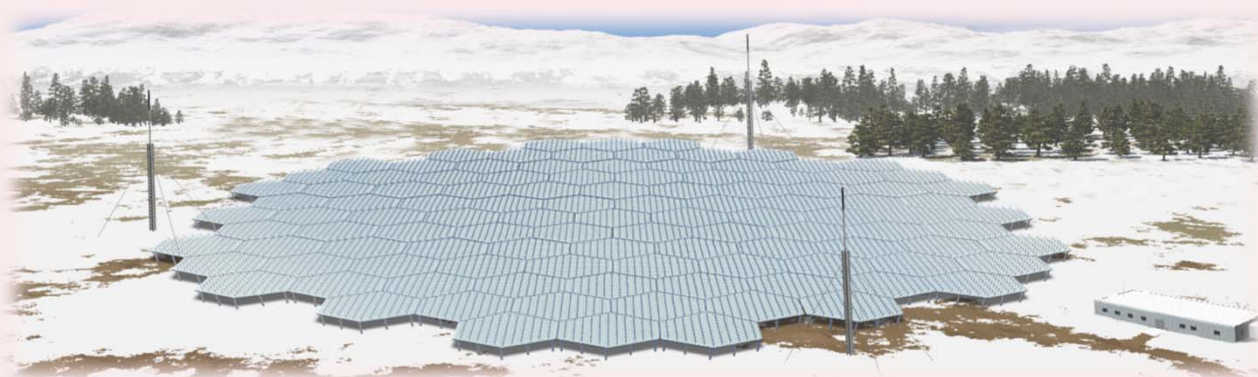
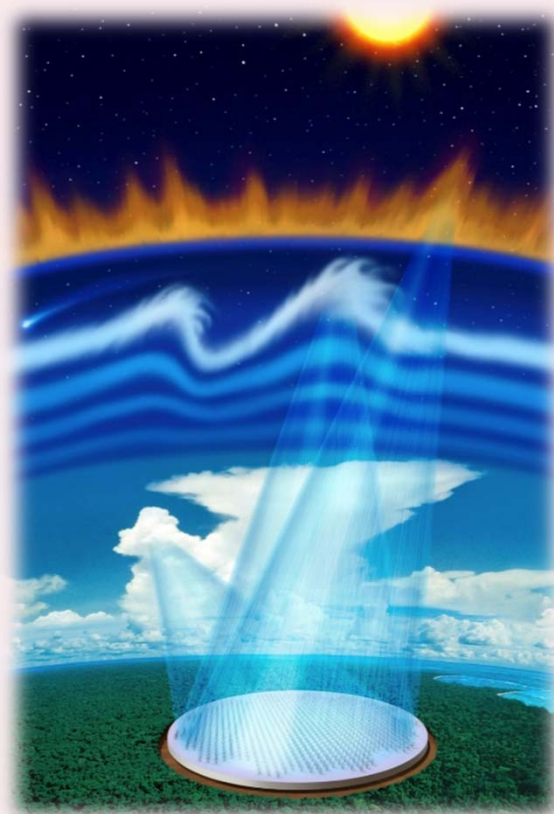


*The 15th International  
Workshop on Technical and  
Scientific Aspects of MST  
Radar (MST15/iMST2)*

*The 18th EISCAT  
International  
Symposium  
(EISCAT18)*

MST15/iMST2 EISCAT18



May 26-31, 2017

National Institute of Polar Research (NIPR), Tachikawa, Tokyo, Japan

*The 15th International  
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## Organizers

National Institute of Polar Research (NIPR)

Research Institute for Sustainable Humanosphere (RISH), Kyoto University

Institute for Space-Earth Environmental Research (ISEE), Nagoya University

EISCAT Scientific Association

"Pulsating Aurora Project (JSPS KAKENHI)"

Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS)



## Sponsors

National Institute of Information and Communications Technology (NICT)

Research Organization of Information and Systems (ROIS)

Kyoto University Foundation

Asia Research Node (ARN), RISH, Kyoto University



# Preface

The EISCAT Scientific Association is an international research organization operating three incoherent scatter radar systems and an ionospheric heating facility in northern Fenno-Scandinavia and Svalbard. The EISCAT systems have, since 1981, been widely used to study coupling processes in the solar-terrestrial system including, in particular, auroral and ionospheric physics and fundamental plasma processes. EISCAT is funded by research organizations in China, Finland, Japan, Norway, Sweden and the United Kingdom (collectively, the EISCAT Associates), and also institutions in France, Russia, South Korea, and the Ukraine (as affiliate members). The aim of the Association is to provide access to radar, and other, high-latitude facilities of the highest technical standard for non-military scientific purposes.

Over the years the EISCAT radars have been extremely productive, largely due to their strategic locations but also because of the ingenuity of the various associated users and user communities. The systems themselves have evolved over time, using the latest innovations in digital technologies and theoretical developments in measurement techniques, particularly in the areas of radar pulse coding and signal processing. How the radars are utilized for scientific goals has also changed over time, with closer and closer collaborations with complementary ground-based instruments such as optical measurement systems (both all sky and narrow field of view), lidars, tomography receivers, other systems utilizing radio-wave techniques, and numerical models of increasing sophistication. Collaborations with satellite and sounding rocket missions have also been and continue to be very scientifically productive.

EISCAT is now on the cusp of a major hardware and software upgrade in the form of EISCAT\_3D. This upgrade represents a significant improvement in measurement capabilities for EISCAT, both qualitatively and quantitatively, and it will place those capabilities at the forefront of incoherent scatter research. The recent successful launch of the Arase satellite presents current users with opportunities for collaborations in a key region of the near-Earth space environment and the planned SMILE mission, as well as others, similarly represents important opportunities for the future.

The EISCAT Scientific Association and the local organizing committee are very happy to be holding our biennial scientific meeting, the 18th EISCAT International Symposium (EISCAT18), in Tachikawa, Japan this year. We are very grateful to the National Institute of Polar Research (NIPR) for hosting us at this interesting location and we look forward to an informative and productive meeting.

Craig Heinselman  
Director, EISCAT Scientific Association

Hiroshi Miyaoka  
Chairman of Local Organization Committee for EISCAT18  
Co-Chairman of Local Organization Committee for MST/EISCAT Joint Meeting

Welcome to Japan! Welcome to the joint MST15/iMST2 and EISCAT18 meeting!

The Fifteenth International Workshop on Technical and Scientific Aspects of MST Radar --- MST15/iMST2 --- is taking place in Tachikawa, Tokyo, at the National Institute of Polar Research (NIPR). MST workshops have a long history of being the primary international meetings on the applications and development of MST radars. The last MST workshop held in Brazil also included topics related to ionospheric applications of soft target radars. This MST meeting in Japan, jointly arranged with the Eighteenth EISCAT International Symposium, will continue with the inclusion of ionospheric applications and science topics within the MST Workshop agenda. The EISCAT Symposium is the biennial conference for EISCAT-related radar research and science which is hosted by member institutions of the EISCAT Scientific Association.

The MST/EISCAT joint meeting at NIPR will be a timely opportunity for close and extensive interactions of the middle-atmosphere and ionospheric radar scientists in our era of rapid technological changes and computational advances. The joint meeting has attracted more than 240 oral and poster presentations which may be the largest participation level ever for either conferences. We are optimistic that the synergy generated in this joint meeting will spark new ideas that can benefit both the EISCAT and MST radar communities.

The MST/EISCAT joint meeting program at NIPR will run from May 26 until May 31, 2017. The selection of Japan as the site of MST15 following the 2014 Brazil meeting was in recognition of the advancements of atmospheric and ionospheric radar science taking place in Japan over the past several decades: The Kyoto University has been operating the MU radar in Shigaraki, Japan, since 1984, and also helped establish the Equatorial Atmosphere Radar (EAR) in 2001 in Indonesia which is a facility operated in close collaborations with the National Institute of Aeronautics and Space of Indonesia (LAPAN). NIPR, on the other hand, joined the EISCAT Scientific Association jointly with the Nagoya University in 1996, and established the Fixed Antenna of EISCAT Svalbard Radar in 1999. NIPR also collaborated with the University of Tokyo to start the Program of the Antarctic Syowa MST/IS Radar (PANSY) which reached its full-system operation in 2015. In the interim, Japan had the honor of hosting the Fourth MST Workshop in Kyoto (1988) and the Tenth International EISCAT Workshop in Tokyo (2001).

The scientific research community in Japan is currently promoting a major thrust of the Study of Coupling Processes in the Solar-Terrestrial System that aims to establish the Equatorial MU radar in Indonesia, to provide Japanese support for the EISCAT\_3D radar project, and establish a global observation network of optical and magnetic instruments. The MST/EISCAT joint meeting will be an excellent opportunity for gathering international support and establish collaborative research connections related to this new major thrust.

Local and international organizers of the MST Workshop are deeply grateful to NIPR for providing financial support and allowing the use of NIPR conference facilities for the joint meeting. We also thank the National Institute of Information and Communications Technology (NICT), the Kyoto University Foundation, Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS), Research Organization of Information and Systems, Institute for Space-Earth Environmental Research of Nagoya University (ISEE), and Research Institute for Sustainable Humanosphere of Kyoto University (RISH) for providing funds for travel support of participants for the joint meeting.

Erhan Kudeki

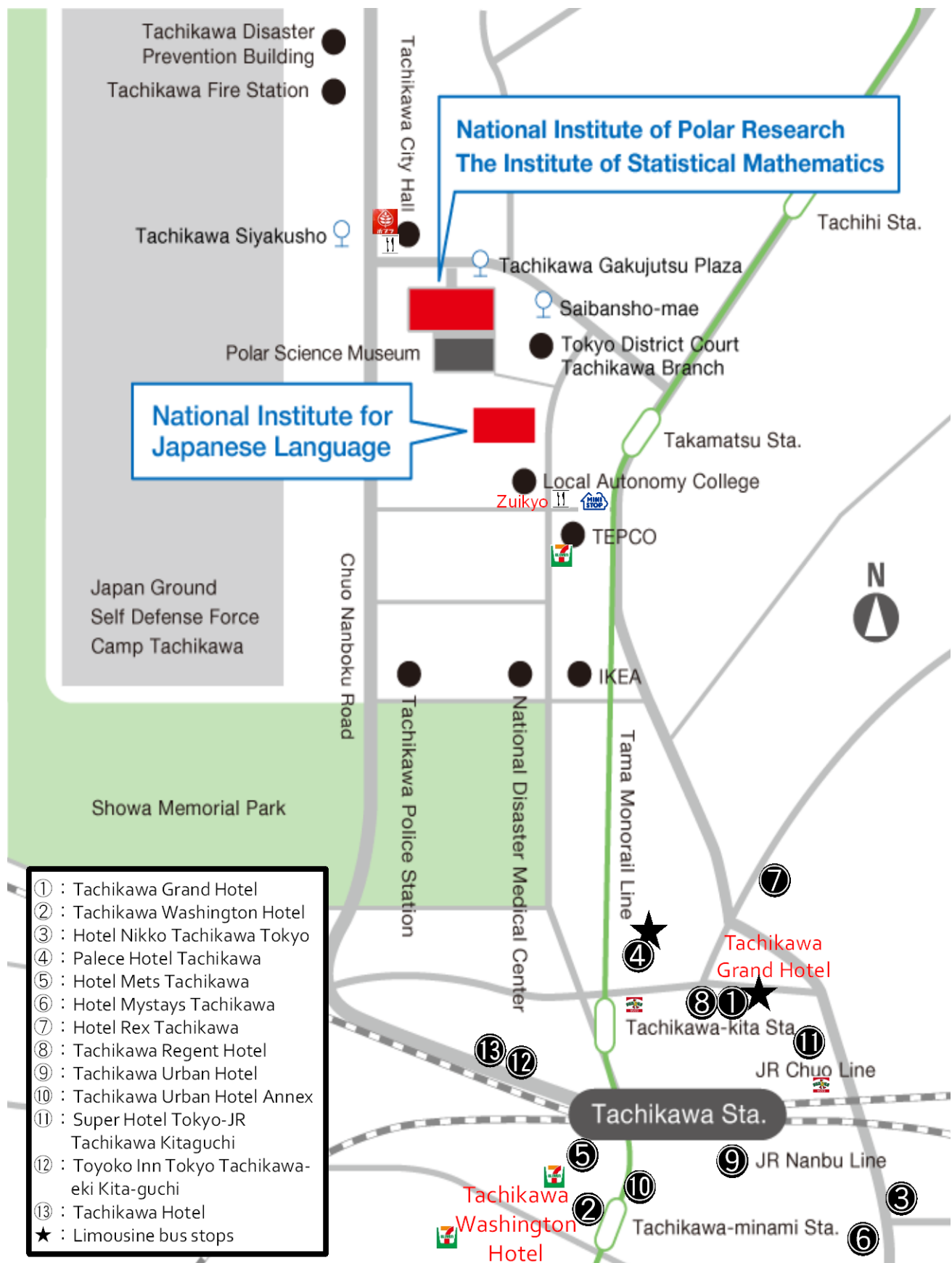
Co-Chairman of International Steering Committee for MST15/iMST2

