# PROCEEDINGS OF SPIE

# Remote Sensing of the Atmosphere, Clouds, and Precipitation V

Eastwood Im Song Yang Peng Zhang Editors

13–15 October 2014 Beijing, China

Sponsored by SPIE

Cosponsored by State Key Laboratory of Remote Sensing Science (China) NASA—National Aeronautics and Space Administration (United States) Ministry of Earth Sciences (India)

## Cooperating Organizations

Institute of Remote Sensing and Digital Earth, China • JAXA—Japan Aerospace Exploration Agency, Japan • NICT—National Institute of Information and Communications Technology, Japan • ISRO—Indian Space Research Organization, India • National Satellite Meteorological Center, China • State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, China • State Key Laboratory of Resources and Environmental Information System, China • Center For Earth System Science, Tsinghua University, China • College of Global Change and Earth System Science, Beijing Normal University, China • Key Laboratory of Digital Earth Science, China

Published by SPIE

Volume 9259

Proceedings of SPIE 0277-786X, V. 9259

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

Remote Sensing of the Atmosphere, Clouds, and Precipitation V, edited by Eastwood Im, Song Yang, Peng Zhang, Proc. of SPIE Vol. 9259, 925901 · © 2014 SPIE · CCC code: 0277-786X/14/\$18 · doi: 10.1117/12.2179055

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 Remote Sensing of the Atmosphere, Clouds, and Precipitation V, edited by Eastwood Im, Song Yang, Peng Zhang, Proceedings of SPIE Vol. 9259 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 0277-786X ISBN: 9781628413267

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 © 2014, 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/14/\$18.00.

Printed in the United States of America.

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



**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 Authors
- ix Symposium Committees
- xi Conference Committee

#### PLENARY SESSION

9259 05 JAXA's activities for environmental health monitoring (Plenary Paper) [9259-504]

#### SESSION 1 REMOTE SENSING OF CLOUD PROPERTIES

- 9259 06 Summer daytime precipitation in ice, mixed, and water phase as viewed by PR and VIRS in tropics and subtropics [9259-1]
- 9259 0A Towards the comparison of satellite- and ground-based cloud amount over China [9259-5]

#### SESSION 2 REMOTE SENSING OF PRECIPITATION

- 9259 0B Comparison of global precipitation climatology products derived from ground- and satellite-based measurements [9259-6]
- 9259 0C Systematical evaluation of VPR- identification and enhancement (VPR-IE) approach for different precipitation types [9259-7]
- 9259 OE MTSAT-1R satellite-based overshooting top detection and relationship to precipitation intensity [9259-9]
- 9259 OF **Downburst prediction applications of meteorological geostationary satellites** [9259-10]

#### SESSION 3 ATMOSPHERIC SOUNDING TECHNIQUES

9259 0G Retrieval of atmospheric and surface parameters from VASS/FY-3C data under nonprecipitation condition [9259-11]

#### SESSION 4 RETRIEVAL TECHNIQUES OF PRECIPITATION AND CLOUDS

9259 0M A review of the super-thin clouds detection algorithm [9259-17]

9259 ON	Estimation of cloud height using ground-based stereophotography: methods, error analysis, and validation [9259-18]
9259 OP	Cloud detection in Landsat imagery for Antarctic region using multispectral thresholds [9259-20]
SESSION 5	PHYSICAL PROCESS AND INTERACTION OF AEROSOL, CLOUD AND PRECIPITATION
9259 OS	Terrestrial aerosol retrieval from PARASOL multi-angle measurements [9259-23]
SESSION 6	CHARACTERISTICS, CALIBRATION, ALGORITHM DEVELOPMENT OF REMOTE SENSING INSTRUMENTS
9259 OV	Feasibility study of water vapor and temperature retrieval using a combined vibrational rotational Raman and Mie scattering multi-wavelength lidar [9259-62]
9259 OW	Analysis of satellite-based aerosol optical thickness over China in 2013 [9259-28]
9259 OZ	Investigation of aerosol optical properties for remote sensing through DRAGON (distributed regional aerosol gridded observation networks) campaign in Korea [9259-48]
SESSION 7	MULTI-SENSOR FUSION METHODS FOR ALGORITHM AND PRODUCT DEVELOPMENTS
9259 10	Development of an ion mobility spectrometer with UV ionization source to detect ketones and BTX [9259-61]
9259 12	Properties and potential radiative impacts of Antarctic blowing snow [9259-33]
9259 13	Comparison of cloud type and frequency over China from surface, FY-2E, and CloudSat observations [9259-34]
9259 14	Investigation and validation of a dust data fusion method based on monitoring data from geostationary and polar-orbiting satellites [9259-35]
SESSION 8	REMOTE SENSING OF AEROSOL AND AIR POLLUTANTS
0050.15	
9259 15	Impacts of aerosol and albedo on TanSat CO2 retrieval using the near infrared CO2 bands [9259-36]
9259 17	Estimating ground-level PM2.5 concentration using Landsat 8 in Chengdu, China [9259-38]
9259 18	Measurements of formaldehyde total content using DOAS technique: a new retrieval method for overcast [9259-39]

