

PROCEEDINGS OF SPIE

Earth Observing Systems XII

James J. Butler
Jack Xiong
Editors

26–28 August 2007
San Diego, California, USA

Sponsored and Published by
SPIE

Volume 6677

Proceedings of SPIE, 0277-786X, v. 6677

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

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 *Earth Observing Systems XII*, edited by James J. Butler, Jack Xiong, Proceedings of SPIE Vol. 6677 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 0277-786X

ISBN 9780819468253

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 © 2007, 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/07/\$18.00.

Printed in the United States of America.

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

The logo for SPIE Digital Library features the word "SPIE" in a bold, sans-serif font above the words "Digital Library" in a similar font. To the right of the text is a stylized graphic consisting of three vertical bars of increasing height, resembling a bar chart or a signal waveform.

SPIDigitalLibrary.org

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 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

xi *Conference Committee*

SESSION 1 PRELAUNCH CALIBRATION I

- 6677 02 **Application of SSULI ground calibration methods to retrieval of spectral emissions on flight instruments** [6677-01]
P. W. Walker, Computational Physics, Inc. (USA); S. A. Budzien, S. E. Thonnard, A. C. Nicholas, K. F. Dymond, Naval Research Lab. (USA)
- 6677 03 **Spectral features, effects, and cures** [6677-02]
H. van Brug, G. Bazalgette Courrèges Lacoste, TNO Science and Industry (Netherlands)
- 6677 04 **System-level pre-launch calibration of onboard solar diffusers** [6677-03]
R. A. Barnes, Science Applications International Corp. (USA); S. W. Brown, K. R. Lykke, G. T. Fraser, National Institute of Standards and Technology (USA); J. J. Butler, NASA Goddard Space Flight Ctr. (USA)
- 6677 05 **Characterization of Earth observing satellite instruments for response to spectrally and spatially variable scenes** [6677-04]
S. W. Brown, National Institute of Standards and Technology (USA); B. Myers, National Institute of Standards and Technology (USA) and Appalachian State Univ. (USA); R. A. Barnes, Science Applications International Corp. (USA); J. P. Rice, National Institute of Standards and Technology (USA)
- 6677 06 **Design and characterization of a large area uniform radiance source for calibration of a remote sensing imaging system** [6677-05]
G. McKee, Labsphere, Inc. (USA); S. Pal, H. Seth, A. Bhardwaj, H. S. Sahoo, Indian Space Research Organisation (India)

SESSION 2 PRELAUNCH CALIBRATION II

- 6677 07 **Validation of radiometric standards for the laboratory calibration of reflected-solar Earth-observing satellite instruments** [6677-06]
J. J. Butler, NASA Goddard Space Flight Ctr. (USA); B. C. Johnson, J. P. Rice, S. W. Brown, National Institute of Standards and Technology (USA); R. A. Barnes, Science Applications International Corp. (USA)
- 6677 08 **Area measurements of apertures for exo-atmospheric solar irradiance for JPL** [6677-07]
M. Litorja, B. C. Johnson, J. Fowler, National Institute of Standards and Technology (USA)
- 6677 09 **The TSI Radiometer Facility: absolute calibrations for total solar irradiance instruments** [6677-08]
G. Kopp, K. Heuerman, D. Harber, G. Drake, Univ. of Colorado, Boulder (USA)

- 6677 0A **VIIRS ZEMAX and FORTRAN polarization models** [6677-09]
E. Waluschka, NASA Goddard Space Flight Ctr. (USA); K. Voss, Univ. of Miami (USA);
D. Moyer, Science Systems and Applications, Inc. (USA); G. Meister, Futuretech Corp. (USA);
L. Liao, Northrop Grumman Corp. (USA)
- 6677 0B **Vacuum focus testing of large telescopes** [6677-10]
J. J. Lumia, Ball Aerospace and Technologies Corp. (USA)
- 6677 0C **Linearity improvement in a high dark-current short-wave infrared array spectrometer**
[6677-11]
D. P. D'Amato, D. Griffiths, J. E. Leland, Labsphere, Inc. (USA)

