

PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 10783

, "Front Matter: Volume 10783," Proc. SPIE 10783, Remote Sensing for Agriculture, Ecosystems, and Hydrology XX, 1078301 (25 October 2018); doi: 10.1117/12.2517108

SPIE.

Event: SPIE Remote Sensing, 2018, Berlin, Germany

PROCEEDINGS OF SPIE

Remote Sensing for Agriculture, Ecosystems, and Hydrology XX

**Christopher M. U. Neale
Antonino Maltese**
Editors

**10–13 September 2018
Berlin, Germany**

Sponsored by
SPIE

Cooperating Organisations
European Optical Society
European Association of Remote Sensing Companies (Belgium)
CENSIS—Innovation Centre for Sensor and Imaging Systems (United Kingdom)
ISPRS—International Society for Photogrammetry and Remote Sensing
EARSeL—European Association of Remote Sensing Laboratories (Germany)
Remote Sensing & Photogrammetry Society (United Kingdom)

Published by
SPIE

Volume 10783

Proceedings of SPIE 0277-786X, V. 10783

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

Remote Sensing for Agriculture, Ecosystems, and Hydrology XX, edited by Christopher M. U. Neale, Antonino Maltese,
Proc. of SPIE Vol. 10783, 1078301 · © 2018 SPIE · CCC code: 0277-786X/18/\$18 · doi: 10.1117/12.2517108

Proc. of SPIE Vol. 10783 1078301-1

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 SPIDigitalLibrary.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 *Remote Sensing for Agriculture, Ecosystems, and Hydrology XX*, edited by Christopher M. U. Neale, Antonino Maltese, Proceedings of SPIE Vol. 10783 (SPIE, Bellingham, WA, 2018) Seven-digit Article CID Number.

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

ISBN: 9781510621497
ISBN: 9781510621503 (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**

SPIDigitalLibrary.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>

SENTINEL APPLICATIONS

10783 05	Random forest classification using Sentinel-1 and Sentinel-2 series for vegetation monitoring in the Pays de Brest (France) [10783-6]
10783 06	Combining Sentinel-1 and Sentinel-2 images to monitor irrigation in sugar cane [10783-8]
10783 07	A novel blending algorithm for satellite-derived high resolution spatio-temporal normalized difference vegetation index [10783-9]
10783 08	Estimating above ground biomass for eucalyptus plantation using data from unmanned aerial vehicle imagery [10783-13]

UAV APPLICATIONS

10783 09	Below-canopy UAS photogrammetry for stem measurement in radiata pine plantation [10783-11]
10783 0A	COTS UAV-borne multispectral system for vegetation monitoring [10783-12]
10783 0B	Flood risk assessment based on LiDAR and UAV points clouds and DEM [10783-102]

RAINFALL AND EVAPOTRANSPIRATION

10783 0D	Landscape heterogeneity around flux measurement stations investigated through Sentinel-2 and PROBA-V satellite imagery [10783-15]
10783 0E	Rain use efficiency changes and its effects on land surface phenology in the Songnen Plain, Northeast China [10783-16]
10783 0G	MODIS satellite data for estimating actual evapotranspiration in Bulgaria (2000-2014) [10783-67]
10783 0H	Evaluating the potential of Sentinel-2 MSI and Landsat-8 OLI data fusion for land cover mapping in Brazilian Amazon [10783-7]

PRECISION FARMING AND SMART AGRICULTURAL SOLUTIONS

- 10783 0I **Phenotyping studies of wheat by multispectral image analysis** [10783-19]
- 10783 0J **Comparative canopy cover estimation using RGB images from UAV and ground** [10783-20]
- 10783 0K **Smartphone-based application for agricultural remote technical assistance and estimation of visible vegetation index to farmer in Colombia: AgroTIC** [10783-21]
- 10783 0L **Multivariety sugarcane sucrose estimation using a combination of spectral and agrotechnology methods** [10783-22]
- 10783 0M **Automatic wheat ear counting in-field conditions: simulation and implication of lower resolution images (Best Student Paper Award)** [10783-23]

SOIL MOISTURE

- 10783 0P **Flood risk assessment of Chervonograd mining-industrial district** [10783-26]
- 10783 0T **Satellite-based cover management factor assessment for soil water erosion in the Alps** [10783-2]

VEGETATION MONITORING

- 10783 0U **Rice height and biomass estimations using multitemporal SAR Sentinel-1: Camargue case study** [10783-31]
- 10783 0W **Vegetation monitoring with satellite time series: an integrated approach for user-oriented knowledge extraction** [10783-33]
- 10783 0X **Trend of normalized difference vegetation index (NDVI) over Turkey** [10783-34]
- 10783 0Y **Application of remote sensing data for a wetland ecosystem services assessment in the area of Negovan village** [10783-90]

TEMPORAL AND SPATIAL ANALYSES

- 10783 0Z **Temporal and spatial aggregation of the normalized difference vegetation index for the prediction of rice yields** [10783-35]
- 10783 12 **Unmixing-based approach as a tool for classification of oil palm diseases using hyperspectral remote sensing in Colombia** [10783-38]

HYDROLOGICAL SCIENCES APPLICATIONS I

- 10783 14 **Drought as a desertification index: remote sensing approaches for its assessment in the East Mediterranean region** [10783-40]
- 10783 15 **Thermal sharpening of Landsat-8 TIRS surface temperatures for inland water bodies based on different VNIR land cover classifications** [10783-41]
- 10783 16 **Assessment of agricultural drought by remote sensing technique** [10783-42]
- 10783 18 **The São Francisco floodplain project: determination of the floodplain terrain using water level data and multi-source satellite imagery** [10783-44]
- 10783 19 **On water surface delineation in rivers using Landsat-8, Sentinel-1 and Sentinel-2 data** [10783-45]