Mamoru Yamamoto

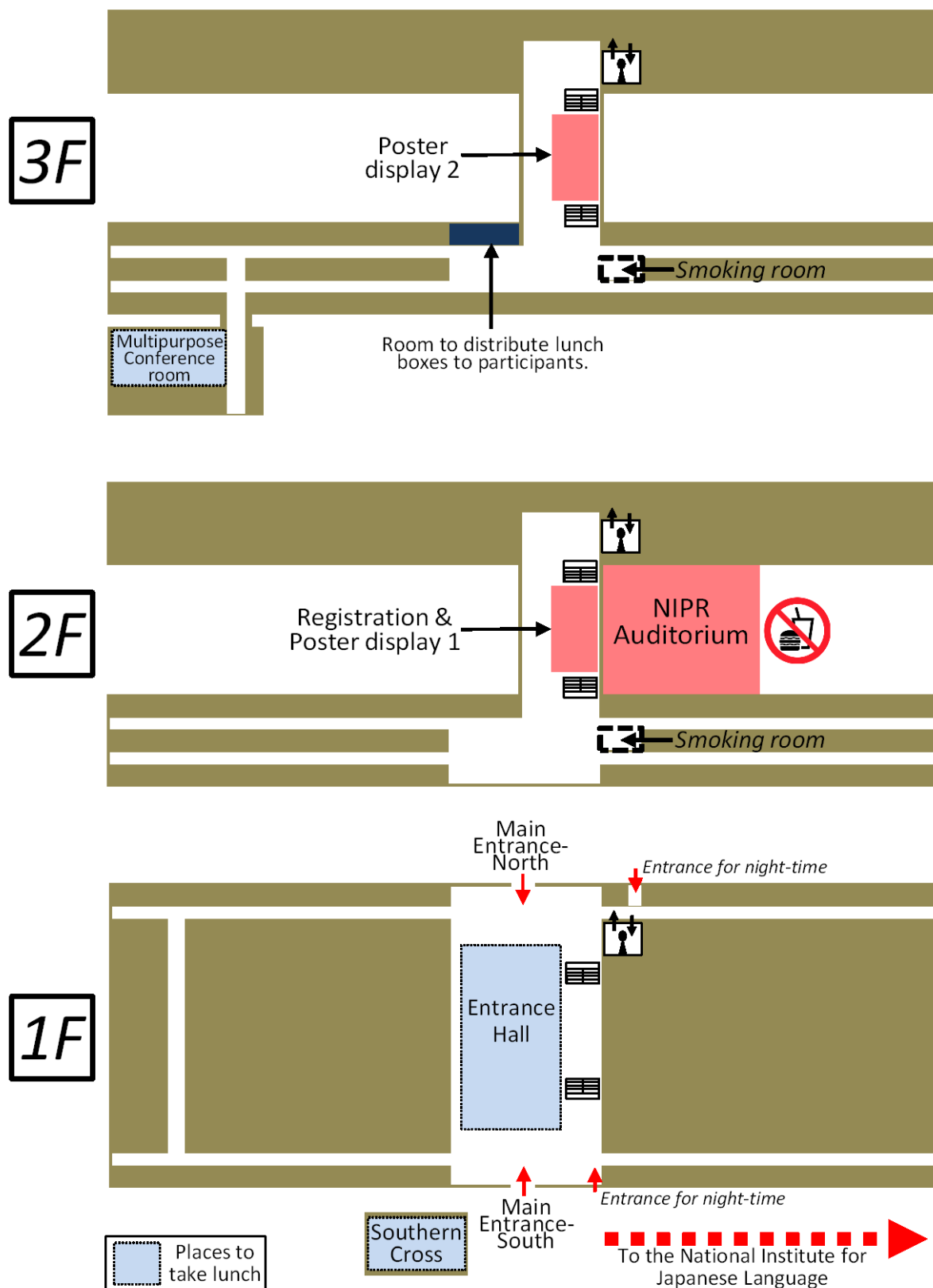
Co-Chairman of International Steering Committee for MST15/iMST2

Co-Chairman of Local Organization Committee for MST/EISCAT Joint Meeting

## Map around NIPR



## Floor Map of NIPR



At the session room (Auditorium), you can drink only water from a plastic bottle.

Smoking is available only in the smoking rooms, not outside the building.

## Session Schedule

	May 26 (Fri)	May 27 (Sat)	May 28 (Sun)	May 29 (Mon)	May 30 (Tue)	May 31 (Wed)
AM1 0900-1045	Registration	E3+M3	Excursion	E1+M1	0900-1015 E2+M2	M5
AM2 1100-1245	E5				1045- E4	M6
PM1 1345-1530	E6			E2+M2		
PM2 1545-1730	E7				M7	
PM3 1800-1930		Poster: E3+M3, E5, E6, E7		Banquet 1900-2100	Poster: E1+M1, E2+M2, E4, M4, M5, M6, M7	M8

## Sessions

E1: Radar and lidar techniques

E2: Future infrastructure and facilities

E3: Ionosphere/thermosphere/mesosphere

E4: Aurora and airglow

E5: Active experiments

E6: The ERG mission and magnetosphere-ionosphere coupling

E7: Space weather and modelling

M1: Radar hardware, signal processing, quality control for coherent and incoherent radars

M2: New radar/radio systems and future MST plans

M3: Ionospheric irregularities and IS experiments

M4: MST Radar scattering, turbulence and small-scale processes

M5: Meteorology and forecasting/nowcasting

M6: Middle atmosphere dynamics and structure

M7: Radar detection of meteors

M8: Brainstorming session

# Program

## May 26 (Fri)

10:50-11:00 Opening of the 18th EISCAT symposium

Welcome and introduction from Conference host and Chair of EISCAT Council

Announcements

11:00-12:40 Chair: Michael Rietveld

Session E5: Active experiments

11:00-11:20 E5-1 (invited)

Could electromagnetic wave pumping in the L mode be of importance for the magnetic zenith effect?

Thomas B. Leyser\*

11:20-11:35 E5-2

ISR observations of topside ionline enhancements during a high-power HF-radio wave modification experiment at high latitudes

Theresa Rexer\*, Bjoern Gustavsson, Tom Grydeland, Mike Rietveld, Thomas Leyser, Urban Braendstroem, and Tima Sergienko

11:35-11:50 E5-3

Comparison between the time development of HF-enhanced Langmuir and ion-acoustic turbulence under O- and X-mode heating at EISCAT

Natalia F. Blagoveshchenskaya\*, T.D. Borisova, T.K. Yeoman, and I. Haeggstroem

11:50-12:05 E5-4

On HF-Radio-Wave Induced Density Structures at F-region Altitudes and Their Dynamics - Observations with a Large Aperture Radar

Bjoern Gustavsson\*, Juha Vierinen, Mike Sulzer, Phil Perillat, and Christiano Brum

12:05-12:20 E5-5

The 3D Distribution of Artificial Aurora Induced by HF Radio Waves in the Ionosphere

Andreas Kvammen\*, Bjoern Gustavsson, Urban Braendstroem, and Juha Vierinen

12:20-12:40 E5-6 (invited)

Dynamic D-Region Heating Experiments at HAARP

Robert C Moore\*

Lunch

13:45-15:30 Chair: Stephan Buchert

Session E6: The ERG mission and magnetosphere-ionosphere coupling

13:45-14:02 E6-1 (invited)

SWARM satellite and EISCAT radar observations of a strong midnight flow channel

Anita Aikio\*, Heikki Vanhamaeki, Ilkka Virtanen, Bjoern Gustavsson, Stephan Buchert, Kirsti Kauristie, Claudia Stolle, and David Knudsen

14:02-14:19 E6-2 (invited)

Pulsating Aurora and the MAPLE Sounding Rocket Experiment

Marc Lessard\*, Y. Miyoshi, K. Asamura, K. Hosokawa, S. Jones, A. Jaynes, K. Lynch, N. Paschalidis, and G. Mcharg

14:19-14:33 E6-3

Geospace Exploration Project: Arase (ERG)

Yoshizumi Miyoshi\*, Iku Shinohara, Takeshi Takashima, Kazushi Asamura, Kazuo Shiokawa, Nana Higashio, Takefumi Mitani, Shoichiro Yokota, Satoshi Kasahara, Yoich Kazama, Shiang-Yu Wang, Yoshiya Kasahara, Yasumasa Kasaba, Satoshi Yagitani, Ayako Matsuoka, Hirotsugu Kojima, Yuto Kato, Mitsuru Hikishima, Kanako Seki, Keisuke Hosokawa, Yasunobu Ogawa, Shin-Ichiro Oyama, Satoshi Kurata, Takayuki Ono, Erg Project Team, and pulsating aurora team



14:33-14:47 E6-4

Coordinated observations of pulsating aurora with multi-point high-speed optical measurements, EISCAT and ARASE/ERG satellite

Keisuke Hosokawa\*, Shin-Ichiro Oyama, Yasunobu Ogawa, Yoshizumi Miyoshi, Rei Kurita, Hiroshi Miyaoka, Yoshimasa Tanaka, Satonori Nozawa, Mariko Teramoto, Kazuo Shiokawa, Takeshi Sakanoi, and Ryoichi Fujii

14:47-15:01 E6-5

Cosmic Radio Noise Absorption in the High-Latitude Ionosphere during Solar Wind High-Speed Streams

Maxime Grandin\*, Anita Aikio, Alexander Kozlovsky, Thomas Ulich, and Tero Raita

15:01-15:15 E6-6

EPP inversion from the EISCAT radar data in support of the ERG satellite mission

Antti Kero\*, Esa Turunen, and Pekka Verronen

15:15-15:29 E6-7

Energetic electron precipitation and auroral morphology at the substorm recovery phase

Shin-ichiro Oyama\*, Antti Kero, Craig J. Rodger, Mark A. Clilverd, Yoshizumi Miyoshi, Noora Partamies, Esa Turunen, Tero Raita, Pekka T. Zerronen, and Shinji Saito

