

PROCEEDINGS OF SPIE

Sensors, Systems, and Next-Generation Satellites XXI

Steven P. Neeck

Jean-Loup Bézy

Toshiyoshi Kimura

Haruhisa Shimoda

Roland Meynart

Editors

11–14 September 2017

Warsaw, Poland

Sponsored by
SPIE

Cooperating Organisations

Innovation Centre for Sensor and Imaging Systems (United Kingdom)

ADS Scotland (United Kingdom)

The Knowledge Transfer Network (United Kingdom)

Visit Scotland (United Kingdom)

European Regional Development Fund (Belgium)

Technology Scotland (United Kingdom)

European Association of Remote Sensing Companies (Belgium)

European Association of Remote Sensing Laboratories (Germany)

The British Association of Remote Sensing Companies (United Kingdom)

Remote Sensing & Photogrammetry Society (United Kingdom)

Published by
SPIE

Volume 10423

Proceedings of SPIE 0277-786X, V. 10423

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

Sensors, Systems, and Next-Generation Satellites XXI, edited by Steven P. Neeck, Jean-Loup Bézy,
Toshiyoshi Kimura, Haruhisa Shimoda, Roland Meynart, Proc. of SPIE Vol. 10423, 1042301
© 2017 SPIE · CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2293020

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 *Sensors, Systems, and Next-Generation Satellites XXI*, edited by Steven P. Neeck, Jean-Loup Bézy, Toshiyoshi Kimura, Haruhisa Shimoda, Roland Meynart, Proceedings of SPIE Vol. 10423 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510613102

ISBN: 9781510613119 (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 © 2017, 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/17/\$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 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 | Authors |
| ix | Conference Committee |

EUROPEAN MISSIONS I

- | | |
|----------|--|
| 10423 03 | AEOLUS mission: the latest preparations before launch [10423-2] |
| 10423 04 | Earth cloud, aerosol, and radiation explorer optical payload development status [10423-3] |
| 10423 05 | Instrument pre-development activities for FLEX [10423-4] |

EUROPEAN MISSIONS II

- | | |
|----------|--|
| 10423 06 | Image quality validation of Sentinel 2 Level-1 products: performance status at the beginning of the constellation routine phase [10423-5] |
| 10423 07 | The Copernicus Sentinel 4 mission: a geostationary imaging UVN spectrometer for air quality monitoring [10423-6] |
| 10423 09 | Sentinel-5 instrument: status of design, performance, and development [10423-8] |
| 10423 0A | StereoSAR: a multi-static SAR mission concept to enhance Sentinel-1 capabilities for measuring ocean dynamics [10423-52] |

EUROPEAN MISSIONS IV

- | | |
|----------|---|
| 10423 0G | Introduction to the next generation EUMETSAT Polar System (EPS-SG) observation missions [10423-14] |
|----------|---|

US MISSIONS

- | | |
|----------|---|
| 10423 0L | HydroCube mission concept: P-Band signals of opportunity for remote sensing of snow and root zone soil moisture [10423-19] |
|----------|---|

JAPANESE MISSIONS I

- | | |
|----------|---|
| 10423 0M | Overview of Japanese Earth observation programs (Invited Paper) [10423-20] |
| 10423 0N | Prime mission results of the dual-frequency precipitation radar on the global precipitation measurement core spacecraft and the version 5 GPM standard products [10423-21] |

10423 0O **Pre-launch instrument characterization results and in-orbit verification plan of GCOM-C/SGLI** [10423-22]

10423 0P **Overview of the Japanese Advanced Optical Satellite: mission objectives, a satellite system, and an onboard imager** [10423-23]

JAPANESE MISSIONS II

10423 0Q **Flight model of HISUI hyperspectral sensor onboard ISS (International Space Station)** [10423-24]

10423 0R **Observation planning algorithm of a Japanese space-borne sensor: Hyperspectral Imager SUIte (HISUI) onboard International Space Station (ISS) as platform** [10423-25]

CALIBRATION II

10423 11 **Sentinel-2B image quality commissioning phase results and Sentinel2 constellation performances** [10423-35]

10423 12 **Near-nadir scan overlap in Earth observations from VIIRS and MODIS** [10423-36]

CALIBRATION III

10423 13 **Lunar calibration improvements for the short-wave infrared bands in Aqua and Terra MODIS** [10423-37]

10423 14 **Aqua MODIS electronic crosstalk survey from Moon observations** [10423-38]

10423 17 **Positional dependence of the SNPP VIIRS SD BRDF degradation factor** [10423-41]

