

PROCEEDINGS OF SPIE

Earth Observing Systems XXIII

James J. Butler
Xiaoxiong (Jack) Xiong
Xingfa Gu
Editors

21–23 August 2018
San Diego, California, United States

Sponsored and Published by
SPIE

Volume 10764

Proceedings of SPIE 0277-786X, V. 10764

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

Earth Observing Systems XXIII, edited by James J. Butler, Xiaoxiong (Jack) Xiong, Xingfa Gu, Proc. of SPIE Vol. 10764, 1076401 · © 2018 SPIE · CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2515129

Proc. of SPIE Vol. 10764 1076401-1

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 SPIEDigitalLibrary.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 Systems XXIII*, edited by James J. Butler, Xiaoxiong (Jack) Xiong, Xingfa Gu, Proceedings of SPIE Vol. 10764 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

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

ISBN: 9781510620995
ISBN: 9781510621008 (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**

SPIEDigitalLibrary.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

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

PRELAUNCH CALIBRATION

10764 03	Prelaunch characterization and performance of JPSS-2 VIIRS reflective solar bands [10764-1]
10764 04	JPSS-1 VIIRS solar diffuser witness sample BRFC calibration using a table-top goniometer at NASA GSFC [10764-2]
10764 05	Spectral testing of the Landsat-9 OLI-2 instrument using the Goddard Laser Absolute Measurement of Radiance (GLAMR) [10764-3]
10764 06	Landsat 9 Thermal Infrared Sensor 2 pre-launch characterization: initial imaging and spectral performance results [10764-4]
10764 07	Characterizations of a KHz pulsed laser detection system [10764-5]

NEW INSTRUMENTS AND TECHNOLOGIES

10764 09	Electro-optical sensors for Earth observation missions [10764-7]
10764 0A	UAV-based remote sensing for NaTech accidents management [10764-9]
10764 0B	Prism spectrometer analysis for field use [10764-10]
10764 0C	Hawkeye radiometric calibration methodology [10764-11]

GOES-16 I

10764 0D	Characterization of GOES-16 ABI detector-level uniformity from post-launch north south scan collections of several earth targets [10764-12]
10764 0E	In-orbit response versus scan-angle (RVS) validation for the GOES-16 ABI solar reflective bands [10764-13]
10764 0F	Validation of GOES-16 ABI infrared spatial response uniformity [10764-14]

10764 OG **GOES-16 ABI navigation assessment** [10764-15]

GOES-16 II

10764 OH **Independent validation of the advanced baseline imager (ABI) on NOAA's GOES-16: post-launch ABI airborne science field campaign results** [10764-16]

10764 OI **Validation of GOES-16 ABI reflective solar band calibration through reanalysis and comparison with field campaign data** [10764-17]

10764 OJ **On-orbit validation of the geolocation accuracy of GOES-16 Geostationary Lightning Mapper (GLM) flashes using ground-based laser beacons** [10764-18]

NEW MISSIONS

10764 OK **An update on EUMETSAT programmes and plans** [10764-20]

10764 OL **The 3MI mission on-board EPS-SG: a multi-spectral multi-polarization multi-directional imager for operational characterization of aerosol and cloud** [10764-21]

10764 OM **A new approach of remote sensing satellite programs in Taiwan** [10764-22]

AIRS

10764 ON **Reducing uncertainty in the AIRS radiometric calibration** [10764-23]

10764 OO **Radiometric stability in 16 years of AIRS hyperspectral infrared data** [10764-24]

10764 OP **Stratified radiometric means for the evaluation of AIRS and CrIS** [10764-25]

CERES

10764 OR **Early trends on the Clouds and the Earth's Radiant Energy System (CERES) Flight Model 6 (FM6) instrument's performance** [10764-27]

10764 OT **Radiometric calibration discrepancy and root cause analysis for radiation budget instrument** [10764-29]

ON-ORBIT, VICARIOUS, AND INTER-INSTRUMENT CALIBRATION

- 10764 0U **NOAA-20 VIIRS on-orbit calibration and characterization using the Moon** [10764-30]
- 10764 0V **MODIS and VIIRS on-orbit calibration and characterization using observations from spacecraft pitch maneuvers** [10764-31]
- 10764 0W **Evaluation of early NOAA-20 VIIRS RSB radiometric performance using intercomparison with Aqua MODIS** [10764-32]
- 10764 0X **Suomi NPP VIIRS DNB and RSB M bands detector-to-detector and HAM side calibration differences assessment using a homogenous ground target** [10764-63]
- 10764 0Y **SBAF for cross-calibration of Landsat-8 OLI and Sentinel-2 MSI over North African PICS** [10764-34]
- 10764 0Z **Directional reflectance studies in support of the Radiometric Calibration Test Site (RadCaTS) at Railroad Valley** [10764-35]

