

PROCEEDINGS OF SPIE

Earth Observing Missions and Sensors: Development, Implementation, and Characterization V

**Xiaoxiong Xiong
Toshiyoshi Kimura**
Editors

**25–26 September 2018
Honolulu, Hawaii, United States**

Sponsored by
SPIE

Cosponsored by
NASA—National Aeronautics and Space Administration (United States) • RAD—Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences (China) • State Key Laboratory of Remote Sensing Science, Chinese Academy of Sciences (China) • Ministry of Earth Sciences (India)

Cooperating Organizations
University of Hawai'i at Mānoa (United States) • JAXA—Japan Aerospace Exploration Agency (Japan)
NICT—National Institute of Information and Communications Technology (Japan) • ISRO—Indian Space Research Organization (India) • ESSO—Earth System Science Organization (India)

Published by
SPIE

Volume 10781

Proceedings of SPIE 0277-786X, V. 10781

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

Earth Observing Missions and Sensors: Development, Implementation, and Characterization V
edited by Xiaoxiong Xiong, Toshiyoshi Kimura, Proc. of SPIE Vol. 10781, 1078101
© 2018 SPIE · CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2520792

Proc. of SPIE Vol. 10781 1078101-1

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.

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 *Earth Observing Missions and Sensors: Development, Implementation, and Characterization V*, edited by Xiaoxiong Xiong, Toshiyoshi Kimura, Proceedings of SPIE Vol. 10781 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

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

ISBN: 9781510621374
ISBN: 9781510621381 (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

Copyright © 2018, 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/18/\$18.00.

Printed in the United States of America.

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

**SPIE. DIGITAL
LIBRARY**

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>Symposium Committees</i>
xi	<i>Conference Committee</i>

EXISTING MISSIONS AND SENSORS I

10781 02	Global Change Observation Mission (GCOM) (Invited Paper) [10781-1]
10781 04	Landsat-8 on-orbit and Landsat-9 pre-launch sensor radiometric characterization (Invited Paper) [10781-3]

ENABLING TECHNOLOGY AND RESEARCH FOR NEW SENSORS

10781 0B	The compact hyperspectral prism spectrometer for sustainable land imaging: continuing the data record and enabling new discoveries [10781-11]
10781 0D	Optical system of high-precision greenhouse gas imaging spectrometer [10781-13]

NEW TECHNIQUES FOR SENSOR CHARACTERIZATION

10781 0F	Initial Determination of the NOAA-20 VIIRS screen transmittances with both yaw maneuver and regular on-orbit data [10781-16]
10781 0H	Characterization and correction of stray light for NOAA-20 VIIRS day/night band [10781-18]

ON-ORBIT CALIBRATION I

10781 0K	NOAA-20 VIIRS on-orbit performance, data quality, and operational Cal/Val support (Invited Paper) [10781-21]
10781 0L	Initial calibration activities and performance assessments of NOAA-20 VIIRS [10781-22]

- 10781 OM **Initial radiometric calibration status and performance of NOAA-20 VIIRS reflective solar bands** [10781-23]
- 10781 ON **NOAA-20 VIIRS thermal emissive bands on-orbit performance** [10781-24]

ON-ORBIT CALIBRATION II

- 10781 OP **Updates to the absolute radiometric accuracy of the AIRS on Aqua** [10781-26]
- 10781 OQ **First year on-orbit calibration activities of SGLI on GCOM-C satellite** [10781-27]
- 10781 OS **Evaluation of geostationary lightning mapper navigation performance with the INR Performance Assessment Toolset (IPATS)** [10781-29]
- 10781 OT **Hyperspectral remote sensing of air pollution from geosynchronous orbit with GEMS and TEMPO** [10781-30]

CALIBRATION INTERCOMPARISON AND PERFORMANCE

- 10781 OU **Traceability and consistency of COSMIC radio occultation in comparison with NOAA-20 CrIS infrared sounder observations** [10781-31]
- 10781 OV **Evaluating NOAA-20 and S-NPP VIIRS radiometric consistency** [10781-32]
- 10781 OW **Initial assessment of radiometric performance of N20 VIIRS reflective solar bands using vicarious approaches** [10781-33]
- 10781 OX **Evaluating radiometric calibration of ASTER VNIR band with Terra MODIS, Landsat 7 ETM+, and Landsat 8 OLI** [10781-34]

FPA

- 10781 OZ **Advances in utilizing deep convective cloud targets to inter-calibrate geostationary reflective solar band imagers with well calibrated imagers** [10781-36]

VICARIOUS CALIBRATION AND PERFORMANCE VALIDATION

- 10781 IO **On-orbit calibration analysis of FY-4A AGRI solar bands** [10781-38]

