The 3rd Asia Research Node Symposium on Humanosphere Science

Present and Future of Humanosphere Science

Date: September 25-27, 2018
Venue: International Conference Hall, Agricultural and Environmental Science Building
National Chung Hsing University (NCHU), Taichung, Taiwan
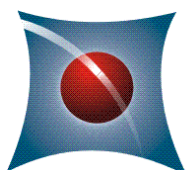
URL: http://www.rish.kyoto-u.ac.jp/arn3/

Organized by

生存圏研究所
Research Institute for Sustainable Humanosphere, Kyoto University

國立中興大學
National Chung Hsing University

Preface

The environment surrounding humans is rapidly changing 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 important.

The Research Institute for Sustainable Humanosphere (RISH) of Kyoto University launched a new program called the Humanosphere Asia Research Node (ARN) in 2016. This program 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 planned to organize "The 3rd Asia Research Node Symposium on Humanosphere Science". The symposium aims 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 ARN Symposium covers scientific and technological advances in the fields of material science, plant science, entomology, microbiology, ecology, forestry, wood science, chemistry, biochemistry, molecular biology, architecture, space science, atmospheric science, environmental science, electromagnetic engineering, agriculture and other related sciences contributing to creating "Sustainable Humanosphere". The symposium at National Chung Hsing University (NCHU) in Taichun, Taiwan runs on September 25-27, 2018 and has attracted about 100 oral and poster presentations.

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.

Collaboration with other research programs.

Hiroyuki Hashiguchi, Professor of Research Institute for Sustainable Humanosphere, Kyoto University
Hwang Shaw-Yhi, Professor of National Chung Hsing University
Co-Chairs of the 3rd Asia Research Node Symposium on Humanosphere Science

Map of the Campus
National Chung Hsing University

Agricultural & Environmental Science Building
10th Floor
International Conference Hall

Main gate

1 Humanities Building
2 Language Center
3 President's Residence (Ying-Lu)
4 Security Office
5 Hui-Sun Auditorium
6 Student Center
7 Small Auditorium
8 Women's Dormitory
9 Faculty Housing
10 Integrated Teaching Building
11 Administration Building
12 Chemical & Material Engineering Building

13 Electrical Engineering Building
14 Structural Proteomics Center
15 Life Science Building
16 Applied Science & Technology Building
17 Science & Engineering Building
18 Forestry Building
19 Water & Soil Conservation Building
20 Water & Soil Conservation Building 2A
21 Graduate Institute of Microbiology and Public Health
22 International Agriculture Center
23 Applied Economics Building 2A

24 Graduate Institute of Biotechnology
25 Center for Advanced Industry Technology and Precision Processing
26 Food Science & Biotechnology Building
27 Food Science & Biotechnology Processing Plant
28 NCHU Mart
29 Bank SinoPac
30 Animal & Plant Health Inspection Building
31 Social Science & Management Building

32 Agricultural & Environmental Science Building
33 Precision Engineering Building
34 Horticultural Experiment Station
35 Plant Science Building
36 Information Science Building
37 Chemistry Building
38 College of Science Building
39 Ex Agricultural Biotechnology Laboratories
40 Applied Economics Building 1A
41 Tennis Court
42 Civil & Environmental Engineering Building

43 Hydraulic Research Lab.
44 Men's Dormitory
45 Yun-Ping Building
46 Library
47 Green House
48 Mechanical Engineering Building
49 Machine Workshop
50 Innovation Incubator
51 Bio-Industrial Mechatronics Engineering Building
52 Mechanical Engineering Building 2A
53 Concrete Technology Building
54 Men's Dormitory
55 Basketball Court
56 Volleyball Court
57 Tennis Court
58 Roller-skating Rink
59 Gymnasium
60 Golf Driving Range
61 Crop Science Laboratory
62 Indoor Swimming Pool
63 Animal Experiment Center
64 Experimental Farm for Agronomy Department
65 Experimental Animal Farm
66 Animal Science Building
67 Veterinary Medicine Building
68 Animal Disease Diagnostic Center
69 Veterinary Medical Teaching Hospital
70 Laboratory Barns
71 The Quarantine Station
72 Motorcycle Parking
73 Parking Lot

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Date:　September 25-27, 2018
Venue: International Conference Hall
　　　Agricultural and Environmental Science Building 10th Floor
　　　National Chung Hsing University
　　　(Poster Session: 9th and 10th Floors, Banquet: Park City Hotel Central Taichung)

September 25 (Tue)		September 26 (Wed)		September 27 (Thu)	
08:30-09:30	Registration	08:30-10:10	Session II-b	08:30-10:10	Session I-d
09:30-10:10	Opening Ceremony	10:10-12:00	Poster Session	10:30-12:10	Session II-c
10:30-12:10	Session I-a	12:00-	Excursion	13:10-14:50	Session I-c
13:10-14:50	Session II-a			15:20-17:00	Session II-d
15:20-17:00	Session I-b			17:00-17:10	Closing Remarks
17:00-18:00	Elevator Speech				
19:00-	Banquet				

September 25 (Tue)

09:30-　　　　　**Opening Ceremony**
Chair: Hiroyuki Hashiguchi (RISH, Kyoto University)
Opening address
　　Takashi Watanabe
　　Director of Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan

　　Chou Chi-Chung
　　Dean of Office of Research and Development, National Chung Hsing University, Taiwan

Photo Session

Coffee break

Session I-a: Atmospheric Observations with MST radars
Chairs: Hiroyuki Hashiguchi (RISH, Kyoto University, Japan)
　　　　Jenn-Shyong Chen (China Medical University, Taiwan)
10:30-10:55　　O-Ia-1
　　Recent Progress of Chung-Li VHF Radar Group in Lower and Upper Atmospheric Researches
　　　　Yen-Hsyang Chu
10:55-11:20　　O-Ia-2
　　25 years of Indian MST radar at NARL, Gadanki
　　　　Thota N. Rao and Amit K. Patra
11:20-11:45　　O-Ia-3
　　An overview of results from ShUREX campaigns (2015-2017) at Shigaraki MU Observatory
　　　　Hubert Luce, Hiroyuki Hashiguchi, and Lakshmi Kantha
11:45-12:10　　O-Ia-4
　　Status of Equatorial MU Radar project in 2018
　　　　Mamoru Yamamoto, Hiroyuki Hashiguchi, and Toshitaka Tsuda

Lunch

Session II-a: Energy Transfer and Conversion in Geospace
Chairs: Yoshiharu Omura (RISH, Kyoto University, Japan)
       Lou-Chuang Lee (Academia Sinica, Taiwan)
13:10-13:30   O-IIa-1
    Auroras and precipitating particles above the high-latitude boreal forests
        Jih-Hong Shue
13:30-13:50   O-IIa-2
    Geospace Exploration Project: Arase
        Yoshizumi Miyoshi, Iku Shinohara, Takeshi Takashima, Kazushi Asamura, Shiang-Yu
        Wang, Yoichi Kazama, Satoshi Kasahara, Syoichiro Yokota, Takefumi Mitani, Nana
        Higashio, Yoshiya Kasahara, Yasumasa Kasaba, Satoshi Yagitani, Ayako Matsuoka,
        Hirotsugu Kojima, Yuto Katoh, Kazuo Shiokawa, and Kanako Seki
13:50-14:10   O-IIa-3
    Parameters of magnetospheric locations associated with occurrences of aurora and comparison
    with their ionospheric counterparts
        Sunny W. Y. Tam, Chih-Yu Chiang, Tzu-Fang Chang, Wun-Jheng Syugu, Shiang-Yu
        Wang, Yoichi Kazama, Bo-Jhou Wang, Satoshi Kasahara, Shoichiro Yokota, Yoshizumi
        Miyoshi, and Iku Shinohara
14:10-14:30   O-IIa-4
    Energy flow from the solar wind to the Earth during substorm: Simulation results
        Yusuke Ebihara, and Takashi Tanaka
14:30-14:50   O-IIa-5
    Magnetic explosion in the Sun-Earth system: Magnetic reconnection
        Seiji Zenitani

<div align="center">Coffee break</div>

Session I-b: Plants for Sustainable Humanosphere - Biomass and Bioactive Compounds -
Chairs: Yuki Tobimatsu (RISH, Kyoto University, Japan)
       Ying-Hsuang Sun (National Chung Hsing University, Taiwan)
15:20-15:50   O-Ib-1
    Genetics and Genomic Analysis of the Heartwood Traits in Taiwania cryptomerioides
        Ying-Hsuan Sun, Nai-Wen Tsao, Shih-Yin Chen, Shin-Hung Pan, Joy H Ding, Hung Lin,
        Cheng-De Chung, Fang-Hua Chu, Ting-Feng Yeh, and Sheng-Yang Wang
15:50-16:20   O-Ib-2
    Reciprocal cross-regulation of VND and SND multigene TF families for wood formation in
    Populus trichocarpa
        Ying-Chung Jimmy Lin
16:20-16:40   O-Ib-3
    Biosynthesis of Heartwood and Antitumor Lignans
        Masaomi Yamamura, Masato Kumatani, Keisuke Kobayashi, and Toshiaki Umezawa
16:40-17:00   O-Ib-4
    Dynamics and functions of plant bioactive compounds in the rhizosphere
        Akifumi Sugiyama

17:00-18:00   **Short Poster Presentation – Elevator Speech (Chair: Chin-Cheng Yang)**

19:00-   **Banquet at Park City Hotel Central Taichung**

September 26 (Wed)
Session II-b: Integrated Vector Management: a Strategy for Sustainable Humanosphere
Chairs: Wu-Chun Tu (National Chung Hsing University, Taiwan)
       Lee-Jin Bong (National Health Research Institute, Taiwan)
08:30-08:50   O-IIb-1
    Establishment of an early warning system for malaria in Southern Africa, incorporating climate
    predictions-the iDEWS project

Noboru Minakawa, Neville Sweijd, Swadhin Behera, Masahiro Hashizume, Takeshi Ikeda, Yoonhee Kim, Peter Witbooi, Gbenga Abiodun, Eric Mabunda, Francois Engelbrecht, Willem Landman, Philip Kruger, Raj Maharaj Yushi Morioka, Masami Nonaka, and Ataru Tsuzuki

08:50-09:10　O-IIb-2

Plant-based repellents to control mosquitoes
　　　Theeraphap Chareonviriyaphap

09:10-09:30　O-IIb-5

Mosquito reproduction control and the effects of mosquito host factors to dengue virus replication
　　　Shin-Hong Shiao

09:30-09:50　O-IIb-4

Dengue Prevention: Alternative Approaches in Managing Aedes Mosquitoes
　　　Wan Fatma Zuharah, Ahbi Rami Rattanam, Thiagaletchumi Maniam, and Rohaiyu Rodzay

09:50-10:10　O-IIb-3

Dengue Vector Control and Aedes aegypti resistance to insecticides from Indonesia
　　　Intan Ahmad

10:10-12:00　**Poster Session**

12:00-　　　**Excursion** (Muh Sheng Museum of Entomology and Sun Moon Lake)

September 27 (Thu)

Session I-d: Our Footprints on Global Environment: Threats to Ecosystem Sustainability
Chairs: Chin-Cheng Yang (RISH, Kyoto University, Japan)
　　　　Shaw-Yhi Hwang (National Chung Hsing University, Taiwan)

08:30-08:55　O-Id-1

Globalization and invasive ants: polydomy as an enigmatic characteristics
　　　Kazuki Tsuji, and Aye Thanda Win

08:55-09:20　O-Id-2

The importance of urban pest management on the sustainable future of urban ecosystem
　　　Chow-Yang Lee

09:20-09:45　O-Id-3

How sublethal neonicotinoid insecticides weaken honey bee colonies?
　　　En-Cheng Yang, Ming-Cheng Wu, Kuang-Hui Lu, and Yun-Ru Chen

09:45-10:10　O-Id-4

How will climate change affect a crop system that includes soybeans (crop), aphids (pest), and ladybugs (biocontrol agent)?
　　　Hsin-Yi Lee, Ying-Jie Wang, and Chuan-Kai Ho

Coffee break

Session II-c: Wireless Power Transfer for Sustainable Electronics
Chairs: Naoki Shinohara (RISH, Kyoto University, Japan)
　　　　Heng-Ming Hsu (National Chung Hsing University, Taiwan)

10:30-10:50　O-IIc-1

Wirelessly-Powered CMOS Electrochemical Sensing Interface Design
　　　Yu-Te Liao, Shao-Yung Lu, Yi-Chia Cheng

10:50-11:10　O-IIc-2

Some preliminary theoretical and experimental research results of WPT system between two points using Microwave power beam at 2.45 GHz
　　　Dao Khac An, Nguyen Chung Dong, and Nguyen Tien Thanh

11:10-11:30　O-IIc-3

Design of a 13.56-MHz Active Rectifier with Digital Offset Compensation for Implantable Medical Devices
　　　Fu-Bin Yang and Po-Hung Chen

11:30-11:50　O-IIc-4

Signal Communication in Wireless Power Transfer For Internet of Things
        Heng-Ming Hsu
11:50-12:10   O-IIc-5
    Recent Research of Wireless Power Transfer at RISH for a Smart, Happy, and Resilient Society
        Naoki Shinohara

                                    Lunch

Session I-c: Water, carbon, and nutrient cycling in forest under climate change
Chairs: Guo-Zhang Song (National Chung Hsing University, Taiwan)
        Masayuki Itoh (Hyogo Prefecture University, Japan)
13:10-13:35   O-Ic-1
    Are the evapotranspiration and canopy photosynthesis of Asian tropical rainforests affected by climate change?
        Yoshiko Kosugi, Satoru Takanashi, Shoji Novughi, Tatsuro Nakaji, Mai Kamakura, Wakana Azuma, Siti Aisha Shumsuddin, and Marryanna Lion
13:35-14:00   O-Ic-2
    Effects of inter-annual climate difference on hydrologic and biogeochemical controls on methane dynamics in forest ecosystems
        Masayuki Itoh, Ayaka Sakabe, Yoshiko Kosugi, and Takashi Hirano
14:00-14:25   O-Ic-3
    Multiple dimensions of fog and ecosystem function in a subtropical montane cloud forest
        Shih-Chieh Chang
14:25-14:50   O-Ic-4
    The linkage between fine root dynamics and community structure in subtropical evergreen forest
        Jyh-Min Chiang, Pui-Wai Leung, Li-Wan Chang, and Cho-Ying Huang

                                Coffee break

Session II-d: Atmospheric and ionospheric studies with new instruments and technology
Chairs: Mamoru Yamamoto (RISH, Kyoto University, Japan)
        Charles Lin (National Cheng Kung University, Taiwan)
15:20-15:45   O-IId-1
    Lessons Learned from the Ongoing Development of the Ionospheric Dynamics Explorer and Attitude Subsystem Satellite (IDEASSat)
        Loren Chang, Chi-Kuang Chao, Amal Chandran, Cheng-Ling Kuo, and Jann-Yenq Liu
15:45-16:10   O-IId-2
    Convective-scale assimilation with the GPS-zenith total delay and radar data and its impact on heavy rainfall prediction in Taiwan
        Shu-Chih Yang, Zih-Mao Huang, Ching-Yuan Huang, and Chih-Chieh Tsai
16:10-16:35   O-IId-3
    Equatorial Plasma Bubble for Space Weather Monitoring in Malaysia
        Suhaila M Buhari
16:35-17:00   O-IId-4
    The development of data assimilation in the ionospheric space weather
        Chia-Hung Chen, Charles Lin, Tomoko Matsuo, and J. Y. Liu

17:00-   **Closing Remarks**
Presentation of Student Poster Award

Closing Address
    Hwang Shaw-Yhi
    Associate Dean of College of Agriculture and Natural Resources, National Chung Hsing University, Taiwan

Poster Session (September 26 (Wed) 10:10-12:00)

P01 Development of Software-Defined Multi-Channel Receiver System for the Equatorial Atmosphere Radar (EAR)
Nor Azlan bin Mohd Aris, Hiroyuki Hashiguchi, and Mamoru Yamamoto

P02 Study on real-time adaptive aircraft clutter suppression using the MU radar
Hiroyuki Hashiguchi, Kohsuke Kubota, and Mamoru Yamamoto

P03 Multi-Frequency Observation of Wind Velocity and Turbulence in Troposphere
Zhao-Yu Chen, Ching-Lun Su and Yen-Hsyang Chu

P04 The Effect of the Acoustic Source Location on the Height Profiles of Virtual Temperature in the Tropical Troposphere
Ina Juaeni, Hiraku Tabata, Noersomadi, Halimurrahman, Hiroyuki Hashiguchi, and Toshitaka Tsuda

P05 Variation of Turbulence Kinetic Energy in the Tropical Tropopause from Long-term Observation of Equatorial Atmosphere Radar (EAR)
Noersomadi and Hiroyuki Hashiguchi

P06 Observations of Meteor Echoes Using VHF Interferometric Radar
Jenn-Shyong Chen

P07 Observation of diurnal precipitation over complex topography in Bandung basin using X-band radar
Tiin Sinatra, Ginaldi Ari Nugroho, Ibnu Fathrio, and Asif Awaludin

P08 New calibration method of system phase offsets at Chung-Li VHF radar
Ting-Han Lin, and Yen-Hsyang Chu

P09 Transparent Polymer Nanocomposites Reinforced with Immiscible Nanocelluloses Fabricated via a Water-Based Pathway
Subir Kumar Biswas, and Hiroyuki Yano

P10 NMR analysis of Non-productive Binding of Carbohydrate Binding Module of Cellobiohydrolase with Lignin
Yuki Tokunaga, Takashi Nagata, Keiko Kondo, Masato Katahira, and Takashi Watanabe

P11 Analysis of santopine, an Amadori compound, in rhizosphere
Tomohisa Shimasaki, Takashi Kawasaki, Kazufumi Yazaki, and Akifumi Sugiyama

P12 A cytosol-localized geranyl diphosphate synthase involved in shikonin biosynthesis in Lithospermum erythrorhizon
Hayato Ueoka, Kanako Sasaki, Tatsuya Miyawaki, Takuji Ichino, Nozomu Sakurai, Hideyuki Suzuki, Daisuke Shibata, and Kazufumi Yazaki

P13 Studies on lytic polysaccharide monooxygenase (LPMO) from the selective white rot fungus, Ceriporiopsis subvermispora
Yu Iseki, Satoshi Oshiro, Takashi Nagata, Keiko Kondo, Masato Katahira, and Takashi Watanabe

P14 Reconstitution of cellulose synthase to know its molecular assembly machinery
Tomoya Imai

P15 Improved biomass digestibility of rice mutants deficient in tricin-lignins
Pui Ying Lam, Yuki Tobimatsu, Toshiaki Umezawa, and Clive Lo

P16 Production of Antiviral Compounds from Sugarcane Bagasse by Microwave Reactions
Chihiro Kimura, Ryota Ouda, Ruibo Li, Hiroshi Nishimura, Takashi Fujita, and Takashi Watanabe

P17 Altered lignocellulose molecular assembly in lignin-modified rice mutants
Andri Fadillah Martin, Yuki Tobimatsu, Naoyuki, Matsumoto, Ryosuke Kusumi, Takuji Miyamoto, Masaomi Yamamura, Taichi Koshiba, Masahiro Sakamoto, and Toshiaki Umezawa