Coffee break

15:45-17:40 Chair: Ian McCrea and Hitoshi Fujiwara

Session E7: Space weather and modelling

15:45-16:05 E7-1 (invited)

Space weather induced forcing of the middle and upper atmosphere and new observational opportunities by the EISCAT\_3D radar

Esa Sakari Turunen\*

16:05-16:25 E7-2 (invited)

Ionosphere and Thermosphere Responses to Solar Flares

Huixin Liu\*

16:25-16:40 E7-3

GAIA Simulations of Electric Potential Variations in the Equatorial Evening Ionosphere after a Severe Solar Flare

Mitsuru Matsumura\*, Kazuo Shiokawa, Hiroyuki Shinagawa, Yuichi Otsuka, Hidekatsu Jin, Yasunobu Miyoshi, and Hitoshi Fujiwara

16:40-16:55 E7-4

Activities of space weather forecast operation and research in Japan

Mamoru Ishii\*

16:55-17:10 E7-5

Studies of disturbances in the polar ionosphere and thermosphere with the EISCAT radar system and whole atmosphere GCM

Hitoshi Fujiwara\*, Satonori Nozawa, Yasunobu Ogawa, Yasunobu Miyoshi, Hidekatsu Jin, Hiroyuki Shinagawa, Ryuho Kataoka, and Huixin Liu

17:10-17:25 E7-6

Modeling the large scale irregularities in the F region polar ionosphere controlled by the solar wind

Renata Lukianova\*

17:25-17:40 E7-7

Use of EISCAT 3D for Observations of Space Debris

Juha Vierinen\*

## May 27 (Sat)

9:00-12:45 Chair: Marco Milla and Hitoshi Fujiwara

Session E3: Ionosphere/thermosphere/mesosphere

Session M3: Ionospheric irregularities and IS experiments

9:00- 9:15 E3M3-1 (invited)

New insights on the physics of equatorial 150 km radar echoes

Erhan Kudeki\*, Pablo Reyes, Koki Chau, Marco Milla, and Gerald Lehmacher

9:15- 9:30 E3M3-2

New observations of daytime 150-km echoes from Gadanki and Kototabang

Amit Kumar Patra\*, P Pavan Chaitanya, Y Otsuka, T Yokoyama, and M Yamamoto

9:30- 9:45 E3M3-3

Seasonal variation of layering and wave activity in 150-km echoes at Jicamarca

Gerald Lehmacher\*, and Abhishek Desai

9:45-10:00 E3M3-4

Daytime zonal drifts in the ionospheric 150 km region estimated using EAR observations

Pavan Chaitanya Peddapati\*, A K Patra, Y Otsuka, T Yokoyama, and M Yamamoto

10:00-10:15 E3M3-5 (invited)

Multi-instrumented observations of June solstice F-region irregularities at Jicamarca

Fabiano S Rodrigues\*, M. A. Milla, C. Martinis, D. A. Hickey, B. G. Fejer, C. Valladares, and J. Arratia

10:15-10:30 E3M3-6

Observations of pre-sunset ionospheric F region bottom-type scattering layer at low latitude

Guozhu Li\*, Baiqi Ning, and M. A. Abdu

10:30-10:45 E3M3-7

Identification of ionogram signatures corresponding to different aspects of equatorial plasma bubbles

Lakshmi Narayanan Viswanathan\*, Sukanta Sau, Sivakandan Mani, Kaliappan Emperumal, Subramanian Gurubaran, T. K. Ramkumar, A. K. Patra, S. Sripathi, and P. Chaitanya

Coffee break

11:00-11:15 E3M3-8 (invited)

Gravity waves in the thermosphere simulated by GAIA

Yasunobu Miyoshi\*, Hitoshi Fujiwara, Hidekatsu Jin, and Hiroyuki Shinagawa

11:15-11:30 E3M3-9 (invited)

High-Latitude Ionosphere-Thermosphere Interactions

Arthur D Richmond\*

11:30-11:45 E3M3-10

Vertical motion of the neutral atmosphere in the polar MLT region

Satonori Nozawa\*, Takuo Tsuda, Yasunobu Ogawa, Hitoshi Fujiwara, Takuya Kawahara, Norihito Saito, Satoshi Wada, Toru Takahashi, Masaki Tsutsumi, Tetsuya Kawabata, Chris Hall, and Asgeir Brekke

11:45-12:00 E3M3-11

D- and E-region ion temperature measured with EISCAT radar facility

Yasunobu Ogawa\*, Satonori Nozawa, Masaki Tsutsumi, and Ingemar Haeggstroem

12:00-12:15 E3M3-12

Long-term variations and trends in the polar E-region

Lindis Merete Bjoland\*, Yasunobu Ogawa, Chris Hall, Mike Rietveld, Unni Pia Loevhaug, Cesar La Hoz, and Hiroshi Miyaoka

12:15-12:30 E3M3-13

TomoScand - Ionospheric 3D multi-instrument tomography

Johannes Norberg\*, Juha Vierinen, Lassi Roininen, Mikko Orispäe, and Kirsti Kauristie

12:30-12:45 E3M3-14

Common volume EISCAT-MAARSY meteor head echo observations

Johan Kero\*, Gunter Stober, Carsten Schult, Peter Brown, Zbigniew Krezminski, Robert Marshall, Ralph Latteck, William Cooke, Asta Pellinenwannberg, and Ingemar Haeggstroem

Lunch

13:45-17:30 Chair: Yoshimasa Tanaka and Baiqi Ning

13:45-14:00 E3M3-15 (invited)

Coordinated Multiple-ISR Studies of Polar Cap Structure

Roger H Varney\*, and Robert G. Gillies

14:00-14:15 E3M3-16

Ionospheric irregularity observation by VHF radar and GNSS scintillation monitor at Sanya

Lianhuan Hu\*, Baiqi Ning, Guozhu Li, Wenjie Sun, and Hongke Li

14:15-14:30 E3M3-17

Plasma Bubble Rise Velocity Estimated from EAR Observation and High-Resolution Bubble Model

Tatsuhiro Yokoyama\*, S. Tulasi Ram, K. K. Ajith, and M. Yamamoto

14:30-14:45 E3M3-18

The Qujing Incoherent Scatter Radar and its preliminary measurements

Ding Zonghua\*, Wu Jian, Dai Liandong, and Xu Zhengwen

14:45-15:00 E3M3-19

Recent High-Altitude ISR Experiments at Jicamarca

David Hysell\*, and Marco Milla

15:00-15:15 E3M3-20

Unusual 5-m E region field-aligned irregularities observed from Northern Germany during the magnetic storm of 17 March 2015

Jorge Luis Chau\*, and Jean Pierre St. Maurice

15:15-15:30 E3M3-21

Realtime three-dimensional ionospheric tomography and validation by MU radar

Susumu Saito\*, Mamoru Yamamoto, and Akinori Saito

Coffee break

15:45-16:00 E3M3-22

Polar Mesospheric Summer Echoes and Wind Profiles Observed Above EISCAT Tromso site

Ingrid B. Mann\*, Chris Hall, Satonori Nozawa, Ingemar Haeggstroem And Anders Tjulin, and Masaki Tsutsumi

16:00-16:15 E3M3-23

EISCAT Tri-Static Observation of Polar Mesosphere Winter Echoes on 8 January 2014

Evgenia Belova\*, Maria Kawnine, Ingemar Haeggstroem, Charles Anyairo, Sheila Kirkwood, Tima Sergienko, and Ingrid Mann

16:15-16:30 E3M3-24

EISCAT observation of wave-like fluctuations in vertical velocities and polar mesospheric summer echoes (PMSE) associated with energetic particle precipitation

Young-Sook Lee\*, Yongha Kim, Kyung-Chan Kim, Young-Sil Kwak, Timothy Sergienko, Sheila Kirkwood, and Magnar G. Johnsen

16:30-16:45 E3M3-25

Lower thermospheric wind variations in auroral patches during the substorm recovery phase

Shin-ichiro Oyama\*, Kazuo Shiokawa, Yoshizumi Miyoshi, Keisuke Hosokawa, Brenton J. Watkins, Junichi Kurihara, Takuo T. Tsuda, and Christopher T. Fallen

16:45-17:00 E3M3-26

Depletion of mesospheric sodium during extended period of pulsating aurora

Toru Takahashi\*, Keisuke Hosokawa, Satonori Nozawa, Takuo T. Tsuda, Yasunobu Ogawa, M. Tsutsumi, Y. Hiraki, H. Fujiwara, T. D. Kawahara, N. Saito, S. Wada, T. Kawabata, C. Hall, and H. Miyaoka

17:00-17:15 E3M3-27

GPS&GLONASS Observations of the Large Scale Travelling Ionosphere Disturbances during Severe Geomagnetic Storms

Irina Zakharenkova\*, and Iurii Cherniak

17:15-17:30 E3M3-28

Probing plasma irregularities with multiple L-band satellite signals

Hiroatsu Sato\*, Norbert Jakowski, and Jun Su Kim

18:00-19:30 Poster session

## May 29 (Mon)

9:00-14:15 Chair: Craig Heinselman and Ralph Latteck

Session E1: Radar and lidar techniques

Session M1: Radar hardware, signal processing, quality control for coherent and incoherent radars

9:00- 9:15 E1M1-1 (invited)

All-Solid-State Coherent Sodium Resonance Light Source: toward Stable Lidar Observation

Norihito Saito\*, Tomohiro Tsukihama, Takuya Kawahara, Satonori Nozawa, Tetsuya Kawabata, Takuo T. Tsuda, and Satoshi Wada

9:15- 9:30 E1M1-2

Resonance Lidar Observations for Polar Ionospheric Studies

Takuji Nakamura\*, Mitsumu K. Ejiri, Takanori Nishiyama, Takuo T. Tsuda, Makoto Abo, Takuya D. Kawahara, and Katsuhiko Tsuno

9:30- 9:45 E1M1-3

An overview of middle atmosphere lidars at National Atmospheric Research Laboratory, India

Raghunath Karnam\*, A Jayaraman, Alok Taori, S Sridharan, and M Venkatratnam

9:45-10:00 E1M1-4

A new active phased array Indian MST radar system with enhanced capabilities for high resolution atmospheric observations

Durga Rao Meka\*, P. Kamaraj, K. Jayaraj, K. M. V. Prasad, J. Kamal Kumar, J. Raghavendra, P. Yasoda, A.K.Patra, M.V.Ratnam, T.N.Rao, and A. Jayaraman

10:00-10:15 E1M1-5

The Chinese Phased Array Incoherent Scatter Radar Systems for Continuous Sounding the Earth's Ionosphere

Ming Yao\*, Xiaohua Deng, and Erhan Kudeki

10:15-10:30 E1M1-6

Range Sidelobe Suppression Using Quasi-Point-Target Echoes for Hainan Coherent Phased Array Radar (HCOPAR)

Ailan Lan\*, Jingye Yan, and Jurgen Rottger

10:30-10:45 E1M1-7

Multistatic Coded Continuous Wave Meteor Radar

Juha Vierinen\*, Jorge L. Chau, Ryan Volz, Gunter Stober, and Nico Pfeffer

Coffee break

11:00-11:15 E1M1-8

Development of EAR Multi-Channel Receiver System Using Software Defined Radio

Nor Azlan Bin Mohd Aris\*, Hiroyuki Hashiguchi, and Mamoru Yamamoto

11:15-11:30 E1M1-9

Development of MU radar real-time processing system with adaptive clutter rejection  
Kohsuke Kubota\*, Hiroyuki Hashiguchi, Mamoru Yamamoto, and Takahiro Manjyo