POSTER SESSION

- 10781 13 **Thermal-structural analysis of geostationary Earth observation satellite with large segmented telescope [10781-41]**
- 10781 15 **Evaluating the calibration of Aqua MODIS bands 33, 35, and 36 during blackbody warm-up cool-down events [10781-43]**
- 10781 16 **Initial investigation of the angular dependence of the NOAA-20 VIIRS solar diffuser BRDF change factor [10781-44]**
- 10781 17 **Conceptual study of 3.5-meter segmented mirror for geostationary Earth observation satellite [10781-45]**
- 10781 19 **Assessment of on-orbit variations of the Clouds and the Earth's Radiant Energy System (CERES) FM5 instrument [10781-47]**
- 10781 1A **Determination of the NOAA-20 VIIRS TEB RVS from emissive radiation measurements during the pitch maneuver [10781-48]**
- 10781 1B **JPSS-2 VIIRS polarization sensitivity comparison with Heritage VIIRS sensors [10781-50]**
- 10781 1C **Improvements in the on-orbit calibration of the Terra MODIS short-wave infrared spectral bands [10781-51]**
- 10781 1D **Prelaunch and on-orbit electronic calibration for Earth-observing instruments [10781-52]**

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.

Amano, Takahiro, 0Q
Anderson, Cody, 04
Angal, Amit, 0L, 0N, 1C, 1D
Aumann, Hartmut H., 0P
Baker, Brian, 0T
Barsi, Julia, 04
Bhatt, Rajendra, 0Z
Blonski, Slawomir, 0H, 0K, 0V
Broberg, Steve, 0P
Cao, Changyong, 0H, 0K, 0U, 0V, 0W
Chance, Kelly, 0T
Chang, T., 0W
Chen, Boyang, 10
Chen, Na, 1D
Chen, Xuexia, 0M
Chiang, Kwofu, 0L, 0N, 1A
Choi, Jason, 0K
De Luccia, Frank J., 0S, 1B
Delker, Thomas, 0T
Doelling, David, 0Z
Flittner, David, 0T
Folley, Christopher N., 0S
Gao, Ling, 10
Gerace, Aaron, 04
Gopalan, Arun, 0Z
Graybill, Justin M., 0S
Guo, Qiang, 10
Gusev, Sergey, 0N
Haas, Evan M., 0S
Haney, Conor O., 0Z
Haque, Md Obaidul, 04
Hook, Simon, 04
Houchin, Scott, 0S
Howell, James, 0T
Isaacson, Peter J., 0S
Kamiya, Tomohiro, 17
Kampe, Thomas U., 0B
Kim, Jhoon, 0T
Kimura, Toshiyoshi, 17
Kitamoto, Kazuya, 17
Lasnik, James, 0T
Lei, Ning, 0F, 0L, 0M, 16
Li, Yonghong, 0N, 15, 1C
Liu, Tung-Chang, 0H
Liu, Xiong, 0T
Loeb, Norman, 19
Lynch, Erin, 0K, 0U
Manning, Evan, 0P
Markham, Brian, 04
McCorkel, Joel, 04
McIntire, Jeff, 0L, 0N, 1B, 1D
Min, Min, 10
Mizutani, Tadahito, 13, 17
Mokuno, Masaaki, 0Q
Montanaro, Matthew, 04
Moy, Gabriel, 0S
Moyer, D., 1B
Nicks, Dennis, 0T
Obata, Kenta, 0X
Okamoto, A., 13
Okamura, Yoshihiko, 0Q
Oudrari, Hassan, 0L, 1B, 1D
Overoye, Kenneth, 0P
Pagano, Thomas S., 0P
Pan, Qiao, 0D
Pedelty, Jeffrey, 04
Porter, Brian C., 0S
Priestley, Kory, 19
Raqueno, Nina, 04
Reth, Alan D., 0S
Sakai, Michito, 17
Scarino, Benjamin, 0Z
Shankar, Mohan, 19
Shao, Xi, 0H, 0K, 0V
Shen, Weimin, 0D
Shimoda, Haruhisa, 02
Slingerland, Philip C., 0S
Smith, Natividad, 19
Sun, Ling, 10
Tanaka, Kazuhiro, 0Q
Tanaka, Marie, 17
Thomas, Susan, 19
Tsuchida, Satoshi, 0X
Tweat, Kevin, 0M
Upreti, Sirish, 0H, 0K, 0V
Walikainen, Dale, 19
Wang, Wenhui, 0H, 0K
Weiler, Margaret, 0P
Wu, Aisheng, 0W, 15, 1A
Xiong, Xiaoxiong, 0F, 0L, 0M, 0N, 0W, 15, 16, 1A, 1C, 1D
Yasuda, Susumu, 13, 17
Yoshida, Jun, 0Q
Yoshioka, Hiroki, 0X
Zhang, Bin, 0H, 0U
Zhang, Yan, 10
Zhang, Zhiqing, 10