P18 Downregulation of p-*COUMAROYL ESTER 3-HYDROXYLASE* in rice leads to altered cell wall structures and improves biomass saccharification
Yuri Takeda, Yuki Tobimatsu, Steven D. Karlen, Taichi Koshiba, Shiro Suzuki, Masaomi Yamamura, Shinya Murakami, Mai Mukai, Takefumi Hattori, Keishi Osakabe, John Ralph,

Masahiro Sakamoto, and Toshiaki Umezawa

P19 Fractionation and analysis of lignin-carbohydrate complex in wood cell wall
Saho Kashima, Hiroshi Nishimura, Shizuka Sakon, Misato Yamada, Yukari Ohta, Keiko Kondo, Yudai Yamaoki, Takashi Nagata, Masato Katahira, and Takashi Watanabe

P20 Preparation of Castor Oil-based Polyurethane Resin for Manufacturing of Low-density Particleboard with Bamboo Charcoal
Yi-Chun Chen and Wei Tai

P21 Isoprene Emission Fux from Moso Bamboo Leaves in Central Taiwan
Tingwei Chang, Motonori Okumura, Yoshiko Kosugi, and Tomonori Kume

P22 Influence of Place Attachment and Socio-demographic Characteristics on Environmental Attitude-Evidence from a Top University in Central Taiwan
Ching Chuang, and Wan-Yu Liu

P23 Latent Preferences of Tourists for the Service Quality of Taichung Calligraphy Greenway in Taiwan
Ching Chuang, and Wan-Yu Liu

P24 Estimating the Amenity Value of Forest Recreation Areas: Evidence from Huisun National Forest Recreation Area
Yen-Yu Lin, and Wan-Yu Liu

P25 In a forest with tall overstory trees, the spatial distribution of recruits is determined by living trees rather than canopy gaps created by dead trees
Ku Chen-Chia, Song Guo-Zhang Michael, Chao Kuo-Jung, Chao Wei-Chun

P26 Canopy tree species may cause more infiltration than do short-statured tree species in terms of individual trees with the same diameters at breast height
Prapasiri Tongsiri, Guo-Zhang Song , Li-Wan Chang, and Jyh-Min Chiang

P27 The Effects of the Pests and diseases on the Optimal Forest Rotation and Land Expected Value Considering the Payment of Environmental Services
Yow-Ru Lin, and Wan-Yu Liu

P28 Evaluating the Recreation Value of Huisun National Forest Recreation Area
Ping-Zheng Chen, and Wan-Yu Liu

P29 The effects of coarse woody debris on the natural regeneration of Chamaecyparis obtusa var. formosana and broadleaved species
Liao Chi-Cheng

P30 Stand Structure and Short-term Dynamics of Abies kawakamii (Hayata) Ito in Mt. Xue, Taiwan
Pei Hua Li, Min Chun Liao, Wei Wang, Jia Rong Yang and Hsy Yu Tzeng

P31 Prediction models for landslide spatial distribution can perform better through including data of pre-landslide basal area of trees
Jian-Hong Yang, Guo-Zhang Michael Song, and Li-Wan Chang

P32 Study the Function of Soil Nutrients Conservation in Forest from Soil Solution of Vegetation Engineering
Kai-Lin Chen, Tzu-Hao Su, and Chiung-Pin Liu

P33 A case study on the impact of climate change on forest vegetation in Taiwan
Huan-Yu Lin, Ching-Feng Li, Tze-Ying Chen, Chang-Fu Hsieh, Tongli Wang, and Jer-Ming

P34 Forest carbon balance in tropical Taiwan
Chao Kuo-Jung, Pin-Siou Liao, Guo-Zhang M. Song, Wei-Chun Chao, and Hsing-Juh Lin

P35 A Case Report of Termite Attack on Mango Fruit: Flexibility of Feeding Habbit Underling Coptotermes gestroi Status as Potential Urban Pest in Indonesia
Bramantyo Wikantyoso, S. Khoirul Himmi, Sulaeman Yusuf, and Tsuyoshi Yoshimura

P36 Horizontal transfer of Wolbachia in longhorn crazy ant
Shu-Ping Tseng, Tsuyoshi Yoshimura, and Chin-Cheng Yang

P37 An analysis on geomagnetic activity related with Formosat-2 and Formosat-3 anomalies for space weather operations
Han-Wen Shen, Jih-Hong Shue, and Tsung-Ping Lee

P38 Response of electrons in near-Earth space to solar wind, and possible region where electromagnetic waves are excited
      Takuya Ikeda, Yusuke Ebihara, Takashi Tanaka, and Fok Mei-ching

P39 Drift-bounce resonance between Pc5 pulsations and ions at multiple energies in the nightside magnetosphere: Arase and MMS observations
      S. Oimatsu, M. Nosé , M. Teramoto, K. Yamamoto, A. Matsuoka, S. Kasahara, S. Yokota, K. Keika, G. Le, R. Nomura, A. Fujimoto, D. Sormakov, O. Troshichev, Y.-M. Tanaka, M. Shinohara, I. Shinohara, Y. Miyoshi, J. A. Slavin, R. E. Ergun, and P.-A. Lindqvist

P40 Turbulences in the geospace, solar wind and interstellar medium
      K. H. Lee and L. C. Lee

P41 Performance Evaluation of Magneto Plasma Sail with Magnetic Nozzle by using MPD Arcjet
      Tatsumasa Hagiwara, Yoshihiro Kajimura, Yuya Oshio, Ikkoh Funaki, Hiroshi Yamakawa, and Hirotsugu Kojima

P42 Dynamics of energetic protons interacting with electromagnetic ion cyclotron waves
      Tomohiro Sekine, Yoshiharu Omura, Danny Summers, and Yikai Hsieh

P43 Interaction between energetic electrons and whistler mode chorus waves in 1-D, 2-D and 3-D magnetic fields
      Keita Takahashi, Yoshiharu Omura, Danny Summers, and Yikai Hsieh

P44 Preliminary results of behavioral responses of 10 strains Aedes aegypti (L.) from Taiwan exposed to permethrin residual treatment
      Jin-Jia Yu and Kok-Boon Neoh

P45 Assessing the Current Insecticides Resistance Status on Dengue Vector, Aedes albopictus (Diptera: Culicidae)
      Wan Fatma Zuharah and Ahmad Mohiddin

P46 Biological Characteristics of Inherited Permethrin Resistance of Field Collected Male Aedes aegypti
      Hadian Iman Sasmita, Kok-Boon Neoh, and Wu-Chun Tu

P47 A New Dengue Vector Monitoring Strategy in Southern Taiwan
      Chin-Gi Huang, Hui-Ching Cheng, Tsung-Ju Tsai, Pei-Qi Chen, Ya-Zhe Lee, Yu-En Chiu, Yu-Ting Huang, Tzu-Ying Chuang, Tzu-Chen Lin, Kun-Ta Chuang, and Wu-Chun Tu

P48 Excito-repellency activity of neem extract and oil-based liquid soap formulations against Culex quinquefasciatus, Anopheles minimus, and Aedes aegypti (Diptera: Culicidae)
      Amonrat Panthawong, Theeraphap Chareonviriyaphap, and Unchalee Sanguanpong

P49 Force oviposition technique of Anopheles minimus (Diptera: Culicidae), a vector of malaria in Thailand
      Pairpailin Jhaiaun, and Theeraphap Chareonviriyaphap

P50 Temephos resistance in Aedes aegypti
      Manop Saeung and Theeraphap Chareonviriyaphap

P51 Strong dayside aurorae and precipitations for radial interplanetary magnetic fields
      Hsien-Ming Li, Jih-Hong Shue, Satoshi Taguchi, Masahito Nosé, Keisuke Hosokawa, Yongliang Zhang, and Simon Wing

P52 A new algorithm of ionogram scaling for the Chung-Li Ioosondne
      Kai-Jun Ke, Kang-Hung Wu, Ching-Lun Su, and Yen-Hsyang Chu

P53 Simulation study on the generation of geomagnetically induced current (GIC) in terms of ground-transmission line coupling
      Kazuki Kurisu, Yusuke Ebihara, and Satoko Nakamura

P54 Study on 3 D Simulation for Shape Estimation of Space Debris Using MU Radar
      Takuto Ueno, Hiroshi Yamakawa, Hiroyuki Hashiguchi, and Mamoru Yamamoto

P55 Orbit Determination of Unidentified Space Debris by Using MU Radar
      Takuya Torii, Hiroshi Yamakawa, Hiroyuki Hashiguchi, and Mamoru Yamamoto

P56 Toward ionosphere forecast using FORMOSAT-7/COSMIC-2
      Charles Lin, Chia-Hung Chen, P. K. Rajesh and C. Y. Lin

P57 Achievements and future plan for study of low-latitude ionosphere by using satellite-ground

beacon experiments
       Mamoru Yamamoto
P58 Remediation of Ectomycorrhiza in Heavy-Metal Soil and the Shift on Bacterial Community Structure in Rhizosphere
       Ying-Ping Sung and Yu-Ting Wu

Organizing Committee

RISH, Kyoto University

[General Chair] Hiroyuki Hashiguchi

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Lee-Jin Bong, Shan-Min Chen, Hooi-Kuan Chong, I-Hsuan Hu, Kuan-Ling Liu, Kok-Boon Neoh, Ming-Hsiao Peng, Hadian Iman Sasmita, Chieh-Yen Tsai, Jin-Jia Yu

Abstracts
Oral Session

O-Ia-1
Recent Progress of Chung-Li VHF Radar Group in Lower and Upper Atmospheric Researches

Yen-Hsyang Chu
Graduate Institute of Space Science, National Central University, Chung-Li, Taiwan, R.O.C.

It has been more than 3 decades since the Chung-Li VHF radar was constructed and fully operated in 1985. Originally, the Chung-Li VHF radar was designed for the purpose of observing and investigating the parameters and phenomena in lower atmosphere, including 3-D wind velocity, precipitation, tropopause, gravity wave, and so on. The observational capability of this radar was greatly enhanced after the function of frequency domain interferometer (FDI) was implemented in 1990 and ionospheric array was constructed in 1993. Since then, the Chung-Li VHF radar can be used to observe and position the discrete targets or ionospheric field-aligned irregularities (FAIs) by using spatial domain interferometer (SDI) technique. The radar was started to refurbish in 2004 due to aging problem and the refurbishment of the whole radar system was completed in 2009. A new interferometer array was added in the Chung-Li VHF radar station in 2012, which is used exclusively to observe and position meteor trail and lightning stroke. In 2015, we designed a portable radar system to detect the sea surface echoes from ocean waves at Bragg wavelength such that the ocean current, significant wave height and wind direction on sea surface can be measured. Some observational results are highlighted and discussed in this paper.

O-Ia-2
25 years of Indian MST radar at NARL, Gadanki

Thota N. Rao and Amit K. Patra
National Atmospheric Research Laboratory, Gadanki, India

The Indian MST radar, located at NARL, Gadanki, has been catering ever-increasing demands of atmospheric and ionospheric research community for the last 25 years. The data have been extremely useful in addressing a wide range of fundamental scientific issues that underpins our understanding of atmosphere –ionospheric system and providing new insights in the field of lower, middle and upper atmospheric research. Important scientific findings obtained from the wealth of data that the radar amassed in its long journey will be presented with a prime focus on 150 km riddle, plasma bubble, mesospheric dynamics, atmospheric waves, stratosphere-troposphere exchange processes, importance of vertical winds in understanding a variety of atmospheric processes, radar meteorology, and potential operational applications. An overview of recent technological advancements that transformed the radar into one of the most powerful active aperture radars in the world will also be presented. The upgraded radar provides new capabilities and enormous flexibility to carry out various modes of experiments to cater the current and future atmospheric and ionospheric research. Several features are built-in in the upgraded system, like 360° beam agility, modularity, multireceiver capability and built-in scalability.

O-Ia-3

An overview of results from ShUREX campaigns (2015-2017) at Shigaraki MU Observatory

Hubert Luce[1], Hiroyuki Hashiguchi[2], and Lakshmi Kantha[3]

1: Toulon University, France, 2: Kyoto University, Japan, 3: University of Colorado, USA

For the first time, Unmanned Aerial Vehicles (UAVs) mainly equipped with high frequency response and low-noise cold wire temperature and pitot tube sensors were flown at the Shigaraki MU Observatory (Japan) for gathering atmospheric parameters in the immediate vicinity (~1 km) of the VHF-band MU (Middle and Upper atmosphere) radar. The UAVs, developed at the University of Colorado (Boulder) were utilized during three campaigns of several weeks in 2015, 2016 and 2017. They were called Shigaraki UAV-Radar Experiment (ShUREX). By comparing direct estimates of atmospheric parameters from UAV measurements (e.g., turbulent kinetic energy dissipation rate, temperature and refractive index structure constants, vertical gradients of refractive index) with those derived from radar measurements by using models, the relevance of the radar methods were evaluated at unprecedented time resolutions in the lower troposphere. An overview of the main outcomes will be presented. Among the noteworthy results, statistical comparisons between UAV-derived and radar-derived kinetic energy dissipation rates using various models permitted us to show that the Weinstock (1981) model commonly used for retrieving dissipation rates from spectral width is not fully adapted in the standard conditions of observations used during the campaigns.

Keywords: MU radar, UAV, turbulence, high-resolution measurements, dissipation rates

O-Ia-4

Status of Equatorial MU Radar project in 2018

Mamoru Yamamoto, Hiroyuki Hashiguchi, and Toshitaka Tsuda

RISH, Kyoto University, Japan

Research Institute for Sustainable Humanosphere, Kyoto University (RISH) has been studying equatorial atmosphere in the Indonesian region since late 1980s. In 2001, we established the Equatorial Atmosphere Radar (EAR) at Kototabang, West Sumatra, Indonesia under close collaboration with Indonesia National Institute for Aeronautics and Space (LAPAN). Since then we have conducted the long-term continuous observations of the equatorial atmosphere/ionosphere. The EAR, however, has a limited sensitivity to the other full-speck atmosphere radars like the MU radar in Shigaraki, Japan. We are now promoting a project to establish "Equatorial MU (EMU) Radar" next to the EAR. The EMU will have an active phased array antenna with the 163 m diameter and 1045 cross-element Yagis. Total output power of the EMU will be more than 500 kW. Then the sensitivity of EMU will exceed the MU radar. The EMU can detect turbulent echoes from the mesosphere (60-80 km). In the ionosphere incoherent-scatter observations of plasma density, drift, and temperature will be possible. Multi-channel receivers of they system will realize radar-imaging observations. The EMU is one of the key element in the project "Study of coupling processes in the solar-terrestrial system" that is one of the important projects in the Master Plan 2014/2017 of the Science Council of Japan (SCJ). Overview and current status of the EMU project will be shown in the presentation.

Keywords: Atmospheric radar, Equatorial atmosphere, Low-latitude ionosphere, Indonesia

O-Ib-1
Genetics and Genomic Analysis of the Heartwood Traits in Taiwania cryptomerioides

Ying-Hsuan Sun[1], Nai-Wen Tsao[1], Shih-Yin Chen[2], Shin-Hung Pan[1], Joy H Ding[1], Hung Lin[1], Cheng-De Chung[3], Fang-Hua Chu[2], Ting-Feng Yeh[2], and Sheng-Yang Wang[1]

1: National Chung Hsing University, Taiwan
2: National Taiwan University, Taiwan
3: Taiwan Forest Research Institute, Taiwan

Taiwania (Taiwania cryptomerioides Hayata) was first discovered in Taiwan in 1904 by Konishi and named in 1906 by Hayata. This species has been found to sparsely scattered at high elevation in Taiwan. It has been listed by the government as one of the most valuable gymnosperm species in Taiwan due to its good wood quality and richness in secondary metabolites that are found to be antifungi, bacteria, and with potential in medical application. Among these valuable secondary metabolites, lignans are major bioactive secondary metabolites that characterized the heartwood formation in Taiwania. Heartwood formation is the last step of the wood formation process. Therefore, understand the regulation of the lignan biosynthesis and heartwood transition in Taiwania will greatly benefit the genetic improvement of these heartwood traits. Genetic analysis results showed that specific lignan content and sapwood ring number are under strong genetic controls. The transition from sapwood to heartwood was also found to highly coincide with the disappearance of live ray parenchymas. In this presentation, we will discuss the distribution and genetics structure, as well as our current efforts using structural and functional genomics approaches to understand the heartwood traits and identify associated genes in Taiwania cryptomerioides.

Keywords: Taiwania cryptomerioides, heartwood, genomics

O-Ib-2
Reciprocal cross-regulation of VND and SND multigene TF families for wood formation in Populus trichocarpa

Ying-Chung Jimmy Lin
Department of Life Science, Institute of Plant Biology, College of Life Science,
National Taiwan University, Taiwan

Secondary cell wall (SCW) biosynthesis is the biological process that generates wood, an important renewable feedstock for materials and energy. NAC domain transcription factors, particularly Vascular-Related NAC-Domain (VND) and Secondary Wall-Associated NAC Domain (SND) proteins, are known to regulate SCW differentiation. The regulation of VND and SND is important to maintain homeostasis for plants to avoid abnormal growth and development. We previously identified a splice variant, PtrSND1-A2IR, derived from PtrSND1-A2 as a dominant-negative regulator, which suppresses the transactivation of all PtrSND1 family members. PtrSND1-A2IR also suppresses the self-activation of the PtrSND1 family members except for its cognate transcription factor, PtrSND1-A2, suggesting the existence of an unknown factor needed to regulate PtrSND1-A2. Here, a splice variant, PtrVND6-C1IR, derived from PtrVND6-C1 was discovered that suppresses the protein functions of all PtrVND6 family members. PtrVND6-C1IR also suppresses the expression of all PtrSND1 members, including PtrSND1-A2, demonstrating that PtrVND6-C1IR is the previously unidentified regulator of PtrSND1-A2. We also found that PtrVND6-C1IR cannot suppress the expression of its cognate transcription factor, PtrVND6-C1. PtrVND6-C1 is suppressed by PtrSND1-A2IR. Both PtrVND6-C1IR and PtrSND1-A2IR cannot suppress their cognate transcription factors but can suppress all members of the other family. The results indicate that the splice variants from the PtrVND6 and PtrSND1 family may exert reciprocal cross-regulation for complete transcriptional regulation of these two families in wood formation. This reciprocal cross-regulation between families suggests a general mechanism among NAC domain proteins and likely other transcription factors, where intron retained splice variants provide an additional level of regulation.