CALIBRATION IV

10423 18 **Assessment of MODIS reflective solar bands calibration stability** [10423-42]

10423 19 **The use of deep convective clouds to uniformly calibrate the next generation of geostationary reflective solar imagers** [10423-43]

10423 1A **A comparison of validation and vicarious calibration of high and medium resolution satellite-borne sensors using RadCalNet** [10423-44]

10423 1B **Ground comparisons at RadCalNet sites to determine the equivalence of sites within the network** [10423-45]

10423 1C **Assessment of polarization correction impact on the calibration of Terra MODIS reflective solar bands** [10423-46]

MISSIONS AND SENSING I

- 10423 1D **High performance optical payloads for microsatellites** [10423-47]
- 10423 1E **Sentinel-5/UVNS instrument: the principle ability of a slit homogenizer to reduce scene contrast for earth observation spectrometer** [10423-48]
- 10423 1G **Local or global? How to choose the training set for principal component compression of hyperspectral satellite measurements: a hybrid approach** [10423-50]
- 10423 1H **Mechanical monolithic compact sensors for real-time linear and angular broadband low frequency monitoring and control of spacecrafts and satellites** [10423-51]

FPA

- 10423 1J **Characterisation results of the CMOS VISNIR spectral band detector for the METimage instrument** [10423-54]
- 10423 1L **Environmental evaluation of the ULIS PICO1024 microbolometer** [10423-56]
- 10423 1M **Measuring Te inclusion uniformity over large areas for CdTe/CZT imaging and spectrometry sensors** [10423-57]

MISSIONS AND SENSING III

- 10423 1Q **High efficient optical remote sensing images acquisition for nano-satellite-framework** [10423-63]
- 10423 1R **The design of visualization telemetry system based on camera module of the commercial smartphone** [10423-64]
- 10423 1S **SRS-lidar for 13C/12C isotops measurements environmental and food** [10423-65]
- 10423 1T **Optical system design of the coded aperture super-resolution imager** [10423-66]
- 10423 1U **Onboard TDI stage estimation and calibration using SNR analysis** [10423-79]

POSTER SESSION

- 10423 1V **An onboard star catalog for satellite angular attitude estimation** [10423-67]
- 10423 1X **Cross comparison of the Collection 6 and Collection 6.1 Terra and Aqua MODIS Bands 1 and 2 using AVHRR N15 and N19** [10423-69]
- 10423 1Y **Near infrared imager for spectral and polarization analysis of planetary surfaces** [10423-70]
- 10423 1Z **Electronic crosstalk impact assessment in the Terra MODIS mid-wave infrared bands** [10423-71]

- 10423 20 **Assessment of BRDF effect of Kunlun Mountain glacier on Tibetan Plateau as a potential pseudo-invariant calibration site** [10423-72]
- 10423 22 **Assessment of stability of the response versus scan angle for the S-NPP VIIRS reflective solar bands using pseudo-invariant desert and Dome C sites** [10423-75]
- 10423 23 **Characterization of imaging spectrometers** [10423-76]
- 10423 24 **Removal of instrument artefacts by harmonisation of hyperspectral sensor data from multiple detectors** [10423-77]
- 10423 26 **Development of a computationally efficient algorithm for attitude estimation of a remote sensing satellite** [10423-80]
- 10423 28 **Modular design of electrical power subsystem for a remote sensing satellite** [10423-82]

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.

