius (m)	1.9
Angular velocity (rad/s)	0.47
Estimated RCS (m <sup>2</sup> )	6.3

Table 1. Estimated Value

#### Shape Estimation method Using MU radar

MU radar is mainly set up to observe Middle and Upper atmosphere, but by lengthening the pulse length and enlarging the transmission power, the debris on low orbit can be sufficiently observed. However, MU radar's range resolution is poor, 4.8 km. So, we study observation method using MU radar. For shape estimation, we use SRDI method and RCS method. Both methods are to utilize debris' rotation.

Single Range Doppler Interferometry (SRDI) method is to use time-frequency analysis. Rotation scatter source generates spin doppler frequency. This spin doppler frequency has rotation radius, initial phase, and angular velocity. In SRDI method, we analyze spin doppler, and can specify debris' rotation radius on polar coordinate. But, for radius, we should specify rotation period correctly.

In RCS method, we utilize Radar-Cross Section (RCS). Due to debris' rotation, RCS signal from debris has fluctuation. RCS fluctuation has debris' rotation period and size. So, by fitting RCS fluctuation to theoretical formula RCS fluctuation of prolate, we can estimate near prolate to debris, and rotation period. By combining SRDI method and RCS method, we can estimate debris' size. However, RCS method is greatly influenced by radar power error, and incident angle of radar.

#### Shape Estimation Result

We show estimation result of SL16RB (debris number:31793U). We specify rotation period by RCS method, use SRDI method, and specify rotation radius. In Figure1, radius is specified 1.9 m. Table 1 is estimated value by using this radius 1.9 m and RCS method. Estimated RCS 6.3 m<sup>2</sup> is relatively near to true value 9.0 m<sup>2</sup>.

#### Acknowledgements

This work was supported by JSPS KAKENHI Grant Number 15K06600.

### 3rd ARN Symposium Report

(Laboratory of Space Systems and Astronautics, RISH, Kyoto University)

Takuya Torii

#### 1. Experiences in 3rd ARN Symposium

First of all, this is my first time to visit Taiwan, I got the impression that the Taiwanese are very kind and warmhearted to the Japanese. In the night market I visited on the last day, I was surprised at the difference in food culture between Taiwan and Japan. Though my visit was on a weekday at night, the stalls were full of crowd without distinction of age or gender. So, I felt that Taiwan is a dining-out culture.

In my case, attending the ARN symposium was the first time to give presentation with poster in English. From this experience, I realized again that I need to acquire more English ability. Furthermore, when I present my research to the researcher and students who are not familiar with my research field, I found that it is difficult for the listeners to understand my presentation with a lot of technical terms. So I realized again that I must have a deeper knowledge and understanding about my research to explain the technical terms briefly. Though my topic was in engineering field while most of the research presented in the symposium were in chemical and biological field, I was interested in some topics from different point of view and able to recognize the position of my research. Also, since I was aware of the problems in other countries, I was able to have a wide perspective.



### 2. Presentation summary

#### **Orbit Determination of Unidentified Space Debris by Using MU Radar**

Takuya Torii<sup>1</sup>, Hiroshi Yamakawa<sup>2</sup>, Hashiguchi Hiroyuki<sup>1</sup>, and Mamoru Yamamoto<sup>1</sup>

<sup>1</sup>RISH, Kyoto, University, Japan

<sup>2</sup>Japan Aerospace Exploration Agency

Today, a large amount of space debris is orbiting around the earth. Since they are orbiting in high velocity such as 7km/s, they will cause severe damage on active satellites if they collided. Therefore, observation and orbit determination of space debris is an important issue for sustainable space exploration. In this study, we aim to establish a method to estimate the orbit of unidentified space debris by observation using the atmospheric radar on the ground for strengthening observation network of space debris. In observation, we use MU radar (Middle-Upper atmosphere radar) owned by the Kyoto University, Research Institute for Sustainable Humanosphere (RISH). In the previous study, we succeeded in observing identified space debris using the Shigaraki MU radar. In that case, the number of beams is small, and they were set along the predicted orbit. However, in order to estimate the orbit of unidentified space debris, it is necessary to increase the number of beams and set the beam in a wider range. Therefore, in this research, we consider the observation method using many beams and the orbit determination method.



