

PROCEEDINGS OF SPIE

# ***Remote Sensing of Clouds and the Atmosphere XXIV***

**Adolfo Comerón  
Evgueni I. Kassianov  
Klaus Schäfer  
Richard H. Picard  
Konradin Weber  
Upendra N. Singh**  
*Editors*

**11–12 September 2019  
Strasbourg, France**

*Sponsored by*  
SPIE

*Cooperating Organisations*  
European Optical Society  
ISPRS—International Society for Photogrammetry and Remote Sensing  
EARSeL—European Association of Remote Sensing Laboratories (Germany)

*Published by*  
SPIE

**Volume 11152**

Proceedings of SPIE 0277-786X, V. 11152

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

Remote Sensing of Clouds and the Atmosphere XXIV, edited by Adolfo Comerón, Evgueni I. Kassianov, Klaus Schäfer, Richard H. Picard, Konradin Weber, Upendra N. Singh, Proc. of SPIE Vol. 11152, 1115201  
© 2019 SPIE · CCC code: 0277-786X/19/\$21 · doi: 10.1117/12.2557006

Proc. of SPIE Vol. 11152 1115201-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at [SPIDigitalLibrary.org](http://SPIDigitalLibrary.org).

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Remote Sensing of Clouds and the Atmosphere XXIV*, edited by Adolfo Comerón, Evgueni I. Kassianov, Klaus Schäfer, Richard H. Picard, Konradin Weber, Upendra N. Singh, Proceedings of SPIE Vol. 11152 (SPIE, Bellingham, WA, 2019) Seven-digit Article CID Number.

ISSN: 0277-786X  
ISSN: 1996-756X (electronic)

ISBN: 9781510630079  
ISBN: 9781510630086 (electronic)

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](http://SPIE.org)

Copyright © 2019, 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 \$21.00 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](http://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/19/\$21.00.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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

**SPIE. DIGITAL  
LIBRARY**

[SPIDigitalLibrary.org](http://SPIDigitalLibrary.org)

---

**Paper Numbering:** *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five 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.

# Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>

---

## REMOTE SENSING OF CLOUDS, ATMOSPHERIC AEROSOLS, TRACE GASES, AND METEOROLOGICAL PARAMETERS I

---

11152 02	<b>Advances in neural network detection and retrieval of multilayer clouds for CERES using multispectral satellite data (Keynote Paper) [11152-1]</b>
11152 04	<b>Comparison of unfiltered CERES radiances measured from the Aqua and S-NPP or JPSS1 satellites over closely matched sites [11152-3]</b>
11152 06	<b>Advancing the remote sensing of desert dust (Keynote Paper) [11152-5]</b>
11152 07	<b>Assessment of cumulative discriminant analysis for cloud detection in the ESA PROBA-V Round Robin exercise [11152-6]</b>
11152 08	<b>An automatic light rain detection algorithm on NASA MPLNET lidar observations in the frame of WMO GALION project [11152-7]</b>

---

## REMOTE SENSING OF CLOUDS, ATMOSPHERIC AEROSOLS, TRACE GASES, AND METEOROLOGICAL PARAMETERS II

---

11152 0A	<b>Macrophysical properties of continental shallow cumuli: diurnal evolution [11152-9]</b>
11152 0B	<b>Comparing three satellite retrieval cloud fraction data over Tibet Plateau [11152-10]</b>
11152 0C	<b>An optimal interpolation scheme for surface and atmospheric parameters: applications to SEVIRI and IASI [11152-11]</b>
11152 0D	<b>An approach to retrieve BRDF from satellite and airborne measurements of surface-reflected radiance based on decoupling of atmospheric radiative transfer and surface reflection [11152-12]</b>
11152 0E	<b>Spatial variation of atmospheric carbon dioxide concentration retrieved from AVIRIS-NG images including water vapor correction and spectroradiometric validation for two urban places of India [11152-13]</b>
11152 0F	<b>Preliminary validation of high-detailed GSA/Resurs-P tropospheric NO<sub>2</sub> maps with alternative satellite measurements and transport simulations [11152-14]</b>

- 11152 0G **CO<sub>2</sub> retrieval algorithm for the Infrared Atmospheric Sounder Interferometer: the potential of retrieving the vertical profile of carbon dioxide from its hot or laser bands in the 800-1200 cm<sup>-1</sup> atmospheric window [11152-15]**
- 11152 0H **Validation of an empirical method for thin cirrus correction with Sentinel-2 data [11152-16]**
- 11152 0I **Surface polarized reflectance analysis for aerosol remote sensing [11152-17]**
- 11152 0L **International reanalysis cooperation on carbon satellites data [11152-54]**