## SESSION 9 RADIATIVE TRANSFER MODELING OF CLOUD AND AEROSOL

9259 1A	Optical properties of ice clouds: new modeling capabilities and relevant applications [9259-41]
9259 1C	Assessment and validation of the community radiative transfer model for ice cloud conditions [9259-43]
9259 1D	The importance of accurate atmospheric modeling [9259-44]
9259 1E	ATOVS microwave sounding observation cycling assimilation on a tropical cyclone case in <b>2012</b> [9259-45]
	POSTER SESSION: REMOTE SENSING OF AEROSOL, CLOUD, AND PRECIPITATION
9259 1F	Retrieving cloud base heights via the combination of CloudSat and MODIS observations [9259-31]
9259 1G	Inter-comparison of various approaches of ground-based active remote sensing of cloud water content [9259-47]
9259 11	Remote sensing of clouds and evaluation with a 220GHz radar [9259-50]
9259 1J	Cloud vertical structures detected by lidar and its statistical results at HeRO site in Hefei, China [9259-51]
9259 1K	Spectral characteristics of precipitating clouds during the Meiyu over the Yangtze-Huaihe River Valley from merged TRMM precipitation radar and visible/infrared scanner data [9259-52]
9259 1L	A novel method for remote sensing image cloud detection [9259-53]
9259 1M	Arctic ozone and circulation changes during boreal spring [9259-54]
9259 1N	Analysis of relations between aerosol optical depth and cloud parameters over land and offshore area of Eastern China and America [9259-55]
9259 10	Estimation of PM10 concentration using satellite data in Ulaanbaatar City [9259-56]
9259 1P	An extended lookup table of cloud detection for MTSAT-1R [9259-57]
9259 1Q	Retrieval of aerosol optical depth over bare soil surfaces using time series of MODIS imagery [9259-58]

#### POSTER SESSION: ANALYSIS, EVALUATION AND APPLICATION OF REMOTE SENSING DATASETS

9259 IS Surface shape estimation of textureless area using shape from shading for Landsat imagery [9259-59] 9259 IT Spectral parameters and signal-to-noise ratio requirement for TANSAT hyper spectral sensor to measure atmospheric CO<sub>2</sub> [9259-60] 9259 1V Possibility of relationship between the yellow sand and the foot-and-mouth disease in Miyazaki Prefecture, Japan in March 2010 by using MODIS images [9259-64] 9259 1X Temperature effects on the retrieval of  $SO_2$  from ultraviolet satellite observations [9259-66] 9259 1Y Comparison between COSMIC radio occultation and radionsonde soundings in the **Qinghai-Tibet Plateau** [9259-67] 9259 20 The sensitivity analysis in the nitrogen dioxide retrieval from space borne measurement [9259-70] 9259 21 Spatial heterogeneity study of vegetation coverage at Heihe River Basin [9259-71] 9259 22 Radio occultation based on BeiDou satellite navigation [9259-72]

# Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Ahn, Joon-Young, 0Z An, Dawei, 11 Andreev, Maksim S., ON Baize, Rosemary R., OM Batbayar, J., 10 Bi, Lei, 1A Bi, Yan-Meng, 15, 1T Bian, Mingming, 11 Bilguunmaa, M., 10 Bo, Guangyu, 1J Borovski, Alexander, 18 Cai, Jun, 0A Cao, C. Y., 0W Cao, GuangZhen, 14 Cao, Qing, 0C Chen, Feng-Jiao, 1K Chen, Hui, OS Chen, Jie, 15 Chen, Liangfu, 1X, 20 Chen, Lin, 14 Chen, Shuzhong, 17 Chen, Wuhan, 1P Chen, Yi-Lun, 1K, 1N Chen, Yunping, 17 Chulichkov, Alexey I., 0N Dong, Peng-ming, 1E Emilenko, Aleksander S., ON Fu, Yun-Fei, 06, 1K, 1N Gao, Ling, 15 Gong, Wenbin, 22 Gourley, J. J., 0C Gu, Junxia, 13 Gu, Songyan, 15 Gu, Xingfa, 1L Guo, Jingran, 10 Guo, Liyu, 21 Guo, Yang, 0G Han, Dong, 20 Han, Jin-Seok, OZ Han, Weihong, 17 Hioki, Souichiro, 1A Hong, Yang, OC Hong, You-Deok, 0Z Hou, Jihu, OP Hou, Peng, 14 Hu, Haiying, 22 Hu, Weidong, 11 Hu, Xiuqing, 14 Jiang, Hu, 22

