PROCEEDINGS OF SPIE

Earth Observing Systems XX

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

10–13 August 2015 San Diego, California, United States

Sponsored and Published by SPIE

Volume 9607

Proceedings of SPIE 0277-786X, V. 9607

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

Earth Observing Systems XX, edited by James J. Butler, Xiaoxiong (Jack) Xiong, Xingfa Gu, Proc. of SPIE Vol. 9607, 960701 ⋅ © 2015 SPIE CCC code: 0277-786X/15/\$18 ⋅ doi: 10.1117/12.2217969

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 XX*, edited by James J. Butler, Xiaoxiong (Jack) Xiong, Xingfa Gu, Proceedings of SPIE Vol. 9607 (SPIE, Bellingham, WA, 2015) Six-digit Article CID Number.

ISSN: 0277-786X

ISSN:1996-756X (electronic) ISBN: 9781628417739

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 © 2015, 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/15/\$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. 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 six-digit CID article numbering system structured as follows:

- 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.

Contents

iv.	Authors
IX	AIIIIIII

xi Conference Committee

SESSION 1	ON-ORBIT INSTRUMENT PERFORMANCE AND DATA PRODUCTS
9607 02	Measuring atmospheric carbon dioxide from space with the Orbiting Carbon Observatory-2 (OCO-2) [9607-1]
9607 03	Toward consistent radiometric calibration of the NOAA AVHRR visible and near-infrared data record [9607-2]
9607 04	Geometric effects in SeaWiFS lunar observations [9607-3]
9607 07	Building vectorization inside a favela utilizing lidar spot elevation [9607-6]
SESSION 2	INSTRUMENT INTERCOMPARISONS AND VICARIOUS CALIBRATION I
9607 09	Design of an ultra-portable field transfer radiometer supporting automated vicarious calibration [9607-8]
9607 0A	Atmospheric measurement analysis for the Radiometric Calibration Test Site (RadCaTS) [9607-9]
9607 OB	Online resource for Earth-observing satellite sensor calibration [9607-10]
9607 OC	Radiometric calibration of G-LiHT's imaging spectrometer using GLAMR for satellite sensor intercalibration [9607-11]
SESSION 3	INSTRUMENT INTERCOMPARISONS AND VICARIOUS CALIBRATION II
9607 0D	Preliminary study for improving the VIIRS DNB low light calibration accuracy with ground based active light source [9607-12]
9607 OE	Validation of S-NPP VIIRS Day-Night band and M bands performance using ground reference targets of Libya 4 and Dome C [9607-13]
9607 OF	Multi-image matching for lunar surface reconstruction from orbital images [9607-14]

SESSION 4	INFRARED SOUNDING INSTRUMENTS
9607 OI	Results from CrIS/ATMS obtained using an "AIRS Version-6 like" retrieval algorithm [9607-17]
9607 OJ	Principle component analysis of AIRS and CrIS data [9607-18]
9607 OK	Improving AIRS radiance spectra in high contrast scenes using MODIS [9607-19]
9607 OL	Tropical simultaneous nadir observations for IR sounder evaluation and comparison [9607-20]
9607 OM	Calibration and data analysis issues in modern infrared spectrometers using large detector arrays [9607-21]
SESSION 5	LANDSAT
9607 ON	Radiometric calibration and stability of the Landsat-8 Operational Land Imager (OLI) [9607-22]
9607 00	Operational Land Imager relative radiometric calibration [9607-23]
9607 OP	Assessing OLI stray light and contamination changes with lunar observations [9607-24]
9607 OQ	TIRS stray light correction: algorithms and performance [9607-25]
9607 OR	Atmospheric correction for Landsat 8 over Case 2 waters [9607-26]
9607 OS	Requirement sensitivity studies for a future Landsat sensor [9607-27]
SESSION 6	CERES AND MODIS INSTRUMENTS
9607 OT	Assessment of the clouds and the Earth's Radiant Energy System (CERES) instrument performance and stability on the Aqua, Terra, and S-NPP spacecraft [9607-28]
9607 OU	Evaluating the impact of cold focal plane temperature on Aqua MODIS thermal emissive band calibration [9607-29]
9607 OV	Electronic crosstalk in Terra MODIS thermal emissive bands [9607-30]
9607 OW	Electronic crosstalk characterization of Terra MODIS long wave infrared channels [9607-31]