## **6. Japanese Summary of the 3rd ARN Symposium Reports**

### 徳永有希 (Yuki Tokunaga)

台湾で行われた第3回 ARN は非常に充実したものだった。発表分野は多岐にわたり、研究者同士の議論が活発になされていた。私はバイオマスの変換を研究している博士後期課程の学生である。従って、多くの発表分野において専門の知識は有していなかったが、ARN で行われた発表は私にとって興味深いものであった。それらの発表から、ARN の活動の重要性は異なる研究分野の交流、または異なる文化の交流にあると感じた。

まず、異なる研究分野の情報交換は生存圏科学の理解に重要である。例えば、私の研究ではセルラーゼとリグノセルロース間の吸着メカニズムを解析し、効率的なリグノセルロースの利用を目的とする研究をしている。しかし、リグノセルロースの利用が炭素循環や生物多様性に与える影響などといった生態学的背景は重要視していない。そのため、生態学的な観点からリグノセルロース資源を認識するセッションは大変興味深く、マテリアルのポテンシャル以外にも生態系におけるリグノセルロースの位置づけを認識することができた。同様に、多くの研究は個別の研究分野内にとどまり、他分野との関りを重要視しないのが普通である。しかし、生存圏とは多様な圏を含み、さらに互いに相互作用しているため、特定の圏から生存圏を評価することはできない。我々は自分の研究が生存圏内のどこに位置し、どのように他の圏と相互作用しているかを認識する必要がある。

また、今回のシンポジウムでは台湾の文化、自然に触れることができた。当然だが、地域によって環境や文化は異なる。多くの研究は気候、資源、病気、経済など、その地域特有の局地的な問題に着目するため、研究の目的や手法も地域によってやや異なることがある。例えば害虫や外来種に関する研究や、デング熱などの病気を媒介するベクターの研究などは地域の特異性が強い。一部の研究は我々の国では目にするのが少ないが、生存圏は特定の地域ではなく広い範囲を包括的に捉えるため、そういった異文化の交流と理解が生存圏科学を理解するうえで重要である。

### 島崎智久 (Tomohisa Shimasaki)

今回の 3rd ARN シンポジウムは、私にとって初めて国際学会に参加する機会になりました。異分野の研究が多かったこともあり、オーラルセッションでは内容を理解するのが難しい発表も多かったです。より広い分野の研究を理解するためにやはり英語が重要であるように思いました。

また、人口爆発や地球温暖化、資源の枯渇、環境汚染など、アジア全体の社会問題について考える機会にもなりました。そのなかで感じたことは、個々の国の環境や情勢、文化の違いから、同様の問題でもその解決へのアプローチが国によって違うということです。各国の事情を理解し、新しい解決策を導き出すために、ARN のような国際シンポジウムを通じ情報共有することが重要であると思いました。

私は現在、植物の根のごく近傍の領域である根圏に注目して研究しています。根圏には多種多様な微生物が生息しており、その中には植物の生育を促進する共生微生物が存在します。こうした共生微生物を有効活用していくことにより、化学肥料の使用を減らした持続的な作物生産に貢献していくことが私の研究の目標です。ですが、ARN シンポジウムに参加し、大気や森林環境、さらには各国の経済状況など様々な要因が作物生産に関わってくることを再認識しました。生存圏という広い視点で自身の研究を試みることも大切だと感じました。

今回の ARN への参加を通じて得られた経験は私にとって大変貴重なものとなりました。またこのような機会があれば是非参加させていただきたいです。

### 上岡 颯人 (Hayato Ueoka)

物資、資源、エネルギーの有効活用による循環型社会の構築に向けて、京都大学生存圏研究所は分野横断的な研究を推進している。持続的社会的な実現は日本のみの問題にとどまらず、今や世界規模で取り組むべき課題である。そのためには国際的な共同研究が必要不可欠である。Asia Research Node(ARN)は宇宙科学、大気圏科学、生物圏科学といった様々な研究領域を統合した国際シンポジウムであり、生存圏科学を推進する人材の育成を通じ、先述した国際的課題の解決を目指している。実に多様な背景を持つ多くの専門家や学生がそれに参加する。ARN においては、個々の研究が紹介される