Keywords: Reciprocal cross-regulation, NAC transcription factors, Alternative splicing, Wood formation, Populus trichocarpa

Biosynthesis of Heartwood and Antitumor Lignans

Masaomi Yamamura[1], Masato Kumatani[1], Keisuke Kobayashi[1], and Toshiaki Umezawa[1,2]

1: RISH, Kyoto University, Japan, 2: RUDGS, Kyoto University, Japan

Lignans are phenylpropanoid dimers in which the monomers are linked by the central carbon (C8) atoms, and are distributed widely in the plant kingdom. Lignan biosynthesis has received widespread interest, mainly because they have various clinically important biological activities. Some lignans are used in medicine and nutritional supplements, such as podophyllotoxin-derived semisynthetic lignans in cancer therapies and sesamin in health and nutrition. In addition, lignans are often biosynthesized and deposited in significant amounts in the heartwood region of trees as a metabolic event of heartwood formation, probably preventing heart rot by heart-rot fungi. Because heartwood formation is specific to trees and does not occur in herbaceous plants, biosynthesis of lignans can be a clue to elucidating heartwood formation mechanisms. Lignans vary substantially in the chemical structure of their basic carbon frameworks, oxidation levels, and aromatic substitution patterns. O-Methylation on the aromatic rings is often crucial in determining the final product distribution including heartwood and antitumor lignans. In this context, we have worked on characterization of O-methyltransferases (OMTs) that catalyze O-methylation of lignans. In this presentation, we outline the recent advances in the study of lignan OMTs.

Keywords: Lignan, O-methyltransferase, heartwood, antitumor, phenylpropanoid

Dynamics and functions of plant bioactive compounds in the rhizosphere

Akifumi Sugiyama

RISH, Kyoto University, Japan

Bioactive compounds produced in plants are important in our life. Various plant-derived compounds are known to have human health benefit, and widely utilized. These compounds also have functions in the rhizosphere, a small region around roots. Rhizosphere is defined as a small area of soil where plant roots have influence, and is possibly one of the smallest "sphere" in the humanosphere. Recent evidence supports that rhizosphere microbes have intense activity and are important for plant growth and health, and for development of sustainable humanosphere. In this presentation, I will summarize recent findings in the bioactive compounds in the rhizosphere and focus on the bioactive compounds from coffee and soybean. Isoflavones are a class of flavonoid predominantly found in legume plants such as soybean, and act as a signal molecule in the rhizosphere to induce the expression of nod genes of rhizobia. We analyzed the secretion of isoflavones into the rhizosphere both in hydroponic culture and in field. Isoflavone secretion is higher at the vegetative stages than at the reproductive stages. The dynamics of isoflavones were then simulated using the analysis of isoflavone decomposition and distribution. These simulation were validated using the rhizobox.

Keywords: Bioactive compounds, Plant, Rhizosphere, Soybean, Isoflavone

Are the evapotranspiration and canopy photosynthesis of Asian tropical rainforests affected by climate change?

Yoshiko Kosugi[1], Satoru Takanashi[2], Shoji Novughi[2], Tatsuro Nakaji[3], Mai Kamakura[1], Wakana Azuma[1], Siti Aisha Shumsuddin[4], and Marryanna Lion[4]

1: Graduate School of Agriculture, Kyoto University, Japan
2: Forestry and Forest Products Research Institute (FFPRI), Japan
3: Hokkaido University, Japan
4: Forest Research Institute Malaysia (FRIM), Malaysia

We have been continuously conducting eddy covariance ecosystem flux observation with micrometeorology at Pasoh Forest Reserve in Peninsula Malaysia since 2002 until now. Pasoh is one of the oldest tower sites in Southeast Asian tropical forests. Up until now they have been revealed the quite stable canopy Evapotranspiration and NEE during these 9 years. Stable evapotranspiration was backboned by the deep root system, and stomatal regulation sensitively occurred depend on soil moisture and vapor pressure deficit. Stable canopy NEE was a result of compensation between decrease of both GPP and ecosystem respiration at the dry periods. Photosynthetic ability declined at the dry period, but soil respiration also declined at that time. These phenomena indicate that dynamic equilibrium of gas exchange at a Southeast Asian tropical rainforest resulted in the very stable canopy fluxes. So stable does not mean static. We evaluated the resilience and its limit under possible climate change, comparing with the results from several other tower sites.

Keywords: Eddy covariance method, Ecosystem Flux, Gas exchange, greenhouse gas, Pasoh Forest Reserve

Effects of inter-annual climate difference on hydrologic and biogeochemical controls on methane dynamics in forest ecosystems

Masayuki Itoh[1], Ayaka Sakabe[2], Yoshiko Kosugi[3], and Takashi Hirano[4]

1: Univ. of Hyogo, Japan, 2: Osaka Pref. Univ., Japan,
3: Kyoto Univ, Japan, 4: Hokkaido Univ, Japan

Forest is considered to function as a sink for methane (CH_4) because of CH_4 oxidation in oxic dry forest soils. However, wetlands often occur in riparian zones especially in forests subject to a humid climate, and peat swamps forest exist in tropical region. To understand how climate condition (e.g., inter-annual differences of precipitation) influences on the CH_4 dynamics in forest ecosystems, we measured CH_4 fluxes and environmental variables, focusing on hydrological and biogeochemical cycles. We conducted observation in two forest ecosystems (temperate forest and tropical peat swamp forest). In temperate forest, CH_4 emission increased in summer and controlled by its inter-annual difference of summer rainfall. In the tropics, peat swamp forest switched from being a CH_4 sink during the dry season to a source of CH_4 during the wet season, and this was dependent on changes in the ground-water level (GWL). In terms of inter-annual variability, CH_4 emissions were constrained in dry and pluvial years, which can shift the subsurface soil to a more oxidized condition. Our results suggest that increase of precipitation pattern with global warming both temperate and tropical region can enhance CH_4 emission from both forest ecosystems.

Keywords: Methane, forest, wetland, precipitation

Multiple dimensions of fog and ecosystem function in a subtropical montane cloud forest

Shih-Chieh Chang

Department of Natural Resources and Environmental Studies, National Dong Hwa University, Taiwan

Fog as a meteorological phenomenon, might exert significant influences on processes and state parameters of some coastal and mountainous ecosystems. Around 50% of forested area in Taiwan could be considered as those fog-affected ecosystems. The Chi-Lan Mountain (CLM) site, which is located in northern Taiwan at an elevation of 1650 m, is a main study site of fog and fog-related ecosystem researches in Taiwan. Fog meteorology has been monitored since 2002 and the annual proportions of foggy time were between 33% and 37%. Fog occurred in a clear seasonal pattern, with highest rate of foggy condition of up to 52% of the time in January, while in July the proportion of foggy time was 13%. Forest canopy intercepted an amount of fog deposition of 241 ± 40 mm yr-1, which, due to the high annual precipitation, contributed only 6% to 10% to the total water input. However, the nutrient concentrations of fog water were much higher than those in rain water, which led to an additional input of nutrients to the ecosystem.

Fog not just brings material (water, nutrients, and pollutants) to the ecosystem, the existence of fog itself changes several micrometeorological parameters and thus affects those ecosystem processes that are driven by the parameters. A pronounced effect of fog to the plant environment is the reduction of solar radiation, which leads to an immediate reduction of photosynthetic rate. However, the extent of reduction might be species-specific. The *Chamaecyparis obtusa* var. *formosana*, which dominates the vegetation of the CLM site, had its photosynthesis less affected than the Cryptomeria japonica, which was introduced and planted in the close vicinity. A close field monitoring of leaf CO2 fluxes showed that the apparent quantum yield was not reduced under foggy condition. The stomatal conductance seemed not to be reduced by the fog droplets that have deposited on the leaf surface. The high air humidity under foggy condition reduces the vapor pressure deficit and thus the evapotranspiration of the ecosystem. A consequence of this is the constantly high soil water content. Soil CO2 efflux of the CLM site was largely constrained compared to other ecosystems with similar mean annual temperature.

Further exploration of the effects of fog on ecosystem function is necessary. We are aiming in building ecosystem models that are capable of simulating vegetation growth under foggy conditions. Such models might be an important tool for the management and conservation of cloud forests under future climate change scenarios.

Keywords: fog, cloud forest, atmospheric deposition, carbon flux

The linkage between fine root dynamics and community structure in subtropical evergreen forest

Jyh-Min Chiang[1], Pui-Wai Leung[1], Li-Wan Chang[2], and Cho-Ying Huang[3]

1: Tunghai University, Taiwan
2: Taiwan Forestry Research Institute, Taiwan
3: National Taiwan University, Taiwan

Fine roots are gateways of belowground resources for plants. To study the roles of fine roots in the trait composition of plant communities and ecosystem carbon dynamics, we examined the functional traits of fine roots (specific root length, nutrient contents, root longevity), their biomass and temporal dynamics (productivity and mortality) in 9 selected quadrats (20m×20m) of Lienhuachih Forest Dynamic Plot (Nantou County, Central Taiwan). Combined with the detailed census data (all trees greater than 1cm DBH were tagged, identified to species, DBH measured, and precisely mapped), aboveground functional traits, and aboveground carbon stocks and dynamics, we propose to ask the following questions: (1) What is the biomass stock, productivity, and turnover of fine roots in a typical subtropical hardwood forest of Taiwan (represented by Lienhuachih forest)? (2) Are productivity, turnover, and phenology of fine roots and leaves correlated? (3) Are functional traits in the aboveground and belowground correlated to form character syndromes? (4) Are species diversity and fine root productivity positively correlated? Is niche complementarity the major mechanism in forming this relationship? The fine root density and biomass varies between plots and depths, with most fine roots distributed at shallow layer (0-7cm). In the principal component analysis of aboveground and belowground traits, we found significant association between leaf traits and fine root traits. Community weighted means of leaf specific leaf area and leaf area were positively correlated with specific root area and specific root length. Fine root productivity and biomass were also correlated with species diversity when diversity measures with high q value (more sensitive to dominant species) were used. Our results establish linkages of functional traits and ecosystem processes between the domains of aboveground and belowground in forested ecosystems. Such linkage will provide comprehensive understandings of community structure and ecosystem properties in forested ecosystems and eventually improve the accuracy in the quantifications of forest carbon balance. In addition, we will also identify the roles of fine roots in shaping the functional structure of plant communities and biodiversity-ecosystem function relationships.

Keywords: fine roots, plant functional traits, carbon sequestration, ecosystem functions, minirhizotrons

O-Id-1

Globalization and invasive ants: polydomy as an enigmatic characteristics

Kazuki Tsuji and Aye Thanda Win

Dept. Agro-Environmental Sci., University of the Ryukyus, Japan,

Globalization of economy is a strong driver of biological invasion. Ants are among the most invasive animals. A characteristic shared by many invasive ants is polydomoy in which a colony has multiple nests. Why are some ants monodomous (single nest per colony) while others are polydomous? We compared response to heterogeneous resource distribution between monodomous and polydomous ants by focusing on the genus Pheidole (monodomous native P. noda vs. polydomous invasive P. megacephala). First, we tested the physiological integration hypothesis that maintains that nests in a polydomous colony exchange complementary resources and the colony as a whole is physiologically integrated. A series of laboratory experiments with nests connected by tubes revealed that when complementary foods (lacking protein or lacking carbohydrates) were provided to each of the connected nests, the polydomous ant flourished. However, when nests were disconnected by plugging the tubes, the polydomous ant failed, supporting the physiological integration hypothesis. In marked contrast, the monodomous ant kept the highest performance over five weeks even when only a nutritionally biased food was provided. This suggests that they store a large amount of nutrients in adult bodies that can be used when the outside food availability becomes poorer. The above suggests that polydomous ants and monodomous ants might adopt different strategies to heterogeneity in resource distribution. Polydomy might be a strategy to counter it spatially by extending the area of resource searching, whereas monodomous ants might deal with it temporarily by withstanding resource depressed periods of time. Human disturbance often creates spatially heterogeneous environments that might be a factor aiding invasion of polydomous ants.

Keywords: Ants, polydomy, monodomy, nutrition, biological invasion

O-Id-2

The importance of urban pest management on the sustainable future of urban ecosystem

Chow-Yang Lee

Urban Entomology Laboratory, Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia. Email: chowyang@usm.my

Human activities affected the urban landscape through land cover, land use conversion, modification of biophysical and ecological processes, and alteration of species habitat and assemblages. These changes also destroyed the clear borders between the urban and natural ecosystems. The urban sprawl increases the risk of the urban environment to infestation by pests and the disease agents that they carry. Globalization and the advances in modern transportation system also have promoted the spread of invasive pest species. Urban pests such as termites, cockroaches, mosquitoes, rodents, flies, fleas, house dust mites and pest ants are severely affecting the physical and mental well-being of the urbanites, their property, and the urban ecosystem. These urban pests are managed using novel and conventional pest management tools. Nevertheless, numerous challenges including insecticide resistance, pesticide over-application, human behavior, and climate change dampened the success of these strategies. In this presentation, I will discuss the impact of urban pests on humans and their resources in the urban ecosystem, the challenges we face in urban pest management and the possible solutions.

Keywords: human activity, insecticide resistance, mosquitoes, rodents, urban pest management, termites.

How sublethal neonicotinoid insecticides weaken honey bee colonies?

En-Cheng Yang[1], Ming-Cheng Wu[2], Kuang-Hui Lu[2], and Yun-Ru Chen[1]

1: Department of Entomology, National Taiwan University, Taipei, Taiwan
2: Department of Entomology, National Chung Hsing University, Taichung, Taiwan

Multiple factors have been associated with colony losses, including the parasitic mite, the fungal parasites, viruses and widespread pesticide application. Although the putative causes of honey bee loss have not yet been determined, the large-scale use of systemic pesticides, such as clothianidin, imidacloprid, and thiamethoxam, and other pesticide types has been implicated as a major contributing factor. Accumulating evidence indicates that at sublethal doses, neonicotinoids cause honey bee brain dysfunction and reduce immunocompetence, leading to impaired navigation and olfactory learning and memory, and susceptibility to pathogens. The sublethal effects of pesticides on honey bees have also been investigated in the larval development stages. Pesticide exposure during the larval development stages prolongs larval development and shortens adult longevity. In addition, the density of synaptic units in the calyces of mushroom bodies in the heads decreases; this effect has been further associated with the abnormal olfactory learning ability of adult honey bees exposed to sublethal doses of imidacloprid during the larval stage. Therefore, numerous physiological aspects of honey bees might be altered after exposure to pesticides at sublethal doses, regardless of the developmental stage. Further investigation on the global gene expression changes in the heads of newly emerged adults observed that 578 genes showed more than 2-fold changes in gene expression after imidacloprid exposure. This information might aid in understanding the effects of pesticides on the health of pollinators.

Keywords: Colony collapse disorder, Honey bee, Neonicotinoid insecticides, Larva, Sublethal effects

How will climate change affect a crop system that includes soybeans (crop), aphids (pest), and ladybugs (biocontrol agent)?

Hsin-Yi Lee[1], Ying-Jie Wang[1], and Chuan-Kai Ho[1,2]

1: Institute of Ecology and Evolutionary Biology, National Taiwan University, Taiwan
2: Department of Life Science, National Taiwan University, Taipei, Taiwan

While climate change (e.g., elevated temperature and CO_2) and trophic structure individually affect species performance, their interactive effects remain unclear. This study empirically examined how elevated temperature, elevated CO_2, and trophic structure may individually and interactively affect a tri-trophic agroecosystem that included soybeans (crop), soybean aphids (pest), and seven-spot ladybugs (biocontrol agent). Specifically, this study used environmental chambers to apply the following treatments. Temperature treatment included control, $2^{\circ}C$, and $4^{\circ}C$ warming (all with daily fluctuation). CO_2 treatment included control and elevation (500 and 1000 ppm, respectively). Trophic structure treatment included Tro1 (soybean), Tro2 (soybean + aphid), and Tro3 (soybean + aphid + ladybug).
The results showed that temperature, CO_2, and trophic structure individually or interactively affected crop (soybean) and pest (aphid) performance. For crop performance, warming generally reduced aboveground soybean biomass under control CO_2, but increased aboveground soybean biomass under elevated CO_2. Pest presence (Tro2) reduced aboveground soybean biomass, but adding biocontrol agent (ladybug) (Tro3) recovered the reduction, suggesting a tropic cascade from biocontrol agent to crop. For pest performance, warming or biocontrol agent presence alone reduced aphid populations, while warming, CO_2 and trophic structure effects also interacted in this case. The results suggest that climate change impact assessment may need to consider the interplay between abiotic (e.g., temperature and CO_2) and biotic factors (e.g., trophic interactions) in order to make a more accurate prediction.

Keywords: Biocontrol, Climate warming, CO_2 elevation, Crop, Pest

O-IIa-1

Auroras and precipitating particles above the high-latitude boreal forests

Jih-Hong Shue

Institute of Space Science, National Central University, Taoyuan, Taiwan

Much of the landscape in the high-latitude region is covered by boreal forests. Boreal auroras can be often seen above the forests when geomagnetic activity is high. The auroras are produced by precipitating particles resulted from an interaction between the solar wind and magnetosphere. Unstructured and structured characteristics of precipitating particles create diffuse and discrete auroras, respectively. When the interplanetary magnetic field (IMF) is southward, the solar wind energy is stored in the tail and then suddenly released into the upper atmosphere, creating two-cell first and substorm auroras later. When the solar wind dynamic pressure is enhanced, compression auroras can be filled up in most of the polar cap region. Sun-aligned, cusp-aligned, or crewcuts auroras can be seen when the geomagnetic activity is low, i.e., when the IMF is northward or radial. In addition, omega auroras can be observed at the poleward boundary of the auroral oval during the recovery phase of a substorm. The central part of the omega structure can be the activity center of pulsating auroras. In this presentation, different types of auroras will be reviewed and the characteristics of precipitating particles that possibly cause the auroras will be discussed.

Keywords: Auroras, Precipitating Particles, Interplanetary Magnetic Fields, Solar Wind-Magnetosphere Interactions, Polar Cap

O-IIa-2

Geospace Exploration Project: Arase

Yoshizumi Miyoshi[1], Iku Shinohara[2], Takeshi Takashima[2], Kazushi Asamura[2], Shiang-Yu Wang[3], Yoichi Kazama[3], Satoshi Kasahara[4], Syoichiro Yokota[5], Takefumi Mitani[2], Nana Higashio[2], Yoshiya Kasahara[6], Yasumasa Kasaba[7], Satoshi Yagitani[6], Ayako Matsuoka[2], Hirotsugu Kojima[8], Yuto Katoh[7], Kazuo Shiokawa[1], and Kanako Seki[4]

1: ISEE, Nagoya University, Japan, 2: ISAS, JAXA, Japan, 3: ASIAA, Taiwan
4: University of Tokyo, Japan, 5: Osaka University, Japan, 6: Kanazawa University, Japan,
7: Tohoku University, Japan, 8: Kyoto University, Japan

Geospace Exploration Project; ERG addresses what mechanisms cause acceleration, transportation and loss of MeV electrons of the radiation belts and evolutions of space storms. Cross-energy and cross-regional couplings are key concepts for the project. In order to address questions, the project has been organized by three research teams; satellite observations, ground-based observations, and modeling/data-analysis studies, and interdisciplinary research are realized for comprehensive understanding of geospace. The Arase satellite was successfully launched on December 20, 2016.Until now, Arase has observed several geomagnetic storms driven by coronal hole streams and CMEs, and several interesting features are observed associated with geomagnetic disturbances. The six particle instruments; LEPe/LEPi/MEPe/MEPi/HEP/XEP have shown large enhancement as well as loss of wide energy electrons and ions and variations as well as changes of pitch angle and energy spectrum. The two field/wave instruments: PWE and MGF observed several kinds of plasma waves such as chorus, hiss, EMIC as well as large scale electric and magnetic field variations. LEP-e has been developed in ASIAA, Taiwan, and the ERG data center in Taiwan has been operated by NCKU and ASIAA, Taiwan. In this presentation, we will report overview and some results highlights and discuss future collaborations between Taiwan and Japan.

