

# PROCEEDINGS OF SPIE

## ***Earth Resources and Environmental Remote Sensing/GIS Applications VIII***

**Ulrich Michel  
Karsten Schulz  
Konstantinos G. Nikolakopoulos  
Daniel Civco**  
*Editors*

**12–14 September 2017  
Warsaw, Poland**

*Sponsored and Published 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)

**Volume 10428**

Proceedings of SPIE 0277-786X, V. 10428

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

Earth Resources and Environmental Remote Sensing/GIS Applications VIII, edited by Ulrich Michel, Karsten Schulz,  
Konstantinos G. Nikolakopoulos, Daniel Civco, Proc. of SPIE Vol. 10428, 1042801  
© 2017 SPIE · CCC code: 0277-786X/17/\$18 · doi: 10.1117/12.2304034

Proc. of SPIE Vol. 10428 1042801-1

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 Resources and Environmental Remote Sensing/GIS Applications VIII*, edited by Ulrich Michel, Karsten Schulz, Konstantinos G. Nikolakopoulos, Daniel Civco, Proceedings of SPIE Vol. 10428 (SPIE, Bellingham, WA, 2017) Seven-digit Article CID Number.

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

ISBN: 9781510613201  
ISBN: 9781510613218 (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](http://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.

**SPIE. DIGITAL  
LIBRARY**

[SPIEDigitalLibrary.org](http://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

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

---

## SESSION 1    INFRASTRUCTURES AND URBAN AREAS

---

10428 02	<b>Change classification in SAR time series: a functional approach [10428-1]</b>
10428 03	<b>Generating high-accuracy urban distribution map for short-term change monitoring based on convolutional neural network by utilizing SAR imagery [10428-2]</b>
10428 04	<b>Simulation of TanDEM-X interferograms for urban change detection [10428-3]</b>
10428 05	<b>Sensor data fusion for textured reconstruction and virtual representation of alpine scenes [10428-4]</b>
10428 06	<b>Building rooftop classification using random forests for large-scale PV deployment [10428-5]</b>
10428 07	<b>3D building reconstruction in a remote sensing workflow [10428-6]</b>

---

## SESSION 2    PROCESSING METHODOLOGIES I

---

10428 08	<b>AMARO-autonomous real-time detection of moving maritime objects: introducing a flight experiment for an on-board ship detection system [10428-7]</b>
10428 09	<b>Evaluation of automatic cloud removal method for high elevation areas in Landsat 8 OLI images to improve environmental indexes computation [10428-8]</b>
10428 0A	<b>A combined use of multispectral and SAR images for ship detection and characterization through object based image analysis [10428-9]</b>
10428 0B	<b>Normalization of time-series satellite reflectance data to a standard sun-target-sensor geometry using a semi-empirical model [10428-10]</b>

---

## SESSION 3    ENVIRONMENTAL MONITORING I

---

10428 0C	<b>Analysis of economic values of land use and land cover changes in crisis territories by satellite data: models of socio-economy and population dynamics in war [10428-11]</b>
10428 0E	<b>The use of UAVs for monitoring land degradation [10428-13]</b>

10428 OF **ERATOSTHENES: excellence research centre for Earth surveillance and space-based monitoring of the environment, the EXCELSIOR Horizon 2020 teaming project** [10428-14]

---

**SESSION 4 ENVIRONMENTAL MONITORING II**

---

10428 OH **Spectral discrimination of macrophyte species during different seasons in a tropical wetland using in-situ hyperspectral remote sensing (Best Student Paper Award)** [10428-16]

10428 OI **Explicit area-based accuracy assessment for mangrove tree crown delineation using Geographic Object-Based Image Analysis (GEOBIA)** [10428-17]

10428 OK **Impacts of post-disaster recovery on land surface temperature after the 2004 earthquake and Indian tsunami: a case study of Banda Aceh, Indonesia** [10428-20]

10428 OM **Application of SAR data for seasonal monitoring of floating reed islands dynamic in Srebarna Lake** [10428-63]