---

#### LIDAR, RADAR, AND PASSIVE ATMOSPHERIC MEASUREMENTS I

---

- 11152 0M **Development of a multispectral scanning lidar system for measuring wind velocity, air temperature and moisture [11152-19]**
- 11152 0N **Assessment of three-dimensional, fine-granular measurement of particulate matter by a smart air quality network in urban area [11152-20]**
- 11152 0O **Modelling of airborne pollen dispersion in the atmosphere in the Catalonia region, Spain: model description, emission scheme and evaluation of model performance for the case of Pinus [11152-21]**
- 11152 0P **Comparison of measured and simulated by SILAM NO<sub>2</sub> integral content in atmospheric boundary layer in Moscow region [11152-22]**
- 11152 0Q **Microwave measurements of variations in night mesospheric ozone over Moscow [11152-23]**
- 11152 0S **8x8 single photon counting module for spaceborne lidar [11152-25]**
- 11152 0T **Fully integrated high-speed electronics for remote sensing with a large array of single photon avalanche diodes [11152-26]**
- 11152 0U **Intercomparison of ozone vertical profiles in the upper troposphere-stratosphere measured at the Siberian lidar station in Tomsk, Russia (56.5 deg. N, 85.0 deg. E) with DIAL, MLS, and IASI [11152-27]**

---

#### LIDAR, RADAR, AND PASSIVE ATMOSPHERIC MEASUREMENTS II

---

- 11152 0V **Development of near/mid IR differential absorption OPO lidar system for remote gas analysis of the atmosphere [11152-28]**
- 11152 0W **Frequency stability of passively Q-switched non-planar ring oscillator under aircraft vibration [11152-29]**
- 11152 0Y **TRMM-retrieved rainfall mechanism over a few tropical locations [11152-31]**

11152 0Z **The Carbon Balance Observatory (CARBO) instrument for remote sensing of greenhouse gases from space** [11152-55]

---

**POSTER SESSION**

---

- 11152 11 **Remote sensing of methane in the atmosphere by the OPO lidar system in 3.30–3.43  $\mu\text{m}$  spectral range** [11152-34]
- 11152 12 **Threshold wind speed and turbulence under LLJs events at Ipero, Brazil** [11152-35]
- 11152 13 **Estimation of atmospheric aerosol volume concentration over the East European region by optimal interpolation of AERONET observations** [11152-36]
- 11152 14 **Variation in climate change as a result of reductions in short-lived climate pollutants** [11152-37]
- 11152 15 **Inheritance of aerosol retrieval by GCOM-C/SGLI from ADEOS-2/GLI** [11152-38]
- 11152 16 **Mapping of vegetation cover using Sentinel-2 to estimate forest fire danger** [11152-39]
- 11152 17 **Preliminary validation of cloud amount product of FengYun-3D satellite** [11152-40]
- 11152 19 **Severe visibility marine fog detection using GOCI/COMS VIS bands** [11152-42]
- 11152 1A **Application of hydrometer profiles from microwave imagers in typhoon numerical simulation** [11152-43]
- 11152 1B **Data quality control with multi-source information for FY-3 microwave sounder observations** [11152-45]
- 11152 1D **Correlation between two different real time data acquisition systems: lidar Raman and cavity ringdown laser spectroscopy, for  $\text{CH}_4$  as a fugitive gas, in São Paulo metropolitan area** [11152-47]
- 11152 1F **Fusion of surface ceilometer data and satellite cloud retrievals in 2D mesh interpolating model with clustering** [11152-49]
- 11152 1H **On estimation of cloud characteristics from spectral measurements of scattered solar radiation using a neural network** [11152-51]
- 11152 1I **Preliminary validation of GF-1/GF-2 surface reflectance products over land using VNIR atmospheric correction method** [11152-52]
- 11152 1K **Monthly analysis of lightning discharges distribution on the territory of the North Caucasus** [11152-57]
- 11152 1L **Research of lightning discharges characteristics based on the data of remote sensing** [11152-58]



# Authors

Numbers in the index correspond to the last two digits of the seven-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first five 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.