Keywords: Geospace, Arase (ERG), Space Science

Parameters of magnetospheric locations associated with occurrences of aurora and comparison with their ionospheric counterparts

Sunny W. Y. Tam[1], Chih-Yu Chiang[1], Tzu-Fang Chang[1,2], Wun-Jheng Syugu[1,3], Shiang-Yu Wang[3], Yoichi Kazama[3], Bo-Jhou Wang[3], Satoshi Kasahara[4], Shoichiro Yokota[5], Yoshizumi Miyoshi[2], and Iku Shinohara[5]

1: Institute of Space and Plasma Sciences, National Cheng Kung University, Taiwan
2: Institute for Space-Earth Environmental Research, Nagoya University, Japan
3: Academia Sinica Institute of Astronomy and Astrophysics, Taiwan
4: The University of Tokyo, Japan, 5: JAXA/ISAS, Japan

The Energization and Radiation in Geospace (ERG) satellite (nicknamed "Arase"), launched from the Uchinoura Space Center in December 2016, began its regular observations of the inner magnetosphere in March 2017. Among the various instruments aboard the Japanese satellite is the Low-Energy Particle Experiments - Electron Analyzer (LEP-e), developed by a Taiwanese team that featured members from Academia Sinica and National Cheng Kung University. The instrument measures electrons in the energy range between ~20 eV and 19 keV. As ERG's orbit covers the range of McIlwain L-parameter roughly from 2 to 9, overlapping with that of the auroral oval in the ionosphere, LEP-e is suitable for studying the magnetospheric origins of auroral electrons. In this study, we statistically compare the Auroral Electrojet (AE) index with LEP-e measurements as well as ERG data from the Medium-Energy Particle Experiments - Electron Analyzer (MEP-e). The correlation coefficients between the AE index and measurements at various electron energies enable us to identify the magnetic local times (MLT) together with L for the magnetospheric locations that are most often in association with occurrences of aurora. These parameters, MLT and L, are compared with those at ionospheric locations where auroral electron precipitation is statistically the dominant density-perturbation effect during disturbed times according to observations by the FORMOSAT-3/COSMIC satellites.

Keywords: aurora, geomagnetic disturbances, magnetosphere, ionosphere

Energy flow from the solar wind to the Earth during substorm: Simulation results

Yusuke Ebihara[1] and Takashi Tanaka[2]

1: RISH, Kyoto University, Japan, 2: Kyushu University, Japan

A substorm is one of the most severe disturbances in the magnetosphere. Sudden brightening of aurora is its visual manifestation. When the substorm occurs, a huge amount of energy, more than 1011 W, is consumed in the auroral ionosphere. The energy is comparable to the averaged energy consumed in United States. An immediate question is where the energy comes from. We analyzed the results of the global magnetohydrodynamics (MHD) simulation. The solar wind kinetic energy is converted to the electromagnetic energy in the cusp/mantle region when the interplanetary magnetic field is southward. The electromagnetic energy is transported to the lobe region in the tail part of the magnetosphere. The magnetic energy is stored in the lobe. When the magnetic field line is reconnected in the near-Earth region, the stored magnetic energy is released. The released electromagnetic energy is transported to the Earth. On the way to the Earth, the electromagnetic energy is converted to the kinetic energy and/or the internal energy, and back to the electromagnetic energy. To visualize the pathway of the energy, we introduced an integral curve of the Poynting flux (S-curve). The S-curve represents the pathway of the electromagnetic energy, and shows a spiral with its center moving toward the ionosphere. The S-curve appears to be attached to the dynamo where the electromagnetic energy is supplied. The S-curve and the dynamo are compared to the heart and the blood vessels in the human body because the dynamo supplies the energy and the S-curve carries it. Just before the expansion onset of a substorm, another dynamo appears in the near-Earth region, which is closely related to the generation of the upward field-aligned current manifesting the sudden brightening of the aurora. We will overview the energy flow and conversion of the energy originating in the solar wind to the Earth, and will answer the question why a huge amount of energy (>1011 W) is consumed in the polar ionosphere during the substorm expansion.

Keywords: Aurora, energy transfer, energy conversion, numerical simulation

O-IIa-5

<center>Magnetic explosion in the Sun-Earth system: Magnetic reconnection</center>

<center>Seiji Zenitani</center>

<center>RISH, Kyoto University, Japan</center>

Phenomena like solar flares and auroras are direct/indirect consequences of magnetic explosion in space, called "magnetic reconnection." The magnetic reconnection event abruptly releases a huge amount of magnetic energy, as it changes the topology of magnetic field lines. Owning to its fundamental importance in the Sun-Earth system and in particular in the Humanosphere, the physics of magnetic reconnection has long been studied since 1950's.

In this talk, I will introduce selected topics in magnetic reconnection research. After general introduction, I will review theoretical studies by means of supercomputer simulations. Principles of simulation methods and selected results by our group will be demonstrated. Then I will introduce spacecraft observation of magnetic reconnection in a near-Earth space, by Japanese Geotail spacecraft and by NASA's Magnetospheric Multiscale (MMS) spacecraft. Comparison of numerical simulations and MMS plasma observations will be also presented.

Keywords: Space, Plasma, Magnetic field, Magnetic reconnection

O-IIb-1

<center>**Establishment of an early warning system for malaria in Southern Africa, incorporating climate predictions – the iDEWS project**</center>

<center>Noboru Minakawa[1], Neville Sweijd[2], Swadhin Behera[3], Masahiro Hashizume[1], Takeshi Ikeda[3], Yoonhee Kim[1], Peter Witbooi[4], Gbenga Abiodun[4], Eric Mabunda[5], Francois Engelbrecht[6], Willem Landman[7], Philip Kruger[5], Raj Maharaj[8], Yushi Morioka[2], Masami Nonaka[2], and Ataru Tsuzuki[1,5]</center>

<center>1: Institute of Tropical Medicine, Nagasaki University, Japan
2: Alliance for Collaboration on Climate and Earth Systems Science (ACCESS/ CSIR)
3: Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
4: University of the Western Cape
5: Tzaneen Malaria Institute, Department of Health, Limpopo
6: Council for Scientific and Industrial Research
7: University of Pretoria
8: South African Medical Research Council</center>

In Southern Africa, where poverty is prominent, lives are threatened by infectious diseases. Recent climate changes have increased the possible risks of infectious disease outbreaks in unexpected regions and on scales previously unknown. This project is developing an infectious disease outbreak prediction model that incorporates the influences of a variety of environmental factors into the climate change models in order to predict the outbreaks of malaria that is predominantly affected by climate conditions. The ultimate aim of the research is to build an early warning system that can be applied in implementing effective countermeasures for malaria. By effectively utilizing the informative resources available to government institutions based on the early warning system, the number of people suffering from malaria can be reduced. The predictions can be applied through approaches involving appropriate preventative measures during warning periods and in high-risk regions (including implementation of countermeasures, preparation of medicines and diagnostic kits for an early response). In the future, the system can also be expected to be developed and deployed in areas outside Southern Africa.

Keywords: Malaria, climate, prediction, early-warning, Africa

O-IIb-2

Plant-based repellents to control mosquitoes

Theeraphap Chareonviriyaphap

Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok, Thailand

Numerous plants with insect repelling properties are native to the tropics. These native plant species have a history of use for personal protection against biting insects. From our investigation, almost 40 plant species within 14 plant families were determined and some demonstrate excellent mosquito repellent properties. Of these, 9 plant species were characterized using an excito-repellency test system against several Thai mosquito species. Results from these studies revealed that at least four essential oils extracted from plants demonstrated promising insect repellent activity. These active ingredients show promise for further development into formulations that may serve as alternatives to DEET or possibly be used as natural bio-pesticides to kill mosquitoes.

Keywords: Irritant, Repellent, Mosquitoes, Control

O-IIb-3

Dengue Vector Control and Aedes aegypti resistance to insecticides from Indonesia

Intan Ahmad

ITB, Bandung Institute of Technology, Indonesia
UNJ, Jakarta State University, Indonesia

Indonesia, with the population of 266,5 million, is an archipelago and located at the equator, dengue hemorrhagic fever (DHF) has been a health problem since the first outbreak in 1968. DHF is endemic throughout Indonesia and the occurrence is reported all year round. Several DHF outbreaks have been reported and the incidence has increased significantly from year to year. For example, in 2010, 150,000 cases with 1317 deaths, and recently, in 2016, 201,885 cases with 1585 deaths were reported. The government with the help from pest control companies have extensively used insecticides to control Aedes aegypti, the main vector of DHF; although additional other methods, i.e., source reduction by community participation has also been implemented since 1992. In addition, some new methods such as sterile insect technique and a biological control using Wolbachia bacteria have also been tried and proposed. Whilst, resistance of Ae. aegypti to insecticides has become a problem, reports from several big cities in Indonesia, showed that Ae. aegypti were resistant to some commonly used insecticides, i.e., pyrethroids. Thus, the availability of data concerning resistance status of mosquitoes to insecticide is importance, as this data could be used to design a better integrated vector management strategies.

Keywords: DHF, control, Aedes aegypti, Indonesia, insecticide resistance

O-IIb-4
Dengue Prevention: Alternative Approaches in Managing Aedes Mosquitoes

Wan Fatma Zuharah, Ahbi Rami Rattanam, Thiagaletchumi Maniam, and Rohaiyu Rodzay

Medical Entomology Laboratory, Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia

The vector control program has become challenging due to the emergence of resistance in Aedes mosquitoes. Therefore, the integrated vector management (IVM) has been proposed as a new concept to optimize the use of resources to maximize the efficacy and sustainability of the vector control. Considering the good performances of Metarhizium anisopliae and Ipomoea cairica against Aedes larvae, here we investigated the possibility of integrated synergism effects of these two natural agents into one formulation tested against vectors of dengue fever, Aedes aegypti and Aedes albopictus. The study revealed the compatibility of I. cairica leaf extracts and M. anisopliae was at the maximum level of 450 ppm and 6×106 conidia/mL, respectively. The synergistic effects of these two integrated agents had shown high susceptibility and caused faster larval mortality for Aedes albopictus at 100% within 6 days of the treatment periods and 15 days for Ae. aegypti. The effectiveness of these integrated agents was reduced to less than 50% after day 21. The current finding shows that the combination of M. anisopliae with I. cairica can produce strong synergistic interaction justified the possibilities of combining these two agents. In facts, the effectiveness of this formulation towards both Aedes larvae has approved the potential to be used in IVM to curb dengue diseases.

Keywords: Aedes, Dengue, Prevention, Metarhizium Fungi, Plant Extract

O-IIb-5
Mosquito reproduction control and the effects of mosquito host factors to dengue virus replication

Shin-Hong Shiao

Department of Parasitology, National Taiwan University, Taipei, Taiwan

Mosquitoes transmit many devastating diseases, including malaria, dengue, and Zika, which together are responsible for over one million deaths per year. Here, we identified a unique feature of Aedes aegypti Notch (AaNotch) in the control of the sterile-like phenotype in female mosquitoes. Silencing AaNotch with a reverse genetic approach significantly reduced the fecundity and fertility of the mosquito. Silencing AaNotch also resulted in the prevention of micropyle formation, which led to impaired fertilization. We demonstrated that non-canonical Notch signaling is essential for controlling fertility in the mosquito. The mosquito Aedes aegypti is also the principal global vector of dengue viruses. Previous studies have indicated that proteins from mosquito salivary gland may influence the dengue virus infectivity in mammalian cell lines. Our results showed that mosquito saliva proteins are associated with dengue virus proteins, and these interactions are crucial for dengue virus infectivity. In addition, we identified a mosquito saliva protein, Calreticulin, which is a prM protein-binding protein and is crucial for dengue virus replication in the mosquito. Our study reveals the pleiotropic action of signaling in the control of mosquito reproduction, and dengue-mosquito interactions, thereby providing new insight for developing environmentally-friendly methods to target vector reproduction.

Keywords: Aedes aegypti, dengue, Notch signaling, saliva protein

O-IIc-1

Wirelessly-Powered CMOS Electrochemical Sensing Interface Design

Shao-Yung Lu, Yi-Chia Chen, and Yu-Te Liao,

Department of Electrical and Computer Engineering, National Chiao Tung University, Taiwan

With the advance of silicon technologies, miniaturized sensing devices enhance the sensing capability around our environments. Sufficient energy sources for the wide deployments of tiny sensors are critical issues to implement ubiquitous sensing systems in the future. Wireless powering technology enables the wireless energy transfer to the end devices without the complexity of the powerline routing. To realize the self-sustaining wireless sensors, low-power consumption and high-efficiency power management in the interface circuits are the keys. In this talk, our recent works of wireless powering electrochemical sensor interface circuits with ultra-low-power design techniques and high-efficiency power management architecture will be presented.

A wirelessly-powered electrochemical sensing chip with high-efficiency adaptive power management for a wide RF-powering range and a low-noise chopper-stabilization potentiostat for high-resolution electrochemical current detection is fabricated using a 0.18-μm CMOS process. A novel, power-aware, multiple-path, RF-energy harvesting front end extends the high-efficiency (>20%) RF-powering range to 8.5 dB. In the sensor-readout interface, a chopper-stabilization potentiostat with an oscillator-based current readout achieves a 3.3-pA current resolution in the current range of 800 nA and an R2 linearity of 0.9989 while consuming only 4.4 μW. The power efficiency of the electrochemical readout interface is 0.17 and the dynamic detection range is 107 dB.

Keywords: Wireless power transfer, CMOS, Electrochemical sensing, Batteryless

O-IIc-2

Some preliminary theoretical and experimental research results of WPT system between two points using Microwave power beam at 2.45 GHz

Dao Khac An[1,2], Nguyen Chung Dong[2], and Nguyen Tien Thanh[2]

1: Institute of Fundamental Research and Application, Duy Tan University, Vietnam
2: Energy Materials and Devices Lab., Institute of Materials Science,
Vietnam Academy of Science and Technology, Vietnam

This presentation firstly outlines several main research activities in Vietnam concerning WPT for charging electronic equipments and Microwave Power Transfer (MPT) using microwave power beam at 2.45 GHz. After that, the presentation will report shortly some theoretical results of setting up 1D model of WPT from the GEO to the Earth, and of the results of the numerical estimated data of complex refractive indexes by the altitude from 100 km up to 1000 km at the several different frequencies. These results could be used for solving numerically to find the transfer efficiency of mathematical problem of WPT from GEO to the Earth at certain conditions. Following that some preliminary experimental results of WPT system using microwave power beam at 2.45 GHz frequency are offered, these results are including the results of setting up the WPT system, the design and fabrication of multi elements rectenna arrays, and of the measurement efficiencies data of multi elements rectennas and WPT system between two points on the earth. Some issues and further research orientation also will be discussed.

Keywords: WPT system, estimation of refractive index of earth atmosphere, numerical solution of transfer efficiency; multi elements rectennas

Design of a 13.56-MHz Active Rectifier with Digital Offset Compensation for Implantable Medical Devices

Fu-Bin Yang and Po-Hung Chen

Institute of Electronics, National Chiao Tung University, Hsinchu, Taiwan

In this paper, a 13.56 MHz power-efficient CMOS active rectifier is proposed for implantable medical devices. The digital offset compensation technique automatically compensates the turn-off and turn-on delays to minimize the reverse leakage current while obtaining the maximum available power to improve the conversion efficiency. Moreover, the paper introduces regulation techniques to provide one or two regulated outputs without using additional dc-dc converters.

Keywords: Active rectifier, wireless power transfer, automatic digital offset compensation, implantable medical device

Signal Communication in Wireless Power Transfer For Internet of Things

Heng-Ming Hsu

Department of Electrical Engineering, National Chung Hsing University, Taichung, Taiwan

A wireless power transfer system for internet of things application is demonstrated in this paper. The system includes transmitter, receiver, magnetic resonance coil, and signal communication. To monitor the transferred power, a communication path is established by using the micro-controller, signal modulator/demodulator, and voltage/current sensing circuits. All modules are integrated in a printed circuit board and incorporates with a micro-controller with embedded software.

Keywords: Internet of things, magnetic resonance, signal communication, transmitter, receiver, wireless power transfer

Recent Research of Wireless Power Transfer at RISH for a Smart, Happy, and Resilient Society

Naoki Shinohara

RISH, Kyoto University, Japan

In RISH, Kyoto University, we join research and development program of Japan Science and Technology Agency (JST) entitled "The Last 5X innovation R&D Center for a Smart, Happy, and Resilient Society via a Microwave Power Transfer (MPT) Technology. The 'Last 5X' is to achieve a cordless environment at home within 5 meters from a wall, outside monitoring within a distance from 50 meters to 5 kilometers, sharing information on a daily basis with family members and friends living far from you (up to 500 km). We are mainly developing a MPT-driven wearable battery-less sensors, a wireless charging system of an electric bicycle via microwaves, a MPT-driven battery-less sensors to rescue missing person whose power is provided from a flying drone, and inspection system of infrastructure, e.g. tunnel, by a microwave power. In this talk, I show the recent results of the MPT experiments in RISH.

Keywords: Microwave Power Transfer (MPT), Wireless Power Transfer (WPT), Sensor, Drone

Lessons Learned from the Ongoing Development of the Ionospheric Dynamics Explorer and Attitude Subsystem Satellite (IDEASSat)

Loren Chang[1,2,] Chi-Kuang Chao[1,2], Amal Chandran[3,4], Cheng-Ling Kuo[1,2], and Jann-Yenq Liu[1,2]

1: Institute of Space Science, National Central University, Taiwan
2: Center for Astronautical and Space Physics, National Central University, Taiwan
3: School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore
4: Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA

In recent years, there has been considerable interest in the use of small satellites as scientific observation platforms. Such spacecraft have the potential to be inexpensive with rapid development and deployment times. However, significant challenges exist including reduced capability of small platforms, as well as development constraints in a university environment. We present the ongoing development of the Ionospheric Dynamics Exploration and Attitude Subsystem Satellite (IDEASSat) – a 3U CubeSat currently in the Phase C Final Design stage, with expected delivery in 2020. IDEASSat is a 3U CubeSat carrying the Compact Ionosphere Probe (CIP) – an all-in-one plasma sensor with flight heritage from the Advanced Ionosphere Probe (AIP) currently functioning aboard FORMOSAT-5. CIP has Planar Langmuir Probe, Ion Trap, Ion Drift Meter, and Retarding Potential Analyzer modes, which will provide in-situ measurements of ionospheric structure, variability, as well as scintillation irregularities from a nominal 500 km Sun-synchronous orbit. The mission is funded by the Taiwan National Space Organization (NSPO), Ministry of Science and Technology, and Ministry of Education. The spacecraft subsystems are a combination of commercial off the shelf (COTS) components, as well as self-developed components designed in collaboration with the University of Colorado and the Indian Institute of Space Science and Technology through the International Satellite Program in Research and Education (INSPIRE) and can be considered the second spacecraft from this consortium. Key challenges include high precision pointing requirements of CIP, as well as the limited power and downlinkable data volume. We present the concept of operations, preliminary design, as well as challenges and lessons learned in the development of IDEASSat. In conjunction with INSPIRESat-1 – a 6U+ CubeSat with the same payload, ionospheric measurements from IDEASSat will extend the coverage of in-situ ionospheric observations from the FORMOSAT-5 and will further enhance our observational coverage of ionospheric variability and irregularities. Development of IDEASSat is also serving to build spacecraft design and operations capacity at NCU, while also providing students with a better appreciation of the relation between space physics and the spacecraft operational environment.