Jiang, Manman, OP Kato, Yoshinobu, 1V Kim, Jhoon, OZ Kim, Sang-Woo, OZ Kirstetter, Pierre, OC Lei, Yu, 10 Li, Fu-ning, OE Li, Hao-ran, 1F Li, Qing, 0S Li, Weisheng, 1P Li, Zhanqing, OV, 1G Liang, Pang, 1D Lim, Jae-Hyun, OZ Liu, Chao, 1A Liu, Dong, 1J Liu, Jun, 1Y Liu, Quanhua, 1C Liu, Yan, 1Y Liu, Zhona, OB Lu, Fena, 11 Lu, Hui, OA Lv, Min, 0V, 1G Ma, Gang, 0G, 1E Marshak, Alexander, 12 Medvedev, Andrey P., 0N Meng, F., OW Murakami, Hiroshi, 05 Ni, Kai, 10 Ou, Guangli, 10 Palm, Stephen P., 12 Park, Jin-Soo, OZ Payne, Dylan, 1D Peng, Jianwei, 1S Postylyakov, Oleg V., 0N, 18 Pryor, Kenneth L., OF Qi, Chengli, 0G Qin, Dan-yu, 1E Qin, Fang, 06 Schroeder, John, 1D Shang, Jian, 11 Shao, X., 0W Shao, Zhenfeng, OP Shen, Xue-min, 22 Su, Lin, 20 Sun, Lu, 1J Sun, Wenbo, 0M Sun, Xue-jin, 1F Tao, Hua J., 20 Tong, Ling, 17

Tuya, S., 10 Videen, Gorden, 0M Wang, Minyan, 13 Wang, Qian, 15, 1T Wang, Qianqian, 0V, 1G Wang, Shengjie, 13 Wang, Shitao, 11 Wang, Weihe, 1M, 1X Wang, Xiaohao, 10 Wang, Yingjian, 1J Wang, Zhenzhu, 1J Wang, Zhien, 1J Wang, Zhongting, OS Wang, Zhongwei, 1L Wei, Xi, 1L Wen, Yixin, 0C Weng, Fuzhong, 1C Wu, Chunqiang, 0G Wu, Decheng, 1J Wu, Lijuan, 21 Wu, Qiong, 11 Wu, Shanlong, 1P Xi, Shuang, 1E Xue, Xianwu, OC Yan, Huanhuan, 1X Yang, Ping, 1A, 1C Yang, Runzhi, 13 Yang, Yuan-Jian, 1K, 1N Yang, Yuekui, 12 Yang, Zhong-Dong, 15, 1T Yi, Bingqi, 1A, 1C You, Ran, OG Yu, Chao, 20 Yu, Fan, OE Yu, Shanshan, 1P Yuan, Ranyin, 1Q Yuan, Zhengwu, 1Q Zeng, Le, 13 Zhang, Ao-Qi, 1N Zhang, Jian, OC Zhang, Peng, 14, 1E, 11 Zhang, Yan, 1M Zhang, Yawen, 0A Zhang, Yi, 1S Zhang, Ying, 20 Zhang, Yonghe, 22 Zhao, Chuanfeng, OV, 1G Zhao, Xiangwei, 21 Zheng, Xiao-Yi, 1K Zhong, Bo, 1P, 1Q, 21 Zhou, Xiran, OP

# Symposium Committees

#### Symposium Chairs

Upendra Singh, NASA Langley Research Center (United States) Jiancheng Shi, Institute of Remote Sensing Applications and Digital Earth (China)

Honorary Symposium Chairs

George Komar, NASA Headquarters (United States)
Toru Fukuda, Japan Aerospace Exploration Agency (Japan)
Deren Li, Wuhan University (China)
Shailesh R. Nayak, Ministry of Earth Sciences (India)
Guanhua Xu, Former Minister of Science and Technology Department of China (China)

## Symposium Co-chair

**Toshio Iguchi**, National Institute of Information and Communications Technology (Japan)

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

## International Organizing and Technical Program Committee

Akimasa Sumi, The University of Tokyo (Japan) Allen M. Larar, NASA Langley Research Center (USA) Delu Pan, The Second Institute of Oceanography, SOA (China) Haruhisa Shimoda, Tokai University (Japan) Huadong Guo, Institute of Remote Sensing and Digital Earth (China) Jiancheng Shi, Institute of Remote Sensing and Digital Earth (China) Jing Ming Chen, Nanjing University (China) and University of Toronto (Canada) Kazuhiro Asai, Tohoku Institute of Technology (Japan) Kohei Mizutani, National Institute of Information and Communications Technology (Japan) Peng Gong, Tsinghua University (China) Peng Zhang, China Meteorological Administration (China) Robert J. Frouin, Scripps Institution of Oceanography (USA) and University of California, San Diego (USA) Shunlin Liang, Beijing Normal University (China) and University of Marvland (USA) Thomas J. Jackson, U.S. Department of Agriculture (USA) Tiruvalam N. Krishnamurti, Florida State University (USA) Toru Fukuda, Japan Aerospace Exploration Agency (Japan) Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)