11:30-11:45 E1M1-10

High-time resolution plasma drift observations with EISCAT and KAIRA  
Ilkka Virtanen\*, Yasunobu Ogawa, Keisuke Hosokawa, Toru Takahashi, Anita Aikio, and Thomas Ulich

11:45-12:00 E1M1-11 (invited)

Recent advances in plasma-line observation techniques  
Juha Vierinen\*, Michael P. Sulzer, Philip J. Erickson, Phil Perillat, Anja Stroemme, Asti Bhat, Bjoern Gustavsson, and Christiano Brum

12:00-12:15 E1M1-12

Double-strong Alternating Code Sets for Mitigation and Elimination of Unwanted Contributions from Unmatched Filtering  
Tom Grydeland\*, and Bjoern Gustavsson

12:15-12:30 E1M1-13

A Near-Optimal Aperture Synthesis Imaging-method for Industrial-Scale ASI work  
Bjoern Gustavsson\*

12:30-12:45 E1M1-14 (invited)

Radar Imaging of Field-aligned Plasma Irregularities Using Multireceiver and Multifrequency Techniques Implemented in Phased-Array VHF Radars  
Jenn-Shyong Chen\*, Yen-Hsyang Chu, Ching-Lun Su, Hiroyuki Hashiguchi, Ying Li, and Chien-Ya Wang

Lunch

13:45-14:00 E1M1-15 (invited)

A user parameter-free diagonal-loading scheme for clutter rejection on radar wind profilers  
Taishi Hashimoto, Koji Nishimura, Masaki Tsutsumi, Kaoru Sato, and Toru Sato\*

14:00-14:15 E1M1-16

Angle-of-arrival determination using pre-calculated phase differences  
Joel P. Younger\*, and Iain M. Reid

14:15-17:30 Chair: Hiroshi Miyaoka and Juha Vierinen

Session E2: Future infrastructure and facilities (EISCAT\_3D user meeting)

Session M2: New radar/radio systems and future MST plans

14:15-14:30 E2M2-1 (invited)

Solar Radar?  
David Hysell\*

14:30-14:45 E2M2-2

What will the future landscape look like?  
Ian William Mccrea\*

14:45-15:00 E2M2-3 (invited)

Equatorial MU radar, plan and progress  
Mamoru Yamamoto\*, Hiroyuki Hashiguchi, and Toshitaka Tsuda

15:00-15:15 E2M2-4

The Aguadilla Radio Array and Puerto Rico CubeSat  
Brett Isham\*, Terence Bullett, Bjoern Gustavsson, Vasyl Belyey, Jan Bergman, Amilcar Rincon-Charris, Fredrik Bruhn, Peter Funk, Linda Krause, and Arturs Stramkals

15:15-15:30 E2M2-5

Observation of Upper Atmospheric and Ionospheric Radar in China  
Baiqi Ning\*, and Weixing Wan

Coffee break

15:45-16:00 E2M2-6

MMARIA: A multi-static, multi-frequency meteor radar approach to improve the MLT wind field measurements

Gunter Stober, Jorge L. Chau, Ralph Latteck\*, and Christoph Jacobi

16:00-16:15 E2M2-7

EISCAT\_3D in the landscape of research infrastructures in Europe

Anders Tjulin\*, Ingemar Haeggstroem, and Ingrid Mann

16:15-16:30 E2M2-8 (invited)

New capabilities of the Gadanki MST radar

Amit Kumar Patra\*, M Durga Rao, P Kamraj, T N Rao, M V Ratnam, and A Jayaraman

16:30-16:45 E2M2-9

3D visualisation and exploitation of incoherent scatter radar data at CDP

Frederic Pitout\*, Vincet Genot, Aurelie Marchaudon, Pierre-Louis Blelly, Laurent Beigbeder, N. Dufourg, M. Gangloff, M. Bouchemit, D. Popescu, S. Caussarieu, J.-P. Toniutti, and J. Durand

16:45-17:00 E2M2-10

Using LOFAR to explore the MLT region in multi-static radar configurations: Preliminary results using KAIRA

Jorge Luis Chau\*, Derek McKay, Gunter Stober, Juha Vierinen, and Markku Lehtinen

17:00-17:15 E2M2-11

EISCAT\_3D Status

Craig James Heinselman\*

17:15-17:30 E2M2-12 (invited)

Autonomous ISR Systems for Operational Space Weather Applications: Lessons from AMISR and Thoughts for the Future

Roger H Varney\*

## May 30 (Tue)

9:00-10:15 Chair: Hiroshi Miyaoka and Juha Vierinen

9:00- 9:15 E2M2-13

Beijing MST Radar detection of the lower, middle and upper atmosphere

Yufang Tian\*, Daren Lu, and Yong Wang

9:15- 9:30 E2M2-14

Radar observations of equatorial electrojet irregularities with a UHF wind profiler at Jicamarca: Preliminary Results

Danny Eddy Scipion\*, Marco Milla, Cristian Castillo, and Julio Oscanoa

9:30- 9:45 E2M2-15

The Australian Wind Profiler Network

Iain Murray Reid\*, Bronwyn Dolman, Chris Adami, Andrew Jenkins, Gary Jonas, Richard Mayo, Jonathan Woithe, and Tom Kane

9:45-10:00 E2M2-16

Technical Description of 205MHz Wind Profiler Radar for Stratosphere Troposphere Probing

Titu K Samson\*, K. Mohankumar, Manoj M. G., Ajil Kottayil, Rakesh V., Rejoy Rebello, P. Mohanan, K. Vasudevan, and K. R. Santosh

10:00-10:15 E2M2-17

Water vapor measurement using propagation delay of digital terrestrial broadcasting waves

Seiji Kawamura\*, Hiroki Ohta, Hiroshi Hanado, Masayuki K. Yamamoto, Nobuyasu Shiga, K. Kido, S. Yasuda, T. Goto, R. Ichikawa, J. Amagai, K. Imamura, M. Fujieda, H. Iwai, S. Sugitani, and T. Iguchi

Coffee break

**[Parallel Session (E4, National Institute for Japanese Language)]**

10:45-12:25 Chair: Akira Kadokura

Session E4: Aurora and airglow

10:45-11:05 E4-1 (invited)

Formation of polar cap patches measured by the RISR radar pair

Toshi Nishimura\*, Roger Varney, Robert Gillies, and Eric Donovan

11:05-11:25 E4-2 (invited)

Quasi-periodic variation in electron density, conductance and electric field during pulsating aurora

Keisuke Hosokawa\*, and Yasunobu Ogawa

11:25-11:40 E4-3

Observation of Pulsating Aurora Signatures in Cosmic Noise Absorption Data

Maxime Grandin\*, Antti Kero, Noora Partamies, Derek McKay, Daniel Whiter, and Alexander Kozlovsky

11:40-11:55 E4-4

Coordinated EISCAT and optical imaging observations of the omega-band aurora and electron density enhancement in the D-region ionosphere

Takeshi Sakanoi\*, Hirona Kondo, Yasunobu Ogawa, Yasumasa Tanaka, Kirsti Kauristie, Urban Braendstroem, Bjoern Gustavsson, Tima Sergienko, and Masato Kagitani

11:55-12:10 E4-5

Electron precipitation energy spectra derived from EISCAT observations

Ilkka Virtanen\*, Bjoern Gustavsson, and Anita Aikio

12:10-12:25 E4-6

SPIDER multi-point measurements to investigate the multi-scale structure of an auroral electrojet.

Gabriel Giono\*, Nickolay Ivchenko, Yunxia Yuan, and Tima Sergienko

12:25-14:30 Chair: Keisuke Hosokawa

12:25-12:40 E4-7 (invited)

The evolution characteristics of polar patches in the nightside ionosphere: multi-instrument observations

Qing-He Zhang\*, Yu-Yan Jin, Zan-Yang Xing, and Ian Mccrea

Lunch

13:45-14:00 E4-8

Localized magnetosphere-ionosphere coupling system along open magnetic field lines in association with airglow patches

Ying Zou\*, Yukitoshi Nishimura, Larry R. Lyons, Kazuo Shiokawa, Steve Chen, Michael J. Nicolls, Johnathan K. Burchill, David J. Knudsen, and Stephan Buchert

14:00-14:15 E4-9

Thermospheric winds in the vicinity of auroral arcs

Lei Cai\*, Shin-ichiro Oyama, Anita Aikio, Heikki Vanhamaeki, and Kirsti Kauristie

14:15-14:30 E4-10

Determining neutral temperatures in the high-latitude upper atmosphere

Joshua Chadney\*, Daniel Whiter, and Betty Lanchester

**[Parallel Session (M7, National Institute for Japanese Language)]**

14:30-17:20 Chair: Joel Younger and Vania Fatima Andrioli

Session M7: Radar detection of meteors

14:30-14:45 M7-1

Correlation between constant density and an upper inflection point in meteor radar echo decay time profiles

Joel Younger\*, Iain M. Reid, Wen Yi, Chris M. Hall, Masaki Tsutsumi, and Damian J. Murphy

14:45-15:00 M7-2

A comparative Study of Meteoroid Fragmentation during Geminid and Leonid Meteor showers using MST radar

Rakesh Chandra Narwa\*, Prem Kumar B, and Yellaiah G

15:00-15:15 M7-3

Long term statistical Analysis of meteor characteristics using a meteor radar

Maria Antonita Thithonis\*, and Geetha Ramkumar

15:15-15:30 M7-4

Comparison of the temperature spectrums derived from two temperature techniques by the Kunming meteor radar

Jinsong Chen\*, Wen Yi, Qingliang Li, and Baiqi Ning

Coffee break

15:45-16:05 M7-5 (invited)

Radar observations of long-duration meteor trails at Sanya

Guozhu Li\*

16:05-16:20 M7-6

MLT winds estimations obtained from specular and non-specular meteor trails at Jicamarca: Preliminary Results

Danny Eddy Scipion\*, Julio Oscanoa, and Marco Milla

16:20-16:35 M7-7

Exotic Phenomena Observed by the Meteor Radar at High Latitudes

Alexander Kozlovsky\*, Renata Lukianova, Sergey Shalimov, and Mark Lester

16:35-16:50 M7-8

Impact of Ozone and Oxygen on Early Stage Decay of Transitionally- and Over-dense Meteor Trails

Wayne Keith Hocking\*, and Reynold E. Silber

16:50-17:05 M7-9

Anomalous ambipolar diffusion observed using meteor radars in northern high latitudes

Masaki Tsutsumi\*, Yasunobu Ogawa, Satonori Nozawa, and Chris Hall

17:05-17:20 M7-10

Orbit and Size Distribution of Faint Meteors by MU Radar

Shinsuke Abe\*, Johan Kero, Takuji Nakamura, Junichi Watanabe, and Hiroyuki Hashiguchi

#### **[Parallel Session (M4, NIPR Auditorium)]**

10:30-15:00 Chair: Gerald Lehmacher and Hubert Luce

Session M4: MST Radar scattering, turbulence and small-scale processes

10:30-10:45 M4-1

Mesospheric wind measurements using the 50 MHz Jicamarca MST radar

Erhan Kudeki\*

10:45-11:00 M4-2 (invited)

High-resolution mesospheric echoes at Jicamarca for probing small scale dynamics in the equatorial region

Gerald Lehmacher\*, Pablo Reyes, Kiwook Lee, and Erhan Kudeki

11:00-11:15 M4-3

On aspect sensitivity of Polar Mesospheric Summer Echoes --- and its dependence on the measuring method

Cesar La Hoz\*, Jorge Chau, and Henry Pinedo



11:15-11:30 M4-4

PMSE spectral parameters from aperture synthesis radar imaging experiments with MAARSY

Ralph Latteck\*, Jorge L. Chau, Miquel Urco, Toralf Renkowitz, and Svenja Sommer

11:30-11:45 M4-5 (invited)

Modeling of Multi-Scale Gravity Wave, Instability, and Turbulence Dynamics: Implications for Measurements Throughout the Atmosphere

Dave Fritts\*, and Ling Wang

11:45-12:00 M4-6 (invited)

Shigaraki UAV-Radar Experiments (ShUREX): Measuring Turbulence in the Lower Troposphere

Lakshmi Kantha\*, Dale Lawrence, Hubert Luce, Hiroyuki Hashiguchi, Toshitaka Tsuda, R.