---

**SESSION 5 HAZARD MITIGATION GEOLOGIC APPLICATIONS I**

---

10428 ON **Estimating the accuracy of vectors derived from open data** [10428-22]

10428 OO **Coastal areas mapping using UAV photogrammetry** [10428-23]

10428 OP **Tunable compact mechanical monolithic sensors for linear and angular large band low frequency monitoring and characterization of sites and structures** [10428-24]

10428 OQ **Monitoring ground deformation of cultural heritage sites using UAVs and geodetic techniques: the case study of Choirokoitia, JPI PROTHEGO project** [10428-25]

10428 OR **Petroleum exploration in Africa from space** [10428-42]

---

**SESSION 6 ENVIRONMENTAL MONITORING III**

---

10428 OS **Can porosity affect the hyperspectral signature of sandy landscapes?** [10428-26]

10428 OU **Discriminating the Mediterranean Pinus spp. using the land surface phenology extracted from the whole MODIS NDVI time series and machine learning algorithms** [10428-28]

10428 OV **Vulnerable land ecosystems classification using spatial context and spectral indices** [10428-29]

10428 OW **Analysis of phenological changes of high vegetation in amplitude images of SAR time series** [10428-30]

<b>SESSION 7      PROCESSING METHODOLOGIES II</b>	
10428 0X	<b>Quick multi-temporal approach to get cloudless improved multispectral imagery for large geographical areas [10428-31]</b>
10428 0Y	<b>Simulation of vegetation and relief induced shadows on rivers with remote sensing data [10428-32]</b>
10428 0Z	<b>Hyperspectral signature analysis of three plant species to long-term hydrocarbon and heavy metal exposure [10428-33]</b>
10428 10	<b>Automated flood extent identification using WorldView imagery for the insurance industry [10428-34]</b>
<b>SESSION 8      PROCESSING METHODOLOGIES III</b>	
10428 12	<b>SYeNERGY: the satellite data-based platform for energy sector in Poland, the pilot study with PGE S.A. company [10428-36]</b>
10428 13	<b>Modeling and testing of geometric processing model based on double baselines stereo photogrammetric system [10428-37]</b>
10428 14	<b>Modeling chlorophyll-a and turbidity concentrations in river Ganga (India) using Landsat-8 OLI imagery [10428-38]</b>
<b>SESSION 9      HAZARD MITIGATION GEOLOGIC APPLICATIONS II</b>	
10428 16	<b>Emergency response to landslide using GNSS measurements and UAV [10428-40]</b>
10428 17	<b>Surface deformation analysis over Vrancea seismogenic area through radar and GPS geospatial data [10428-41]</b>
10428 18	<b>Passive thermal infrared hyperspectral imaging for quantitative imaging of shale gas leaks [10428-43]</b>
<b>SESSION 10      ENVIRONMENTAL MONITORING IV</b>	
10428 19	<b>Monitoring structural breaks in vegetation dynamics of the nature reserve Königsbrücker Heide [10428-44]</b>
10428 1A	<b>Analyses of GIMMS NDVI time series in Kogi State, Nigeria [10428-45]</b>
10428 1B	<b>Distinguishing sliding area by decision analyzing with remote sensing image and lidar data combined [10428-46]</b>
10428 1D	<b>SAR and optical data in land degradation processes estimation: a case study from Southeast Bulgaria [10428-52]</b>