だけでなく、高品位生存圏の確立に向けた熱心な議論が交わされる。

私は今回の ARN を通して、初めて海外でポスター発表する機会に恵まれた。私は薬用植物ムラサキ (*Lithospermum erythrorhizon*) について研究している。この植物の根には、特徴的な赤色を呈するシコニン誘導体が含まれる。シコニン誘導体は染料として用いられるのみならず、様々な薬効を示すために薬用に利用される。このような背景を説明した後、私の研究対象である、ある酵素について紹介しようとしたときに数々の問題に直面した。目的の遺伝子をどうやって選択するのか、酵素活性をどのように測定するのか、遺伝子発現とは何か、細胞内局在とは何かなどの専門的な話題について、生物学専攻ではない人たちに説明するのはとても難しかった。自分自身の研究をよく理解できていないからこそ、わかりやすく説明できなかったのだと思う。ARN においてポスター発表したことは、学問に対する自分の姿勢を反省するいい機会になった。

一方、各専門家たちの研究紹介を通して、初めて宇宙科学や大気圏科学といったマクロな科学について知ることができた。オーロラがどのようにできるのか、気象をどのように観測するのかといった、日常的にあまりなじみのない話を聞く中で、人間生活に直接的に寄与する科学の意義を実感できた。それと同時に、生存圏科学に対して改めて魅力を感じた。これらマクロな研究とは反対に、自分の現在の研究は人間生活に直接的に寄与するものでない。ARN を通して、生物圏科学として、自分の研究をさらに発展させ、意義深いものにする必要があると思った。

自分の専門分野をもっと深く理解しなければならないこと、生存圏科学として自身の研究を発展させなければならないことに気付くことができたため、ARN に参加したことは私にとってとても有意義であった。私にこのような機会を与えてくださったこと、ARN を組織してくださった方々に対し、心から感謝したい。

## 井関優侑 (Yu Iseki)

台湾での 3rd ARN シンポジウムに参加させて頂き、ありがとうございます。このシンポジウムでは、様々な国からの参加者がおりました。私たちはそれぞれの国によって様々な問題を抱えていますが、それを知することは重要だと思います。仮に、同じ議題について討論していたとしても、お互い異なる思考を持つため、様々な意見が生じます。時には、相手の言っていることがまるで重要ではなく、効率的ではないと感じられ、そのため相手のことを理解できないといったことが起こり得ると考えられます。しかし、お互いの背景を理解することで、こういった問題をも乗り越えられ、さらには我々が持つ数々の問題の解決へと繋がると思います。

2017 年の HSS では、インドネシア人の一部の方は自然災害について研究をしていました。今回のシンポジウムでは、ある台湾人は観光や経済効果を狙った森林の活用について研究をしていました。熱帯地域の人は Dengue 熱や Zika 熱を防ぐために、それを媒介する蚊の研究をしていました。私は、溶解性多糖モノオキシゲナーゼの研究をしており、この酵素はセルロース加水分解酵素の活性を促進し、セルロースを分解します。セルロースは地球上で最も多く存在する再生可能資源であり、燃料や化成品へと変換できます。バイオケミストリーは、通常目に見えない小さな世界を対象とします。一方で今回のシンポジウムでは、ある研究者は生物や宇宙といった、大きなスケールで研究がされておりました。私も自分の研究について原子レベルでしか考えないのではなく、幅広い視野を持って、研究に取り組む方が良いと感じました。生存圏科学は広い分野に渡っていますが、そのためにかえって、個々の研究の繋がりを認識することができませんでした。今後同じテーマに関して、社会、政治、自然科学などの様々な観点から議論している様子を見てみたいと思いました。

海外の研究者と英語で話すことは良い経験になりました。ただ、彼らの英語は母国語の訛りが入っているので、聞き取ることが難しい時もありました。しかし、この経験により、自分の英語が上達しました。1 分間で話すエレベータースピーチではとても緊張しました。英語で口頭発表することが初めてであり、難しかったです。自分と研究分野がかけ離れた内容が発表された時、その内容を理解することができませんでした。しかし、一部の人はスライドと発表をわかりやすく作られており、内容を理解することが容易でした。異分野の発表が多い中では、わかりやすく発表を行うことは特に重要だと感じました。最後になりましたが、このシンポジウムでは多くのことが勉強になりました。生存圏科学がこれからも発展することを願います。