Acconcia, G., 0S, 0T  
Adzhieva, Aida A., 1K, 1L  
Alarcón, Marta, 0O  
Amato, Umberto, 07  
Amiridis, Vassilis, 06  
Andrade, Izabel, 1D  
Ansmann, Albert, 06  
Araujo, Elaine, 1D  
Arleques, Antônio G., 1D  
Badmaev, Nimazhap B., 16  
Baranovskiy, Nikolay V., 16  
Baulig, Claudia, 0M  
Bazarov, Alexander V., 16  
Beigl, M., 0N  
Belmonte, Jordina, 0O  
Beregovski, Yuri, 0Z  
Berg, Larry K., 0A  
Bespalov, Dmitry A., 1K, 1L  
Beu, Cássia M. L., 12  
Binietoglou, Ioannis, 06  
Boldyreff, Anton S., 1K, 1L  
Borovski, Alexander N., 0F, 0P, 1H  
Briottet, X., 0H  
Brooks, Cynthia B., 0Z  
Budde, M., 0N  
Carfora, Maria Francesca, 07  
Chaurasia, Sasmita, 0E  
Chen, Yan, 02  
Chen, Zhengchao, 1I  
Chulichkov, Alexey I., 1H  
Comerón, Adolfo, 08  
Correa, Thais, 1D  
Cyrus, J., 0N  
da Silva, Jonatan, 1D  
Daskalopoulou, Vassiliki, 06  
Davydova, Marina A., 0F  
De Feis, Italia, 0C  
De Linares, Concepción, 0O  
de Melo Miranda, Juliana Tavares, 1D  
Dolgi, Sergey I., 0U  
Elansky, Nikolay F., 0P  
Eldering, Annmarie, 0Z  
Emeis, S., 0N  
Freudenthaler, Volker, 06  
Fu, Dejian, 0Z  
Gasteiger, Josef, 06  
Ghioni, M., 0S, 0T  
Gialitaki, Anna, 06  
Giudici, A., 0S, 0T  
Gkikas, Antonis, 06  
Gratza, T., 0N  
Griffith, Michael S., 0W  
Grimm, H., 0N  
Guardani, Roberto, 1D  
Hank, M., 0N  
Hare, R., 0S, 0T  
Holst, C., 0N  
Hong, Gang, 02  
Huang, Z. C., 0L  
Ignatyev, Alexandr N., 0Q  
Izquierdo, Rebeca, 0O  
Jaiswal, Sunakshi, 0Y  
Jorba, Oriol, 0O  
K., Thirumala Lakshmi, 0Y  
Kassianov, Evgueni, 0A  
Keymeulen, Didier, 0Z  
Kharchenko, Olga V., 0U, 0V, 11  
Khlopenkov, Konstantin, 1F  
Kim, Donghee, 19  
Klaas, Björn, 0M  
Kleiss, Jessica M., 0A  
Korkin, Sergey, 0I  
Labanca, I., 0S, 0T  
Landulfo, Eduardo, 12, 1D  
Lewis, Jasper R., 08  
Li, G. Q., 0L  
Li, Xiaoping, 17, 1A, 1B  
Liu, Hui, 1B  
Liu, Jian, 0B  
Liu, Jie, 17  
Liu, Ruixia, 17, 1A, 1B  
Liu, Tao, 1I  
Liu, Y., 0L  
Lolli, Simone, 08  
Lu, Qifeng, 1B  
Lyapustin, Alexei, 0I  
M., Rasheed, 0Y  
M., Siva, 0Y  
Macedo, Fernanda M., 1D  
Mainzer, Amy, 0Z  
Makarenkov, Aleksandr A., 0F  
Mamouri, Rodanthe-Elisaveth, 06  
Marinou, Eleni, 06  
Masiello, Guido, 07, 0C, 0G  
Mathieu, S., 0H  
McCarthy, Andrew G., 0W  
Miatselskaya, Natallia, 13  
Miller, Charles E., 0Z