Wilson, T. Mixa, and M. Yabuki

12:00-12:15 M4-7

Comparisons between turbulent kinetic energy dissipation rates estimated from MU radar data and UAV-borne Pitot sensors during ShUREX 2016 campaign.

Hubert Yves Luce\*, Lakshmi Kantha, Hiroyuki Hashiguchi, Dale Lawrence, Masanori Yabuki, and Toshitaka Tsuda

12:15-12:30 M4-8

Simultaneous observations of structure function parameter of refractive index using a high resolution radar and the DataHawk small airborne measurement system

Danny Eddy Scipion\*, Dale A. Lawrence, Marco A. Milla, Ronald F. Woodman, Diego A. Lume, and Ben Balsley

12:30-12:45 M4-9

A comparison of turbulence measurements made by balloon-borne accelerometers and MST radar

Graeme John Marlton\*, David Hooper, Giles Harrison, Keri Nicoll, Paul Williams, and Chris Lee

Lunch

13:45-14:00 M4-10

Vertical Eddy Diffusivity in Relatively Stable Condition Derived from a 205 MHz Stratosphere-Troposphere Wind Profiler Radar

Manoj Manguttathil Gopalakrishnan\*, Titu K. Samson, Rakesh V., Rejoy Rebello, and Mohankumar K

14:00-14:15 M4-11

On the quantification of turbulence in cirrus clouds using MST Radar and Lidar measurements

Satheesh Kumar Shekatam\*, and Narayana Rao Thota

14:15-14:30 M4-12

On the nature and origin of the post sunset turbulence over complex terrain

Araveti Sandeep\*, T Naryana Rao, and S Vijaya Bhaskara Rao

14:30-14:45 M4-13

Boundary layer characteristics on cloudless days in Beijing based on UHF wind-profiler and related meteorological observations

Yufang Tian\*, and Daren Lu

14:45-15:00 M4-14

Radar simulation engine based on the convolution operation

Marcial Garbanzo-Salas\*, and Wayne Hocking

#### **[Parallel Session (M5, NIPR Auditorium)]**

15:00-17:30 Chair: Volker Lehmann and Yoshiaki Shibagaki

Session M5: Meteorology and forecasting/nowcasting

15:00-15:15 M5-1 (invited)

Operational radar wind profilers network in JMA

Kazuya Yashiro\*

15:15-15:30 M5-2

The U.S. West Coast 449-MHz Wind Profiler Network and New Algorithms to Improve the Detection and Removal of Spurious Signals

Allen B White\*, Daniel J. Gottas, Laura Bianco, Coy Chandlers, Thomas E. Ayers, and J. M. Wilczak

Coffee break

15:45-16:00 M5-3

Impacts of the Australian Wind Profiler Network on Global Numerical Weather Prediction

Bronwyn Kaye Dolman\*, Chris Tingwell, Iain Reid, and Maxime Hervo

16:00-16:15 M5-4

The E-PROFILE network for the operational measurement of wind and aerosol profiles in Europe

Volker Lehmann\*, Alexander Haefele, and the E-PROFILE team

16:15-16:30 M5-5

Evolution, structure and Dynamics of Tropical Cyclone using Doppler Weather Radar and MST Radar

Uma Kn\*, M. Venkat Ratnam, and S. B. Thampi

16:30-16:45 M5-6

Equatorial upwelling in the upper troposphere lower stratosphere: Results from long-term equatorial atmospheric radar observations

Kishore Kumar Karanam\*, Sneha Susan Mathew, and K.V.Subrahmanyam

16:45-17:00 M5-7

Detection of Monsoon Signal Observed by EAR and CHIRPS Data Analysis

Shailla Rustiana\*, Eddy Hermawan, and Adi Witono

17:00-17:15 M5-8

DSD profiles estimated from the EAR and an L-band wind profiler in IndonesiaDSD profiles estimated from the EAR and an L-band wind profiler in Indonesia

Toyoshi Shimomai\*, Ryo Fujihara, and Hiroyuki Hashiguchi

17:15-17:30 M5-9

Fine Structure of Vertically Propagating Kelvin Waves and Tropopause Height Variability at Upper Troposphere and Lower Stratosphere Observed by Equatorial Atmospheric Radar (EAR)

Eddy Hermawan\*, and Hiroyuki Hashiguchi

18:00-19:30 Poster session

## May 31 (Wed)

9:00-10:00 Chair: Volker Lehmann and Yoshiaki Shibagaki

9:00- 9:15 M5-10 (invited)

Role of convective sources in shaping the troposphere and stratosphere

Surendra Kumar Dhaka\*, Hiroyuki Hasiguchi, Yoshiaki Shibagaki, Vinay Kumar, and Hye-Yeong Chun

9:15- 9:30 M5-11

Tornado Detection with Windprofiler Radar

Anna M Hocking, and Wayne K. Hocking\*

9:30- 9:45 M5-12

Fine structure of meso-gamma-scale convective system developed over/around the MU radar

Yoshiaki Shibagaki\*, Hiroyuki Hashiguchi, Hubert Luce, and Manabu D. Yamanaka

9:45-10:00 M5-13

Improvement of vertical resolution by applying variational assimilation to the oversampled radar data

Junichi Furumoto\*

10:00-17:30 Chair: Iain Reid and M. Venkat Ratnam

Session M6: Middle atmosphere dynamics and structure

10:00-10:20 M6-1 (invited)

A Review on middle atmospheric structure, dynamics and coupling: Highlights from 25 years Indian MST radar and complimentary observations

Venkat Ratnam Madineni\*, and A. Jayaraman

10:20-10:40 M6-2 (invited)

Gravity wave measurements using spaced antenna and meteor radar techniques: A review

Robert A. Vincent\*

Coffee break

10:55-11:10 M6-3

A review on meteor radar techniques for gravity wave observations in the mesosphere lower thermosphere

Kishore Kumar Karanam\*, K.V. Subrahmanyam, and Geetha Ramkumar

11:10-11:30 M6-4 (invited)

Frequency spectra and vertical profiles of wind fluctuations in the summer Antarctic mesosphere revealed by MST radar observations

Kaoru Sato\*, Masashi Kohma, Masaki Tsutsumi, and Toru Sato

11:30-11:45 M6-5

Estimation of mesospheric gravity wave momentum flux using Hybrid Doppler Interferometry

Andrew John Spargo\*, Iain Murray Reid, Andrew David Mackinnon, and David Andrew Holdsworth

11:45-12:00 M6-6

Nonlinear Gravity Waves Dynamics in the Mesosphere and Lower Thermosphere

Dave Fritts\*, Brian Laughman, Ling Wang, and Tom Lund

12:00-12:15 M6-7

Twelve years' of mesospheric observations from Aberystwyth

David Andrew Hooper\*

12:15-12:30 M6-8

Climatology and inter-annual variability of the auroral MLT region inferred from the meteor radar observations during solar cycle 24

Renata Lukianova\*, Alexander Kozlovsky, and Mark Lester

12:30-12:45 M6-9

Observation of Meteor radar neutral winds over 11 stations and comparison with GSWM

Na Li\*, Jiuhou Lei, Jinsong Chen, Zhengwen Xu, and Leke Lin

Lunch

13:45-14:00 M6-10

Introduction to recent meteor radar measurements of MLT-winds over Eastern Europe, Kazan (55.8N, 48.8E).

Dmitry Victorovich Korotyshkin\*, Oleg Sherstyukov, Fargat Valiullin, and Gayfullin Ilgiz

14:00-14:15 M6-11

Quasi 12 h inertia-gravity waves in the lower mesosphere observed by the PANSY radar at Syowa Station (39.6E, 69.0S)

Ryosuke Shibuya\*, Kaoru Sato, Masaki Tsutsumi, Toru Sato, Yoshihiro Tomikawa, Koji Nishimura, and Masashi Kohma

14:15-14:30 M6-12

Anomalous QBO influence in the long period Kelvin waves in the low latitude mesosphere and lower thermosphere region over Kolhapur (16.7N, 74.2E)

Sundaraman Sathishkumar\*, S. Gurubaran, P.T.Patil, and R. Ghodpage

14:30-14:45 M6-13

Mid-latitude horizontal wind structure from 0-100 km based on Beijing MST radar, radiosonde, meteor radar, TIMED/TIDI observations and ERA-Interim reanalysis and HWM07

Yufang Tian\*, and Daren Lu

14:45-15:00 M6-14

Effect of Stratosphere Sudden Warmings on the mesosphere structure and dynamics over Antarctica: An overview

Eswaraiah Sunkara\*, Yong Ha Kim, Hosik Kam, Jeong-Han Kim, M. Venkat Ratnam, and Dennis Rigin

15:00-15:15 M6-15

Mid-latitude mesospheric winter echoes and their unusual behavior in the winter season 2016/2017

Marius Zecha\*, Toralf Renkwitz, and Michael Gerding

15:15-15:30 M6-16

VHF Radar Observations Of The Dynamics Of The Summer Polar Mesopause Region

Iain Murray Reid\*, Andrew Spargo, Rudiger Ruster, and Peter Czechowsky

Coffee break

15:45-16:00 M6-17

About the inhomogeneity of MF/HF radar echoes and its application improving the estimation of mesospheric winds

Toralf Renkwitz\*, Werner Singer, and Fazlul I. Laskar

16:00-16:15 M6-18

A study of gravity waves in the Antarctic troposphere and lower stratosphere observed by the PANSY radar

Yuichi Minamihara\*, Kaoru Sato, Masaki Tsutsumi, and Toru Sato

16:15-16:30 M6-19

Meteor radar observations of Quasi Two Day Wave Activity during major Sudden Stratospheric Warming events

Maria Antonita Thithonis\*, and Geetha Ramkumar

16:30-16:45 M6-20

Tropopause structure and variability observed using long-term Indian MST radar observations

Ravindra Babu Saginela\*, Venkat Ratnam, Ghoush Basha, S. V. Sunilkumar, K. Parameswaran, and B. V. Krishna Murthy

16:45-17:00 M6-21

Role of Tropical easterly jet (TEJ) in stratospheric-troposphere exchange: Observations inferred from Indian MST Radar

Siddarth Shankar Das\*, K.V.Suneeth, and M.V. Ratnam

17:00-17:15 M6-22

Coupling between the lower and middle atmosphere observed during a very severe cyclonic storm 'Madi'

Hima Bindu Hanumanthu\*, M. Venkat Ratnam, V. Yesubabu, C. V. Naidu, and S. Vijaya Bhaskara Rao

17:15-17:30 M6-23

On the enhancement of upper mesospheric quasi-lunar tides during sudden stratospheric warming events

Maosheng He\*, Jorge Luis Chau, Gunter Stober & Peter Hoffmann, Chris Hall, Masaki Tsutsumi, and Peter Hoffmann