MODIS

- 10764 11 **MODIS cross-talk effects and areas of potential performance differences for Terra from Aqua characteristics** [10764-37]
- 10764 12 **Assessment of the on-orbit MODIS SRCA spectral uncertainty** [10764-38]
- 10764 13 **Effects of time-varying relative spectral response on the calibration of MODIS reflective solar bands** [10764-39]
- 10764 14 **MODIS solar diffuser degradation determination and its spectral dependency** [10764-40]

DATA ANALYSIS AND ALGORITHMS

- 10764 15 **On the effectiveness of remote monitoring systems** [10764-41]
- 10764 16 **Change detection for high resolution image based on pyramid mean shift smoothness and morphology** [10764-42]
- 10764 17 **Hyperspectral image denoising using improved low-rank and sparsity constraints** [10764-43]
- 10764 18 **Enhancements to the open access spectral band adjustment factor online calculation tool for visible channels** [10764-44]

VIIRS I

- 10764 1A **SNPP VIIRS reflective solar bands on-orbit calibration six-year update: extension and improvements** [10764-45]
- 10764 1B **Initial on-orbit radiometric calibration of the NOAA-20 VIIRS Reflective Solar Bands** [10764-46]
- 10764 1C **NOAA-20 VIIRS reflective solar bands on-orbit calibration using solar diffuser and solar diffuser stability monitor** [10764-47]
- 10764 1D **On-orbit RSB calibration of SNPP VIIRS using the full illumination profile of solar diffuser** [10764-48]

VIIRS II

- 10764 1F **Analysis of S-NPP VIIRS RSB bands detector saturation status and its change with time** [10764-50]
- 10764 1H **JPSS-1/NOAA-20 VIIRS early on-orbit geometric performance** [10764-52]
- 10764 1I **A light contamination ranking index-based method for automating VIIRS day/night band stray light correction** [10764-53]
- 10764 1J **An improved algorithm for VIIRS Day/Night Band (DNB) high gain stage (HGS) dark offset determination** [10764-54]

POSTER SESSION

- 10764 1L **Ring laser in angle measurements** [10764-56]
- 10764 1M **Identification of seismic signals at the output of large ring laser gyroscope** [10764-57]
- 10764 1N **Detection and characterization of striping in GOES-16 ABI VNIR/IR bands** [10764-58]
- 10764 1O **On-orbit performance of the Terra and Aqua MODIS solar diffuser stability monitor** [10764-59]
- 10764 1P **Methods of Earth-view-based calibration of the response versus scan angle of the MODIS reflective solar bands** [10764-60]
- 10764 1Q **NOAA-20 VIIRS radiometric band saturation evaluation and comparison with Suomi NPP VIIRS using global probability distribution function method** [10764-61]
- 10764 1T **Radiometric quality assessment of GOES-16 ABI L1b images** [10764-65]
- 10764 1U **Orbital variations and impacts on observations from SNPP, NOAA 18-20, and AQUA sun-synchronous satellites** [10764-66]

- 10764 1V **Comparison of the MODIS and VIIRS on-board SD and SDSM performance** [10764-67]
- 10764 1W **Object detection in multispectral and panchromatic image using superpixel segmentation and multisource feature** [10764-68]
- 10764 1X **Saliency and density enhanced region-of-interest extraction for large-scale high-resolution remote sensing images** [10764-69]
- 10764 1Y **A land-cover classification method of high-resolution remote sensing imagery based on convolution neural network** [10764-71]
- 10764 1Z **A building edge extraction method based on dual-scale classification with decision fusion for satellite image** [10764-72]
- 10764 20 **Optical multi-spectral strip filter by lithography and ion beam assisted deposition for multi-spectral remote sensing instrument** [10764-73]

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.