### 木村智洋 (Chihiro Kimura)

昨年の HSS/ISSH に引き続き、3rd ARN に参加させていただいたことに非常に感謝している。今回のシンポジウムでは特に 3 つの素晴らしい経験を得ることができた。1 つ目はポスター発表者に与えられたエレベータースピーチである。1 分間以内に自分の研究をまとめ、聞き手の関心を惹くように話す難しさを味わった。研究を魅力的に紹介するためには、内容だけでなく、堂々とした話し方が必要であるように感じた。また、他の発表者の話し方を見ることで、自分の発表を反省し、今後につながる良い経験ができた。2 つ目は他の研究室のインドネシア人と同室で滞在できたことである。2 人でテレビを見ていると坂本龍馬が紹介され、彼はどのような人かと聞かれた。しかし、日本人でありながら、知識不足のため全く説明することはできなかった。さらには、日本語についての話を何度かしたが、ある単語と他の単語との意味の違いを質問されても、十分に明確な返答をすることができなかった。彼と過ごす時間はとても楽しかったが、それと同時にもっと日本に私自信が興味を持つべきであると痛感した体験となった。3 つ目は台湾と日本の違いを感じたことである。台湾の犬は全てリードが付いておらず、自由に家の周りをうろうろしていた。また、国立中興大学内には大きな池があり、鳥や魚、亀などたくさんの動物を見ることができた。これらの状況から、台湾人は日本人に比べ他の動物とうまく共生で来ているように感じた。夜は日本により暗かったが、外国人だけでも散歩できるほど安全であり、夜が明るすぎる日本に比べ、省エネで他の動物にも配慮した優しい町であるように思った。

ARN に参加することができ、植物体内の分子から宇宙までの広範囲での研究を聴くことができ、さらには様々な分野の研究者と自分の研究について議論することができた。普段参加する学会では、同じ分野の専門家だけで議論することが多いため、このような機会により自分の研究の意義や面白さを他分野から見ること、一層研究を深めることができると思っている。現在、我々は地球規模の問題に直面し、持続可能な社会を構築していくことを目指しているが、この問題を一分野で解決することはできない。そのため、生存圏科学は様々な分野からの視点を基に異分野内の協力を促す重要な役目を担っていると考えられる。今後も、自分の専門分野だけにとらわれず、生存圏科学という大きな枠組みを意識しながら研究を続けていく。

### 鹿島早帆 (Saho Kashima)

まず、今回のシンポジウム参加にあたり、日頃から実験のサポートをしてくださった先生、研究員の方々に感謝申し上げます。シンポジウムの参加やポスターによる研究発表は初めてだったので、サポートが無かったら準備が間に合っていなかったと思います。またデータとして出せる結果もほとんどない状態でしたが、それでも発表の機会をいただけたことに感謝しています。今回のシンポジウムでの発表は私にとってハードルが高いものでしたが、無事終わられて安心しています。3 日間貴重な時間を過ごすことができました。ありがとうございました。

プログラムを通して様々な経験をし、成長に繋がったと思います。特にポスターセッションにおいて、自分が行っている研究に興味を示し、聞いてもらえることを嬉しく感じました。しかし、時に質問に答えられない部分が生じたことから勉強不足であることを実感しました。とても悔しいですが、この経験からどの部分の知識が足りていないか把握することができました。一研究者として成長できるようこの経験を最大限に生かしたいと思います。またこのセッションを通して、グローバルに研究するには英語を話せる能力が大事であることも実感しました。英語を母国語としない学生でも英語を流暢に話している姿を見てとても刺激になり、英語習得に向けた意欲が湧きました。

またオーラルセッションにおいても、自分が専攻している分野以外の発表を聞くことができ、新鮮味を感じました。特にマラリアやデング熱に関する研究には興味を持ちました。そしてこれらの熱の発生には降水量が関係していることを知り驚きました。以前日本でもデング熱が話題になったので、より身近な話として印象に残りました。この分野の研究が発展することで、これらの熱に苦しむ人々が救われることを願っています。