SESSION 7	PRE-LAUNCH INSTRUMENT CALIBRATION I
9607 0X	Solar diffusers in earth observation instruments with an illumination angle of up to 70°: design and verification of performance in BRDF [9607-32]
9607 OY	Characterization and application of a LED-driven integrating sphere source [9607-33]
9607 OZ	Improved thermal-vacuum compatible flat plate radiometric source for system-level testing of optical sensors [9607-34]
9607 10	JPSS-1 VIIRS pre-launch radiometric performance [9607-35]
9607 11	JPSS-1 VIIRS prelaunch spectral characterization and performance [9607-36]
SESSION 8	PRE-LAUNCH INSTRUMENT CALIBRATION II
9607 12	VIIRS/J1 polarization narrative [9607-37]
9607 13	Analysis of JPSS J1 VIIRS polarization sensitivity using the NIST T-SIRCUS [9607-38]
9607 14	Impacts of VIIRS polarization sensitivity on non-ocean scenes [9607-39]
9607 15	JPSS-1 VIIRS solar diffuser stability monitor response versus sun angle of incidence [9607-40]
SESSION 9	PRE-LAUNCH INSTRUMENT CALIBRATION III
9607 17	JPSS-1 VIIRS DNB nonlinearity and its impact on SDR calibration [9607-42]
9607 19	A robust method for determining calibration coefficients for VIIRS reflective solar bands [9607-44]
9607 1A	Modeling spectrally varying resolution in broadband imaging systems [9607-45]
9607 1B	Simple techniques for modeling wavefront error in imaging systems [9607-46]
SESSION 10	NEW MISSIONS, INSTRUMENTS, AND TECHNOLOGIES I
9607 1C	Demonstrating the error budget for the Climate Absolute Radiance and Refractivity Observatory through solar irradiance measurements [9607-47]
SESSION 11	NEW MISSIONS, INSTRUMENTS, AND TECHNOLOGIES II
9607 11	An update on EUMETSAT programmes and plans [9607-52]
9607 1K	Collaboration pathway(s) using new tools for optimizing 'operational' climate monitoring from space [9607-54]

SESSION 12	SUOMI NPP VIIRS I
9607 1L	S-NPP VIIRS instrument telemetry and calibration data trend study [9607-55]
9607 1N	Mission history of reflective solar band calibration performance of VIIRS [9607-57]
SESSION 13	SUOMI NPP VIIRS II
9607 1P	Updates to the on-orbit calibration of SNPP VIIRS for ocean color applications [9607-59]
9607 1Q	Visible Infrared Imaging Radiometer Suite (VIIRS) and uncertainty in the ocean color calibration methodology [9607-60]
9607 1R	JPSS-1 VIIRS prelaunch RSB/DNB RVS characterization and water vapor correction [9607-61]
9607 1S	Suomi-NPP VIIRS day/night band calibration with stars [9607-62]
SESSION 14	SUOMI NPP VIIRS III
9607 IT	Assessment of MODIS and VIIRS solar diffuser on-orbit degradation [9607-63]
9607 1V	Estimation of the accuracy of the SNPP VIIRS SD BRDF degradation factor determined by the solar diffuser stability monitor [9607-65]
9607 1W	Determination of the SNPP VIIRS solar diffuser BRDF degradation factor over wavelengths longer than 1 μm [9607-66]
9607 1Y	Impact of the angular dependence of the SNPP VIIRS solar diffuser BRDF degradation factor on the radiometric calibration of the reflective solar bands [9607-68]
SESSION 15	SUOMI NPP VIIRS IV
9607 1Z	Calibration improvements for MODIS and VIIRS SWIR spectral bands [9607-69]
9607 20	Update on the performance of Suomi-NPP VIIRS lunar calibration [9607-70]
9607 21	Improved VIIRS offset correction during lunar intrusion into space view [9607-71]
9607 22	An improved algorithm for VIIRS band-to-band registration characterization with lunar observation [9607-72]
9607 23	Analysis of VIIRS TEB noise using solar diffuser measurements [9607-73]

POSTER SESSION

9607 24	Radiometric cross-calibration of Terra ASTER and MODIS [9607-74]
9607 25	Implementation of electronic crosstalk correction for Terra MODIS PV LWIR bands [9607-75]
9607 26	Precise prelaunch radiometric calibration of VIIRs [9607-76]
9607 27	Assessment of scan-angle dependent radiometric bias of Suomi-NPP VIIRS day/night band from night light point source observations [9607-77]
9607 28	Noise characteristics research of Overhauser magnetometer sensor [9607-78]
9607 29	An improved proton magnetometer for Earth's magnetic field observation [9607-79]
9607 2B	Assessment of the Collection 6 Terra and Aqua MODIS bands 1 and 2 calibration performance [9607-82]
9607 2C	Radiometric performance assessment of Suomi NPP VIIRS SWIR band (2.25 µm) [9607-83]
9607 2D	Measured polarized spectral responsivity of JPSS J1 VIIRS using the NIST T-SIRCUS [9607-84]
9607 2E	Preliminary validation of Himawari-8/AHI navigation and calibration [9607-85]
9607 2G	Extracting information on urban impervious surface from GF-1 data in Tianjin City of China [9607-87]
9607 2H	Vicarious validation of straylight correction for VIIRS day/night band using Dome-C [9607-88]

Proc. of SPIE Vol. 9607 960701-8

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.