---

**POSTER SESSION**

---

- 10428 1E **The multi-scale classification system and grid encoding mode of ecological land in China** [10428-49]
- 10428 1F **Demarcation of mineral rich zones in areas adjoining to a copper prospect in Rajasthan, India using ASTER, DEM (ALOS) and spaceborne gravity data** [10428-50]
- 10428 1G **Image object-based water body types identification in coastal area** [10428-51]
- 10428 1H **PI2GIS: processing image to geographical information systems, a learning tool for QGIS** [10428-53]
- 10428 1I **Mapping impervious surfaces in the Xiangjiang River basin based on remote sensing spectral indices: a case study in Chang-Zhu-Tan region** [10428-54]
- 10428 1J **Satellite infrared imagery for thermal plume contamination monitoring in coastal ecosystem of Cernavoda NPP** [10428-55]
- 10428 1K **Impact factors on expansion of built-up areas in Zhejiang Province, China** [10428-56]
- 10428 1L **Analysis of ozone observation at atmospheric monitoring network station using Brewer ozone spectrophotometer** [10428-57]
- 10428 1M **Peculiarities of use of ECOC and AdaBoost based classifiers for thematic processing of hyperspectral data** [10428-58]
- 10428 1O **Characterisation of macrophyte phenology in the Doñana marshland using MODIS NDVI time series from 2000 to 2015** [10428-60]
- 10428 1P **High-resolution Earth observation data and spatial analysis for burn severity evaluation and post-fire effects assessment in the island of Chios, Greece** [10428-61]
- 10428 1Q **A geospatial database model for the management of remote sensing datasets at multiple spectral, spatial, and temporal scales** [10428-62]
- 10428 1R **Analysis of changes in crop farming in the Dudh Koshi (Nepal) driven by climate changes** [10428-64]

# 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.

Acernese, F., 0P	Gianinetto, Marco, 0A, 0R, 1R
Aiello, Martina, 0A, 0R, 1R	Giordano, G., 0P
Alvarez, César I., 09	Giroux, Jean, 18
Ansmann, Albert, 0F	Gong, Fang, 1I, 1K
Aragones, David, 0U	Gonzalo-Martín, Consuelo, 0V
Arroyo-Mora, J. Pablo, 1Q	Guyot, Éric, 18
Assouline, Dan, 06	Hadjimitsis, Diofantos G., 0F
Athanasakis, George, 1P	Hammer, Horst, 04
Avetisyan, Daniela, 1D	Hao, Zengzhou, 1G
Baranoski, Gladimir V. G., 0S	Häufel, Gisela, 05
Barone, F., 0P	He, Jinping, 13
Becker, Merlin, 07	Hédacq, Rémy, 0Z
Bocchiola, Daniele, 1R	Hikosaka, Shuhei, 03
Boldt, Markus, 02	Hinz, Stefan, 02, 04, 0W
Borisova, Denitsa, 0M, 1D	Hu, Bin, 13
Bulatov, Dimitri, 05	Hu, Yongyue, 1G
Caparros-Santiago, Jose A., 0U	Hunger, Sebastian, 0Y
Chamberland, Martin, 18	Ibarrola-Ulzurrun, Edurne, 0V
Champati Ray, P. K., 1F	Ifimov, Gabriela, 1Q
Chang, Chia-Hao, 1B	Ihrig, Ramona, 0W
Chattoraj, Shovan L., 1F	Iino, Shota, 03
Chatziantoniou, Andromachi, 1P	Imaizumi, Tomoyuki, 03
Chen, Jian, 1G	Ito, Riho, 03
Chen, Jianyu, 1G	Ivanova, Iva, 0M
Chen, Peng, 1G	Johansen, Kasper, 0I
Christofe, Andreas, 0F	Kamal, Muhammad, 0I
Colaninno, Nicola, 0X	Karrasch, Pierre, 0Y, 19, 1A
Correia, R., 1H	Kimmel, Bradley W., 0S
Credoz, Anthony, 0Z	Kiryta, Wojciech, 12
Danezis, Chris, 0Q	Kogkas, Stefanos, 0O
Dementev, A. O., 1M	Komodromos, George, 0F
Dida, Adrian I., 1J	Kontoos, Haris, 0F
Dimitropoulos, George, 0N	Konwar, Purnima, 1F
Dmitriev, E. V., 1M	Kopachevsky, Ivan, 0C
Doi, Kento, 03	Kostyuchenko, Yuriy V., 0C
Duarte, L., 1H	Koukouvelas, Ioannis K., 16
Dubucq, Dominique, 0Z	Kozarski, Dimitrios, 0O
Egorov, V. D., 1M	Kozoderov, V. V., 1M
Elger, Arnaud, 0Z	Kuny, Silvia, 0W
Espinosa, Nayeli S., 07	Lagueux, Philippe, 18
Evagorou, Evagoras, 0F	Lassalle, Guillaume, 0Z
Fabre, Sophie, 0Z	Leblanc, George, 1Q
Farley, Vincent, 18	Li, Chaokui, 1I
Fernandez-Carrillo, A., 1O	Li, Chuanrong, 0B
Frassy, Federico, 0R, 1R	Li, Yan, 1K
Gagnon, Marc-André, 18	Li, Yingbo, 13
Garg, J. K., 0H, 14	Lim, Hwee San, 0K, 1L
Gatkowska, Martyna, 12	Lin, Yifan, 1E
Geller, Christina, 10	Liu, Aixia, 1E