- | | |
|--------------------------------------|-------------------------------|
| Alexander, W. Brock, 1M | Dobrolenskiy, Y. S., 1Y |
| Alhammoud, Bahjat, 06 | Doelling, David R., 19 |
| Amano, Takahiro, 0O | Donlon, Craig J., 0A |
| Anderson, Nikolaus, 1B | Durand, Michael, 0L |
| Ando, Shigemasa, 0O | Elder, Kelly, 0L |
| Angal, Amit, 13, 18, 1C | Elfving, A., 03 |
| Anikin, S. P., 1Y | Elizarov, Valentin, 1S |
| Atanassov, Valentin, 23 | Engen, Geir, 0A |
| August, Thomas, 1G, 24 | Erdmann, L., 05 |
| Bagnasco, G., 07 | Espeset, Aude, 06 |
| Bahrami, Amir Hossein, 26 | Evdokimova, N. A., 1Y |
| Banks, Andrew C., 1A | Fois, Franco, 0A |
| Barone, F., 1H | Fossati, E., 05 |
| Bartsch, P., 09 | Fox, Nigel P., 1A, 1B |
| Bauer, M., 1E | Francesconi, Benjamin, 06 |
| Bazalgette Courrèges-Lacoste, G., 07 | Francois, M., 05 |
| Beaudry, Jean-Nicolas, 1M | Fu, Jie, 1Q |
| Belyaev, D. A., 1Y | Furukawa, K., 0N |
| Benitez, Victor, 1J | Gascon, Ferran, 06 |
| Bézy, Jean-Loup, 05, 1L | Gaudel, A., 11 |
| Bhatt, Rajendra, 19 | Gélinas, Guillaume, 1M |
| Bibby, David, 0A | Geng, Xu, 1C |
| Binet, R., 11 | Geyl, Roland, 1D |
| Blonski, Slawomir, 12 | Ghazanfarinia, Sajjad, 28 |
| Boccia, Valentina, 0A | Giordano, G., 1H |
| Bolke, Joe, 1M | Girault, Jean-Philippe, 1D |
| Borisova, Denitsa, 23 | Goodman, Teresa, 1B |
| Bouzinac, Catherine, 06 | Gopalan, Arun, 19 |
| Bowring, Steve, 1J | Gorroño, Javier, 1A |
| Breart De Boisanger, Michel, 1J | Greenwell, Claire, 1B |
| Bulsa, G., 07 | Grishkanich, Aleksandr, 1S |
| Burbidge, Geoff, 0A | Gühne, T., 09 |
| Cao, Changyong, 12, 22 | Guo, Yi, 1Q |
| Cao, Qipeng, 1R | Haghshenas, Javad, 1U, 26, 28 |
| Capanni, A., 05 | Haney, Conor O., 19 |
| Chae, Chun Sik, 0L | Hélière, A., 04 |
| Chang, Tiejun, 17 | Honda, Yoshiaki, 0M |
| Chen, Lin, 20 | Hosseingholi, Mahboobeh, 28 |
| Chen, Na, 1X | Hu, Xiuqing, 20 |
| Chen, Xuexia, 17, 1X | Hultberg, Tim, 1G, 24 |
| Chernetsov, Andrey, 1V | Hunt, Samuel E., 1A |
| Chubchenko, Yan, 1S | Iguchi, T., 0N |
| Clerc, Sébastien, 06 | Irizar, J., 1E |
| Coppo, P. M., 05 | Ito, Yoshiyuki, 0Q |
| Culoma, A., 03 | Iwasaki, Akira, 0Q |
| Czapla-Myers, Jeffrey, 1B | Johnsen, Harald, 0A |
| Dartois, Thierry, 1L | Kashimura, Osamu, 0Q |
| De Witte, Erik, 0A | Katayama, Haruyoshi, 0P |
| Derkens, Chris, 0L | Kato, Eri, 0P |