Keywords: Ionosphere, CubeSat, Small Satellite, Spacecraft Design

Convective-scale assimilation with the GPS-zenith total delay and radar data and its impact on heavy rainfall prediction in Taiwan

Shu-Chih Yang[1], Zih-Mao Huang[2], Ching-Yuan Huang[1,3], and Chih-Chieh Tsai[3]

1: Dept. of Atmospheric Sciences, National Central University, Taiwan
2: Central Weather Bureau
3: Taiwan Typhoon Flood Research Institute, Taiwan

The GPS ZTD observations are assimilated in addition to the radar data for the purpose of convective-scale data assimilation and heavy rainfall prediction. In this study, the performance of this convective-scale ensemble data assimilation system is investigated based on a heavy rainfall event in Taiwan on 10 June, 2012. The assimilation is performed using the framework of WRF-Local Ensemble Transform Kalman Filter with a model grid-spacing of 2 km.
While assimilating either ZTD or radar data has positive impact on improving the short-term precipitation prediction, radar data has a dominant role in improving the rainfall intensity and tends to over-predict the rainfall amount during the first 3-h forecast. In comparison, ZTD data has a great impact on the moisture field by providing the meso-convective scale moisture corrections. In particular, it can compensate the non-precipitating areas, where limited radar data is available. Results show that the forecast skill in rainfall prediction is best when both the ZTD and radar data are assimilated. Therefore, ZTD and radar data can be complementary for improving short-term precipitation prediction. However, considering the observation density and the characteristic scale of the moisture under the synoptic-scale condition, the impact of ZTD data needs to be optimized with a horizontal localization scale broader than that used for radar data assimilation.

Equatorial Plasma Bubble for Space Weather Monitoring in Malaysia

Suhaila M Buhari

GNSS & Geodynamics Research Group, Universiti Teknologi Malaysia

The equatorial ionosphere most often shows a nighttime plasma irregularity that is commonly referred as equatorial plasma bubble (EPB). EPBs could cause rapid fluctuations in the amplitude and phase of the propagation radio signals and crucial to communication and navigation systems. EPBs are generated by Rayleigh-Taylor instability (RTI) during high solar activity. But the onset time and location of the EPBs are ubiquitous because the seed of the initial perturbation is not completely understood. In this study, high-density GPS receivers in Malaysia will be utilized to obtain two-dimensional maps of EPB with 5-min interval. The post-processing GPS data can be collected from Department of Survey and Mapping Malaysia (DSMM) which currently owned 99 GPS receivers called Malaysia Real-Time Kinematics Network (MyRTKnet). On the other hand, Geomatic Innovation Research Group (GnG), Universiti Teknologi Malaysia (UTM) has real time GPS data from 18 receivers, which can be used for real-time monitoring of EPB in the future. Statistical results from 2008 to 2013 showed that the EPB structures tend to occur successively in one night during equinoxes in high solar activity years. The horizontal modulation in a form of wavelike structures along the observed longitudes might be responsible for the development of successive EPBs. The wavelike structures that appear at the bottom-side of the ionospheric layer could not be detected from GPS data, where radio beacon experiment from low earth orbit satellite (LEOS) such as Communications/Navigation Outage Forecasting System (C/NOFS) will be useful. Results from the beacon receivers in Kuala Lumpur and Georgetown will be discussed.

The development of data assimilation in the ionospheric space weather

Chia-Hung Chen[1], Charles Lin[1], Tomoko Matsuo[2], and J. Y. Liu[3,4]

1: Department of Earth Sciences, National Cheng Kung University, Tainan, Taiwan
2: Ann and H.J. Smead Department of Aerospace Engineering Sciences,
University of Colorado at Boulder, CO 80309-0429
3: Institute of Space Science, National Central University, Chung-Li, Taiwan
4: Center for Space and Remote Sensing Research, National Central University, Chung-Li, Taiwan

An ionospheric data assimilation forecast model has been developed by ensemble Kalman filter (EnKF) to adjust ionospheric observations into a thermosphere-ionosphere-electrodynamics general circulation model (TIEGCM). Using this assimilation model, the performances of ionospheric forecast during the geomagnetic storm conditions are further evaluated in this study. Results suggest a rapid assimilation-forecast cycling (10-min in this study) can greatly improve the quality of the model forecast. Furthermore, updating the thermospheric state variables in the coupled thermosphere-ionosphere forecast model in the assimilation step is an important factor in improving the trajectory of model forecasting. Different high-latitude ionospheric convection models, Heelis and Weimer, are further evaluated in different latitude regions. Results show the better forecast in the electron density at the low-latitude region during the storm main phase and the recovery phase. The well reproduced eastward electric field at the low-latitude region by the assimilation model reveals that the electric fields may be an important factor to have the contributions on the accuracy of ionospheric forecast.

Keywords: data assimilation, ionospheric forecast model, geomagnetic storm

Abstracts
Poster Session

P01

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

Nor Azlan bin Mohd Aris[1,2], Hiroyuki Hashiguchi[1], and Mamoru Yamamoto[1]

1: RISH, Kyoto University, Japan, 2: 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, 100.32ºE, 865 m above sea level). 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. 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.

Keywords: Atmospheric radar, equatorial, multi-channel receiver, USRP, Spaced-antenna

P02

Study on real-time adaptive aircraft clutter suppression using the MU radar

Hiroyuki Hashiguchi, Kohsuke Kubota, and Mamoru Yamamoto

Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan

Strong clutter echoes from a hard target such as a mountain, building, or airplane sometimes cause problems of observations with atmospheric radars. In order to suppress ground clutter echoes, it is effective to use NC-DCMP (Norm Constrained- Directionally Constrained Minimum Power) method, which makes null toward the direction of the clutter, if we can receive signals independently from plural antennas. We successfully implemented the clutter suppression by NC-DCMP method into the on-line processing system of the MU radar.

The conventional NC-DCMP method cannot sufficiently suppress echoes from a moving target such as an airplane. In the previous study, a two-step NC-DCMP method has been proposed as a method to suppress the airplane clutter echoes. First, airplane clutter echoes reproduced using the NC-DCMP method based on the estimated arrival direction of the airplane echo are subtracted from the original received signal. Next, ground clutter echoes are suppressed using the NC-DCMP method. In the previous study, real time processing was impossible because all directions were searched to estimate the arrival direction. Therefore, we consider limiting the search range of the arrival direction by using ADS-B (Automatic Dependent Surveillance-Broadcast) which is a system in which the airplane broadcasts the information such as position and altitude with high accuracy. The suppression performance of two-step NC-DCMP is improved about 5 dB more than the conventional method.

Keywords: Atmospheric radar, Clutter rejection, NC-DCMP method, MU radar

Multi-Frequency Observations of Wind Velocity and Turbulence in Troposphere

Zhao-Yu Chen, Ching-Lun Su, and Yen-Hsyang Chu

Institute of Space Science, National Central University, Chung-Li, Taiwan, R.O.C.

In the past decades, wind profilers and MST radars have been widely applied to observe and investigate atmosphere structure and dynamics. In this paper, we used three different wind profiler radars with different operating frequencies, i.e., 52 MHz, 449 MHz, and 1290 MHz, to observe atmosphere wind field and turbulence during the period 12-16 September 2017, which are co-located at the Chung-Li radar station site on the campus of National Central University. The horizontal wind velocities are estimated by using velocity-azimuth-display (VAD) method and the atmospheric turbulences are estimated from the Doppler spectral width after the components of beam broadening spectral widths are removed. It appears that the wind velocities estimated by different radars tend to be consistent with one another. However, large discrepancies in the turbulence strengths estimated by different radars are seen. The plausible causes responsible for the discrepancies are discussed.

**The Effect of the Acoustic Source Location on the Height Profiles of
Virtual Temperature in the Tropical Troposphere**

Ina Juaeni[1], Hiraku Tabata[2], Noersomadi[1,2], Halimurrahman[1],
Hiroyuki Hashiguchi[2], and Toshitaka Tsuda[2]

1: Center for Atmospheric Science and Technology,
National Institute of Aeronautics and Space (LAPAN), Indonesia
2: Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan

Because local and mesoscale effects are more dominant than synoptic influences in the tropics, continuous observations are required. Therefore, the ground-based remote sensing techniques are useful for studying the tropical troposphere. The radio acoustic sounding system (RASS) with the equatorial atmosphere radar (EAR) at Koto Tabang, Indonesia was adapted to test the effects of acoustic source location on height profiles of temperature measurement in the tropical Troposphere. We first operated all speakers (10 speakers), and we stopped the four speakers in the antenna center, so that only the speakers outside the antenna were running. Then, we turned on the central speakers one by one. The RASS echo power was basically in proportion to the number of the speakers in the antenna center. Meanwhile, at 4.48 km, the echo power was nearly constant during this experiment, indicating that the speakers outside the antenna contributed to produce RASS echoes. These outside speakers were also effective, at 1.64 km. We analyzed the RASS results from August 29 to September 3, 2016, when radiosondes were launched for 12 times from the EAR site. RASS virtual temperature profile have a good agreement with radiosonde and the single column model profiles.

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

Noersomadi[1,2] and Hiroyuki Hashiguchi[1]

1: RISH, Kyoto University, Japan,
2: National Institute of Aeronautics and Space (LAPAN), Indonesia

We investigate the turbulence kinetic energy (TKE) near the tropical tropopause using long-term dataset of Equatorial Atmosphere Radar (EAR) version 02.0212 from July 2001 to June 2018. TKE is estimated from the observed spectral width data in the northward beam to reduce the effect of strong zonal wind shear. We analyze the variation of TKE 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 TKE and U in the active and inactive period of MJO (MJOa and MJOi), on the basis of the amplitude RMM, at Phase 3 and Phase 4 (P3 and P4) when MJO propagates from Indian Ocean to Maritime Continent. The results show that both during MJOa and MJOi, TKE is found larger up to 1.0-1.5 $(m/s)^2$ associated with strong westward wind than with eastward wind (about 0.5 $(m/s)^2$). The magnitude interval of westward wind in MJOa is larger than in MJOi, particularly at P4. The variation of TKE and U in seasonal MJOa at P4 indicates contrast between northern hemisphere winter and summer. Our analysis describes large turbulence occurred associated with strong westward wind especially during the active period of MJO.

Keywords: Turbulence Kinetic Energy, tropical tropopause, MJO, EAR

Observations of Meteor Echoes Using VHF Interferometric Radar

Jenn-Shyong Chen

Center for General Education, China Medical University

Observation with multifrequency and multireceiver techniques was made in this study to investigate the meteor echoes occurring often in the height interval of 70 and 110 km. The experiment was carried out by using the Middle and Upper atmosphere Radar (MUR) with twenty receivers, five frequencies (46.25, 46.375, 46.5, 46.625, 46.75 MHz), and an oblique radar beam perpendicular to the geomagnetic line at an altitude of about 100 km (i.e., the geographic north at the zenith angle of 51º). MUR is operated and maintained by the Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan. With the multichannel radar echoes, adaptive constrained method based on the Capon method was used to image the meteor structure in the radar volume and thereby determine the angle of arrival of the echoes as well as the range distributions of meteor heads and trails. It showed that the fragmentation and bifurcate trails of the meteors can be identified from the imaging results. It is expected that the imaging techniques employed can be of use to a further study of small-scale meteor structure.

Keywords: Meteor, VHF radar, angle of arrival, range distribution, fragmentation

P07

Observation of diurnal precipitation over complex topography in Bandung basin using X-band radar

Tiin Sinatra, Ginaldi Ari Nugroho, Ibnu Fathrio, and Asif Awaludin

Center of Science and Technology Atmosphere,
National Institute of Aeronautics and Space (LAPAN)

This study investigated the characteristic of diurnal cycle over Bandung basin, bounded on in the north and the south by mountains using X-band radar and rain gauge. The period of study was from March, 23th to May, 5th, 2017. The composite analysis showed that the rain over the mountain occurred earlier in the north than in the south. The frequency of rain in the north is greater than in the south. On the other hand, the rain over basin area frequently occurred around 16.30-19.30 LT. More localized precipitation was observed over the mountains in the late afternoon and early morning.

Keywords: diurnal precipitation, complex topography, X-band radar

P08

New calibration method of system phase offsets at Chung-Li VHF radar

Ting-Han Lin, and Yen-Hsyang Chu

Institute of Space Science, National Central University, Taiwan

The phase imbalance between receiving channels so-called initial system phase bias is one of the most crucial parameters that should be considered to calibrate when spatial domain interferometry (SDI), frequency domain interferometry (FDI) or coherent radar imaging (CRI) techniques are employed to observe and position targets in lower and upper atmospheres. In the past decades, a lot of radio sources (e.g., radio stars, satellites, radio stations, etc.) can be utilized to estimate initial system phase bias. In this study, the commercial aircraft that equip automatic dependent surveillance-broadcast (ADS-B) system are utilized to estimate initial system phase bias of the Chung-Li VHF radar that locates about 20 km southwest of the Taoyuan international airport. ADS-B system uses the avionics within an aircraft to broadcast aviation data (e.g., altitude, position, speed, etc.) for real-time air traffic control. From the ADS-B information combined with the SDI technique implemented on the Chung-Li VHF radar, the 3-dimensional trajectory and phase difference trend of aircraft can be reconstructed from the radar returns of the aircraft. By comparing the ADS-B-derived phase differences with the radar-measured phase differences, the initial system phase bias of the Chung-Li VF radar can be estimated. On the basis of the data collected for the period from August 31, 2017 to September 3, 2017, in which tens of the aircraft were successfully detected and positioned, the initial system phase bias of Chung-Li VHF radar are presented and discussed.

Keywords: System phase offset, System phase bias, Phase imbalance, ADS-B

P09
Transparent Polymer Nanocomposites Reinforced with Immiscible Nanocelluloses Fabricated via a Water-Based Pathway

Subir Kumar Biswas and Hiroyuki Yano

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. 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. 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. 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. The CNFs played a dual-role both as the resin-in-water emulsion stabilizer and the resin reinforcing element. In this paper, 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. The nanocomposites feature a unique biomimetic hierarchical structure and an ultrahigh thermos-mechanical, -dimensional, and -optical stability.

Keywords: nanocellulose, polymer nanocomposite, Pickering emulsion, nacre, thermal stability

P10
NMR analysis of Non-productive Binding of Carbohydrate Binding Module of Cellobiohydrolase with Lignin

Yuki Tokunaga[1], Takashi Nagata[2], Keiko Kondo[2], Masato Katahira[2], and Takashi Watanabe[1]

1: RISH, Kyoto University, Japan, 2: IAE Kyoto University, Japan

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 (*Tr*CBM1) connected with highly glycosylated linker. *Tr*CBM1 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 *Tr*CBM1 and lignin has not been clearly understood. In this study, we analyzed interaction site of *Tr*CBM1 with lignin at a molecular level using NMR. ^{15}N-labeled TrCBM1 was expressed and purified peptide with correct folding. Binding site of *Tr*CBM1 was analyzed by ^{1}H-^{15}N HSQC NMR with incremental titration of cellohexaose 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 *Tr*CBM1 based on chemical shift perturbation. From these NMR analysis and adsorption experiments, mechanism of the non-productive binding was discussed.

Keywords: Biorefinery, Carbohydrate Binding Module, Cellulase, Lignin, NMR

P11

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 secret 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.

Keywords: rhizosphere, plant-microbe interactions, root exudates, santopine, Amadori compound

P12

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

Hayato Ueoka[1], Kanako Sasaki[1], Tatsuya Miyawaki[1], Takuji Ichino[1], Nozomu Sakurai[2], Hideyuki Suzuki[2], Daisuke Shibata[2], and Kazufumi Yazaki[1]

1: RISH, Kyoto, University, Japan, 2: Kazusa DNA Research Institute, Japan

Terpenoids are the largest class of plant specialized metabolites representing flavors, phytoalexins and natural rubber. Among terpenoids, monoterpenes (C10) 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 C10 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 uses IPP and DMAPP from 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 cells of L. erythrorhizon. 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.

Keywords: Lithospermum erythrorhizon, shikonin, geranyl diphosphate synthase, subcellular localization, terpenoid biosynthesis

P13

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

Yu Iseki[1], Satoshi Oshiro[1], Takashi Nagata[2], Keiko Kondo[2],
Masato Katahira[2], and Takashi Watanabe[1]

1: RISH, Kyoto University, Japan, 2: 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* secrets cellulolytic enzymes, cellobiohydrolase, endoglucanase and β-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 β-1,4-glycocide 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.

Keywords: LPMO, Cellulase, Lignin, Biomass, Selective white rot fungi

P14

Reconstitution of cellulose synthase to know its molecular assembly machinery

Tomoya Imai

RISH, Kyoto University, Japan

Cellulose is a major biomass to be utilized in our sustainable feature on Humanosphere. All the cellulose is derived from the biological resource, indicating that cellulose is originally produced by enzyme in living organisms in any cases. This enzyme, cellulose synthase, has an unusual function. Namely cellulose synthase catalyzes a chemical reaction to polymerize glucose, but also controls the polymerized long cellulose molecules to pack them into a slender long fiber called "microfibril". These two points (the product is an assembly of many polymer molecules) are very important aspects of cellulose synthase as well as many other enzymes involved in biomass formation. This presentation will show our trials to reconstitute the activity of cellulose synthase: polymerization of glucose and assembling the resultant β1→4-glucan chains into a microfibril. Although no successful data is obtained until now, those "negative" data are helpful to find the essential factor to produce polymer molecular assembly of cellulose or biomass, I believe.

Keywords: cellulose synthase, cellulose, polymer molecules, biomass formation

Improved biomass digestibility of rice mutants deficient in tricin-lignins

Pui Ying Lam[1,2], Yuki Tobimatsu[1], Toshiaki Umezawa[1,3], and Clive Lo[2]

1: RISH, Kyoto University, Japan
2: SBS, The University of Hong Kong, Hong Kong, China
3: RUDGS, Kyoto University, Japan

Lignin is a heterologous phenylpropanoid polymer ubiquitously found in secondary cell walls of vascular plants. While lignins of dicots and gymnosperms are formed by oxidative polymerization of monolignols, species in the grass family additionally utilize a flavone, tricin, as a natural lignin monomer. However, how such flavonolignin (tricin-lignin) is biosynthesized and function in plants, and how it affects the biomass utilization properties remain largely unknown. In this study, we examined the structure and digestibility of cell walls produced in tricin-depleted rice mutants. The rice mutants deficient in tricin biosynthetic genes were largely depleted in lignin-bound tricin and some of them incorporated non-canonical flavonoid intermediates in the tricin pathway into their lignin polymers; for example, rice flavone synthase II mutant incorporated naringenin as a novel lignin monomer. Besides, these mutants displayed reductions in total lignin content as well as improved biomass digestibility, suggesting that manipulation of tricin biosynthesis in grasses might serve as an alternative strategy to improve the production of fermentable sugars that could be further converted into useful biofuels and biomaterials.