 Upendra N. Singh, NASA Langley Research Center (USA)
 Xiaoxiong Xiong, NASA Goddard Space Flight Center (USA)
 Zhanqing Li, Beijing Normal University (China) and University of Maryland, College Park (USA)
 Guoqing Zhou, Guilin University of Technology (China)

#### Local Organizing Committee

Liangfu Chen, Institute of Remote Sensing and Digital Earth (China) Zifeng Wang, Institute of Remote Sensing and Digital Earth (China) Mingmei Chen, Institute of Remote Sensing and Digital Earth (China) Dandan Li, Institute of Remote Sensing and Digital Earth (China) Tianxing Wang, Institute of Remote Sensing and Digital Earth (China) Xiliang Ni, Institute of Remote Sensing and Digital Earth (China) Xiaofeng Yang, Institute of Remote Sensing and Digital Earth (China) Ying Zhang, Institute of Remote Sensing and Digital Earth (China) Tiantian Wang, Institute of Remote Sensing and Digital Earth (China) Xiaoying Ouyang, Institute of Remote Sensing and Digital Earth (China) Xiaoying Ouyang, Institute of Remote Sensing and Digital Earth (China)

Le Yang, Institute of Remote Sensing and Digital Earth (China) Man Peng, Institute of Remote Sensing and Digital Earth (China)

# **Conference Committee**

**Conference** Chairs

Eastwood Im, Jet Propulsion Laboratory (United States) Song Yang, U.S. Naval Research Laboratory (United States) Peng Zhang, China Meteorological Administration (China)

## Conference Program Committee

Jianping Huang, Lanzhou University (China)
Toshio Iguchi, National Institute of Information and Communications Technology (Japan)
Paul Joe, Environment Canada (Canada)
Zhanqing Li, Beijing Normal University (China) and University of Maryland, College Park (USA)
Gail Skofronick-Jackson, NASA Goddard Space Flight Center (United States)
Byung-Ju Sohn, Seoul National University (Korea, Republic of)
Graeme L. Stephens, Jet Propulsion Laboratory (United States)
Zhongdong Yang, China Meteorological Administration (China)

## Session Chairs

- Remote Sensing of Cloud Properties
   Eastwood Im, Jet Propulsion Laboratory (United States)
   Peng Zhang, China Meteorological Administration (China)
- Remote Sensing of Precipitation
   Yunfei Fu, University of Science and Technology of China (China)
   Jonathan H. Jiang, Jet Propulsion Laboratory (United States)
- Atmospheric Sounding Techniques
   Peng Zhang, China Meteorological Administration (China)
   Lei Bi, Texas A&M University (United States)
- Retrieval Techniques of Precipitation and Clouds
   Zhanqing Li, Beijing Normal University (China) and University of Maryland, College Park (USA)
   Zhong Dong Yang, China Meteorological Administration (China)
- 5 Physical Process and Interaction of Aerosol, Cloud and Precipitation Jonathan H. Jiang, Jet Propulsion Laboratory (United States)
   Toshio Iguchi, National Institute of Information and Communications Technology (Japan)

- 6 Characteristics, Calibration, Algorithm Development of Remote Sensing Instruments
   Toshio Iguchi, National Institute of Information and Communications Technology (Japan)
   Yunfei Fu, University of Science and Technology of China (China)
- 7 Multi-sensor Fusion Methods for Algorithm and Product Developments Yunfei Fu, University of Science and Technology of China (China) Eastwood Im, Jet Propulsion Laboratory (United States)
- 8 Remote Sensing of Aerosol and Air Pollutants
   Oleg V. Postylyakov, A.M. Obukhov Institute of Atmospheric Physics (Russian Federation)
   Lei Bi, Texas A&M University (United States)
- Radiative Transfer Modeling of Cloud and Aerosol
   Jianping Huang, Lanzhou University (China)
   Toshio Iguchi, National Institute of Information and Communications Technology (Japan)

Poster Session: Remote Sensing of Aerosol, Cloud and Precipitation **Zhong Dong Yang**, China Meteorological Administration (China) **Zhanqing Li**, Beijing Normal University (China) and University of Maryland, College Park (USA)

Poster Session: Analysis, Evaluation, and Application of Remote Sensing Datasets

**Peng Zhang**, China Meteorological Administration (China) **Eastwood Im**, Jet Propulsion Laboratory (United States)