PROCEEDINGS OF SPIE

[SPIDigitalLibrary.org/conference-proceedings-of-spie](https://spiedigitallibrary.org/conference-proceedings-of-spie)

Front Matter: Volume 8526

, "Front Matter: Volume 8526," Proc. SPIE 8526, Lidar Remote Sensing for Environmental Monitoring XIII, 852601 (29 November 2012); doi: 10.1117/12.2017700

SPIE.

Event: SPIE Asia-Pacific Remote Sensing, 2012, Kyoto, Japan

PROCEEDINGS OF SPIE

Lidar Remote Sensing for Environmental Monitoring XIII

**Kazuhiro Asai
Nobuo Sugimoto
Upendra N. Singh
Achuthan Jayaraman
Jianping Huang
Detlef Mueller**
Editors

**29–31 October 2012
Kyoto, Japan**

Sponsored by
SPIE

Cosponsored by
JAXA—Japan Aerospace Exploration Agency (Japan) • NASA—National Aeronautics and Space Administration (United States) • National Institute of Information and Communications Technology (Japan) • Commemorative Organization for the Japan World Exposition (Japan) • ISRO—Indian Space Research Organization (India) • State Key Laboratory of Remote Sensing Science (China)

Cooperating Organizations
ISPRS—International Society for Photogrammetry and Remote Sensing

Supported by
Japan Society of Atmospheric Environment • Japan Society of Photogrammetry and Remote Sensing • Laser Radar Society of Japan • Meteorological Society of Japan • Optical Society of Japan • Society of Environmental Science, Japan • Society of Geomagnetism and Earth, Planetary and Space Sciences • The Astronomical Society of Japan • The Geodetic Society of Japan • The Institute of Electrical Engineers of Japan • The Institute of Electronics, Information and Communication Engineers (Japan) • The Japan Society of Applied Physics • The Laser Society of Japan • The Remote Sensing Society of Japan • The Society of Instrument and Control Engineers (Japan) • The Spectroscopical Society of Japan

Published by
SPIE

Volume 8526

Proceedings of SPIE 0277-786X, V.8526

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Lidar Remote Sensing for Environmental Monitoring XIII, edited by Kazuhiro Asai,
Nobuo Sugimoto, Upendra N. Singh, Achuthan Jayaraman, Jianping Huang, Detlef Mueller,
Proc. of SPIE Vol. 8526, 852601 • © 2012 SPIE • CCC code: 0277-786/12/\$18 • doi: 10.1117/12.2017700

Proc. of SPIE Vol. 8526 852601-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Lidar Remote Sensing for Environmental Monitoring XIII*, edited by Kazuhiro Asai, Nobuo Sugimoto, Upendra N. Singh, Achuthan Jayaraman, Jianping Huang, Detlef Mueller, Proceedings of SPIE Vol. 8526 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN: 0277-786X

ISBN: 9780819492654

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445

SPIE.org

Copyright © 2012, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/12/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

- vii *Conference Committee*
- ix *The benefit of space derived geo-spatial information for sustainable development (Keynote Speech)*
Y. Horikawa, Japan Aerospace Exploration Agency (Japan)
- xv *JAXA Earth Observation Program update (Plenary Paper) [8523-507]*
M. Homma, Japan Aerospace Exploration Agency (Japan)

SESSION 1 LASERS FOR LIDAR REMOTE SENSING

- 8526 03 **Conductive-cooled 2-micron laser development for wind and CO₂ measurements** [8526-1]
K. Mizutani, S. Ishii, M. Yasui, T. Itabe, National Institute of Information and Communications Technology (Japan); A. Sato, K. Asai, Tohoku Institute of Technology (Japan); H. Fukuoka, Hamamatsu Photonics K.K. (Japan); T. Ishikawa, Nippon Aleph Corp. (Japan)
- 8526 04 **1.5- μ m high-average power laser amplifier using a Er,Yb:glass planar waveguide for coherent Doppler lidar** [8526-2]
T. Sakimura, Y. Watanabe, T. Ando, S. Kameyama, K. Asaka, H. Tanaka, T. Yanagisawa, Y. Hirano, Mitsubishi Electric Corp. (Japan); H. Inokuchi, Japan Aerospace Exploration Agency (Japan)
- 8526 05 **All-solid-state rapidly tunable coherent 6-10 μ m light source for lidar environmental sensing** [8526-3]
N. Saito, M. Yumoto, T. Tomida, U. Takagi, S. Wada, RIKEN (Japan)
- 8526 06 **Development of a simultaneous dual-wavelength Q-switched Nd:YAG laser at 1064 and 1319 nm** [8526-4]
A. Sato, T. Abe, S. Okubo, K. Asai, Tohoku Institute of Technology (Japan); N. Sugimoto, National Institute for Environmental Studies (Japan); S. Ishii, K. Mizutani, National Institute of Information and Communications Technology (Japan)