Coffee break

18:00-19:30 Chair: Erhan Kudeki and Wayne Hocking

Session M8: Brainstorming

**[Poster Session (May 27 (Sat) 18:00-19:30)]**

E5-P1

Gyroharmonic features of ASSI generation

Vladimir Frolov\*, and Iliya Bolotin

E5-P2

Study of TEC variations by means of two dimensional maps constructed for HF-disturbed ionosphere around the SURA heating facility

Vladimir Frolov\*, Ruslan Sherstyukov, and Adel Akchurin

E5-P3

API Technique and Lower Ionosphere Diagnostics during Solar Eclipses

Nataliya V. Bakhmetieva\*, E.E. Kalinina, G.P. Komrakov, and V.D. Vyakhirev

E5-P4

A novel method to estimate thermospheric neutral density using ionospheric velocity observations

Michael Kosch, Lois Sarno-Smith, Amore Nel, Tim Yeoman, and Michael Rietveld\*

E5-P5

Capabilities of the Upgraded EISCAT High-Power HF Facility

Michael T. Rietveld\*, A. Senior, J. Markkanen, A. Westman, and J. Vierinen

E5-P6

X-mode HF pump-induced phenomena for a frequency stepping through the fifth electron gyro-harmonic

Natalia F. Blagoveshchenskaya\*, T.D. Borisova, A.S. Kalishin, T.K. Yeoman, and I. Haeggstroem

E6-P1

EISCAT\_3D as an important segment of the ESCAPE mission proposed for ESA's M5-call

Iannis Dandouras, Masatoshi Yamauchi, Tima Sergienko\*, Ingemar Haeggstroem, Anders Tjulin, and the ESCAPE proposal team

E6-P2

Electron hot-spots in the ionospheric troughs

Stephan C. Buchert\*

E6-P3

First detection of the plasma bubbles over Europe

Iurii Cherniak\*, and Irina Zkharenkova

E6-P4

A New Method to Combine Spacecraft and Incoherent Scatter Radar Measurements to Examine Particle Precipitation Mechanisms

Ennio R Sanchez, Roger Varney\*, Stephen Kaeppler, Robert Marshall, Jacob Bortnik, and Q. Ma

E6-P5

Future Collaborations of the First Japanese Formation Flight Mission Using Polar-Orbiting Compact/Micro Satellites with EISCAT\_3D and ALIS\_4D Based on In-Situ and Remote-Sensing Observations for the Space-Earth Coupling Mechanisms

Masafumi Hirahara\*, Yoshifumi Saito, Hirotugu Kojima, Anders Tjulin, Carl-Fredrik Enell, Tima Sergienko, Urban Braendstroem, Masatoshi Yamauchi, and Yasunobu Ogawa

E6-P6

Estimating the energy of pulsating aurora electrons: simultaneous observations with multi-wavelength all-sky imagers and EISCAT

Yasunobu Ogawa\*, Keisuke Hosokawa, Shin-Ichiro Oyama, Yoshizumi Miyoshi, Hiroshi Miyaoka, Yoshimasa Tanaka, Satonori Nozawa, Rei Kurita, Kazuo Shiokawa, Takeshi Sakanoi, and Ryoichi Fujii

E7-P1

Ionospheric single station TEC short term prediction at low latitude region in Indonesia using RBF neural network

Buldan Muslim\*, and Sri Ekawati

E7-P2

Simulation of Extreme Weather Events over India by using High-resolution Non hydrostatic Model

Payoshni Samantray\*, and K C Gouda

E7-P3

3-D structure of the high-latitude ionospheric irregularities: ground- and space-based GPS measurements during the 2015 St. Patrick's Day storm

Iurii Cherniak\*, and Irina Zkharenkova

E7-P4

Observations and simulation of X-class solar flares

Frederic Pitout\*, Aurelie Marchaudon, Pierre-Louis Blelly, and Imene Belahcene

E7-P5

Effect of intrinsic magnetic field decrease on the low-to-middle latitude ionosphere-thermosphere dynamics simulated by GAIA

Chihiro Tao\*, Hidekatsu Jin, Hiroyuki Shinagawa, Hitoshi Fujiwara, and Yasunobu Miyoshi

E3M3-P1

TEC modeling of disturbed and quiet period

Lalit Mohan Joshi\*, and S. Sripathi

E3M3-P2

A comparison study of the polar cap and auroral zone ionosphere

Lindis Merete Bjoland\*, Yasunobu Ogawa, Unni Pia Loevhaug, and Cesar La Hoz

E3M3-P3

Ionospheric plasma drift and neutral winds modeling

Narayan P Chapagain\*

E3M3-P4

Solar activity variations of the equatorial ionization anomaly

Oyedemi Samuel Oyekola\*, and Juliano Moro

E3M3-P5

Impact of Solar cycle variation on Critical Frequency of F layer

Pramod Kumar Purohit\*, and Roshni Atulkar

E3M3-P6

Characteristics of the electron density profiles in the polar ionosphere using long-term incoherent scatter radar observations

Eunsol Kim\*, Yong Ha Kim, and Geonhwa Jee

E3M3-P7

Occurrence of ion upflow associated with ion/electron heating in the polar cap and cusp regions

Eun-Young Ji, Geonhwa Jee\*, and Young-Sil Kwak

E3M3-P8

Studies of PMSE and NLC Layers in the Common Atmospheric Volume Above the EISCAT Tromsø Site

Ingrid B. Mann, Peter Dalin\*, and Ingemar Haeggstroem

E3M3-P9

Naturally Enhanced Ion-Acoustic Lines events at high latitude ionosphere and the behavior of the electron temperature during such events

Bashkim Dalipi\*, Naim Sylja, and Fisnik Aliaj

E3M3-P10

Preliminary results of the ionospheric observation by new ionosondes, VIPIR2, in Japan

Michi Nishioka\*, Hisao Kato, Masayuki Yamamoto, Seiji Kawamura, Takuya Tsugawa, and Mamoru Ishii

E3M3-P11

Average field-aligned ion velocity over the EISCAT radars

Yosuke Yamazaki, Michael Kosch, and Yasunobu Ogawa\*

E3M3-P12

Relationship between electron density height profile and convection flow speed in the polar cap patches and blobs

Mizuki Fukizawa\*, Takeshi Sakanoi, Yasunobu Ogawa, Yoshimasa Tanaka, Keisuke Hosokawa, S. Taguchi, and E. Thomas

E3M3-P13

A statistical study of the polar cap patches observed by the EISCAT Svalbard Radar

Yu-Yan Jin, Qing-He Zhang\*, X.-Z. Yang, Y. Wang, and Y.-Z. Ma

E3M3-P14

Occurrence climatology of E-region field-aligned irregularities in the middle latitudes as observed by the Daejeon 40.8 MHz coherent scatter radar in South Korea

Young-Sil Kwak, Tae-Yong Yang\*, Hyosub Kil, Jaeheung Park, and Jong-Min Choi

E3M3-P15

Case study of simultaneous observations of sporadic sodium layer, E-region field-aligned irregularities and sporadic E layer at low latitude of China

Haiyong Xie\*, Ning, B. Q., Zhao, X. K., Hu, and L. H.

E3M3-P16

Mid-latitude E Region Irregularity Excited by Kelvin Helmholtz Instability

Chen Zhou\*, Yi Liu, Xudong Gu, Binbin Ni, and Zhengyu Zhao

E3M3-P17

Inhibition of the F3 layer at low latitude station Sanya during geomagnetic storms in the summer of 2012-2013

Biqiang Zhao\*, and Weixing Wan

E3M3-P18

Statistical study on plasma bubble with Equatorial Atmosphere Radar, GPS scintillation, and GAIA model

Mamoru Yamamoto\*, Dyah Martiningrum, Yuichi Otsuka, and Hidekatsu Jin

E3M3-P19

Multi-beam incoherent scatter radar modes at the Jicamarca radio observatory

Marco Antonio Milla\*

E3M3-P20

Development of a methodology for deriving Plasmaspheric Total Electron Content from In-Situ electron density measurements in highly eccentric equatorial orbits

Aliyuthuman Mohamed Ilyaz Sadhique\*, Andrew Buckley, and Paul Gaugh

E3M3-P21

Simultaneous Observation of Nighttime Medium-Scale Traveling Ionospheric Disturbance and Field-Aligned Irregularities in Indonesia

Yuichi Otsuka\*, Tam Dao, Kazuo Shiokawa, Mamoru Yamamoto, and Asnawi Husin

E3M3-P22

Large Scale wave structure and its actual role in modifying the RT instability

Lalit Mohan Joshi\*

E3M3-P23

Significance of IMF By and Substorms on Ionospheric Electric Fields: New Results

Debrup Hui\*, and D. Chakrabarty

**[Poster Session (May 30 (Tue) 18:00-19:30)]**

E1M1-P1

Development of 30-MHz radar system with wide scanning capability for dedicated probing of ionosphere

Durga Rao Meka\*, P. Kamaraj, P. Yasoda, K. Jayaraj, J. Raghavendra, Amit Kumar Patra, and A. Jayaraman

E1M1-P2

Radar images of the Moon at 6-meter Wavelength

Juha Vierinen\*, Torbjørn Tveito, Veena Kesaraju, Marco Milla, and Bjoern Gustavsson

E1M1-P3

Na layer observations by lidar and spectrograph in the EISCAT Tromsø site

Takuo T. Tsuda\*, Shiori Hamada, Keisuke Hosokawa, Tetsuya Kawabata, Satonori Nozawa, and Akira Mizuno

E1M1-P4

Upgrade plan of an injection seeded, laser diode-pumped Nd:YAG laser-based sodium lidar

Takuya D Kawahara\*, Satonori Nozawa, Norihito Saito, Tetsuya Kawabata, Takuo T. Tsuda, and Toru Takahashi Satoshi Wada

E1M1-P5

Deconvolution method to improve altitude resolution for ISR observations

Lingqi Zeng\*, Biqiang Zhao, and Baiqi Ning

E1M1-P6

Aperture synthesis radar imaging and phase error correction using compressed sensing applied to E region studies

Juan Miguel Urco\*, and Jorge L. Chau

E1M1-P7

Evaluation of the performance of the range imaging technique using small UAVs as hard targets during ShUREX campaigns (2015-2016)

Hubert Yves Luce\*, Hiroyuki Hashiguchi, Lakshmi Kantha, Dale Lawrence, Tyler Mixa, Toshitaka Tsuda, and Masanori Yabuki

E1M1-P8

Aspect sensitivity revisited from the perspective of improving wind-profile data quality

David Andrew Hooper\*, Christopher F. Lee, and Geraint Vaughan

E1M1-P9

The development of software defined FMCW ionosonde based on the GNU Radio

Hiromitsu Ishibashi\*, Takumi Kondo, and Takuya Tsugawa

E1M1-P10

Design, development and validation of RF system for Active Phased Array MST Radar

Durga Rao Meka\*, P. Kamaraj, K. Jayaraj, K.M.V.Prasad, J. Raghavendra, J. Kamal Kumar, and A. Jayaraman

E1M1-P11

Development of web based Radar Control Software for future generation Active Phased Array Radars

Kamal Kumar Jeldi, Durga Rao Meka\*, P. Kamaraj, K. Jayaraj, K. M. V. Prasad, J. Raghavendra, and A. Jayaraman

E1M1-P12

Design and Development of Optical Control Signal Distribution Network for 1024 Element Active Phased Array Indian MST Radar

Kamaraj Pandian\*, M. Durga Rao, K. Jayaraj, J. Raghavendra, K. Jayaraj, K. M. V. Prasad, J. Kamal Kumar, J. Raghavendra, and A. Jayaraman