プログラム内で訪れた昆虫博物館では様々な昆虫について知ることができました。ガイドの方がどのような生態なのか説明してくださると同時に触れることもできたので、日本で見るよりも理解が深まりました。日本では基本的に触ることができないのでとても驚きました。実際に触ることは生き物を理解するのに一番良い方法で、日本でも導入すべきだと思いました。

以上のように各プログラムで貴重な体験をしました。3 日間本当にありがとうございました。

### 池田拓也 (Takuya Ikeda)

私は台湾へ2度旅行に行ったことがありますが、台中へは行ったことがありませんでした。そんな私の、初めての台中旅行は非常に良い思い出になりました。台中にはとてもおいしい料理や美しい景色があり、そしてやさしい人々がいました。私は観光で、ホテル近くの夜市と宝覺寺に訪れました。夜市では様々な種類の中国料理を楽しみました。宝覺寺には、非常に大きな仏像がありました。

その中でも、3rd ARN Symposium はもっとも良い経験のひとつです。シンポジウムでの経験は、非常に価値のあるものでした。様々なアジア諸国から来た人々と話をし、彼らから多くの知識を得ました。彼らは全員が、彼らの研究テーマにおける専門家であり、様々な分野の、正確で深い知識を得られる機会は貴重であり、1学生としての私にとってシンポジウムは非常に重要なものでした。これに加え、シンポジウムは研究に関してプレゼンテーションを拝見したり、行ったりすることのできる機会でもありました。たくさんの専門家たちのプレゼンテーションを聞いて、私は多くのことを知り、またプレゼンテーションを行う際の構成やアプローチのやり方を学びました。自分のポスタープレゼンテーションを通して、私はプレゼンテーションを聞いていただけた、自分のテーマの専門家やそうでない人々を含むすべての人々と意見を交換することができました。彼らからのアドバイスは、私の研究にさらなる発展を与えてくださいました。

この経験は私にとって非常に価値のあるものでした。このシンポジウムで価値のある情報をたくさん得ることができました。次のシンポジウムにも、ぜひ参加したいと思います。

### 萩原達将 (Tatsumasa Hagiwara)

ARN シンポジウムに参加して感じたことは、外国人とコミュニケーション、意思疎通を図るためには、英語力だけでなく、コミュニケーション能力も必要であると感じた。さらに、自分の研究分野を他分野の方々に伝えるときは、専門用語を多く用いると理解してもらえない。そのため、日本語のみならず外国語においても専門用語を使用するときは、その用語について簡単に説明するだけでなく、簡単な単語へ言い換えたりする必要があることを実感した。

また、自分の専門分野以外の発表を公聴することにより、専門分野以外の幅広い知識を得ることができた。さらに、様々な分野のアジア諸国の研究者や年齢の近い学生たちと現在の研究状況や直面している問題について議論することにより、その分野ではどのようなことが問題となっており、どのような解決策で解決していくかなどをすることができた。さらに、専門分野外からの視点でアドバイスをもらうことにより、異なる解決策を見出すことができ、非常に有意義であった。

今回のシンポジウムを通して、生存圏研究所とほかの研究機関との共同研究や連携がさらに深まることで、更なる技術発展へとつながると考える。そのため、定期的にこのようなシンポジウムを開催し、意見交換の場を設けることは非常に重要であると感じた。さらに、今後は、アジア諸国のみならず、ヨーロッパやアメリカといった国々とも連携していく必要があると感じた。

最後に私の研究は次世代の宇宙探査機の推進システムに関する研究である。宇宙探査は、小惑星の探査や、土星や木星といった太陽系惑星の探査に利用されている。現在の推進システムの問題としては、燃料の使用効率の低さ、つまり、推進効率が悪いことである。そこで、本研究では、より高効率な推進システムを提案し、ミッション期間の短縮を目指している。ミッション期間を探索することにより、機器の故障率を下げるだけでなく、宇宙空間の解明が急速に進むことが期待されている。宇宙探査を行うことは、地球の起源を調べるだけでなく、惑星からの資源調達の可能性を秘めている。地球上の資源は、有限であり、将来的な枯渇が問題となっている。そこで、宇宙への移住を実現することで生存圏の拡大と、資源調達の可能性を探ることが可能である。つまり、宇宙探査は、生存圏を考える上で非常に重要なことである。