Keywords: lignin, flavonoid, rice, biomass digestibility, tricin

Production of Antiviral Compounds from Sugarcane Bagasse by Microwave Reactions

Chihiro Kimura[1], Ryota Ouda[1,2], Ruibo Li[1], Hiroshi Nishimura[1],
Takashi Fujita[2], and Takashi Watanabe[1]

1: RISH, Kyoto University, Japan, 2: 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. 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 ^{1}H-^{13}C heteronuclear single quantum coherence correlation NMR. These results suggested that antiviral fraction is composed of p-etherified benzoate unit and xylan.

Keywords: Antiviral agent, Microwave degradation, Sugarcane bagasse, Lignin, Xylan

P17
Altered lignocellulose molecular assembly in lignin-modified rice mutants

Andri Fadillah Martin[1,2], Yuki Tobimatsu[1], Naoyuki Matsumoto[1], Ryosuke Kusumi[3], Takuji Miyamoto[1], Masaomi Yamamura[1], Taichi Koshiba[1], Masahiro Sakamoto[3], and Toshiaki Umezawa[1,4]

1: RISH, Kyoto University, Japan
2: Reserach Center for Biotechnology, LIPI, Indonesia
3: Graduate School of Agriculture, Kyoto University, Japan
4: RUDGS, Kyoto University, Japan

Metabolic engineering of lignin as a strategy to improve the utilization properties of lignocellulosic biomass has been extensively pursued. Thus far, numerous transgenic/mutant plants that produce lignocelluloses variously altered in lignin content and/or structures have been generated via up- and/or down-regulation(s) of lignin biosynthetic pathway genes. However, the relationship between the modified lignin characteristics and the supramolecular structures of lignocellulose, i.e., associations and assembly modes of polysaccharide and lignin polymer molecules in cell walls, remains largely unknown. In this study, we closely examined the lignin chemical structure as well as polysaccharide assembly in a rice mutant deficient in cinnamyl alcohol dehydrogenase (CAD), a key lignin biosynthetic enzyme, by using solution/solid-state NMRs, X-ray crystallography and wet-chemical methods, and discussed in conjunction with the improved lignocellulose digestibility.

Keywords: biomass digestibility, cinnamyl alcohol dehydrogenase, lignin, rice, nuclear magnetic resonance (NMR) spectroscopy

P18
Downregulation of p-*COUMAROYL ESTER 3-HYDROXYLASE* in rice leads to altered cell wall structures and improves biomass saccharification

Yuri Takeda[1], Yuki Tobimatsu[1], Steven D. Karlen[2], Taichi Koshiba[1], Shiro Suzuki[1], Masaomi Yamamura[1], Shinya Murakami[1], Mai Mukai[1], Takefumi Hattori[1], Keishi Osakabe[3], John Ralph[2], Masahiro Sakamoto[4], and Toshiaki Umezawa[1,5]

1: RISH, Kyoto University, Japan
2: Department of Biochemistry, University of Wisconsin, United States
3: Faculty of Bioscience and Bioindustry, Tokushima University, Japan
4: Graduate School of Agriculture, Kyoto University, Japan
5: RUDGS, Kyoto University, Japan

p-Coumaroyl ester 3-hydroxylase (C3´H) is a key enzyme involved in the biosynthesis of lignin, a phenylpropanoid polymer that is the major constituent in vascular plants' secondary cell walls. Although the crucial role of C3´H in lignin biosynthesis and its manipulation to upgrade lignocellulose have been investigated in eudicots, limited information is yet available in monocotyledonous grass species despite their great potential as biomass feedstocks. Here we address the impacts of C3´H-deficiency on the structure and properties of grass cell walls through the analysis of C3´H-dificient transgenic rice plants. C3´H-knockdown lines generated via RNAi-mediated gene silencing reached maturity and set seeds, whereas C3´H-knockout rice mutants generated via CRISPR/Cas9-mediated mutagenesis were severely dwarfed and sterile. Cell wall analysis of the C3´H-deficient transgenic lines by using a series of chemical methods and 2D NMR revealed that C3´H-suppression resulted in altered lignins largely enriched in p-hydroxyphenyl units, augmentation of lignin-integrated tricin residues, and substantial reduction in wall cross-linking ferulates. We also demonstrated that such structural alterations enhanced cell wall saccharification to produce fermentable sugars from rice lignocellulose.

Keywords: lignin, *Oryza sativa*, RNAi, CRISPR/Cas9, saccharification

P19

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

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

1: Research Institute for Sustainable Humanosphere (RISH), Kyoto University, Japan
2: Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan
3: Institute of Advanced Energy, Kyoto University, Japan

Building a sustainable society is essential for the future. We use petroleum now, but petroleum is a limited resource and CO_2 generated by petroleum influences the global warming. As an alternative to petroleum, utilization of biomass has been focused. Wood is composed of cellulose, lignin, and hemicellulose. Lignin is composed of aromatics and has a potential to use as energy, chemicals, and materials. Lignin associates with hemicellulose in plant cell walls. This complex is called Lignin Carbohydrate Complex (LCC). Our aim in this study is a better understanding of LCC at the molecular level to develop an effective wood biomass conversion. Enzymatic digestions for both polysaccharide and lignin is effective to fractionate and concentrate LCC. We are now trying to fractionate LCC from an extracted wood and analyze 2D-NMR and LC-MS.

Keywords: Wood biomass, Lignin, Lignin Carbohydrate Complex, NMR

P20

Preparation of Castor Oil-based Polyurethane Resin for Manufacturing of Low-density Particleboard with Bamboo Charcoal

Yi-Chun Chen and Wei Tai

Department of Forestry, National Chung Hsing University, Taiwan

In this study, polyurethane (PU) resins were prepared by castor oil as polyol with isocyanate PMDI. The PU foams were prepared with the molar ratio of functional group of 1.5 of NCO/OH was investigated the effect of the PU foams properties. The water, organosiloxane and dibutyltin dilaurate play roles as a blowing agent, surfactant and catalyst, respectively. Effects of the dosage of blowing agent and catalyst be adjusted to optimize the properties of PU foams were also studied. The results showed that 4% catalyst and blowing agent showed the minimization of the water absorption and maximization of volume expansion as castor oil was used in the manufacturing of PU foams. The properties of these PU resins for low density particleboard manufacturing were investigated. FT-IR analysis showed that urethane bond was formed by hydroxyl group of castor oil and –NCO group of isocyanate PMDI. Increasing the amount of catalyst could improve the volume expansion ratio, pore volume, water absorbing and weight loss (<1.5%) of PU foams. Increasing the amount of bamboo charcoal (0, 50, 75 and 100%) could improve the water absorbing and volume expansion ratio. The castor oil-based particleboards contained bamboo charcoal fulfilled the requirement of the CNS 2215 standard of particleboard.
This investigation was supported by a grant from the Taiwan Forestry Bureau , R.O.C.

Keywords: Bamboo charcoal, Particleboards, Castor Oil, Polyurethane

P21

Isoprene Emission Flux from Moso Bamboo Leaves in Central Taiwan

Tingwei Chang[1], Motonori Okumura[2], Yoshiko Kosugi[1], and Tomonori Kume[3,4]

1: Graduate School of Agriculture, Kyoto University
2: Research Institute of Environment, Agriculture, and Fisheries, Japan
3: School of Forestry and Resource Conservation, National Taiwan University
4: Kasuya Research Forest, Kyushu University, Japan

Isoprene is a highly volatile and reactive compound with involves in the formation of air pollutants such as ozone (O_3) and secondary organic aerosols (SOAs) and can also prolong the lifetime of methane (CH_4) in the atmosphere. Therefore, by understanding the isoprene emission dynamics can contribute to the control and the evaluation of these pollutants and greenhouse gases. As the largest source of isoprene emission, vegetation is broadly investigated on their isoprene emission and found that light and temperature are the mainly factors controlled over the emission speed, and responses are different among plant species. In recent, Moso bamboo, which has demonstrated several expansions and invasions, is reported with significant isoprene emission flux from leaves. However, the isoprene emission dynamics in the Moso bamboo leaf were not confident in Taiwan. Therefore, we put our goal on clarifying the response to the factors of isoprene emission from Moso bamboo leaves. We had observed the isoprene emission and leaf temperature with light control in Xitou Experimental Forest at central Taiwan by 7 months. The responses of isoprene emission flux to light is different among months, gradually decreasing from September 2015 to March 2016, which generally corresponding to the trend of the leaf temperature. The isoprene emission flux became very weak or without detection when temperature below 23°C but intensely increase in higher temperature. This situation leads an authorized model for simulating isoprene emission flux from plant leaf to misestimate the response of isoprene emission flux to leaf temperature. For establish an accurate assessment on isoprene emission fluxes from Moso bamboo, we parameterized this model with the observation to reduce the misestimation.

Keywords: Isoprene Emission, Moso Bamboo, Temperature Dependence

P22

Influence of Place Attachment and Socio-demographic Characteristics on Environmental Attitude - Evidence from a Top University in Central Taiwan

Ching Chuang and Wan-Yu Liu

National Chung Hsing University, Taiwan

Environmental attitude, which would be influenced by enormous factors and would be enhanced by education, demonstrates the perspective, attitude, or opinions people have toward the environment. In recent years, as the environmental issues had been more and more essential, environmental attitude, as one of the attitude that could extend influence people's behavior and decision, had become more significant. There are numerous studies focusing on investigating the factors influence the environmental attitude. However, few studies concentrate on the place attachment and environmental attitude considering factors related to education. Our study investigates the influence of place attachment and socio-demographic characteristics on environmental attitude, using National Chung Hsing University as the experimental site. According to the 382 surveys collected by our study, the result shows that the socio-demographic characteristics significantly influence the environmental attitude. In addition, place attachment also has positive influence on environmental attitude. The results could be used as a suggestion toward improving the university facility, course and design. Furthermore, our study would benefit the future similar studies.

Keywords: Place Attachment, Environmental Attitude, Regression analysis

P23

Latent Preferences of Tourists for the Service Quality of
Taichung Calligraphy Greenway in Taiwan

Ching Chung and Wan-Yu Liu

National Chung Hsing University, Taiwan

This study explores visitors' latent preferences for a set of attributes that characterize the recreational value of Calligraphy Greenway, the most notable greenbelt in Taichung City, Taiwan. As an urban green space, the Calligraphy Greenway has its own recreational attributes and visitors' preferences. This study uses the choice experiment method to determine visitors' preference levels for five major attributes to improve the recreational quality. On average, each visitor visited there 9.15 times in the past year and spent 2.37 hours per visit. Of the five recreational attributes, satisfaction with recreational activity opportunities had the highest score and satisfaction with cultural landscape resources had the lowest score. The importance is ranked in the order of recreational service quality, total recreational cost, natural landscape resources, cultural landscape resources, and recreational activity opportunities. Considering difference of groups, female visitors were more concerned with cost and activities, but male visitors were more concerned with service quality and natural/cultural landscape resources. Local visitors were more concerned with cost and activities, but non-local visitors were more concerned with natural/cultural landscape resources. Both were concerned with service quality. Based on the results, this study makes the following recommendations: Cultural landscape resources and quality of recreational services and facilities should be improved, and more complete interpretative educational guidance should be provided, to increase visitors' willingness to visit. Additionally, it is suggested to set up various districts to cater for preferences of different visitor groups.

Keywords: Greenway, urban forest, latent preferences, choice experiment

P24

Estimating the Amenity Value of Forest Recreation Areas:
Evidence from Huisun National Forest Recreation Area

Yen-Yu Lin and Wan-Yu Liu

National Chung Hsing University, Taiwan

This study investigated the amenity value of the Huisun National Forest Recreation Area (HNFRA). Why tourists visit the area and whether socioeconomic characteristics affect tourists' willingness to pay (WTP) for the area's amenities were also determined. The payment card method was employed to evaluate amenity use. Likert scales were used to assess purposes for coming to the HNFRA. We distributed 250 questionnaires, and the number of valid responses was 223, an effective response rate of 89.2%. The respondents visited the HNFRA because of its forest, well-preserved environment, lots of green space, clean environment, beautiful scenery, and quietness. The important stated purposes for visiting were to be close to nature, for quietness, for relaxation, and for enjoying the beautiful scenery. The amenity value of the HNFRA is NT\$2,884 per year per person in winter and NT\$2,905 per year per person in summer. Multiplication of this amount by the number of visitors to the HNFRA each year (182,390) indicates that the total amenity value of the HNFRA is NT\$473,978,430–474,755,774 per year. The WTP of tourists regarding the HNFRA is thus high. Women were discovered to have higher WTP than men; those with a college or higher education level had higher WTP; and the respondents who did not live locally to the HNFRA had higher WTP. Furthermore, tourists who had participated in environmental groups had higher WTP. An ordered probit model was used to estimate the association between WTP and basic socioeconomic variables. Sex, age, education level, monthly income, place of residence, participation in environmental groups, frequency of visiting the HNFRA, and stay period were found to significantly influence WTP.

Keywords: Willingness to pay (WTP), Contingent valuation method (CVM), Payment card, Amenity Value, Probit Regression

P25

In a forest with tall overstory trees, the spatial distribution of recruits is determined by living trees rather than canopy gaps created by dead trees

Ku Chen-Chia[1], Song Guo-Zhang Michael[2], Chao, Kuo-Jung[2], and Chao, Wei-Chun[1]

1: Department of Forest and Nature Resources, National Chiayi University, Taiwan
2: International Master Program of Agriculture, National Chung Hsing University, Taiwan

The different spatial pattern of different species is the critical information to understand the mechanism of species coexistence in the forest ecosystem. The gap provides a suitable regeneration habitat for the seedling to get more nutrient for growth. To understand how recruits survive in regeneration habitat in 3 ha of Mt Peitunyen Forest Dynamic Plot. Univariate of Ripley's K-function was used to analyze the spatial pattern of recruitment, large dead tree and large survival tree. Bivariate of Ripley's K-function was used to analyze the relationship between the spatial pattern between recruitment and large dead tree, and the relationship between recruitment and survival large tree.
Our result indicated that recruit individual shows the aggregation of distribution in 2007. Furthermore, recruit individual shows random distribution under the large dead trees, and exclusion distribution shows under the survival of large trees. These individuals use a semi-shaded habitat to regenerate, and more than half of the species of our plot utilizing this kind of regeneration habitat. These species should belong to moderately tolerant species under the photosynthetic capacity. However, not all species' characteristics can understand their demand for lights by means of spatial point pattern. Different species have its suitable habitat to survive. Our research provides a possible way for different species to regenerate from the spatial point pattern and suggest that the regeneration of species use the semi-shaded habitat to regenerate the individual in Mt. Peitungyen.

Keywords: Gap Regeneration, Habitat association, Spatial point pattern, Species coexistence

P26

Canopy tree species may cause more infiltration than do short-statured tree species in terms of individual trees with the same diameters at breast height

Prapasiri Tongsiri[1], Guo-Zhang Song[1], Li-Wan Chang[2], and Jyh-Min Chiang[3]

1: National Chung Hsing University, Taiwan (pom.prapasiri@gmail.com)
2: Taiwan Forestry Research Institute, Taiwan
3: Tunghai University, Taiwan

Infiltration is among the main factors determining the occurrence of rainfall-induced landslide. Trees promote infiltration by penetrating soil surfaces with roots, so that trees' effects on infiltration can be estimated with their root collar diameters (RCDs). There is a need to establish regression models with which RCDs can be estimated from DBHs because most vegetation data record only trees' diameters at breast height (DBHs) rather than RCDs. The study site is located in the 25-ha Lianhuachih Forest Dynamics Plot, central Taiwan. This plot is established in 2007 and 1.22 ha of its vegetation is removed by landslides in 2008. At least 10 individuals which DBHs range from 1 cm to species-specific maximum DBHs were sampled for each of the ten most dominant tree species (including 5 canopy, 4 sub-canopy and 1 shrub species) to measure their DBHs and RCDs. It was showed that the DBH-RCD regression models of these species are all linear (R= a·D; R, RCD; D, DBH; a, the scaling factor) ($r^2 > 0.75$). The scaling factors of these models differ significantly between species (F test, $p < 0.001$). Species with greater maximum DBHs tend to have higher scaling factors (Pearson correlation, $p=0.005$). That is, with the same DBHs, canopy tree species tend to have higher RCDs than do sub-canopy and shrub species. If trees' effects on infiltration promotion is a positive linear function of their RCDs, in a given DBHs, individuals of canopy species can cause more infiltration than do those of smaller tree species.

Keywords: Forest Dynamics Plot, landslide, infiltration, root collar diameter

P27

**The Effects of the Pests and diseases on the Optimal Forest Rotation and
Land Expected Value Considering the Payment of Environmental Services**

Yow-Ru Lin and Wan-Yu Liu

National Chung Hsing University, Taiwan

Despite the important impact of tree pests and pathogens on forest, and the variety of analyses within the optimal rotation length literature, there is a lack of published work linking the effect of disease to the optimal rotation length. Macpherson et al. (2017) is about the effect of disease and carbon payment on the optimal rotation length. This study applies the current information of Taiwan forest on Macpherson et al. (2017) to model the effect of disease on the optimal rotation length and the maximum land expectation value of Taiwan forest management. In the empirical analysis of this study, the situation of disease has a shorter optimal rotation length and a lower maximum land expectation value than the situation of no disease. In the sensitivity analysis of this study, at the both of the situation of no disease and disease, the increase of the carbon price, per-cubic-metre price of timber and land rent after harvesting (distribution rate of timber volume) will increase the optimal rotation length and maximum land expectation value. The increase of the timber logging cost and carbon release rate after harvesting will increase the optimal rotation length and decrease the maximum land expectation value. The increase of the discount rate will decrease the optimal rotation length and maximum land expectation value. In the situation of disease, the increase of the infection rate will not necessarily decrease the optimal rotation length, but the maximum land expectation value will be decreased.

Keywords: Disease, Carbon payment, Optimal rotation length, Maximum land expectation value

P28

Evaluating the Recreation Value of Huisun National Forest Recreation Area

Ping-Zheng Chen and Wan-Yu Liu

National Chung Hsing University, Taiwan

With over 85% of the forest still preserved to its primitive state, Huisun National Forest Recreation Area (HNFRA) provides people with environmental education, ecological conservation, recreation, and other functions. The present study used the travel cost method and the zero-truncated negative binomial regression model to evaluate the recreational value of HNFRA and to analyze the recreational demands that influence tourists visiting the area, the annual recreational value per person, and the total annual recreational value. The results revealed that the travel costs for nonlocal visitors were higher than those for local visitors, and that the recreational demand was negatively correlated to income, which had a significantly positive correlation with place of residence, age, and length of stay. Local visitors mainly traveled with the whole family. The estimated annual recreational value of HNFRA was NT$3,237 per person and the total annual recreational value was NT$347,270,560.