E1M1-P13

Development of a high-resolution 1.3 GHz wind profiler radar

Seiji Kawamura\*, Masayuki K. Yamamoto, and Koji Nishimura



E1M1-P14

Cancellation of Multiple-Trip (Range-Aliasing) Echoes for MST Radar

Koji Nishimura\*, Masaki Tsutsumi, Taishi Hashimoto, Kaoru Sato, and Toru Sato

E2M2-P1

A Novel 205 MHz Stratosphere Troposphere Wind Profiler Radar at Cochin (10N, 77E), India

Mohanakumar Kesava Pillai\*

E2M2-P2

Estimation of horizontal wind gradient using 205 MHz ST radar

Satheesan Karathazhiyath\*, Ajil Kottayil, Rejoy Rebello, and K Mohankumar

E2M2-P3

ST Radar @205MHz, APAR Wind Profiler for Tropics

Viswanathan - Gouravaram\*, Karthikeyan, Muniprasad, Ramesh, and Mohan Kumar

E2M2-P4

Acoustic system for turbulent layers in Costa Rica

Marcial Garbanzo-salas\*

E4-P1

Characteristics of auroral vortices observed by multiple imagers and EISCAT radar

Yoshimasa Tanaka\*, Yasunobu Ogawa, Akira Kadokura, Kirsti Kauristie, Carl-fredrik Enell, Urban Braendstroem, Tima Sergienko, Bjoern Gustavsson, Daniel Whiter, Alexander Kozlovsky, Hiroshi Miyaoka, and Mike Kosch

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$N_2^+$  resonant scattering light observation in the sunlit topside ionosphere with the auroral spectrograph

Yu Endo\*, Takeshi Sakanoi, and Yasunobu Ogawa

E4-P3

Study of large scale ionosphere-thermosphere phenomena in low latitudes using 630nm airglow imaging technique

Sivakandan Mani\*, V Lakshmi Narayanan, T K Ramkumar, A. Taori, and K Niranjana

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Naturally enhanced plasma line generated by auroral secondary electrons: modelling results

Tima Sergienko\*, Nickolay Ivchenko, and Ingemar Haeggstroem

M7-P1

Testing Hainan's meteor radar for inferring Gravity Waves momentum fluxes

Vania Fatima Andrioli\*, Paulo Prado Batista, Jiyao Xu, Chunxiao Yan, Guotao Yang, Wang Chi, and Liu Zhengkuan

M7-P2

Measurement of neutral mesopause density at low latitudes using the Kunming meteor radar

Wen Yi, Xianghui Xue, Jinsong Chen, Xiankang Dou, Iain Reid\*, and J. P. Younger

M7-P3

Ionospheric Irregularities Detected by the Meteor Radar at High Latitudes

Alexander Kozlovsky\*, Sergey Shalimov, Renata Lukianova, and Mark Lester

M7-P4

New meteor detection algorithm for Skiyet meteor radar in Kazan (55.8N, 48.8E).

Dmitry Victorovich Korotyshkin\*, and Oleg Sherstyukov

M7-P5

Seasonal height variation of meteor decay time observed from SKiYMET radar at Thumba

Prem Kumar Battula\*, K. Chenna Reddy, G. Yellaiah, and K. Kishore Kumar

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Turbulence measurements from UAV and meteorological balloons: a comparison

Richard Wilson\*, H. Hashiguchi, L. Kantha, D. Laurence, T. Mixa, M. Yabuki, H. Luce, and T. Tsuda

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Comparisons between high-resolution profiles of squared refractive index gradient  $M^2$  estimated from MU radar and UAV data collected during the ShUREX 2015 campaign

Hubert Yves Luce\*, Lakshmi Kantha, Hiroyuki Hashiguchi, Dale Lawrence, Masanori Yabuki, Toshitaka Tsuda, and Tyler Mixa

M4-P3

Deep, in-cloud Kelvin-Helmholtz billows observed simultaneously by the MU radar, a fisheye camera and two lidars.

Hubert Yves Luce\*, Masanori Yabuki, Hiroyuki Hashiguchi, and Lakshmi Kantha

M4-P4

A detailed analysis of steep humidity gradients above a turbulent cloud top using MU radar, UAV and balloon measurements.

Hubert Yves Luce\*, Lakshmi Kantha, Hiroyuki Hashiguchi, Noriyuki Nishi, Dale Lawrence, T. Tsuda, and M. Yabuki

M4-P5

High-Range Resolution Analysis of Atmospheric Layers and Precipitation Through Range Imaging of the Chung-Li VHF Radar

Shih-Chiao Tsai, Jenn-Shyong Chen\*, Yen-Hsyang Chu, and Ching-Lun Su

M4-P6

Concurrent MU radar, UAV and balloon observations of temperature and moisture finescale structures during the ShUREX2015 campaign

Hubert Yves Luce\*, Lakshmi Kantha, Hiroyuki Hashiguchi, Dale Lawrence, Masanori Yabuki, Toshitaka Tsuda, and Tyler Mixa

M4-P7

MU radar observations of turbulence possibly due a convective instability below melting layer of precipitation

Hubert Yves Luce\*, Atsushi Kudo, and Hiroyuki Hashiguchi

M4-P8

Simultaneous observations of atmospheric structure with UAV and the MU radar

Hiroyuki Hashiguchi\*, Takashi Mori, Hubert Luce, Lakshmi Kantha, Dale Lawrence, Tyler Mixa, Richard Wilson, Toshitaka Tsuda, and Masanori Yabuki

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On the Gust characterization for wind biasing the rocket launches

Satheesh Kumar Shekatam\*, and Narayana Rao Thota

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A study on aspect sensitivity with 205MHz ST Wind Profiler Radar at Cochin coastal region

Rakesh V\*, Titu K. Samson, Manoj M. G., Ajil Kottayil, Rejoy Rebello, K. Mohankumar, P. Mohanan, K. Vasudevan, and K. R. Santosh

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Characteristics of mesosphere echoes over Antarctica obtained using PANSY and MF radars

Masaki Tsutsumi\*, Kaoru Sato, Toru Sato, Masashi Kohma, and Takuji Nakamura

M5-P1

Inertia-Gravity Waves at Upper Troposphere/ Lower Stratosphere Region: An Observational Study from 205 MHz Wind Profiler Radar

Ajil Kottayil\*, K. Satheesan, K. Mohankumar, and Titu K. Samson

M5-P2

Coupling between Monsoon Low Level Jet and Tropical Easterly Jet and its Impact on Monsoon Rainfall: A case study using 205 MHz ST Radar

Anu Xavier\*, Ajil Kottayil, and K. Mohankumar

M5-P3

Vertical profiles of precipitation observed by radars and radiometer

Meng-Yuan Chen\*, and Hsin-Hao Liao

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Araveti Sandeep\*, V S Prasad, and C J Johny
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Sanjay Kumar Mehta\*, D. Narayana Rao, B.V. Krishna Murthy, T. V. Lakshmikumar, M. S. Narayanan, Aravindhavel A. Vanmathi A., and Saleem Ali
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Amitava Guharay\*, and Paulo Prado Batista

# Session Description

## **E1: Radar and lidar techniques**

**Session Conveners: Craig Heinselman, Takuo Tsuda, and Masaki Tsutsumi**

RADARs and LIDARs are two of the most powerful classes of instruments for remote sensing of the Earth's atmospheric and ionospheric environment. They provide continuous access to key physical parameters of the system in a spatially-resolved sense. A number of technological improvements have enabled significant enhancements in the capabilities of these systems. In particular, advances in transmitter modulation capabilities, antenna flexibility, spatial light modulation techniques, data acquisition methods, and detector technologies have all provided greater sensitivity and, at times, radically new observational modalities. In addition, proper exploitation of these capabilities has rested on advances in the mathematical underpinnings of the measurements. This session invites presentations in any of these areas as well as other uses of the technologies for scientific remote sensing.

## **E2: Future infrastructure and facilities (EISCAT\_3D user meeting)**

**Session Conveners: Hiroshi Miyaoka, Ian McCrea, and Craig Heinselman**

EISCAT\_3D represents one of the biggest opportunities in the history of EISCAT, but also one of our biggest ever challenges. The possibility to replace the current mainland systems with new phased arrays offers a huge increase in capability and flexibility, enabling quasi-simultaneous observations over a wide area of ionosphere, while also facilitating observations with better temporal and spatial resolution than have ever been possible. The new EISCAT\_3D radars will completely change EISCAT's mode of operating, with the possibility to run experiments serving the needs of multiple users simultaneously and the potential capability to modify the amount of system resources used by each one in a very dynamic way. Constructing and operating such a system will, however, involve a substantial learning process. This session, which replaces the EISCAT\_3D Users Meeting for 2017, will cover all aspects related to EISCAT\_3D, ranging from hardware and software specifications, through project planning, organization and governance, to the scientific programme of the new radars and their prospective modes of operation. In addition we invite contributions from users of similar facilities worldwide, whose experience promises to provide very useful perspectives for EISCAT\_3D operations. Contributions are also encouraged from users of other types of observing instruments, especially in cases where there is expected to be a strong synergy with the operations and science of EISCAT\_3D.

## **E3: Ionosphere/thermosphere/mesosphere**

**Session Conveners: Ingrid Mann, Yoshimasa Tanaka, and Hitoshi Fujiwara**

This session mainly focuses on physics and chemistry in the mesosphere, thermosphere, and ionosphere (MTI) from the polar to equatorial regions. For example, the coupling processes between plasmas and neutrals in association with auroral phenomena and between lower and upper atmospheric regions through atmospheric waves are important topics to understand features of the MTI region. These features also involve as important components mesospheric dust and ice, their link to meteors and their observation with radar. The long-term variations of the MTI region and the effects of solar activity on this region are also important issues. The presentations of observations with ground-based and/or space-borne instruments, in-situ measurements, theoretical studies, numerical simulations, and development of new instruments are invited in the session.

## **E4: Aurora and airglow**

**Session Conveners: Mike Kosch, Satonori Nozawa, and Akira Kadokura**

The aurorae are signatures of electron and proton precipitation and currents from the magnetosphere into the ionosphere. The thermosphere is a significant sink for electrical and particle energy stored in the

magnetosphere. Airglow is a useful tracer for a variety of atmospheric phenomena, such as gravity waves and neutral winds. This session welcomes all experimental, modelling and theoretical contributions concerning the natural auroras and airglow. Both large-scale (e.g. conjugate auroras) and small-scale structures (e.g. black auroras) as well as supporting observations by non-radar techniques (e.g. LIDAR, spectrograph, riometer) are also welcome.

### **E5: Active experiments**

**Session Conveners: Mike Rietveld, and Mike Kosch**

The magnetized plasma of the ionosphere provides a natural laboratory for a range of active experiments such as in-situ chemical releases from rockets or injected radio waves. Such experiments may examine fundamental plasma-physical processes such as turbulence and electron acceleration, or they can be used to learn about the ionospheric or mesospheric environment. Each ionospheric region holds different opportunities, for example, PMSE/PMWE dusty plasma in the D region, plasma irregularities in the E and F regions, as well as plasma resonances, optical emissions and ion outflow in the F region. Improvements in the diagnostic techniques used to measure the effects have allowed the development of detailed models which give us a better comprehensive understanding of many phenomena. Nevertheless new, surprising results have appeared in recent years, like artificial ionization, the unexpected effects of X-mode pumping and the enhancements in field-aligned UHF radar backscatter above the F region. This session welcomes all observational, modelling and theoretical contributions concerning ionospheric modification experiments as well as recent technical developments.