### 関根友博 (Tomohiro Sekine)

私は今回のシンポジウムで多くの新しい経験をしました。まず一つ目は海外での英語での発表です。海外での発表経験はこれまでにありましたが、今までの発表は、相手がほぼ全員同じ専門分野の方々だったこともあり、こちらが詳しい説明をしなくとも理解をしてくださる方ばかりでした。しかし、今回の発表では、聞き手は植物や昆虫、環境などについての専門家が多く、そのような人たちに英語で自分の研究



内容を伝えるということがいかに難しいかを感じました。また、自分の英語力が不足しているために、わかりやすく説明をしようとしても、伝えたいことがうまく伝わらないといったことも多くありました。以上のような経験から、二つの課題を見出しました。一つは専門知識がない方にも説明ができるほど、自分の研究について深く理解をすること。そしてもう一つは英語でのコミュニケーション能力の向上です。こういった課題というのは、うっすらと感じてはいても、実際に困難に直面しない限り、乗り越えようというモチベーションはなかなかわかないものです。そういう意味で今回のシンポジウムでの発表は自分のためになったと感じています。

また、専門分野が同じかつ著名な教授達や、非常に優秀な学生から有用なアドバイスをもらえたことも大きな収穫でした。そういう方々から、研究内容を面白い、興味深いというポジティブなお言葉をいただけたことは、研究に対する大きなモチベーションになっています。また、今後の課題としても多くのアドバイスをいただきました。その中で、まだ自分が理解できていない内容に関するお話もあり、もっと多くの知識を蓄積する必要があるなど感じました。このシンポジウムでの経験は、今後研究を進めていくうえで、道標となっていくと思っています。

### 高橋 溪太 (Keita Takahashi)

今回 ARN シンポジウムに参加することで、さまざまな経験を得られました。

第一に、英語の重要性を改めて認識させられました。私はポスター発表を行い、何人の方と英語で交流しましたが、うまくコミュニケーションを取れずに苦戦した印象が残っています。ARN シンポジウムは、優秀な参加者の方々と交流できる貴重な機会です。しかし今回、自分の英語の拙さゆえに、相手の言いたいことをしっかり理解し、自分の言いたいことをしっかり伝えられなかったことを非常に残念に感じました。自分の研究をよりよいものにするためにも、いろいろな方々とコミュニケーションを取ることでできる英語は必須であることを改めて思い知りました。

加えて、自分の領域以外の研究がどのようなプロセスを経て研究されているのかも学ぶことができました。通常、他分野に深く触れられる機会はなかなか得られません。ですので、今回さまざまな研究に触れ、生存圏研究の重要性、知見を深めることができ、単純に興味深く感じるのみならず、このような機会をいただいた感謝の念を感じました。

ARN のように、さまざまな国の、さまざまな分野の方々が集まって行われる学会でなければ、このような経験はなかなか得られません。今回いただいた貴重な経験を自らの今後に活かしていきたいと思います。

### 栗栖 一樹 (Kazuki Kurisu)

このシンポジウムでは、私は自分の研究対象である *geomagnetically induced current (GIC)* について発表しました。私のプレゼンテーションサマリーでも書いてありますが、GIC は太陽擾乱現象によって起こる、大規模停電の原因となりうる現象であり、近い将来中低緯度地域で発生する恐れがあります。しかし GIC の発生理由はよく分かっていません。私は今回の ARN シンポジウムによって多くの、専門分野や国籍の違う人々に自分の研究を発表する機会を頂きました。少しでも多くの方が GIC に対して危機感を持ち、GIC の研究に携わることにつながることを願っています。

ARN シンポジウムは様々な領域の研究者が集まるシンポジウムです。私は宇宙天気という領域を研究対象としていますが、今回のシンポジウムでは森林、虫、レーダ観測など様々な研究について知ることができました。私は学会やシンポジウムの経験がまだ浅いですが、ここまで様々な領域の研究者が集まるシンポジウムは他にはなかなか無いと思います。普段は自分自身の領域に近い研究しか知る機会が無いと思うので、ARN シンポジウムは自分の視野を広げるいい機会ではないでしょうか。