Symposium Committees

Symposium Chair

Upendra Singh, NASA Langley Research Center (United States)

Symposium Co-chairs

Toshiyoshi Kimura, Japan Aerospace Exploration Agency
(Japan)

K. J. Ramesh, Ministry of Earth Sciences (India)

Jiancheng Shi, Institute of Remote Sensing and Digital Earth
(China)

Honorary Symposium Chairs

Huadong Guo, Institute of Remote Sensing and Digital Earth
(China)

Stephen Jurczyk, National Aeronautics and Space Administration
(United States)

A. S. Kiran Kumar, Indian Space Research Organisation (India)

Jean-Yves Le Gall, Centre National d'Études Spatiales (France)

Robert M. Lightfoot, Jr., National Aeronautics and Space
Administration (United States)

Madhavan N. Rajeevan, Ministry of Earth Sciences (India)

Alain Ratier, EUMETSAT (Germany)

Hiroshi Yamakawa, Japan Aerospace Exploration Agency
(Japan)

Symposium International Organizing Committee

Michael H. Freilich, *Chair*, National Aeronautics and Space
Administration (United States)

Jack A. Kaye, National Aeronautics and Space Administration
(United States)

Barry L. Lefer, National Aeronautics and Space Administration
(United States)

Clayton P. Turner, NASA Langley Research Center (United States)

Pamela Millar, NASA Goddard Space Flight Center
(United States)

David F. Young, NASA Langley Research Center (United States)

Tapsan Misra, Indian Space Research Organisation
(India)

Kazuo Tachi, Japan Aerospace Exploration Agency (Japan)

Katsuhiro Nakagawa, National Institute of Information and
Communications Technology (Japan)
Haruhisa Shimoda, Tokai University (Japan)
Kohei Mizutani, National Institute of Information and
Communications Technology (Japan)
Wonkook Kim, Korea Institute of Ocean Science and Technology
(Republic of Korea)
YoungJe Park, Korea Institute of Ocean Science and Technology
(Republic of Korea)
Jhoon Kim, Yonsei University (Republic of Korea)
Xianqiang He, Second Institute of Oceanography, State Oceanic
Administration (China)
Shunling Liang, Beijing Normal University (China)

Conference Committee

Conference Chairs

Xiaoxiong Xiong, NASA Goddard Space Flight Center (United States)
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)

Conference Co-chairs

James J. Butler, NASA Goddard Space Flight Center (United States)
Changyong Cao, NOAA National Environmental Satellite, Data, and Information Service (United States)

Conference Program Committee

Sachidananda R. Babu, NASA Goddard Space Flight Center (United States)
Steven W. Brown, National Institute of Standards and Technology (United States)
Xiaolong Dong, National Space Science Center (China)
Jen-Chow Duh, NASA Headquarters (United States)
Philippe Goryl, ESRIN (Italy)
Xingfa Gu, Institute of Remote Sensing and Digital Earth (China)
Raj Kumar, Space Applications Center (India)
Saji Abraham Kuriakose, Indian Institute of Space Science and Technology (India)
Jens Nieke, European Space Research and Technology Centre (Netherlands)
Thomas S. Pagano, Jet Propulsion Laboratory (United States)
Dong-Bin Shin, Yonsei University (Korea, Republic of)
Junqiang Sun, National Oceanic and Atmospheric Administration (United States)
Kazuhiro Tanaka, Japan Aerospace Exploration Agency (Japan)
John T. Woodward, National Institute of Standards and Technology (United States)

Session Chairs

- 1 Existing Missions and Sensors I
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)

- 2 Existing Missions and Sensors II
Changyong Cao, NOAA National Environmental Satellite, Data, and Information Service (United States)
- 3 Enabling Technology and Research for New Sensors
Xiaoxiong Xiong, NASA Goddard Space Flight Center (United States)
Jen-Chow Duh, NASA Headquarters (United States)
- 4 New Techniques for Sensor Characterization
Jens Nieke, European Space Research and Technology Centre (Netherlands)
Kazuhiro Tanaka, Japan Aerospace Exploration Agency (Japan)
- 5 On-Orbit Calibration I
Thomas S. Pagano, Jet Propulsion Laboratory (United States)
- 6 On-Orbit Calibration II
Brian L. Markham, NASA Goddard Space Flight Center (United States)
- 7 Calibration Intercomparison and Performance
Junqiang Sun, National Oceanic and Atmospheric Administration (United States)
- 8 FPA
Sachidananda R. Babu, NASA Goddard Space Flight Center (United States)
- 9 Vicarious Calibration and Performance Validation
Kazuhiro Tanaka, Japan Aerospace Exploration Agency (Japan)
Xiaoxiong Xiong, NASA Goddard Space Flight Center (United States)