### **E6: The ERG mission and magnetosphere-ionosphere coupling**

**Session Conveners: Yoshizumi Miyoshi and Stephan Buchert**

The ionosphere and near-Earth space interact with each other by exchanging dynamically particles, energy and momentum. The coupling can affect the ionosphere and the atmosphere even down into the stratosphere when the most energetic, relativistic electrons originating from the magnetosphere precipitate. The ERG mission (Exploration of energization and Radiation in Geospace) will provide new insights into processes involved in energizing the particles in the radiation belts. Radars observe effects when these particles are scattered into the atmosphere. We invite especially contributions with first results from the ERG mission and studies of energetic particle precipitation with radars and riometers. In addition the session is also the place for studies of the top-side ionosphere, field-aligned currents, electric fields and magnetic disturbances, sub-auroral and equatorial phenomena with satellites and radars, particularly in conjugate configurations.

### **E7: Space weather and modelling**

**Session Conveners: Ian McCrea and Hitoshi Fujiwara**

Space weather is an issue of growing relevance to human society, as we become increasingly dependent on space-borne technologies. As well as damage to satellites and effects on ground-satellite communications, space weather has the potential to cause disruption to a number of other sectors, including power distribution, transport (especially aviation), radio communications and any technologies dependent on global positioning and timing. In order to protect the infrastructures which are essential to our daily lives from the risk of space weather effects, we need to better understand the connection processes between the Sun and Earth and their resulting effects on the Sun, solar wind, near Earth space, magnetosphere and upper atmosphere. The test of whether our understanding of these phenomena has become good enough lies in our ability to predict effects in a way that is useful to stakeholders in all sectors which might be potentially impacted by space weather. This session solicits contributions based around such space weather studies: for example, observations of the Sun, near Earth space, and the upper atmosphere with ground-based and/or space-borne instruments, modelling and numerical simulations of solar, magnetospheric, ionospheric, and thermospheric phenomena, and future plans for further developing observations and improving modelling and predictions.

## **M1: Radar hardware, signal processing, quality control for coherent and incoherent radars**

**Session Conveners: Ralph Latteck and Yuichi Otsuka**

Instrument design and performance, signal processing algorithms and data quality control are the basis of remote sensing of the MST region using atmospheric radars. Advances in radar technology allowed the deployment of new features applicable for modern phased-array atmospheric and ionospheric radar systems such as e.g. PANSY in Antarctica or MAARSY in northern Norway. Several existing radar facilities have already been upgraded for new capabilities during the recent years. This session will provide a forum for discussing the design, implementation, and engineering aspects of techniques associated to MST and Incoherent Scatter radar systems as well as related signal processing algorithms and quality control methods. This includes the development of new radar system components as e.g. transceivers, receivers or digitizers as well as new approaches to signal-processing as e.g. adaptive array systems to remove clutter echoes or radar imaging techniques to measure fine structures. The re-evaluation of older or existing techniques as used for e.g. the rejection of poor data or outliers should be also discussed in this session. The session is directed to develop synergies between the various user groups which study the lower, middle and upper atmosphere and the ionosphere. The main topics of the session are implementation of new radar techniques, new radar components (transceiver, receivers, digitizers, ...), new approaches to signal-processing, and re-evaluation of signal-processing and analysis techniques.

## **M2: New radar/radio systems and future MST plans**

**Session Conveners: Jorge L. Chau and Juha Vierinen**

We invite contributions that present newly constructed or planned instrumentation to study the mesosphere, stratosphere, troposphere, and the lower ionosphere. Submissions can describe new large, medium, and small scale projects and they can also describe planned upgrades to capabilities of existing instruments. Examples of possible contribution topics can include: MST radars, incoherent scatter radars, new rocket and satellite missions, meteor radars, boundary layer radars, wind profilers, ST radars, specular meteor radars, MF radars, LIDARs, airglow imagers, aperture synthesis imaging radars, HF radars, and ionospheric heaters. We also encourage submissions on cross-cutting novel instrumentation plans, which can be used also for MST studies as a secondary purpose, e.g., passive radars, LOFAR, LWA, etc.

## **M3: Ionospheric irregularities and IS experiments**

**Session Conveners: Marco Milla and Baiqi Ning**

Observations made using coherent and incoherent scatter radars are contributing to a better understanding of the dynamics and irregularities of the ionosphere. New radar techniques, antenna deployments, and imaging systems have been implemented in recent years to improve the quality, resolution, and spatial coverage of the ionospheric measurements. Extensions of the incoherent scatter theory considering radio propagation effects through the ionosphere have also been carried out to describe further details of the radar observations. Meanwhile, new GNSS (GPS + GLONASS + Galileo + Beidou) TEC/scintillation receivers and the expanded ionospheric observational network have allowed significant progress in the study of the ionosphere on a global scale. This session welcomes all papers on the recent advances in understanding the ionosphere with radar and other techniques. Of particular interest are (1) E/F region plasma irregularities and associated ionospheric scintillations, valley (150 km) region irregularities, possible effects of E-F region coupling and of lower atmosphere-ionosphere coupling on irregularity generation; (2) advances in experimental and data analysis techniques, coordinated studies with coherent and incoherent scatter radars, new facilities; (3) Magnetosphere-ionosphere-thermosphere (MIT) coupling studies using coordinated multiple instrument observations (e.g., Super-DARN and GNSS TEC receiver network).

#### **M4: MST Radar scattering, turbulence and small-scale processes**

**Session Conveners: Hubert Luce and Phil Chilson**

For more than four decades, MST radars and wind profilers have been used for studying atmospheric structures and dynamics at various scales, as well as for operational applications. Technological advances and innovations in signal and data processing methods have made it possible to improve the performance of these radars in terms of sensitivity, accuracy and resolution, so that a better understanding of radar backscatter mechanisms and small-scale processes in the atmosphere could be achieved. A large number of studies have demonstrated the usefulness of MST radars and wind profilers for investigating the fine-scale structure of the atmospheric fields from the planetary boundary layer all the way to the ionosphere, convective and dynamic instabilities near frontal zones and interfaces, small-scale turbulence and atmospheric gravity waves, and the characteristics of precipitating clouds in association with clear air dynamics, among other processes. These studies have generally been performed during field campaigns by coupling radars, other remote sensing instruments such as lidars, in situ observations (balloons, aircraft, unmanned aerial systems, rockets, ...), and theoretical and modelling approaches. The present session welcomes collaborative and innovative contributions devoted to the study of radar scatter mechanisms, the structure of turbulence and small-scale processes in the troposphere and the middle and upper atmosphere.

#### **M5: Meteorology and forecasting/nowcasting**

**Session Conveners: Volker Lehmann and Yoshiaki Shibagaki**

This session focuses on all meteorological phenomena of the boundary-layer, troposphere, and lower-stratosphere that are observed by radar wind profilers or that are of relevance to radar wind profiler observations. Radar wind profilers are capable of continuously measuring winds with high time and height resolution in both the clear and the cloudy atmosphere, which allows the sampling of small scale phenomena in the atmosphere. For example, radar wind profiler observations can reveal a fine structure of cumulus convection as the source of gravity waves. They can also provide valuable information about atmospheric stability, turbulence, humidity, clouds, and precipitation, especially in the context of multi-instrument measurements (sensor synergy). Generally, wind profiler data are effective and helpful for short-term forecasting application. We invite presentations on meteorological application of wind profilers, special observation campaigns with multi-instruments, the assimilation of wind profiler data in numerical prediction models, and the impact of profiler network data on operational weather forecasting and nowcasting.

#### **M6: Middle atmosphere dynamics and structure**

**Session Conveners: Iain Reid and M. Venkat Ratnam**

The middle atmosphere, the region between 10 and 100 km, remains a critical region of study of the coupling between the lowest part of the atmosphere, the troposphere, where significant gravity wave generation takes place, and the thermosphere, where major dissipation occurs. It is also the region that shields the surface from a major part of the ionizing radiations from the Sun. The strong interplay between the chemistry, dynamics and thermal structure of the middle atmosphere, and the potential for changes in these relationships in a changing climate scenario, underscore the importance of better understanding the region. Indeed, there are already indications of long-term changes in the mean winds, gravity wave activity and electron densities in parts of the region. Radar studies have contributed significantly to an improved understanding of the Middle Atmosphere and its important role. However, the region between about 20 and 60 km, a significant part of the Middle Atmosphere, remains inaccessible to radar. For this reason, coordinated studies using a variety of techniques, including balloon borne instruments, rockets, lidar, satellite observations and modeling are required to fully understand it. In this session, recent advances in the field of Middle Atmosphere Structure and Dynamics using standalone MST/MF/Meteor radars, as well as coordinated multi-instrument investigations of the 10 to 100 km height region are particularly encouraged. Topics of particular interest include both case studies and climatologies of turbulence, mean winds, gravity waves, tides and planetary

waves, and possible long-term changes and coupling from the troposphere to the thermosphere and the lateral coupling (low to high latitude and vice versa) studies are highly encouraged. We are also interested in reconciling observed trends in the middle atmosphere with those in the lower atmosphere, again against model projections, and understanding the differences.

### **M7: Radar detection of meteors**

**Session Conveners: Joel Younger and Vania Fatima Andrioli**

Radar detections of meteors are a valuable resource for geophysical and astronomical studies in the mesosphere/lower thermosphere (MLT) region of the atmosphere at heights between 70-110 km. This session will discuss applications of meteor detections by dedicated meteor radars, MST radars, and other radar systems to studies of the dynamics and structure of the MLT, the origins and distribution of meteoric material, and the development of hardware, software, and analysis techniques for radio detection of meteors. Meteor radars are often used in conjunction with other sensors such as airglow imagers and spectrometers, lidar, satellites, and rocket measurements, making sensor fusion and validation techniques of particular interest. Participants are encouraged to submit meteor radar based research including, but not limited to, wave activity and perturbations in the middle atmosphere, the construction of three-dimensional wind fields using meteor radar data, estimates of the vertical flux of horizontal momentum, short and long term studies of the temperature and density of the MLT, and more exotic phenomena such as anomalous diffusion, meteor plasma chemistry, aerosols and polar mesospheric clouds (PMC), and ionospheric irregularities. Beyond atmospheric studies, presentations of astronomical applications are sought including the determination of the orbital parameters of meteors, the detection of discrete meteor showers, characterization of the interplanetary meteoroid flux, and the study of atmospheric entry processes and the deposition of meteoric material in the atmosphere. Discussion of advances in meteor detection methods is also encouraged, including software defined radio, interferometer calibration techniques, multistatic radar arrays, novel antenna designs, and passive radar systems.

### **M8: Brainstorming**

**Session Conveners: Erhan Kudeki and Wayne Hocking**

This session is designed as an interactive, impromptu (= without advance preparation) session. It will be the responsibility of Drs. Kudeki and Hocking to keep the conversation flowing, and ensure every person has a chance to speak. We encourage workshop participants to give us topics for discussion during the week, and even prior, but there will be no invited speakers, nor any formal talks. Participants who wish may bring one (only) slide which can be used to trigger a conversation, but this is not mandatory. Typical topics might include controversial issues, unclear issues, campaign proposals which invite participation from other audience members, proposals for large-group data-sharing, collaborative software development, cross-disciplinary interaction with other communities, lessons learned from other communities that we can adapt, student opportunities and schools, and any other ideas which require wide-spread discussion. The purpose is to invigorate the community, and help us see past our day-to-day struggles and into the future; to ensure we have a vision of where we are headed. Kudeki and Hocking will try to keep the conversation rolling, but will redirect discussions when one topic is exhausted and another should be introduced. So please, bring your ideas and visions - we want to hear them!



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