Al-Jarrah, Ahmad, 0F Anderson, Nikolaus, 09 Andou, Akiyoshi, 2E Angal, Amit, 0C, 1T, 1Z, 2B Aumann, Hartmut H., 0J, 0K, 0L, 0M Bai, Yan, 0D, 27 Barsi, Julia A., 0N, 0O Beckmann, Tim. 0Q

Beckmann, Tim, OQ Bessho, Kotaro, 2E Bhatt, Rajendra, 03 Biggar, Stuart, 09 Bol, Hans, OX

Borovytsky, Volodymyr, 26 Botelho, Lucas M. R., 07 Bousquet, Robert, 0Z Broberg, Steven E., 0K Brown, Steven W., 0Z, 12 Butler, James J., 0Y, 10, 12, 1T

Cao, Changyong, 0D, 17, 1R, 23, 27, 2C, 2H

Cardema, Jason C., 1L, 1N

Carney, Trevor, 0Q Chen, Na, 25 Chen, Xuexia, 0E, 2B Chiang, Kwofu, 0E, 0W Choi, Taeyoung, 23 Concha, Javier A., 0R Cook, Bruce, 0C Cooper, John W., 0Y Corp, Lawrence A., 0C Cota, Stephen A., 1A, 1B Cozzo, Alexandra, 0Q

Crisp, D., 02 Cui, Zhaoyu, 0S

Czapla-Myers, Jeffrey, 09, 0A, 0B

Dabney, Philip, 0P Date, Kenji, 2E

De Luccia, Frank J., 1L, 1N, 21

Ding, Leibo, OY
Doelling, David R., 03
Dwyer, Morgan M., 1K
Efremova, Boryana, 10, 19
Elaksher, Ahmed F., OF
Elliott, Denis A., 0K, 0M
Eplee, Robert E., 04, 1P, 1Q

Fest, Eric, 12 Franz, Bryan A., 1P Fu, Haoyang, 28, 29

Fulbright, Jon P., 1S, 1T, 1Z, 20

Geng, Xu, 1T, 25

Georgiev, Georgi T., 0Y Georgieva, Elena M., 0Y Gerace, Aaron, 0Q, 0S Gopalan, Arun, 03 Gu, Lingjia, 28 Gu, Xingfa, 2G Guo, Xin, 29 Gür, Bilgehan, 0X Haas, E., 1N Haney, Conor O., 03 Haque, Md. Obaidul, 0N

Helmuth, Douglas B., 1K Hess, Phillip C., 0T Hoasaka, Keita, 2E Holmlund, Kenneth, 11 Hudz, Oleksii, 26 Iredell, Lena, 01 Isaacson, Peter J., 21 Ji, Qiang, 10, 19 Kaita, Edward, 0N Kent, Craig J., 0Z Klaes, K. Dieter, 11 Kouvaris, Louis, 01 Lee, Shihyan, 10, 17, 1R Lei, Ning, 0E, 1V, 1W, 1Y, 1Z

Levy, Raviv, OP Li, Bicen, OX Li, Bin, 2G

Li, Yonghong, OU, 22, 2B

Liu, Tala, 28

Lopes, Matheus E. C., 07 Loverro, Adam L., 1A Lykke, Keith R., 12

Madhavan, Sriharsha, 0V, 0W, 25 Manning, Evan M., 0J, 0K, 0L Markham, Brian L., 0N, 0O, 0P, 0S McAndrew, Brendan, 12, 1C

McCarthy, James, 15

McCorkel, Joel, 0B, 0C, 12, 1C, 24 McIntire, Jeffrey, 10, 11, 12, 13, 19, 2D

Meister, Gerhard, 04, 12, 1P, 1Q

Meng, Qingyan, 2G Mikheenko, Leonid, 26 Moeller, Chris, 11 Monroy, Eslim O., 12

Montanaro, Matthew, 0Q, 0S

Morfitt, Ron A., 0N Mori, Nobutaka, 2E Moy, Gabriel, 1L, 1N, 21 Moyer, David, 11, 12, 13, 2D