- Kayal, Gökhan, 0G
 Keim, C., 09, 1E
 Keller, Graziela R., 14
 Komoda, Mako, 0R
 Konno, Yukiko, 0R
 Konopelko, Leonid, 1S
 Korablev, O. I., 1Y
 Kosari, Ehsan, 28
 Kruzhilov, Ivan, 1V
 Kruzhilov, Svyatoslav, 1V
 Krzizok, Natalie, 1J
 Kubota, T., 0N
 Labate, D., 05
 Labibian, Amir, 26
 Languille, F., 11
 Lefebvre, A., 04
 Lei, Ning, 17
 Lenti, Flavia, 1G
 Li, Feng, 1Q
 Linduška, Petr, 1B
 Link, D., 18
 Liston, Glen, 0L
 Liu, Yang, 1Q
 Liu, Yangyang, 1T
 Liu, Yuhong, 1Q
 Lukarski, Hristo, 23
 Lv, Qunbo, 1T
 Manolis, Ilias, 1L
 Mantsevich, S. N., 1Y
 Margulis, Steve, 0L
 Matsunaga, Tsuneo, 0R
 Maurer, R., 07
 Meister, Ch., 1E
 Melf, M., 09
 Meynard, Roland, 03, 05, 1L
 Mokuno, Masaaki, 0O
 Molchanov, V. Ya, 1Y
 Neveu-VanMalle, Marion, 06
 Nio, T., 0N
 Niwa, Tomoya, 0P
 O'Brien, Kathryn, 1M
 Ogawa, Kenta, 0R
 Okamura, Yoshihiko, 0O
 Oki, R., 0N
 Pei, Linlin, 1T
 Pereira do Carmo, J., 04
 Petkov, Doyno, 23
 Pettinato, L., 05
 Porrovecchio, Geiland, 1B
 Potanin, S. A., 1Y
 Poulain, V., 11
 Pratlong, Jérôme, 1J
 Riedl, S., 07
 Rodolfo, Jacques, 1D
 Roselló, Josep, 0A
 Sagisaka, Masakazu, 0P
 Sallusti, M., 07
 Scanlon, Tracy, 1A, 1B
 Scarino, Benjamin R., 19
 Schlüssel, Peter, 0G
 Schmuelling, Frank, 1J
 Scipal, Klaus, 0A
 Seefelder, W., 09
 Shah, Rashmi, 0L
 Shimoda, Haruhisa, 0M
 Shiratama, Koichi, 0O
 Shrestha, Ashish, 13, 1Z
 Simpson, Robert, 1J
 Skegg, Michael, 1J
 Šmid, Marek, 1B
 Smith, D. J., 07
 Spicer, Mike, 1M
 Straume, A., 03
 Taccola, M., 05
 Tachikawa, Tetsushi, 0R
 Tadono, Takeo, 0P
 Taiti, A., 05
 Tanaka, Kazuhiro, 0O
 Tanii, Jun, 0Q
 Thome, Kurt, 1B
 Tisse, Christel-Loïc, 1L
 Tossaint, Michel, 0A
 Trémas, T., 11
 Triebel, P., 05
 Urabe, Tomoyuki, 0O
 Veihelmann, Ben, 07
 Vidal, B., 11
 Wall, Peter, 1M
 Wallace, K., 04
 Wang, Chao, 1R
 Wang, Jianwei, 1T
 Wang, Ling, 20
 Wang, Zhipeng, 14
 Watarai, Hidenori, 0P
 Weiß, S., 09
 Wernham, D., 03
 Wilson, Truman, 13, 1Z
 Woolliams, Emma R., 1A, 1B
 Wu, Aisheng, 14, 18, 1C, 1X, 22
 Wu, Bin, 1R
 Xin, Lei, 1Q
 Xiong, Xiaoxiong J., 13, 14, 17, 18, 1C, 1X, 1Z, 22
 Xu, Xiaolan, 0L
 Yamamoto, Satoru, 0R
 Ye, Zhao, 1R
 Yin, Huan, 1R
 Yoshida, Jun, 0O
 Yueh, Simon, 0L
 Yushkov, K. B., 1Y
 Zakharov, Andrei, 1V
 Zhevylakov, Aleksandr, 1S
 Zhu, Jun, 1R

Conference Committee

Symposium Chair

Klaus Schäfer, (Retired) Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research (Germany)

Symposium Co-chair

Christopher M. U. Neale, University of Nebraska-Lincoln
(United States), Daugherty Water for Food Institute (United States)

Conference Chairs

Steven P. Neeck, NASA Headquarters (United States)
Jean-Loup Bézy, European Space Research and Technology Centre
(Netherlands)
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)

Conference Co-chairs

Haruhisa Shimoda, Tokai University (Japan)
Roland Meynart, European Space Research and Technology Centre
(Netherlands)

Conference Programme Committee

Olivier Saint-Pé, Airbus Defence and Space (France)
Xiaoxiong J. Xiong, NASA Goddard Space Flight Center
(United States)

Session Chairs

- 1 European Missions I
Jean-Loup Bézy, European Space Research and Technology Centre
(Netherlands)
- 2 European Missions II
Jean-Loup Bézy, European Space Research and Technology Centre
(Netherlands)
- 3 European Missions III
K. Dieter Klaes, EUMETSAT (Germany)

- 4 European Missions IV
K. Dieter Klaes, EUMETSAT (Germany)
- 5 US Missions
Steven P. Neeck, NASA Headquarters (United States)
- 6 Japanese Missions I
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)
- 7 Japanese Missions II
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)
- 8 Calibration I
Xiaoxiong J. Xiong, NASA Goddard Space Flight Center
(United States)
- 9 Calibration II
Xiaoxiong J. Xiong, NASA Goddard Space Flight Center
(United States)
- 10 Calibration III
Xiaoxiong J. Xiong, NASA Goddard Space Flight Center
(United States)
- 11 Calibration IV
Xiaoxiong J. Xiong, NASA Goddard Space Flight Center
(United States)
- 12 Missions and Sensing I
Jean-Loup Bézy, European Space Research and Technology Centre
(Netherlands)
- 13 FPA
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)
- 14 Missions and Sensing II
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)
- 15 Missions and Sensing III
Jean-Loup Bézy, European Space Research and Technology Centre
(Netherlands)