Abdelatif, Adam, 0B
Aldoretta, Emily J., 12, 1O
Anderson, Nikolaus J., 0B, 0Z
Angal, Amit, 03, 0V, 13, 1O, 1P, 1V
Armstrong, Peter, 0J
Aumann, Hartmut H., 0N, 0O, 0P
Barbieri Vita, Linda, 0A
Barsi, Julia A., 05
Bartlett, Brent, 0D, 0H, 0I
Bhatt, Rajendra, 18
Blonski, Slawomir, 1B, 1J
Bremer, James, 0J
Broberg, Steven E., 0N, 0O
Buechler, Dennis, 0J
Butler, James J., 04, 07, 0V
Cao, Changyong, 0D, 0H, 0I, 1B, 1I, 1J, 1Q, 1U
Cao, Zhimin, 1Z
Casey, Jason, 0D, 0H, 0I
Chee, Thad, 18
Chen, Chia-Ray, 0M
Chen, Hongda, 1O, 1P
Chen, Xuexia, 0X, 1F
Chiang, Kwofu, 0V, 1F
Choi, Taeyoung, 0I, 1B
Chu, Mike, 0W, 1D
Ciucci, Mariano, 0A
Coburn, Craig A., 0Z
Cook, Monica, 0D
Cooper, John W., 07
Czapla-Myers, Jeffrey S., 0B, 0Z
Dellomo, John J., 0G, 1H
Ding, Leibo, 07
Doelling, David R., 18
Efremova, Boryana, 06
Eno, N. Abraham, 1L, 1M
Fan, Xintong, 1Y
Feldman, Gene, 0C
Filatov, Yuri V., 1L
Fougnie, Bertrand, 0L
Fulbright, Jon, 0J
Geng, Xu, 1P
Georgiev, Georgi T., 0T
Goodman, Steve, 0J
Gopalan, Arun, 18
Gravelle, Chad, 0F
Gu, Lingjia, 1Y
Gu, Yalong, 1J
Guenther, B., 1I
Gunshor, Mathew, 0F
Guo, Qingle, 16, 17, 1W, 1X, 1Z
Hair, Jason, 06
Haney, Conor, 18
Hao, Lechuan, 1Z
Hasan, Nahid, 0Y
Helder, Dennis, 0Y
Hernandez, Oscar, 0B
Hertel, Richard, 0T
Holmes, Alan, 0C
Huang, Chien-Fu, 20
Huang, Po-Hsuan, 20
Iacovazzi, Robert, 0F, 1N, 1T
Ji, Qiang, 03
Johnston, Shaida, 05
Kahn, Brian H., 0P
Kelley, Nathan, 04
Klaes, K. Dieter, 0K
Kondratovich, Vladimir, 0F, 1T
Lacan, Antoine, 0L
Lalanne, Elaine N., 07
Lamb, Rivers, 0J
Lang, Ruediger, 0L
Lee, Hyung R., 0T
Lee, Shihyan, 0C, 14
Lei, Ning, 0X, 1F, 1V
Leigh, Larry, 0Y
Li, Tong, 1X
Lin, Guoqing, 1H
Lindsey, Dan, 0F
Link, Daniel, 12
Liu, Tung-Chang, 1I, 1U
Lunsford, Allen, 06
Manning, Evan M., 0N, 0O, 0P
Marbach, Thierry, 0L
Marino, Alessandra, 0A
Markham, Brian, 05
McAndrew, Brendan, 05
McCorkel, Joel, 05, 06
McIntire, Jeff, 03
Meister, Gerhard, 0C, 14
Mkrtychyan, F. A., 15
Moeller, Christopher, 1I
Montanaro, Matthew, 06
Morris, D., 09
Moyer, David, 03
Munro, Rosemary, 0L
Oudrari, Hassan, 03
Padula, Francis, 0D, 0H, 0I
Pagano, Thomas S., 0N