SESSION 3 ON-ORBIT CALIBRATION I

- 6677 0D **Absolute ultraviolet irradiance of the moon from SORCE SOLSTICE** [6677-12]
M. Snow, G. Holsclaw, W. E. McClintock, T. Woods, Univ. of Colorado, Boulder (USA)
- 6677 0E **The on-orbit calibration of SeaWiFS: revised temperature and gain corrections** [6677-13]
R. E. Eplee, Jr., F. S. Patt, Science Applications International Corp. (USA); G. Meister,
FutureTech Corp. (USA); B. A. Franz, Science Applications International Corp. (USA);
S. W. Bailey, FutureTech Corp. (USA); C. R. McClain, NASA Goddard Space Flight Ctr. (USA)
- 6677 0F **Consistency of L4 TM absolute calibration with respect to the L5 TM sensor based on near-
simultaneous image acquisition** [6677-14]
G. Chander, Science Applications International Corp. (USA) and U.S. Geological Survey
Ctr. for Earth Resources Observation and Science (USA); D. L. Helder, R. Malla, South
Dakota State Univ. (USA); E. Micijevic, Science Applications International Corp. (USA) and
U.S. Geological Survey Ctr. for Earth Resources Observation and Science (USA);
C. J. Mettler, South Dakota State Univ. (USA)
- 6677 0G **Comparison of outgassing models for the Landsat thematic mapper sensors** [6677-15]
E. Micijevic, G. Chander, Science Applications International Corp. (USA) and U.S.
Geological Survey Ctr. for Earth Resources Observation and Science (USA)

SESSION 4 ON-ORBIT CALIBRATION II

- 6677 0H **Radiometric performance of the CERES Earth radiation budget climate record sensors on
the EOS Aqua and Terra spacecraft** [6677-17]
K. J. Priestley, NASA Langley Research Ctr. (USA); G. L. Smith, National Institute for
Aerospace (USA); S. Thomas, SSAI (USA); D. Cooper, SSAI (USA) and National Institute for
Aerospace (USA); R. B. Lee III, National Institute for Aerospace (USA); D. Walikainen, P. Hess,
Z. P. Szewczyk, R. Wilson, SSAI (USA)
- 6677 0I **Transfer of radiometric standards between multiple low earth orbit climate observing
broadband radiometers: application to CERES** [6677-18]
G. Matthews, Analytical Services and Materials (USA); K. Priestley, NASA Langley Research
Ctr. (USA); S. Thomas, Science Systems and Applications Inc. (USA)

6677 OJ **A method for jointly estimating the noise and bias of AIRS and TES over homogeneous ocean scenes** [6677-19]
L. J. Scharenbroich, H. H. Aumann, Jet Propulsion Lab. (USA)

6677 OK **RADARSAT ScanSAR wind retrieval under hurricane conditions** [6677-20]
C. Nie, D. G. Long, Brigham Young Univ. (USA)

SESSION 5 MODIS

6677 OL **Detector noise characterization and performance of MODIS thermal emissive bands** [6677-21]
X. Xiong, NASA Goddard Space Flight Ctr. (USA); A. Wu, N. Chen, K. Chiang, S. Xiong, B. Wenny, Science Systems and Applications, Inc. (USA); W. L. Barnes, Univ. of Maryland, Baltimore County (USA)

6677 OM **Monitoring MODIS thermal emissive band stability through brightness temperature trending of a ground target** [6677-22]
B. N. Wenny, Science Systems and Applications, Inc. (USA); X. Xiong, NASA Goddard Space Flight Ctr. (USA)

6677 ON **Aqua MODIS L1B radiometric accuracy update for TIR bands: Tahoe 2006 field data from the NASA ER-2** [6677-23]
C. C. Moeller, Univ. of Wisconsin, Madison (USA); S. Hook, Jet Propulsion Lab. (USA); R. Knuteson, D. Tobin, Univ. of Wisconsin, Madison (USA)

6677 OO **Characterization of MODIS solar diffuser on-orbit degradation** [6677-24]
X. Xiong, NASA Goddard Space Flight Ctr. (USA); X. Xie, A. Angal, J. Choi, J. Sun, Science Systems and Applications, Inc. (USA); W. L. Barnes, Univ. of Maryland, Baltimore County (USA)