Liu, Dong, 1K  
 Lympelopoulou, Efstathia, 0Q  
 Lyu, Ying, 1I  
 Ma, Lingling, 0B  
 Mamouri, Rodanthi, 0F  
 Marambio Castillo, Alejandro, 0X  
 Marcello, Javier, 0V  
 Mat Jafri, Mohamad Zubir, 0K, 1L  
 Mateciuc, Doru N., 17  
 Melillos, George, 0F  
 Mendonidis, Evangelos, 0Q  
 Mettas, Christodoulos, 0F  
 Michaelides, Silas, 0F  
 Middelmann, Wolfgang, 07  
 Mohajeri, Nahid, 06  
 Morton, Vince, 18  
 Movchan, Dmytro, 0C  
 Navarro-Cerrillo, Rafael M., 0U  
 Nedkov, Roumen, 0M, 1D  
 Neocleous, Kyriacos, 0F  
 Nikolakopoulos, Konstantinos G., 0N, 0O, 16  
 Nisantzi, Argyro, 0F  
 Palka, Jessica, 1A  
 Papoutsas, Christiana, 0F  
 Papoutsis, Ioannis, 0F  
 Pigeau, Grace, 1Q  
 Pless, Sebastian, 08  
 Polinelli, Francesco, 1R  
 Prasad, Satish, 14  
 Psomiadis, Emmanouil, 1P  
 Qian, Yonggang, 0B  
 Roca Cladera, Josep, 0X  
 Rodriguez-Galiano, Victor, 0U, 1O  
 Romano, R., 0P  
 Rota Nodari, Francesco, 0R, 1R  
 Runkel, Irmgard, 07  
 Sajeev, R., 1F  
 Saluja, Ridhi, 0H, 14  
 Sanchez-Rodriguez, E., 1O  
 Savary, Simon, 18  
 Savastru, Dan M., 17  
 Savastru, Roxana S., 17  
 Scartezzini, Jean-Louis, 06  
 Schreier, Gunter, 0F  
 Schulz, Karsten, 02  
 Schwenk, Kurt, 08  
 Sengar, Vivek K., 1F  
 Serban, Florin S., 17  
 Soffer, Raymond, 1Q  
 Solbrig, Peter, 05  
 Soncini, Andrea, 1R  
 Surbakti, M. Syukri, 0K  
 Syahreza, Saumi, 0K  
 Tan, Kok Chooi, 0K, 1L  
 Tan, Mou Leong, 1L  
 Tang, Lingli, 0B  
 Teleaga, Delia M., 17  
 Teodoro, Ana, 09, 1H  
 Thapa, Shailaja, 1F  
 Themistocleous, Kyriacos, 0E, 0F, 0Q  
 Thiele, Antje, 02, 04, 0W  
 Tierra, Alfonso, 09  
 Tremblay, Pierre, 18  
 Tzouvaras, Marios, 0F  
 Velizarova, Emiliya, 1D  
 Venkatesh, A. S., 1F  
 Wang, Jing, 1E  
 Wang, Ning, 0B  
 Welte, Amelie, 04  
 Wessollek, Christine, 19, 1A  
 Willburger, Katharina, 08  
 Wu, Jee-Cheng, 1B  
 Yuschenko, Maxim, 0C  
 Zhang, Huaguo, 1I  
 Zhang, Xiaoping, 1I  
 Zhang, Yongxin, 1I  
 Zhao, Haibo, 13  
 Zhao, Sisi, 13  
 Zhao, Xuemin, 13  
 Zhao, Yongguang, 0B  
 Zhou, Chunheng, 0B  
 Zhu, Qiankun, 1K  
 Zoran, Liviu Florin V., 1J  
 Zoran, Maria A., 17, 1J