Keywords: Huisun National Forest Recreation Area, the travel cost method, recreational value, zero-truncated negative binomial regression

The effects of coarse woody debris on the natural regeneration of Chamaecyparis obtusa var. formosana and broadleaved species

Liao Chi-Cheng

Department of Life Science, Chinese Culture University, Taipei, Taiwan

Coarse woody debris (CWD) provide habitat abundance in forest floor for regeneration of different plant species and enhance species diversity. In this study, an extraordinary natural regeneration process is proposed in a mixed conifer-broadleaved forest dominated by Taiwan yellow false cypress (Chamaecyparis obtusa Sieb. & Zucc. var. formosana (Hayata) Rehder). CWD provide establishment sites for seedling establishment of the conifer and many broadleaved species. Seedling of Taiwan yellow false cypress is a weak competitor in the forest and CWD is the only substrate for seedling establishment of the conifer. Seedlings of the conifer were plentifully established on down logs only once after the down logs formed on forest floor, while establishment of the conifer seedlings are prior to that of broadleaved species. Seedlings of many broadleaved species continuing established on CWD and the establishment processes lasting for many years after formation of the down logs on forest floor. On the other hand, on soil substrate, large numbers of newly emerged seedlings of Taiwan yellow false cypress have extremely low chance of survival, whereas abundant broadleaved seedlings and saplings are able to grow on soil substrate. Species diversity increases in forests because of the temporal differentiation of seedling establishment between the conifer and broadleaved species on CWD and the spatial differentiation of that on soil and CWD substrate. The characteristics of natural regeneration processes in mixed conifer-broadleaved forests are suggested applying to alter reforestation lands of Taiwan yellow false cypress from monocultural to mixed-species plantation by leaving some segments of new down logs on forest floor.

Key words: Chamaecyparis obtusa var. formosana, mixed-species plantation, coarse woody debris,

Stand Structure and Short-term Dynamics of Abies kawakamii (Hayata) Ito in Mt. Xue, Taiwan

Pei Hua Li[1], Min Chun Liao[2], Wei Wang[1], Jia Rong Yang[1], and Hsy Yu Tzeng[1*]

1: National Chung Hsing University, Taiwan
2: Taiwan Forestry Research Institute, Taiwan
*erecta@dragon.nchu.edu.tw

Abies kawakamii (Kawakami fir) is one of critical ecological indicators, composed mostly of pure forests distributing among 3,000-3,600 m above sea level (a.s.l.) in subalpine ecosystem of Taiwan. On study of the structure and dynamics of Kawakami fir forest, we found the relationship between dynamic structure of forest and environmental changes was used to predict the trend of succession. Seven permanent plots were established, which located on the ecotone of Tsuga chinensis var. formosana - Abies kawakamii, Abies kawakamii forest type and the ecotone of Abies kawakamii - Juniperus squamata var. morrisonicola in Mt. Xue, Taiwan. We compared with the stand structure of the plots between 2008 and 2017, which showed the abundance of some species had decreased, except J. fomosana. Variation of dominant species in the plots were affected by typhoons, compositions of groundcover vegetation, development of forest, spatial patterns and competition between neighbouring trees. Recruirments of Kawakami fir in higher altitude plots without Yushania niitakayamensis (Yushan cane) were more than those in lower altitude plots with abundance of Yushan cane. In this study, stability of population structure based on the size-class structure of Kawakami fir which showed the inverse J-shaped size.

Keywords: Abies kawakamii, subalpine, Mt. Xue, size-class structure, inverse J-shaped

P31

Prediction models for landslide spatial distribution can perform better through including data of pre-landslide basal area of trees

Jian-Hong Yang[1], Guo-Zhang Michael Song[1,] and Li-Wan Chang[2]

1: National Chung Hsing University, Taiwan, 2: Taiwan forestry research institute, Taiwan

Vegetation is an important factor for reducing the occurrence of shallow landslides, but most previous landslide prediction models don't include pre-landslide vegetation data. Even though pre-landslide vegetation data are included, most models quantify vegetation effects via parameters with soil physical (e.g. root reinforcement) or hydrological meanings (e.g. leaf area index). However, the most available pre-landslide vegetation data are diameter at breast height (DBH) for trees. The main goals of our study are to confirm (1) whether including basal area (BA, a parameter which can be derived directly from DBH but is of few soil physical or hydrological meanings) in models can improve model performance and (2) whether including BA in models change the optimal window size? The study area was the Lienhuachih Forest Dynamics Plot (23°54'49"N, 120°52'43"E), located in center Taiwan. This 25-ha plot was established in 2007 and its vegetation of 0.92 ha was removed by landslides in 2008. Two types of logistic regression models were established to predict landslide occurrence. One was established with only topographic data (slope, curvature, aspect, topographic wetness index) (hereafter TO model), the other included both topographic and vegetation data (trees's BA) (TV model). Window sizes in models were varied from 1 m×1 m to 40 m×40 m. Results showed that model performance of TV models was always better than that of TO models in all window sizes. The optimal window size was 10 m and 30 m for TO model and TV model, respectively. Our study highlight the need of including pre-landslide vegetation data in landslide prediction models even vegetation data are of few soil physical or hydrological meanings.

Keywords: Landslide, pre-landslide data, logistic regression, window size

P32

Study the Function of Soil Nutrients Conservation in Forest from Soil Solution of Vegetation Engineering

Kai-Lin Chen, Tzu-Hao Su, and Chiung-Pin Liu

National Chung Hsing University, Taiwan

Forest ecosystems have generally favorable nutrient cycling, whereas dynamics of nutrient cycling in forest were caused by natural succession or anthropic disturbances. To better understand the values of forest ecosystem services for soil nutrient conservation, dissolved nutrient in forest soil solution monitoring is a way to establish long-term fluctuant trend of nutrient in forest ecosystems. The aim of this study is to monitor the long-term soil solution chemistry regarding silvicultural treatments closed to woody structures (SW) and natural forest nearby (FW) at Sun Moon Lake and Kengneikeng respectively. Soil solution samples were analyzed for electric conductivity (EC), pH value, K^+, Na^+, Ca^{2+}, Mg^{2+}, NO_3^-, SO_4^{2-} and dissolved organic carbon (DOC). In long-term dynamics of soil solution chemistry, the results showed that pH of SW was higher than these of FW in both areas. The EC and the K^+, Ca^{2+}, Mg^{2+}, NO_3^- and DOC concentrations of soil solution in FW at Sun Moon Lake showed long-term stable fluctuations, indicating quite stable forest ecosystem. In addition, the concentration of K^+, Na^+, Mg^{2+} and NO_3^- in SW were lower in long-term variation, whereas the DOC concentration in SW was similar to in FW. Apart from carbon source from woody structure decomposition, the litter input was also an important source after plantation. Besides, the EC and the concentrations of Ca^{2+}, Mg^{2+}, NO_3^-, SO_4^{2-} and DOC were increased with the passing years in SW at Kengneikeng. On the contrary, the EC and the concentrations of K^+, Na^+, Ca^{2+}, Mg^+, NO_3^-, SO_4^{2-} and DOC in FW were decreased. The results suggested that the forest at Kengneikeng lacked for tending and renewal and had higher crown closure inducing soil organic matter decomposition and mineralization rate decreasing. Our results provided a synthetic understanding that plantation and woody structure were conducive to nutrients conservation of soil solution, and forest tending was important to maintain stable ecosystem as well.

Keywords: vegetation engineering, woody structure, soil solution, nutrients conservation

A case study on the impact of climate change on forest vegetation in Taiwan

Huan-Yu Lin[1,2], Ching-Feng Li[1], Tze-Ying Chen[3], Chang-Fu Hsieh[1], Tongli Wang[4] and Jer-Ming Hu[1]

1: National Taiwan University, Taiwan
2: Taiwan Forestry Research Institute, Taiwan
3: National Ilan University, Taiwan
4: University of British Columbia, Canada

The vegetation-climate relationship is a long studied topic and has been applied to depict the regionalization of ecoregions or vegetation types for decades. A total of 3824 plots, belong to 13 climate-related forest types in Taiwan, with 57 climatic variable estimates were incorporated into the Random Forests to establish ecological niche model. The climate environment of regions higher than 100 m a.s.l., with a total area of 2.7 million hectares, was classified into potential habitats of 13 forest types based on the RF model by average mismatch rate of 6.59%. The projected vegetation map displayed evident altitudinal stratification from subalpine to montane cloud forests, and followed by the latitudinal differentiation of subtropical montane forests in the north and tropical montane forests in the south. We further selected six GCM models which are suitable for Taiwan, incorporate two RCP scenarios and six future periods, to simulate potential habitats of each forest types under the changing climate. We found that potential habitats of two forest types, the Fagus forest and the subalpine Juniperus forest, could decline to 2.06%-13.97% and 2.24%-34.28% in relative to its current distribution under RCP 4.5 scenario till the end of 21th century. Most current habitats of Fagus and Juniperus are located on the ridge of North-East mountains and the Central Mountain Range, which could increase their vulnerability to climate change and lead to local extinctions significantly.

Keywords: Climate change; Random Forest; Impact and vulnerability; Altitudinal stratification; Zonal forests.

Forest carbon balance in tropical Taiwan

Kuo-Jung Chao[1], Pin-Siou Liao[1,2], Guo-Zhang M. Song[3], Wei-Chun Chao[4], and Hsing-Juh Lin[2]

1: International Master Program of Agriculture, National Chung Hsing University, Taiwan
2: Department of Life Sciences, National Chung Hsing University, Taiwan
3: Department of Soil and Water Conservation, National Chung Hsing University, Taiwan
4: Department of Forest and Nature Resources, National Chiayi University, Taiwan

Under climate change, carbon sequestration capacity in tropical rainforests is a critical issue of ecosystem functioning. The aim of this study is to estimate the carbon balance in tropical rainforests. The forests are experiencing frequent typhoon disturbances and annual northeast monsoon stress. We measured three major carbon pools in forests: above-ground living-tree biomass, woody debris necromass and soil organic carbon in the Nanjenshan tropical forests in Taiwan. We also compared the carbon stocks and fluxes on windward and leeward habitats. The results showed that the carbon stocks in the above-ground biomass pool were higher in the leeward habitat. The low carbon stocks in the windward habitat could be due to the stress of the northeast monsoon. Woody debris carbon stocks and inputs in the windward habitat are also lower than the leeward habitat. Necromass carbon inputs were significantly higher during the monsoon season. However, soil carbon stocks were similar between the two habitats, and soil respiration rates are high during spring and summer seasons. Based on current carbon balance estimations, Nanjenshan tropical forests seem to be in a non-steady-state status.

Keywords: Tropical primary forests, carbon sequestration, carbon flux, carbon stock

P35

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

Bramantyo Wikantyoso[1,2], S. Khoirul Himmi[1], Sulaeman Yusuf[1], and Tsuyoshi Yoshimura[2]

1: Research Center for Biomaterials, Indonesian Institute of Sciences (LIPI)
Jl. Raya Bogor km 46 Cibinong, Bogor 16911, Indonesia
2: Research Institute for Sustainable Humanosphere (RISH) Kyoto University
Gokasho, Uji, Kyoto 611-0011, Japan

Termite are generally regarded as wood attacking insect that exploit wood (either rotten or sound dead), living herbaceous plants, grass, various plant debris and dung for either nesting or foraging. Genus Coptotermes is particularly considered as an economically important structural pest globally as well as source of agricultural nuisance. As this group of termites are widespread distributed, the attack incidence of Coptotermes on plantation has been quite common across Southeast Asian countries. Nevertheless, little is known about incidences on fruits. In the present study, we reported the first case of Coptotermes termite attack on mango (Mangivera indica) fruit at home-based storage in Jakarta. Ten collected termite specimens were identified as C. havilandi, which currently is known as a synonym of C. gestroi. The result was surprising as the subterranean termite pest in Indonesian urban area has longtime been believed to be C. curvignathus. Three potential factors may explain the occurrence of the attack, namely fruit water content, fructose content, and termite-microbe coevolution. The present study provides an important insight into feeding flexibility and adaptability of termite in urban area.

Keywords: Coptotermes gestroi, Mangivera indica, flexibility, adaptability, feeding habit

P36

Horizontal transfer of Wolbachia in longhorn crazy ant

Shu-Ping Tseng, Tsuyoshi Yoshimura, and Chin-Cheng 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.

Keywords: horizontal transmission, myrmecophile, Paratrechina longicornis, Wolbachia

P37

An analysis on geomagnetic activity related with Formosat-2 and Formosat-3 anomalies for space weather operations

Han-Wen Shen[1], Jih-Hong Shue[2], and Tsung-Ping Lee[3]

1: Institute of Space Science, National Central University, Taiwan
2: National Space Organization, Taiwan

When an anomaly occurs in a satellite, it can have an influence on the operation to the satellite and the instruments on board, possibly resulting in a disruption the satellite operation or some inaccuracy in the data obtained. Therefore, we need to well understand the causes of anomalies so that we can develop an application to predict them earlier and mitigate the impacts. In this study, we classify the satellite anomalies reported from the Formosat-2 (FS2) and Formosat-3/Cosmic (FS3) satellite for different types of anomalies. After we removed the non-space weather events, we analyze the remaining events in combination with geomagnetic fields and solar wind data. In our study, we find that there is no positive correlation between anomalies and solar activity, and there are not many anomalies accompanied by active geomagnetic activity. However, more active geomagnetic activity can increase the chance of satellite anomalies in the condition of Kp value larger than 6. In addition, we also find that anomalies usually occur in a position where the magnetic field was small. In the analysis of the solar wind speed, a significant increase that occurred prior to the anomalies of FS2 was found. When the solar wind speed increases, it can bring more energetic particles into the magnetosphere.

Keywords: Satellite anomalies, geomagnetic activity, Solar wind speed

P38

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

Takuya Ikeda[1], Yusuke Ebihara[1], Takashi Tanaka[2], and Fok Mei-ching[3]

1: RISH, Kyoto University, Japan, 2: Kyushu University, Japan, 3: 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.

Keywords: Temperature anisotropy, Whistler mode, Chorus wave

**Drift-bounce resonance between Pc5 pulsations and ions at multiple energies
in the nightside magnetosphere: Arase and MMS observations**

S. Oimatsu[1], M. Nosé[1], M. Teramoto[2], K. Yamamoto[1], A. Matsuoka[3], S. Kasahara[4], S. Yokota[5],
K. Keika[4], G. Le[6], R. Nomura[7], A. Fujimoto[8], D. Sormakov[9], O. Troshichev[9], Y.-M. Tanaka[10],
M. Shinohara[11], I. Shinohara[3], Y. Miyoshi[2], J. A. Slavin1[2], R. E. Ergun[13], and P.-A. Lindqvist[14]

1: Graduate School of Science, Kyoto University
2: Institute for Space-Earth Environmental Research, Nagoya University
3: Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency
4: Graduate School of Science, University of Tokyo
5: Graduate School of Science, Osaka University
6: Heliophysics Science Division, NASA Goddard Space Flight Center
7: Environmental Test Technology Unit, Japan Aerospace Exploration Agency
8: International Center for Space Weather Science and Education, Kyusyu University
9: Arctic and Antarctic Research Institute
10: National Institute of Polar Research
11: National Institute of Technology, Kagoshima College
12: Department of Climate and Space Sciences & Engineering, University of Michigan
13: Department of Astrophysical and Planetary Sciences, University of Colorado
14: Royal Institute of Technology, Stockholm, Sweden

A Pc5 wave is observed by the Exploration of energization and Radiation in Geospace "Arase" satellite in the inner magnetosphere (L ~ 5.4–6.1) near postmidnight (MLT ~ 1.8–2.5 h) during the storm recovery phase on 27 March 2017. We estimate the azimuthal wave number (*m*-number) of the Pc5 wave by two independent methods using satellites and ground observations. The methods give the m-number of −10 to −15. Direct measurement of *m*-number enables us to calculate the resonance energy. We find that the flux oscillations of H^+ and O^+ ions at $\geq$ 56.3 keV are caused by drift resonance and that of O^+ ions at $\leq$ 18.6 keV is caused by bounce resonance. The resonances of O^+ ions at multiple energies are simultaneously observed for the first time. The enhancement of the O^+/H^+ flux ratio at $\leq$ 18.6 keV indicates the selective acceleration of O^+ ions through the bounce resonance.

Keywords: Magnetosphere, Ring current, Drift-bounce resonance, Arase

Turbulences in the geospace, solar wind and interstellar medium

K. H. Lee[1] and L. C. Lee[1,2]

1: Institute of Earth Sciences, Academia Sinica, Nankang, Taipei
2: Institute of Space Science, National Central University, Zhongli, Taoyuan

Turbulent phenomena are commonly observed on the Earth and in the space plasmas. In a turbulent flow, energy is transferring from large to small scales due to successively breaking of eddies from large to small sizes. This energy cascade leads to the power law spectra of some physical quantities, such as pressure and velocity. Starting from the interstellar medium, we present the latest result of electron density turbulence spectrum from in situ observations of Voyager 1. In the solar wind and the Earth's magnetosphere, similar turbulence spectra of, e.g., electric and magnetic fields and plasma density have been observed by many satellites. On the Earth, turbulences can be found, e.g., in surf zones and air flows. The Kolmogorov power law is usually observed in a highly turbulent medium. The properties of these turbulence spectra of various scales are briefly discussed.

Keywords: Turbulences, Kolmogorov power law

P41

Performance Evaluation of Magneto Plasma Sail with Magnetic Nozzle by using MPD Arcjet

Tatsumasa Hagiwara[1], Yoshihiro Kajimura[2], Yuya Oshio[3], Ikkoh Funaki[4],
Hiroshi Yamakawa[4], and Hirotsugu Kojima[1]

1: RISH, Kyoto University, Japan
2: National Institute of Technology, Akashi College, Japan,
3: Tokyo University of Agriculture and Technology, Japan
4: 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.

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Dynamics of energetic protons interacting with electromagnetic ion cyclotron waves

Tomohiro Sekine, Yoshiharu Omura, Danny Summers, and Yikai Hsieh

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 conform that our results satisfy the theoretical conditions for RTA.

P43

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

Keita Takahashi, Yoshiharu Omura, Danny Summers, and Yikai Hsieh

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.

P44

Preliminary results of behavioral responses of 10 strains Aedes aegypti (L.) from Taiwan exposed to permethrin residual treatment

Jin-Jia Yu and Kok-Boon Neoh

Department of Entomology, National Chung Hsing University,
145, Xingda Rd. South District, Taichung 402 Taiwan

Dengue fever is an infectious disease occurring in tropical and sub- tropical countries and is primarily transferred by Aedes mosquitoes. Aedes aegypti (L.) is the major vector to transmit the dengue virus in humans and is distributed only in southern Taiwan. Chemical control is the most economical and widespread methods in vector disease management. Among insecticides, pyrethroids are commonly employed for indoor residual spraying in mosquito management. Besides its knockdown properties, pyrethroids potentially cause behavioral changes in mosquitoes. Early escaping from treated area may decrease the efficacy of insecticide. The objective of this study was to compare the behavioral responses between ten different field strains from southern Taiwan that characteristic of different level of resistance ratio exposed to permethrin residual treatment. Four strains from Tainan, five strains from Kaohsiung and one susceptible colony from National Yang-Ming University were tested by World Health Organization (WHO) bioassay test and excito-repellency test system. The result showed that Xiaogang district in Kaohsiung demonstrated the greatest resistance ratio in lethal time 50%. The relationship between resistant ratio and escape time of mosquito in repellent test was conducted.