6677 OP **Correction of subframe striping in high-resolution MODIS ocean color products** [6677-25]
G. Meister, FutureTech Corp. (USA); C. Pan, Science Systems and Applications, Inc. (USA); F. S. Patt, B. Franz, SAIC (USA); J. Xiong, C. R. McClain, NASA Goddard Space Flight Ctr. (USA)

6677 OQ **Utility of MODIS-Terra for ocean color applications** [6677-26]
B. A. Franz, E. J. Kwiatkowska, NASA (USA) and Science Applications International Corp. (USA); G. Meister, NASA (USA) and Futuretech Corp. (USA); C. R. McClain, NASA (USA)

6677 OR **MODIS pre-launch reflective solar band response vs. scan angle** [6677-27]
C. Pan, Science Systems and Applications, Inc. (USA); J. Xiong, NASA Goddard Space Flight Ctr. (USA); N. Che, Science Systems and Applications, Inc. (USA)

SESSION 6 VICARIOUS CALIBRATION I

- 6677 OS **Prime candidate Earth targets for the post-launch radiometric calibration of space-based optical imaging instruments** [6677-28]
P. M. Teillet, Univ. of Lethbridge (Canada); J. A. Barsi, Science Systems and Applications, Inc. (USA); G. Chander, Science Applications International Corp. (USA) and U.S. Geological Survey Ctr. for Earth Resources Observation and Science (USA); K. J. Thome, Optical Sciences Ctr., Univ. of Arizona (USA)
- 6677 OT **Retrieval of surface BRDF for reflectance-based calibration** [6677-29]
K. Thome, J. Czapla-Myers, J. McCorkel, Optical Sciences Ctr., Univ. of Arizona (USA)
- 6677 OU **Implication of spatial uniformity on vicarious calibration using automated test sites** [6677-30]
J. S. Czapla-Myers, K. J. Thome, J. H. Buchanan, College of Optical Sciences, Univ. of Arizona (USA)
- 6677 OV **LED Spectrometer (LSpec) autonomous vicarious calibration facility** [6677-31]
M. C. Helmlinger, Northrop Grumman Space Technology (USA); C. J. Bruegge, Jet Propulsion Lab. (USA); E. H. Lubka, Dartmouth College (USA); H. N. Gross, Integrity Applications Inc. (USA)

SESSION 7 VICARIOUS CALIBRATION II

- 6677 OW **VNIR transfer radiometer for validation of calibration sources for hyperspectral sensors** [6677-32]
S. F. Biggar, K. J. Thome, College of Optical Sciences, Univ. of Arizona (USA); R. B. Lockwood, S. Miller, Air Force Research Lab. (USA)
- 6677 OX **Solar radiation-based calibration of laboratory grade radiometers** [6677-33]
N. Anderson, S. Biggar, K. Thome, N. Leisso, College of Optical Sciences, Univ. of Arizona (USA)
- 6677 OY **Cross-calibration of the Terra MODIS, Landsat 7 ETM+ and EO-1 ALI sensors using near-simultaneous surface observation over the Railroad Valley Playa, Nevada, test site** [6677-34]
G. Chander, Science Applications International Corp. (USA) and U.S. Geological Survey, Ctr. for Earth Resources Observation and Science (USA); A. Angal, T. Choi, Science Systems and Applications, Inc. (USA); D. J. Meyer, Science Applications International Corp. (USA) and U.S. Geological Survey, Ctr. for Earth Resources Observation and Science (USA); X. Xiong, NASA Goddard Space Flight Ctr. (USA); P. M. Teillet, Univ. of Lethbridge (Canada)
- 6677 OZ **Calibration of NOAA-17 AVHRR solar reflectance channels using the time series observation of the desert target** [6677-35]
F. Yu, ERT, Inc. (USA); X. F. Wu, NOAA/NESDIS/STAR (USA)