Patt, Frederick S., 0C
 Pavlov, P. A., 1L
 Pearlman, Aaron, 06, 0D, 0H, 0I
 Piccirilli, Chiara, 0A
 Pogorzala, Dave, 0D, 0H
 Poli, Gabriele, 0L
 Predina, Joe, 0T
 Priestley, Kory J., 0R, 0T
 Qian, Haifeng, 0E, 0F, 0I, 1N, 1T
 Ramirez, Michael, 0F
 Randall, Christopher R., 0T
 Ren, Ruizhi, 1Y
 Reth, Alan, 0G
 Reuter, Dennis, 06
 Scarino, Benjamin, 18
 Schluessel, Peter, 0L
 Schmit, Tim, 0F
 Shankar, Mohan, 0T
 Shao, Xi, 0E, 0F, 0I, 1I, 1N, 1Q, 1T, 1U
 Shrestha, Mahesh, 0Y
 Shuman, Timothy, 05
 Simon, Amy, 06
 Smith, Nathaniel P., 0R
 Strow, Larrabee, 0N
 Sun, Chengbo, 1F
 Sun, Junqiang, 0U, 0W, 1I, 1A, 1C, 1D
 Swindells, I., 09
 Szewczyk, Z. Peter, 0R
 Tan, Bin, 0G, 1H
 Tari, J. B., 1M
 Teixeira Pinto, Cibele, 0Y
 Thomas, Susan, 0R
 Thome, Kurtis J., 0Z
 Tilton, James C., 1H
 Twedt, Kevin A., 12, 13, 1O, 1P, 1V
 Uprety, Sirish, 0I, 1I, 1J, 1Q, 1U
 Van Naarden, John, 0F
 Varghese, Thomas, 0J
 Wang, Menghua, 0U, 0W, 1A, 1C, 1D
 Wang, Wenhui, 1I
 Wang, Yuhan, 1Y
 Wang, Zhipeng, 0F, 1N, 1T
 Weiler, Margie, 0N
 Wenny, Brian N., 06, 0Z
 Williams, Yana Z., 0T
 Wilson, Robert, 0R
 Wolfe, Robert E., 0G, 1H
 Woody, Loren, 0T
 Wu, Aisheng, 0V, 1P
 Wu, Di, 1W
 Wu, Xiangqian, 0E, 0F, 0I, 1N, 1T
 Xiong, Xiaoxiong, 03, 04, 0V, 0X, 12, 13, 1F, 1O,
 1P, 1U, 1V
 Yoo, Hyelim, 0F, 1N, 1T
 Young, Cindy L, 0T
 Yu, Fangfang, 0E, 0F, 0I, 1N, 1T
 Zeng, Jinan, 04, 07
 Zhang, Bin, 1I, 1J, 1Q, 1U
 Zhang, Junping, 16, 17, 1X
 Zhang, Ping, 1H
 Zhang, Ye, 16, 1W, 1Z
 Zheng, Xu, 1Y
 Zhong, Chongxiao, 17
 Zou, Bin, 1X
 Zukowski, Barbara, 05

Conference Committee

Program Chair

Allen H.-L. Huang, University of Wisconsin-Madison (United States)

Conference Chairs

James J. Butler, NASA Goddard Space Flight Center (United States)

Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center
(United States)

Xingfa Gu, Institute of Remote Sensing Applications (China)

Conference Program Committee

Philip E. Ardanuy, Innovim, LLC (United States)

Jeffrey S. Czapl-Myers, College of Optical Sciences, The University of
Arizona (United States)

Armin Doerry, Sandia National Laboratories (United States)

Christopher N. Durell, Labsphere, Inc. (United States)

Bertrand Fougnie, EUMETSAT (Germany)

Dennis L. Helder, South Dakota State University (United States)

Joel McCorkel, NASA Goddard Space Flight Center (United States)

Vijay Murgai, Raytheon Space and Airborne Systems (United States)

Thomas S. Pagano, Jet Propulsion Laboratory (United States)

Jeffery J. Puschell, Raytheon Space & Airborne Systems
(United States)

Mark A. Schwarz, SAIC (United States)

Session Chairs

1 Prelaunch Calibration

Christopher N. Durell, Labsphere, Inc. (United States)

2 New Instruments and Technologies

Bertrand Fougnie, EUMETSAT (Germany)

3 GOES-16 I

Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center
(United States)

4 GOES-16 II

James J. Butler, NASA Goddard Space Flight Center (United States)

- 5 New Missions
Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center
(United States)
- 6 AIRS
Armin W. Doerry, Sandia National Labs. (United States)
- 7 CERES
Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center
(United States)
- 8 On-Orbit, Vicarious, and Inter-Instrument Calibration
James J. Butler, NASA Goddard Space Flight Center (United States)
- 9 MODIS
Jeffrey S. Czaplak-Myers, College of Optical Sciences, The University of
Arizona (United States)
- 10 Data Analysis and Algorithms
Amit Angal, Science Systems and Applications, Inc. (United States)
- 11 VIIRS I
Thomas S. Pagano, Jet Propulsion Laboratory (United States)
- 12 VIIRS II
Joel McCorkel, NASA Goddard Space Flight Center (United States)