私は国外で学会発表する機会は今回で二回目でした。一回目の時もそうだったのですが、このシンポジウムでも日本で生活するだけでは得られない刺激をたくさん得ることができました。他の学生の方にも ARN シンポジウムのような、国際的な活動に参加することをお勧めします。国外の研究者との英語の議論や会話を通して、英語も多少上達できたのではないかと思います。

最後に、第三回 ARN では、本当に貴重な体験をすることができました。第三回 ARN の運営の皆様や会場の設営に携わった皆様に感謝を申し上げます。



### 上埜拓仁 (Takuto Ueno)

はじめに第3回 ARN シンポジウムに参加する機会をいただき、また貴重な経験をさせていただいたことに誠に感謝致します。今回の ARN シンポジウムでは多くの国から様々な分野の研究者の方が参加し、発表されており幅広い人との交流が図れたと思いました。

今回の ARN シンポジウムを通して、生存圏研究が非常に大切な研究分野であることを再認識致しました。私は宇宙開発において、大きな問題となっている宇宙ゴミ、スペースデブリの研究をしています。デブリが宇宙ステーションや人工衛星にとって、大きな障害となっています。将来、人類が宇宙空間を生存圏とする上でデブリ除去に向けた取り組みは非常に大切なことだと考えております。しかし、当たり前のことで忘れてしまいがちですが、人類が生存圏を広げるためには、現在土台となっている地球環境について研究する必要があります。

現在、問題となっているこれまでに類を見ない気候変化や豪雨などの異常気象、蚊を媒介とした病気の蔓延といった事柄はニュースなどで見聞きしたことがありました。しかし、これらの問題に対する取り組みを知らず、ARN シンポジウムに参加することで解決方法を知り、大変興味深かったです。特に、最近になって高く評価されている物とインターネットを組み合わせる IoT 技術を導入した取り組みには驚かされました。

私は今回、ポスターで発表をさせていただきましたが、説明の工夫が必要だと考え至りました。ポスター発表自体は度々参加したことがあるのですが、その参加した学会の分野が電気系分野や宇宙工学分野などの自分が普段、研究しているものと近い分野でした。そのため、ポスター発表で話をする人とは、その分野の知識ある程度、持っていることがほとんどで説明する場合もその知識を説明する必要がなく、説明しやすさがありました。しかしながら、ARN シンポジウムでは生存圏という電気系、工化系、生物系といった幅広い分野の人が参加しているためその前提知識がないことを踏まえて説明する難しさがありました。また、そのような人達に分かりやすく説明する工夫がいるということを改めて学びました。

最後に、ARN シンポジウムでは非常に多くのことを学び、感じ取りました。今後の自身の取り組みの中に活かしていきたいと思います。

### 鳥居拓哉 (Takuya Torii)

まず第一に私は今回初めて台湾を訪れたが、やはり台湾の方々には日本人に優しく温かい国であると感じた。最終日に訪れた夜市では台湾と日本の食文化の違いに驚いた。平日の夜であるにも関わらず、老若男女問わず、屋台は人混みでいっぱいであり、台湾の食文化を身をもって体感した。

私は今回が初めて参加した国際学会であったが、ARN シンポジウムのポスター発表に参加し、当たり前ではあるが、まず第一に英語力をもっと身につける必要があることを痛感した。加えて自分の研究分野について他分野の方々に伝えるためには、専門用語を多く用いると理解してもらえない為、その用語について簡単に説明する必要がある。そのためには、自分自身がその内容についてより深い知識・理解を持っていなければならないことを改めて実感した。私の研究は工学的な分野である一方で、参加者の研究内容は化学や生物学的なものも多く、深く理解することは難しかったが、様々な分野の研究内容に触れることにより、自分の研究内容の立ち位置を再認識することが出来た。また他国の抱えている諸問題などを知る機会が与えられ、広い視野を持つことが出来た。



# 生存圏アジアリサーチノード活動報告

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