SESSION 8 VICARIOUS CALIBRATION III

- 6677 10 **Airborne prototype instrument suite test flight of a low-light high-dynamic range imager and visible spectrometer** [6677-36]
M. A. Kuester, J. K. Lasnik, T. Ramond, T. Lin, B. Johnson, P. Kaptchen, W. Good, Ball Aerospace and Technologies Corp. (USA)
- 6677 11 **Seasonal and interannual variations in Antarctic backscatter signature from 2000 to 2006 as observed by QuikSCAT** [6677-38]
B. Lambert, D. G. Long, Brigham Young Univ. (USA)

SESSION 9 ON-ORBIT DATA ANALYSIS

- 6677 13 **Distributed database schema** [6677-41]
J. Burke, J. Ericson, A. Mousessian, Raytheon Intelligence and Information Systems (USA)
- 6677 14 **Contributions to climate studies from four years of hyperspectral data from the Atmospheric Infrared Sounder (AIRS)** [6677-42]
D. A. Elliott, H. H. Aumann, Jet Propulsion Lab. (USA); L. L. Strow, Univ. of Maryland, Baltimore County (USA); D. T. Gregorich, Jet Propulsion Lab. (USA)
- 6677 15 **Analysis of clouds and the Earth's radiant energy system (CERES) lunar measurements** [6677-43]
S. Thomas, Science Systems and Applications, Inc. (USA); K. J. Priestley, NASA Langley Research Ctr. (USA); G. M. Matthews, Analytical Systems and Materials (USA)
- 6677 16 **ENVISAT-ASAR single polarized SLC data analysis for the study of snow pack characteristics** [6677-44]
G. Singh, V. Kumar, K. Mohite, G. Venkataraman, Y. S. Rao, Indian Institute of Technology Bombay (India); Snehmani, Snow and Avalanche Study Establishment (India)
- 6677 17 **Investigating snow wetness using dual polarization advanced synthetic aperture radar imagery** [6677-45]
G. Venkataraman, G. Singh, V. Kumar, K. Mohite, Y. S. Rao, Indian Institute of Technology Bombay (India)
- 6677 18 **Snow grain size estimation in Himalayan snow covered region using advanced synthetic aperture radar data** [6677-46]
G. Venkataraman, G. Singh, V. Kumar, K. Mohite, Y. S. Rao, Indian Institute of Technology Bombay (India)

SESSION 10 FUTURE INSTRUMENTS AND DEVELOPMENTS I

- 6677 19 **Development of dual imaging optical sensor (DIOS) for small satellites** [6677-47]
Y.-W. Choi, M.-S. Kang, S.-K. Jeong, J.-H. Yun, S.-U. Yang, J. Kim, E.-E. Kim, Satrec Initiative (South Korea)
- 6677 1A **Development of high-performance optical system for small satellites** [6677-48]
Y.-W. Choi, S.-U. Yang, M.-S. Kang, E.-E. Kim, Satrec Initiative (South Korea)

6677 1B **GeoSTAR: a geostationary microwave sounder for the future** [6677-49]
B. H. Lambrigtsen, S. T. Brown, S. J. Dinardo, T. C. Gaier, P. P. Kangaslahti, A. B. Tanner, Jet Propulsion Lab. (USA)

6677 1C **Passive A-band Wind Sounder (PAWS) for measuring tropospheric wind velocity profile** [6677-50]
G. Miecznik, R. Pierce, P. Huang, P. A. Slaymaker, P. Kaptchen, S. Roark, B. R. Johnson, D. F. Heath, Ball Aerospace and Technologies Corp. (USA)

SESSION 11 FUTURE INSTRUMENTS AND DEVELOPMENTS II

6677 1D **VEN μ S (vegetation and environment monitoring on a new micro satellite) image quality** [6677-51]
A. Meygret, O. Hagolle, CNES (France); E. Hillairet, Magellium (France); G. Dedieu, CESBIO (France); P. Crebassol, P. Ferrier, CNES (France)

6677 1F **Improving GLM design capabilities with high-fidelity analytic and simulation tools** [6677-53]
D. Down, S. P. Hagerty, T. F. Updike, Ball Aerospace and Technologies Corp. (USA)