# Conference Committee

## *Symposium Chair*

**Klaus Schäfer**, Karlsruher 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*

**Ulrich Michel**, Jade University of Applied Sciences Oldenburg (Germany)

**Karsten Schulz**, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

## *Conference Co-chairs*

**Konstantinos G. Nikolakopoulos**, University of Patras (Greece)

**Daniel Civco**, University of Connecticut (United States)

## *Conference Programme Committee*

**Thomas Blaschke**, University Salzburg (Austria)

**Markus Boldt**, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

**Tilman U. Bucher**, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

**Dimitri Bulatov**, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany)

**Garik Gutman**, NASA Headquarters (United States)

**Marguerite M. Madden**, The University of Georgia (United States)

**Derya Maktav**, Istanbul Technical University (Turkey)

**Matthias S. Moeller**, University of Applied Sciences Berlin (Germany)

**Pablo H. Rosso**, RapidEye AG (Germany)

**Florian Savopol**, Natural Resources Canada (Canada)

**Jochen Schiewe**, HafenCity Universität Hamburg (Germany)

**Wenzhong Shi**, The Hong Kong Polytechnic University (Hong Kong, China)

**Karl Staenz**, University of Lethbridge (Canada)

### *Session Chairs*

- 1    Infrastructures and Urban Areas  
    **Markus Boldt**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)
- 2    Processing Methodologies I  
    **Markus Boldt**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)
- 3    Environmental Monitoring I  
    **Ulrich Michel**, Jade Hochschule (Germany)  
    **Karsten Schulz**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)
- 4    Environmental Monitoring II  
    **Christine Wessollek**, TU Dresden (Germany)
- 5    Hazard Mitigation Geologic Applications I  
    **Konstantinos G. Nikolakopoulos**, University of Patras (Greece)
- 6    Environmental Monitoring III  
    **Karsten Schulz**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)
- 7    Processing Methodologies II  
    **Karsten Schulz**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)
- 8    Processing Methodologies III  
    **Horst Hammer**, Fraunhofer-Gesellschaft (Germany)
- 9    Hazard Mitigation Geologic Applications II  
    **Konstantinos G. Nikolakopoulos**, University of Patras (Greece)
- 10   Environmental Monitoring IV  
    **Gisela Häufel**, Fraunhofer-Institut für Optronik, Systemtechnik und  
    Bildauswertung (Germany)  
    **Christine Wessollek**, TU Dresden (Germany)

## Introduction

This proceedings volume includes 53 papers that were presented at the SPIE conference, *Earth Resources and Environmental Remote Sensing/GIS Applications*. The conference took place in Warsaw, Poland, from 12-14 September 2017. It was the seventeenth conference with this topic since its inauguration in Toulouse, France, in 2001.

The conference sessions with presented papers and interactive posters were grouped into the following themes: Infrastructures and Urban Areas, Processing Methodologies, Hazard Mitigation Geologic Applications, and Environmental Monitoring.

Although the session topics seem to be rather diverse, the multidisciplinary community of this conference allows the discussion of important topics from several interesting points of view. More than six presented papers addressed hyperspectral imaging and its application in remote sensing tasks. This year, the Best Student Paper Award was assigned to paper 10428-16 (presented by Ridhi Saluya) which discusses the spectral discrimination of macrophyte species among different seasons. It is quite obvious that hyperspectral imaging is still relevant for our community and has potential.

In the last decades we witnessed the preservation of our cultural heritage endangered by natural hazards and man-made destruction. New hardware solutions in combination with specialized algorithms can extend our possibilities to preserve ore, and in some cases even reconstruct parts of our cultural heritage using digitalization. The interesting presentations dealing with this topic resulted in the idea to create a special session next year, with five papers already committed.

It also becomes more and more obvious that hot topics like machine learning and deep learning are more than relevant to our applications. Presentations addressing convolutional neural networks were given and will be emphasized next year's program.

We would like to thank the SPIE staff on-site for their responsiveness and support. We are also grateful to our Programme Committee for their help in reviewing manuscripts and the session compilation process.

**Ulrich Michel  
Karsten Schulz**