SESSION 2 LIDAR METHODS AND TECHNOLOGIES

- 8526 07 **Study of fluorescence of atmospheric aerosols using a lidar spectrometer** [8526-5]
N. Sugimoto, National Institute for Environmental Studies (Japan); Z. Huang, Lanzhou Univ. (China); T. Nishizawa, I. Matsui, National Institute for Environmental Studies (Japan); B. Tatarov, Gwangju Institute of Science and Technology (Korea, Republic of)
- 8526 08 **Application of lidar and optical data for oil palm plantation management in Malaysia** [8526-7]
H. Z. M. Shafri, M. H. Ismail, Univ. Putra Malaysia (Malaysia); M. K. M. Razi, Felda Technoplant Sdn Bhd (Malaysia); M. I. Anuar, Univ. Putra Malaysia (Malaysia); A. R. Ahmad, Federal Land Development Authority (Malaysia)

- 8526 09 **Development of polarization optical particle counter to detect particle shape information** [8526-8]
H. Kobayashi, Univ. of Yamanashi (Japan); M. Hayashi, Fukuoka Univ. (Japan); Y. Nakura, Yamanashi Gijyutsu Kobo (Japan); T. Enomoto, K. Miura, Tokyo Univ. of Science (Japan); H. Takahashi, Y. Igarashi, Meteorological Research Institute (Japan); H. Naoe, Japan Meteorological Agency (Japan); T. Nishizawa, N. Sugimoto, National Institute for Environmental Studies (Japan); N. Kaneyasu, National Institute of Advanced Industrial Science and Technology (Japan)

SESSION 3 LASER RANGING

- 8526 0B **Lie-EM-ICP algorithm: a novel frame for 2D shape registration** [8526-10]
C. Shao, Shanghai Univ. (China); C. Shen, East China Normal Univ. (China); Y. Peng, S. Ying, Shanghai Univ. (China)
- 8526 0C **A study of lidar-based sense making and topographic mapping** [8526-11]
Q. Wu, Y. Lu, Nanyang Technological Univ. (Singapore)

SESSION 4 METEOROLOGICAL MEASUREMENTS (WIND AND WATER VAPOR)

- 8526 0D **Profiling tropospheric water vapour with a coherent infrared differential absorption lidar: a sensitivity analysis** [8526-12]
P. Baron, S. Ishii, K. Mizutani, T. Itabe, M. Yasui, National Institute of Information and Communications Technology (Japan)
- 8526 0E **Wind sensing demonstration of more than 30km measurable range with a 1.5 μ m coherent Doppler lidar which has the laser amplifier using Er,Yb:glass planar waveguide** [8526-13]
S. Kameyama, T. Sakimura, Y. Watanabe, T. Ando, K. Asaka, H. Tanaka, T. Yanagisawa, Y. Hirano, Mitsubishi Electric Corp. (Japan); H. Inokuchi, Japan Aerospace Exploration Agency (Japan)

SESSION 5 SPACE LIDARS AND APPLICATIONS

- 8526 0H **Remote sensing for physical geography from ISS by JEM-EUSO** [8526-17]
T. Tomida, T. Ogawa, S. Wada, RIKEN (Japan); M. D. Rodriguez Frias, Univ. de Alcala (Spain); A. Neronov, ISDC Data Ctr. for Astrophysics (Switzerland)
- 8526 0K **i-LOVE: ISS-JEM lidar for observation of vegetation environment** [8526-20]
K. Asai, Tohoku Institute of Technology (Japan); H. Sawada, The Univ. of Tokyo (Japan); N. Sugimoto, National Institute for Environmental Studies (Japan); K. Mizutani, S. Ishii, National Institute of Information and Communications Technology (Japan); T. Nishizawa, National Institute for Environmental Studies (Japan); H. Shimoda, Tokai Univ. (Japan); Y. Honda, K. Kajiwara, Chiba Univ. (Japan); Gen Takao, Y. Hirata, Forestry and Forest Products Research Institute (Japan); N. Saigusa, M. Hayashi, H. Oguma, National Institute for Environmental Studies (Japan); H. Saito, Forestry and Forest Products Research Institute (Japan); Y. Awaya, Gifu Univ. (Japan); T. Endo, The Univ. of Tokyo (Japan); T. Imai, J. Murooka, T. Kobayashi, K. Suzuki, R. Sato, Japan Aerospace Exploration Agency (Japan)