6677 1G **Modeling and optimal design of optical remote sensing payloads** [6677-54]
R. W. Tarde, E. Donley, Ball Aerospace and Technologies Corp. (USA); J. L. Carr, Carr Astronautics (USA)

POSTER SESSION

6677 1H **Improvement of low temperature estimation for MODIS thermal emissive bands by adjusting calibration offset and nonlinear terms** [6677-55]
A. Wu, Science Systems and Applications, Inc. (USA); X. Xiong, NASA Goddard Space Flight Ctr. (USA); B. Wenny, Science Systems and Applications, Inc. (USA); C. Moeller, SSEC/CIMSS (USA); N. Chen, K. Chiang, Science Systems and Applications, Inc. (USA)

6677 1I **WindSat passive microwave polarimetric observations of soil moisture and land variables** [6677-56]
J. Du, T. J. Jackson, R. Bindlish, M. H. Cosh, USDA ARS Hydrology and Remote Sensing Lab. (USA); L. Li, Naval Research Lab. (USA)

6677 1J **Pre-launch characterization of aqua MODIS scan mirror response versus scan angle for thermal emissive bands** [6677-57]
K.-F. Chiang, Science Systems and Applications, Inc. (USA); X. Xiong, NASA Goddard Space Flight Ctr. (USA)

6677 1K **MODIS reflective solar bands unscheduled lunar observations** [6677-58]
J. Sun, Science Systems and Applications, Inc. (USA); X. Xiong, NASA Goddard Space Flight Ctr. (USA); W. Barnes, Univ. of Maryland, Baltimore County (USA)

6677 1L **The simulator of the photon counting planetary altimeter** [6677-59]
J. Blazej, I. Prochazka, Czech Technical Univ. in Prague (Czech Republic)

- 6677 1N **Scene identification and clear-sky compositing algorithms for generating North America coverage at 250m spatial resolution from MODIS land channels** [6677-61]
Y. Luo, A. P. Trishchenko, K. V. Khlopenkov, W. M. Park, Canada Ctr. for Remote Sensing (Canada)
- 6677 1O **Low uncertainty measurements of bidirectional reflectance factor on the NPOESS/VIIRS solar diffuser** [6677-62]
K. Lessel, S. McClain, Raytheon Santa Barbara Remote Sensing (USA)

Author Index

Conference Committee

Conference Chairs

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

Jack Xiong, NASA Goddard Space Flight Center (USA)

Program Committee

Philip E. Ardanuy, Raytheon Company (USA)

Robert A. Barnes, Science Applications International Corporation
(USA)

Stuart F. Biggar, College of Optical Sciences, University of Arizona
(USA)

Armin W. Doerry, Sandia National Laboratories (USA)

Thomas S. Pagano, Jet Propulsion Laboratory (USA)

Carl F. Schueler, Consultant (USA)

Session Chairs

- 1 Prelaunch Calibration I
Hartmut H. Aumann, Jet Propulsion Laboratory (USA)
- 2 Prelaunch Calibration II
Jeffrey S. Czapla-Myers, College of Optical Sciences, University of
Arizona (USA)
- 3 On-Orbit Calibration I
Jack Xiong, NASA Goddard Space Flight Center (USA)
- 4 On-orbit Calibration II
Carl F. Schueler, Consultant (USA)
Philip E. Ardanuy, Raytheon Company (USA)
- 5 MODIS
Robert A. Barnes, Science Applications International Corporation
(USA)
- 6 Vicarious Calibration I
James J. Butler, NASA Goddard Space Flight Center (USA)
- 7 Vicarious Calibration II
Armin W. Doerry, Sandia National Laboratories (USA)

- 8 Vicarious Calibration III
Jack Xiong, NASA Goddard Space Flight Center (USA)
- 9 On-Orbit Data Analysis
James J. Butler, NASA Goddard Space Flight Center (USA)
- 10 Future Instruments and Developments I
Philip E. Ardanuy, Raytheon Company (USA)
- 11 Future Instruments and Developments II
Jack Xiong, NASA Goddard Space Flight Center (USA)