Minnis, Patrick, 02  
Mona, Lucia, 06  
Mukai, Sonoyo, 15  
Münkel, C., 0N  
Nakata, Makiko, 14, 15  
Nevzorov, Aleksie V., 0U  
Nevzorov, Alexey A., 0U  
Nikitin, Stanislav V., 1H  
Park, Myung-Sook, 19  
Paschou, Peristera, 06  
Pesch, M., 0N  
Petersen, E., 0N  
Philipp, A., 0N  
Ponomarev, Nikolay A., 0P  
Postlyakov, Oleg V., 0F, 0P, 1H  
Poutier, L., 0H  
Predehl, Katharina, 0M  
Priestley, Kory J., 04  
Proestakis, Emmanouel, 06  
Radkevich, Alexander, 0D  
Raychaudhuri, Barun, 0E  
Rech, I., 0S, 0T  
Redelstein, J., 0N  
Riedel, T., 0N  
Riesterer, J., 0N  
Riihimaki, Laura, 0A  
Riley, Erin A., 0A  
Romanovskii, Oleg A., 0U, 0V, 11  
Romanovskii, Ya. O., 11  
Roy, Santanu, 0E  
Rozanov, Sergey B., 0Q  
Rud, Mayer, 0Z  
Sadovnikov, S. A., 0V, 11  
Salgado, S., 0H  
Sano, Itaru, 15  
Schäfer, K., 0N  
Schnelle-Kreis, J., 0N  
Schwarzer, Stefan, 0M  
Sellar, Glenn, 0Z  
Sen Jaiswal, Rajasri, 0Y  
Serio, Carmine, 07, 0C, 0G  
Shapovalov, Vitaliy A., 1K, 1L  
Sicard, Michaël, 08, 0O  
Siomos, Nikos, 06  
Smith, J., 0S, 0T  
Smith, William L., Jr., 02, 1F  
Spangenberg, Douglas, 1F  
Sullivan, Peter, 0Z  
Sun-Mack, Sunny, 02  
Sychev, Roman S., 16  
Szewczyk, Z. Peter, 04  
Thomas, Susan, 04  
Tsekeri, Alexandra, 06  
Uhrner, U., 0N  
Venafra, Sara, 0G  
Venturini, M., 0T  
Veselovskii, Igor, 1D  
Vivone, Gemine, 08  
Wallace, J. Kent, 0Z  
Welton, Ellsworth J., 08  
Werhahn, J., 0N  
Williams, Andrew J., 0W  
Wilson, Daniel W., 0Z  
Wong, Andre, 0Z  
Wu, Chunqiang, 1B  
Xu, Guoqiang, 1A  
Xu, Jiafei, 1I  
Yakovlev, S. V., 0V, 11  
Yankovich, Elena P., 16  
Yankovich, Ksenia S., 16  
Yao, L., 0L  
Zareh, Shannon Kian, 0Z  
Zavgorodniy, Alexey S., 0Q  
Zhang, Bing, 1I  
Zhang, Hao, 1I  
Zhang, L. C., 0L  
Zhao, J., 0L  
Ziegler, V., 0N

# Conference Committee

## *Symposium Chairs*

**Christopher M. U. Neale**, University of Nebraska-Lincoln (United States)  
and Daugherty Water for Food Institute (United States)  
**Karsten Schulz**, Fraunhofer-Institut für Optronik, Systemtechnik und  
Bildauswertung (Germany)

## *Conference Chairs*

**Adolfo Comerón**, Universidad Politècnica de Catalunya (Spain)  
**Evgueni I. Kassianov**, Pacific Northwest National Laboratory  
(United States)  
**Klaus Schäfer**, Atmospheric Physics Consulting (Germany)

## *Conference Co-chairs*

**Richard H. Picard**, ARCON Corporation (United States)  
**Konradin Weber**, Hochschule Düsseldorf (Germany)  
**Upendra N. Singh**, NASA Langley Research Center (United States)

## *Conference Programme Committee*

**Aldo Amodeo**, Istituto di Metodologie per l'Analisi Ambientale (Italy)  
**Christoph C. Borel-Donohue**, U.S. Army Research Laboratory  
(United States)  
**Young Joon Kim**, Gwangju Institute of Science and Technology  
(Korea, Republic of)

## *Session Chairs*

- 1 Remote Sensing of Clouds, Atmospheric Aerosols, Trace Gases, and  
Meteorological Parameters I  
**Adolfo Comerón**, Universidad Politècnica de Catalunya (Spain)  
**Evgueni I. Kassianov**, Pacific Northwest National Laboratory  
(United States)
- 2 Remote Sensing of Clouds, Atmospheric Aerosols, Trace Gases, and  
Meteorological Parameters II  
**Adolfo Comerón**, Universidad Politècnica de Catalunya (Spain)  
**Evgueni I. Kassianov**, Pacific Northwest National Laboratory  
(United States)

- 3 Lidar, Radar, and Passive Atmospheric Measurements I  
**Konradin Weber**, Hochschule Düsseldorf (Germany)
- 4 Lidar, Radar, and Passive Atmospheric Measurements II  
**Klaus Schäfer**, Atmospheric Physics Consulting (Germany)