Mu, Qiaozhen, 1Z

Murata, Hidehiko, 2E

Murgai, Vijay, 15

Nelson, Neil, 15

Nero, Marcelo A., 07

Ngan, Vicki, 0Q

Okuyama, Arata, 2E

Ong, Lawrence, 0N

Oudrari, Hassan, 10, 13, 19

Pagano, Thomas S., OK Patt, Frederick S., O4, 1P

Priestley, Kory J., OT

Qiu, Shi, 2H

Rausch, K., 1N

Scarino, Benjamin R., 03

Schnee, Scott L., 1A, 1B

Schott, John R., OR, OS

Schwarting, Thomas, 10, 11, 19

Schwarz, Mark A., 0Z

Selva, Daniel, 1K

Shankar, Mohan, OT

Shao, Xi, 0D, 27, 2H

Smith, Gilbert R., 0Y

Smith, Nathaniel P., 0T

Smith, Natividad M., 0T

Sun, Junqiang, 0V, 0W

Sun, ZiPing (Frank), 1L

Susskind, Joel, 01

Tabata, Tasuku, 2E

Takahashi, Masaya, 2E

Temba, Plinio, 07

Thomas, Susan, OT

Thome, Kurtis J., 09, 0B, 0C, 12, 1C, 24

Turpie, Kevin R., 12, 1P, 1Q

Tyrrell, Kaitlin, 0Q

Uprety, Sirish, 2C

Vandermierden, Nicholas R., 21

Walikainen, Dale R., 0T

Walker, Kyle, 0F

Waluschka, Eugene, 12, 13, 2D

Wang, Menghua, 0V

Wang, Tung R., 12

Wang, Wenhui, 17, 2H

Wang, Zhipeng, 0E, 1T, 1Z, 20, 22

Weng, Fuzhong, 23

Wenny, Brian, OB, OU

Wilkinson, Timothy S., 14, 1N

Wilson, Robert S., OT

Wu, Aisheng, 0E, 0U, 0W, 1Z, 2B

Wu, Jun, 2G

Xiao, Chengyu, 29

Xiong, Xiaoxiong (Jack), 0E, 0U, 0V, 0W, 10,

13, 19, 1S, 1T, 1V, 1W, 1Y, 1Z, 20, 22, 25, 2B, 2D

Xu, Pengmei, 0X

Yoshino, Ryoko, 2E

Young, James B., 12, 13, 2D

Yu, Kristie, 15

Yuan, Karen, 24

Zeng, Jinan, 19

Zhang, Shuang, 28, 29 Zong, Yuqing, 0D

Х

Conference Committee

Program Track 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 (United States)

Hal J. Bloom, Science & Technology Corporation (United States)
Jeffrey S. Czapla-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, Centre National d'Études Spatiales (France)

Mitchell D. Goldberg, National Environmental Satellite, Data, and Information Service (United States)

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

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

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

Carl F. Schueler, Schueler Consulting-Santa Barbara (United States)

Session Chairs

- On-orbit Instrument Performance and Data Products

 Joel McCorkel, NASA Goddard Space Flight Center (United States)
- 2 Instrument Intercomparisons and Vicarious Calibration I Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center (United States)
- 3 Instrument Intercomparisons and Vicarious Calibration II **Philip E. Ardanuy**, INNOVIM (United States)
- 4 Infrared Sounding Instruments

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

- 5 Landsat
 Armin W. Doerry, Sandia National Laboratories (United States)
- 6 CERES and MODIS Instruments Jeffrey S. Czapla-Myers, College of Optical Sciences, The University of Arizona (United States)
- 7 Pre-launch Instrument Calibration I Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center (United States)
- 8 Pre-launch Instrument Calibration II
 James J. Butler, NASA Goddard Space Flight Center (United States)
- 9 Pre-launch Instrument Calibration III Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Center (United States)
- 10 New Missions, Instruments, and Technologies I Carl F. Schueler, Schueler Consulting (United States)
- New Missions, Instruments, and Technologies IIThomas S. Pagano, Jet Propulsion Laboratory (United States)
- 12 Suomi NPP VIIRS I James J. Butler, NASA Goddard Space Flight Center (United States)
- 13 Suomi NPP VIIRS II Xingfa Gu, Institute of Remote Sensing Applications (China)
- 14 Suomi NPP VIIRS III

 Christopher N. Durell, Labsphere, Inc. (United States)
- Suomi NPP VIIRS IV James J. Butler, NASA Goddard Space Flight Center (United States)