- 8526 OL **Simulation and visualization of echo signals from forest for iLOVE** [8526-21]
T. Endo, National Institute for Environmental Studies (Japan); T. Kobayashi, Y. Satoh, Japan Aerospace Exploration Agency (Japan); Y. Sawada, The Univ. of Tokyo (Japan); N. Sugimoto, National Institute for Environmental Studies (Japan); K. Mizutani, National Institute of Information and Communications Technology (Japan); H. Sawada, The Univ. of Tokyo (Japan); K. Asai, Tohoku Institute of Technology (Japan)
- 8526 OM **Measuring forest canopy height using ICESat/GLAS data for applying to Japanese spaceborne lidar mission** [8526-22]
M. Hayashi, N. Saigusa, H. Oguma, Y. Yamagata, National Institute for Environmental Studies (Japan); G. Takao, Forestry and Forest Products Research Institute (Japan); H. Sawada, The Univ. of Tokyo (Japan); K. Mizutani, National Institute of Information and Communications Technology (Japan); N. Sugimoto, National Institute for Environmental Studies (Japan); K. Asai, Tohoku Institute of Technology (Japan)

SESSION 6 AEROSOL AND CLOUD MEASUREMENTS

- 8526 ON **Lidar remote sensing of atmospheric aerosol and cloudiness: Monte Carlo modeling** [8526-23]
E. G. Kablukova, A. B. Kargin, Institute of Computational Mathematics and Mathematical Geophysics (Russian Federation); B. A. Kargin, Institute of Computational Mathematics and Mathematical Geophysics (Russian Federation) and Novosibirsk State Univ. (Russian Federation)
- 8526 OO **Interaction between the low altitude atmosphere and clouds by high-precision polarization lidar** [8526-25]
T. Shiina, Chiba Univ. (Japan); K. Noguchi, Chiba Institute of Technology (Japan); T. Fukuchi, Central Research Institute of Electric Power Industry (Japan)
- 8526 OP **Low altitude fog-haze measurements by Raman-Rayleigh-Mie lidar in Nanjing** [8526-26]
N. Cao, F. Yang, J. Shi, Nanjing Univ. of Information Science & Technology (China)
- 8526 OQ **Improvement of NIES lidar network observations by adding Raman scatter measurement function** [8526-27]
T. Nishizawa, N. Sugimoto, I. Matsui, A. Shimizu, National Institute for Environmental Studies (Japan)
- 8526 OS **Observation and analysis of urban boundary layer characteristics with Raman-Mie lidar** [8526-29]
Q. Yan, D. Hua, Y. Wang, S. Li, Xi'an Univ. of Technology (China); T. Kobayashi, Univ. of Fukui (Japan)
- 8526 OU **Typical patterns of PBL structure and dynamics in transitional ocean-continent zone in summer and winter in Far East region** [8526-31]
K. A. Shmirko, Institute for Automation and Control Processes (Russian Federation) and Maritime State Univ. named after G.I. Nevelskoi (Russian Federation); A. N. Pavlov, S. Y. Stolyarchuk, A. Y. Mayor, Institute for Automation and Control Processes (Russian Federation); O. A. Bukin, Institute for Automation and Control Processes (Russian Federation) and Maritime State Univ. named after G.I. Nevelskoi (Russian Federation)

POSTER SESSION

- 8526 0V **Three-year-program to improve critical 1-micron Qsw laser technology for Earth observation** [8526-32]
D. Sakaizawa, Y. Chishiki, Y. Satoh, T. Hanada, S. Yamakawa, Japan Aerospace Exploration Agency (Japan); T. Ogawa, S. Wada, RIKEN (Japan); S. Ishii, K. Mizutani, M. Yasui, National Institute of Information and Communications Technology (Japan)
- 8526 0X **Remote sensing of hydrogen gas concentration distribution by Raman lidar** [8526-34]
I. Asahi, S. Sugimoto, H. Ninomiya, Shikoku Research Institute Inc. (Japan); T. Fukuchi, Central Research Institute of Electric Power Industry (Japan); T. Shiina, Chiba Univ. (Japan)
- 8526 0Y **The characteristics of solid etalon Doppler discriminator and transmitter in designing Doppler lidar** [8526-35]
D. Kim, H.-D. Cheong, Hanbat National Univ. (Korea, Republic of)
- 8526 0Z **Performance evaluation of coherent 2- μ m differential absorption and wind lidar for wind measurement** [8526-36]
H. Iwai, S. Ishii, National Institute of Information and Communications Technology (Japan); R. Oda, Chiba Institute of Technology (Japan); K. Mizutani, Y. Murayama, National Institute of Information and Communications Technology (Japan)
- 8526 10 **Evaluation of water vapor Raman lidar signals from clouds** [8526-37]
T. Fukuchi, T. Fujii, Central Research Institute of Electric Power Industry (Japan)
- 8526 11 **Meteorological observation with Doppler and Raman lidars and comparison with numerical weather simulations** [8526-38]
H. Tamura, N. Kihara, T. Fujii, T. Fukuchi, K. Wada, H. Hirakuchi, Central Research Institute of Electric Power Industry (Japan)
- 8526 13 **Observation of aerosol parameters at Saga using GOSAT product validation lidar** [8526-40]
S. Takubo, H. Okumura, T. Kawasaki, I. N. Abdullah, Saga Univ. (Japan); O. Uchino, I. Morino, T. Yokota, National Institute for Environmental Studies (Japan); T. Nagai, T. Sakai, T. Maki, Meteorological Research Institute (Japan); K. Arai, Saga Univ. (Japan)