Keywords: Behavioral response, Aedes aegypti, excito-repellency test, permethrin

P45

Assessing the Current Insecticides Resistance Status on Dengue Vector, Aedes albopictus (Diptera: Culicidae)

Wan Fatma Zuharah and Ahmad Mohiddin

Medical Entomology Laboratory, Vector Control Research Unit, School of Biological Sciences, Universiti Sains Malaysia

Despite major insecticide-based vector control program, dengue continues threat the health in Malaysia. The emergence of resistance occurs in the dengue vectors have led to the failure of the control program. Assessing the current pattern of insecticide resistance in Aedes mosquitoes is essential for the success of vector control program. Three strains of Ae. albopictus collected from the dengue hotspot areas were tested against common used insecticides by the Ministry of Health. Using the WHO adult bioassay test, the susceptibility status of Aedes albopictus on permethrin, deltamethrin and malathion was identified in this study. The adult bioassay results suggested the Flat Hamna strain (FH) was found to develop incipient resistance after 24h exposure towards all three insecticides tested; permethrin, deltamethrin and malathion (mortality 97-87%). With 1.93 folds of Resistance Ratio 50 (RR50) values, FH strains have the highest chances to develop resistance towards permethrin. Among all insecticides tested, malathion was contributed to significantly higher KdT50 in all Ae. albopictus strains as compared to VCRU reference strain (p<0.001). Thus, suggesting malathion insecticide is the least effective insecticide in our vector control program. Whereas, permethrin and deltamethrin are still reliable to be used in the control program, nonetheless require continuous monitoring on their susceptibility towards Ae. albopictus. Our finding can be used as a baseline for insecticide resistance of Ae. albopictus to improve vector control program across Malaysia.

Keywords: Aedes, Dengue, Insecticide, Resistance, Susceptibility

P46

Biological Characteristics of Inherited Permethrin Resistance of Field Collected Male Aedes aegypti

Hadian Iman Sasmita, Kok-Boon Neoh, and Wu-Chun Tu

National Chung Hsing University, Taiwan

Insecticide resistance may alter the biological characteristics of mosquito dengue vector Aedes aegypti. In general, resistant mosquitoes are thought to be fitness disadvantage as energy expenditure is mainly channeled for detoxifying mechanism. The male fitness is crucial to ensure the mating competitiveness within wild populations. However, the study on the alteration of biological attributes, particularly on male mosquito is limited. In this study, we provided the information of immature developmental time, survival rate, longevity, sex ratio, pupal size and wing length of six male-descendant permethrin resistance strains. In addition, we analyzed the glucose, glycogen and trehalose content of the males to append the information in respect of energy budget related to insecticide resistance. The result showed that the status of permethrin resistance of six field collected strains from southern Taiwan varied from medium to very high resistant. Of those resistant strains, no significant different of immature developmental time (F=1.474, P=0.176), survival rate to adult (F=0.115, P=0.997), longevity (F=1.536, P=0.159) and sex ratio (F=0.996, P=0.458) was detected. In contrast, the morphological measurement of the ratio of pupal size (F=8.602, P=0.000) and wing length (F=2.855, P=0.008) were significantly different compared to susceptible strain and highly resistant lab-reared strains. The resistant field strains tended to have higher energy reserve in the form of glucose, glycogen and trehalose compared to susceptible and highly resistant lab-reared strains.

Keywords: life history traits, biochemical content, resistance ratio, dengue

A New Dengue Vector Monitoring Strategy in Southern Taiwan

Chin-Gi Huang[1], Hui-Ching Cheng[1], Tsung-Ju Tsai[1], Pei-Qi Chen[1], Ya-Zhe Lee[1], Yu-En Chiu[1], Yu-Ting Huang[1], Tzu-Ying Chuang[1], Tzu-Chen Lin[1], Kun-Ta Chuang[2], and Wu-Chun Tu[3]

1: National Mosquito-Borne Diseases Control Research Center, National Health Research Institutes
2: Department of Entomology, National Chung Hsing University
3: Department of Computer Science and Information Engineering, National Cheng Kung University

Among factors associated with the 2015 dengue fever outbreak in southern Taiwan, the existence of vector mosquitoes in communities is probably the most prominent factor in the spread of the disease. Thus, the existing mosquito vector surveillance systems which focused on adult mosquito survey and the Breteau index may need to be improved. In the autumn of 2016, we started the pilot program: deploying ovitraps widely to monitor dengue vectors in hot zones – recording the numbers of mosquito eggs and the percentage of positive ovitraps weekly. Based on this, the standard operating procedure is established. In 2017, a partnership between local governments and ourselves set up 4,109 ovitrap monitoring sites in 359 villages in Tainan, Kaohsiung and Pingtung. Relevant data were presented weekly for immediate reference and appropriate environmental management measures for all levels of governments. Also, the effectiveness of the management can be evaluated by comparing the data before and after the measures were taken. Furthermore, the current data revealed that mosquito vectors increase significantly in the second week after rain, and the distribution of mosquito species are affected by human population densities. This information will be valuable for governments to prioritize areas and timing of management measures' execution in the future.

Keywords: Dengue, Vector, Monitoring

Excito-repellency activity of neem extract and oil-based liquid soap formulations against Culex quinquefasciatus, Anopheles minimus, and Aedes aegypti (Diptera: Culicidae)

Amonrat Panthawong[1], Theeraphap Chareonviriyaphap[1], and Unchalee Sanguanpong[2]

1: Kasetsart University, Thailand
2: Rajamangala University of Technology Thanyaburi, Thailand

Use of chemical insecticides is a serious environmental concern and often results in insecticide resistance in mosquito populations. Using natural products to protect humans from mosquito bites is a preferred strategy and plant-based essential oil is one alternative to synthetic insect repellents. In this study, neem (Azadirachta indica) extract and essential oil was incorporated at a 5% concentration into two different soap formulations, Neem Liquid Soap (NLS) with extract only, and Neem Oil Liquid Soap (NOLS). Each formulation was evaluated for behavioral responses of three primary mosquito pests and potential disease vectors: Aedes aegypti (dengue and Zika), Anopheles minimus (malaria), and Culex quinquefasciatus (lymphatic filariasis) using an excito-repellency test system. Results demonstrated NLS was effective in eliciting a stronger combined direct contact excitation (irritancy) response together with repellency compared to non-contact spatial repellency action alone against An. minimus (74.58% contact escape, 59.26% non-contact escape. The NOLS formulation produced a greater repellency response than NLS with no discernable contact irritancy action against Cx. quinquefasciatus (82.45% non-contact escape, 77.19% contact escape. Ae. aegypti showed the least response to both formulations. Very minimal knockdown and mortality was seen with both formulations. We conclude that neem extract and essential oil could be developed further and used to protect human from mosquito attack and prevent mosquito-borne disease transmission. These findings can lead to further development of neem as a repellent active ingredient advancing to human use trials. Effective personal protection integrated with other means of vector control can potentially provide greater reduction in disease transmission risk while also reducing use of synthetic compounds.

Keywords: Excito, Repellency, Neem, Culex quinquefasciatus, Anopheles minimus, Aedes aegypti

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Force oviposition technique of Anopheles minimus (Diptera: Culicidae), a vector of malaria in Thailand

Pairpailin Jhaiaun and Theeraphap Chareonviriyaphap

Kasetsart University, Thailand

Anopheles minimus (Diptera: Culicidae) is a major malaria vector in Greater-Mekong Sub-region. This species has a wide distribution in Asia including Thailand, Cambodia, Lao, Vietnam, Myanmar, Malaysia, and India. To detect the insecticide susceptible status in mosquito population, the large number of mosquitoes is needed. The objective of this study was to compare the percentage of oviposit and survival rate between laboratory and field test populations of An. minimus using force oviposition technique. In this study, 180 females mosquitoes were equivalently divided into two cohorts, laboratory (n = 90) and flied test populations (n = 90). Results demonstrated the significant difference in percentage of laid eggs among the two cohorts (P<0.05). The percentage of oviposit is 44.44% (19.78 ± 2.82 eggs/mosquito) for a laboratory colony and is 62.22% (22.61 ± 3.68 eggs/mosquito) for the field test population. The survival rate of An. minimus was 0.9 (laboratory colony) and 0.55 (field population). The results from this experiment are very useful in the preparing the F1 progeny sufficiently large for further laboratory testing, including behavioral studies, insecticide resistance assessment and molecular characterization, as well as vector competence studies.

Keywords: Anopheles minimus, Malaria, Mosquito oviposition, Force oviposition, Thailand

P50

Temephos resistance in Aedes aegypti

Manop Saeungand Theeraphap Chareonviriyaphap

Department of Entomology, Faculty of Agriculture, Kasetsart University, Thailand

Aedes aegypti is a principle vector of several diseases, including dengue. In 2017, it was reported that dengue fever caused 53,190 patients and 63 deaths in Thailand. The main method to control the transmission is the vector control. The BVBD, DDC, Ministry of Public Health, Thailand has used temephos to eliminate Ae. aegypti larvae in its breeding habitat since 1978. However, intensive use of temephos results in the resistance development in mosquito populations which decrease the efficiency of the control measure. Therefore, the aim of this research was to present the status of temephos resistance in Ae. aegypti populations from 2003 to 2017 using the GIS technology. The resistant information was displayed in 3 periods of time: 2003-2005, 2006-2009 and 2011-2015. The results revealed that each period shows an increasing of temephos resistance which is a crucial evidence for the OPH to be more precise in the use of temephos.

Keywords: Aedes agypti, temephos, resistance, control, Thailand

P51
Strong dayside aurorae and precipitations for radial interplanetary magnetic fields

Hsien-Ming Li[1], Jih-Hong Shue[1], Satoshi Taguchi[2], Masahito Nosé[2],
Keisuke Hosokawa[3], Yongliang Zhang[4], and Simon Wing[4]

1: Institute of Space Science, National Central University, Taoyuan, Taiwan
2: Graduate School of Science, Kyoto University, Kyoto, Japan
3: Department of Communication Engineering and Informatics, University of Electro-Communications, Tokyo, Japan
4: The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, USA

Aurorae are created by precipitating particles in the upper atmosphere resulting from an interaction between the solar wind and magnetosphere. The orientation of the interplanetary magnetic field (IMF) is usually in a form of Parker spiral, but sometimes it can acquire a radial orientation, i.e., the magnetic field is aligned with the solar wind. The dayside aurora and precipitation for radial IMF has not been well understood in the past. In this study, we use coordinated observations obtained from an all-sky camera (ASC) over Svalbard, in situ particle detectors, and auroral imagers of the DMSP satellites to examine the type of auroras and the characteristics of precipitating particles in a radial IMF event with $Bx < 0$. From the keogram derived from the ASC images, we find that the footprints of the open/closed boundary did not change substantially during the period of radial IMF. The aurora seen from the DMSP images was mainly aligned in the east-west direction, but with some detached arcs found in the poleward direction. An analysis of the particle spectra from DMSP reveals that the electrons that produced the auroras have a mixture of origins from the cusp, mantle, and polar rain with a feature of structured broadband acceleration, and the ions also have a characteristic of structured precipitation. The magnetic reconnection behind the cusp can occur in the northern hemisphere for Earthward IMF ($Bx < 0$). This reconnection can be a possible mechanism that creates the structured precipitations in electrons and ions.

Keywords: Aurora, radial interplanetary magnetic fields

P52
A new algorithm of ionogram scaling for the Chung-Li Ionosonde

Kai-Jun Ke, Kang-Hung Wu, Ching-Lun Su, and Yen-Hsyang Chu

Institute of Space Science, National Central University, Chung-Li, Taiwan, ROC

A new ionosonde is under construction at Chung-Li VHF radar station on the campus of National Central University in Taiwan. In other to precisely estimate ionospheric parameters with corresponding electron density profiles form the ionogram observed by this ionosonde system, a new algorithm is developed to scale the ionogram traces. We first use statistical analysis method to remove interference and background noise from the ionogram. A two-dimensional autocorrelation function is then employed to identify and separate the observed O- and X-wave traces, and the multiple reflected traces can also be effectively discerned. We use an image processing technique to obtain preliminary ionospheric parameters based on separated O- and X-wave traces. In this study, the quasi-parabolic segment (QPS) model is used to obtain the electron density profile, and the IRI model is also used to provide initial inputs. According to the scaled ionospheric parameters from the O-wave traces combined with the inputs of the IRI model, it is easy to retrieve the QPS model-based electron density profiles. From the retrieved electron density profiles, the corresponding O-wave traces can be constructed and compared with the observed one. The root mean square errors (RMSEs) between observed and constructed O-wave traces are computed and the ionospheric parameters of the constructed trace with the least RMSE value are then selected as the final result of the ionogram scaling. The accuracy and precision of the estimated ionospheric parameters by using the proposed algorithm are also analyzed and discussed.

Keywords: 2D autocorrelation, true height analysis, ionogram

P53

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

Kazuki Kurisu, Yusuke Ebihara, and Satoko Nakamura
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.

Keywords: GIC, transmission line, solar flares, simulation, FDTD method

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

Takuto Ueno[1], Hiroshi Yamakawa[2], Hiroyuki Hashiguchi[1], and Mamoru Yamamoto[1]

1: RISH, Kyoto University, Japan, 2: Japan Aerospace Exploration Agency

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 m will cause sufficient damage by colliding with artificial satellites and the space station. In the year 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 method of space debris 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. 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. Debris can be imaging by using Single Range Doppler Interferometry(SRDI) method, by which we can estimate the shape of space debris with the Doppler shift generated from the rotating of target in a period time.

Keywords: Debris, Shape estimation, Atmospheric radar, MU radar

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Orbit Determination of Unidentified Space Debris by Using MU Radar

Takuya Torii[1], Hiroshi Yamakawa[2], Hiroyuki Hashiguchi[1], and Mamoru Yamamoto[1]

1: RISH, Kyoto University, Japan, 2: 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 7 km/s, they will cause severe damage on active sattlites 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.

Keywords: Space debris, Orbit Determination, MU radar

P56

Toward ionosphere forecast using FORMOSAT-7/COSMIC-2

Charles Lin[1], Chia-Hung Chen[1], P. K. Rajesh[1], and C. Y. Lin[2]

1: Department of Earth Sciences, National Cheng Kung University, Taiwan
2: National Chung Hsing University, Taiwan

We report that assimilating ground-based and space borne GNSS observations into a coupled thermosphere-ionosphere model by using the ensemble Kalman filter (DART-TIEGCM) results in improved specification and forecast of eastward pre-reversal enhancement (PRE) electric field (E-field). Through data assimilation, not only the ionospheric plasma density, but thermospheric winds, temperature and compositions are also adjusted simultaneously according to their relationship to ionospheric plasma density. The improvement of dusk-side PRE E-field over the prior state is achieved primarily by intensification of eastward neutral wind. The improved E-field subsequently promotes a stronger plasma fountain and deepens the equatorial trough. As a result, the horizontal gradients of Pedersen conductivity and eastward wind are increased due to greater zonal electron density gradient and smaller ion drag at dusk, respectively. Such modifications provide preferable conditions and obtain a strengthened PRE magnitude closer to the observation. The adjustment of PRE E-field is enabled through self-consistent thermosphere and ionosphere coupling processes captured in the model. The assimilative outputs are further utilized to calculate the flux tube integrated Rayleigh-Taylor instability growth rate during March 2015 for investigation of global plasma bubble occurrence. Significant improvements in the calculated growth rates could be achieved because of the improved update of zonal electric field in the data assimilation forecast. As the upcoming COSMIC-2 mission is equipped with radio occultation observations of global electron density as well as in-situ ion density and velocity measurements at low latitudes, the observations will benefit the assimilation model by providing rich data and validation of plasma bubble occurrence.

Keywords: Ionosphere forecast, FORMOSAT-7/COSMIC-2

P57

Achievements and future plan for study of low-latitude ionosphere by using satellite-ground beacon experiments

Mamoru Yamamoto

RISH, Kyoto University, Japan

We have been successfully conducted observations of total-electron content (TEC) of the ionosphere by the satellite-ground beacon experiment. A unique dual-band (150/400MHz) digital receiver GNU Radio Beacon Receiver (GRBR) were developed based on the recent digital signal processing technologies. The GRBR receivers were deployed first in Japan, and then in southeast Asia, and other areas. Data from the GRBR network were used for the investigations of variety of ionospheric phenomena. Longitudinal "large-scale wave structures (LSWS)" in the low latitude were studied in detail as a possible seeding of equatorial plasma bubble (EPB). Also, we were successful to measure the equatorial ionospheric anomaly (EIA) in large latitudinal extent of at most +/-20 degrees in Thailand-west Indonesia region. We now have a project to start new satellite-ground beacon experiment with new satellite constellations. One of them is TBEx (Tandem Beacon Explorer), a project by SRI International, to fly a constellation of two 3U cubesats with triband beacon transmitters. Another one is a project of FORMOSAT-7/COSMIC-2 by Taiwan/USA. Well-known mission of COSMIC-2 is GNSS occultation experiment, but the satellites carry triband beacon transmitters. We are now developing the next generation beacon receiver, GRBR2, that should be useful for these new projects. We will review achievements with GRBR, show a new GRBR2 system, and discuss possibility of the new satellite beacon experiment.

Keywords: Satellite-ground Beacon experiment, Low-latitude Ionosphere Structure, New Beacon Satellites, Software Defined Radio

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Remediation of Ectomycorrhiza in Heavy-Metal Soil and the Shift on Bacterial Community Structure in Rhizosphere

Ying-Ping Sung and Yu-Ting Wu

Department of Forestry, National Pingtung University of Science and Technology, Taiwan

Mycorrhizal fungi are able to form a symbiotic relationship with plants, which known as mycorrhiza, play an important role in terrestrial ecosystems. The symbiont mycorrhizal fungi can facilitate the absorbance of nutrients, water, and resistance of soil heavy metals. In addition, mycorrhizal exudates are one of the determinants driving bacterial assemblage in the rhizosphere. However, the interaction between mycorrhizal fungi and soil microorganisms in the rhizosphere are still being underexplored. We will use next-generation sequencing to investigate the shift of soil bacterial community composition after inoculation of specific ectomycorrhizal fungi (ECMF) during heavy-metal remediation. The fungal strains (K2 and D1) were isolated from roots of *Pinus taiwanensis*. Inoculation experiments showed that D1, K2 and *Pisolithus tinctorius* (as the positive control) could form mycorrhiza with *Pinus taiwanensis*. After that, the inoculated seedlings were transplanted to the heavy-metal soil for about 6 months. After harvesting and analysis, the results showed that both isolated ECMF were able to reduce the concentration of heavy metals in soil.

Keywords: ectomycorrhizal fungi, bacteria community structure, soil heavy metals, next-generation sequencing