Author Index

Conference Committee

Symposium Chairs

Upendra N. Singh, NASA Langley Research Center (United States)
Toshio Iguchi, National Institute of Information and Communications
Technology (Japan)

Symposium Cochair

A. S. Kiran Kumar, Space Applications Centre (India)

Conference Chairs

Kazuhiro Asai, Tohoku Institute of Technology (Japan)
Nobuo Sugimoto, National Institute for Environmental Studies (Japan)
Upendra N. Singh, NASA Langley Research Center (United States)
Achuthan Jayaraman, National Atmospheric Research Laboratory
(India)
Jianping Huang, Lanzhou University (China)
Detlef Mueller, Gwangju Institute of Science and Technology (Korea,
Republic of), Science Systems and Applications, Inc. (United
States), and Leibniz Institute for Tropospheric Research (IfT)
(Germany)

Conference Program Committee

Makoto Abo, Tokyo Metropolitan University (Japan)
Robert L. Byer, Stanford University (United States)
Weibiao Chen, Shanghai Institute of Optics and Fine Mechanics
(China)
Takashi Fujii, Central Research Institute of Electric Power Industry
(Japan)
Yongxiang Hu, NASA Langley Research Center (United States)
Dengxin Hua, Xi'an University of Technology (China)
Philippe L. Keckhut, Université de Versailles Saint-Quentin-en Yvelines
(France)
Dukhyeon Kim, Han Bat National University (Korea, Republic of)
Dong Liu, Anhui Institute of Optics and Fine Mechanics (China)
Thomas J. McGee, NASA Goddard Space Flight Center
(United States)
Kohei Mizutani, National Institute of Information and Communications
Technology (Japan)
Tomohiro Nagai, Meteorological Research Institute (Japan)
Masakatsu Nakajima, Japan Aerospace Exploration Agency (Japan)

Laurent Sauvage, Leosphere France (France)
Takashi Shibata, Nagoya University (Japan)
Tatsuo Shiina, Chiba University (Japan)
Venkataraman Sivakumar, Council for Scientific and Industrial
 Research (South Africa)
Jinxue Wang, Raytheon Company (United States)
Yingjian Wang, Anhui Institute of Optics and Fine Mechanics (China)
Songhua Wu, Ocean University of China (China)
Fan Yi, Wuhan University (China)
Jirong Yu, NASA Langley Research Center (United States)

Session Chairs

- 1 Lasers for Lidar Remote Sensing
Upendra N. Singh, NASA Langley Research Center (United States)
Kazuhiro Asai, Tohoku Institute of Technology (Japan)
- 2 Lidar Methods and Technologies
Jirong Yu, NASA Langley Research Center (United States)
Takashi Fujii, Central Research Institute of Electric Power Industry
 (Japan)
- 3 Laser Ranging
Tatsuo Shiina, Chiba University (Japan)
Shoken Ishii, National Institute of Information and Communications
 Technology (Japan)
- 4 Meteorological Measurements (Wind and Water Vapor)
Kohei Mizutani, National Institute of Information and Communications
 Technology (Japan)
Nobuo Sugimoto, National Institute for Environmental Studies (Japan)
- 5 Space Lidars and Applications
Kohei Mizutani, National Institute of Information and Communications
 Technology (Japan)
Nobuo Sugimoto, National Institute for Environmental Studies (Japan)
- 6 Aerosol and Cloud Measurements
Tetsuo Fukuchi, Central Research Institute of Electric Power Industry
 (Japan)
Atsushi Sato, Tohoku Institute of Technology (Japan)