HYDROLOGICAL SCIENCES APPLICATIONS II

- 10783 1A **Evaluation of different InSAR multi-baseline construction methods over a dam in southern Italy** [10783-46]
- 10783 1C **Network-based flow accumulation for point clouds: Facet-Flow Networks (FFN)** [10783-48]
- 10783 1D **BLUEWATER EYE: using satellite as a low cost water pollution sensor: analytics for deriving long term pollution insights based on mapping water turbidity** [10783-50]
- 10783 1F **Assessment of biological and physic chemical water quality parameters using Landsat 8 time series** [10783-101]

FOREST MONITORING

- 10783 1H **NDVI/EVI monitoring in forest areas to assessment the climate change effects in Hungarian Great Plain from 2000** [10783-56]
- 10783 1I **Forest stock assessment using IRS1C data and principal component analysis of Kalsi soil conservation division, Dehradun (India)** [10783-58]
- 10783 1K **Application of SAR and optical data from Sentinel satellites for spatial-temporal analysis of the flood in the region of Bregovo-Bulgaria, 11/03/2018** [10783-95]
- 10783 1M **Palm trees detecting and counting from high-resolution WorldView-3 satellite images in United Arab Emirates** [10783-61]

POSTER SESSION

- 10783 1N **Assessment of the capability of precision paddy field area and crop classification monitoring using drone and smart farm map** [10783-62]

- 10783 1O **Mapping the spatial distribution of highland kimchi cabbage growth based on unmanned aerial vehicle** [10783-63]
- 10783 1P **Development of field scale model for estimating barley growth based on UAV NDVI and meteorological factors** [10783-64]
- 10783 1Q **The study of the vortex trace of unmanned multicopters** [10783-65]
- 10783 1R **Development of drought index using drone imagery in South Korea** [10783-66]
- 10783 1S **Ground validation of GPM IMERG rainfall products over the Capital Circle in Northeast China on rainstorm monitoring** [10783-68]
- 10783 1T **Evaluation of soil moisture estimated from IASI measurements** [10783-69]
- 10783 1U **High resolution mapping of soil moisture in agriculture based on Sentinel-1 interferometric data** [10783-70]
- 10783 1V **Multitemporal soil moisture monitoring by use of optical remote sensing data in a dike relocation area** [10783-71]
- 10783 1W **Land degradation assessment of agricultural zone and its causes: a case study in Mongolia** [10783-72]
- 10783 1X **Infrared reflectance factor of various asphalts** [10783-73]
- 10783 1Y **Applicability of digital color imaging for monitoring nitrogen uptake and fertilizer requirements in crops** [10783-74]
- 10783 24 **Analysis of crop condition during monsoon season using multispectral and polarimetric SAR images** [10783-81]
- 10783 27 **Remote sensing for assessing soil erosion susceptibility of the lesser Himalayan watershed by Multi Criteria Analysis (MCA) of morphometry, hypsometry, and land cover** [10783-85]
- 10783 2E **Remote sensing and GIS combination to evaluate the ecosystems' conditions in "Serras do Porto"** [10783-93]
- 10783 2F **Forest land cover phenologies and their relation to climatic variables in a Carpathian Mountains region** [10783-96]
- 10783 2H **Comparison of scoring, matching, SMCE and geographically weighted regression In malaria vulnerability spatial modelling using satellite imagery: an Indonesian example** [10783-98]
- 10783 2I **Destriping methods for high resolution satellite multispectral remote sensing image based on GPU adaptive partitioning technology** [10783-99]
- 10783 2K **Estimating of rice crop yield in Thailand using satellite data** [10783-103]

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.

Ahn, Ho-yong, 1O, 1P
Aiello, Martina, 0T
Alcalá Canales, Adriana, 15
AlMaazmi, A., 1M
Almeida, R., 2E
Althuwaynee, Omar F., 0X
Álvarez-Taboada, Flor, 0B, 1F
Amann, Simon, 1X
Ametov, Fevzi, 0A
Aparício Medrano, E., 0Z
Araújo Soares de Paula, Ramille, 18
Araus, José L., 0J, 0M
Arguello, Henry, 0K, 12
Asovsky, Valery P., 1Q
Baghdadi, Nicolas, 0U
Balivada, Srinivas Rao, 1D
Balzarolo, M., 0D
Barrios, J. M., 0D
Baschek, Björn, 15
Baumgartner, Andreas, 1X
Beltrão, Norma, 0H
Ben Asher, Jiftah, 1Y
Benevides, Pedro, 1U
Billey, Antoine, 05
Birman, Santosh, 1I
Bocchiola, Daniele, 0T
Bondarenko, Oksana, 0A
Bookhagen, Bodo, 1C
Borisova, Denitsa, 0G, 1K
Burud, Ingunn, 0I
Camacho, Ariolfo, 0K, 12
Capodici, Fulvio, 1A
Carvalho Vianna C6, Jessica, 18
Catalão, João, 1U
Chang, Shuai, 0E
Chang, Xing, 2I
Chiarelli, Davide Danilo, 0T
Conde, Vasco, 1U
Corbari, Chiara, 0T
Courault, Dominique, 0U
Dancheva, Adlin, 0Y
Danoedoro, Projo, 2H
Dardanelli, Gino, 1A
Dash, J., 2K
de Oliveira Leão, Guilherme, 19
Del Perugia, Barbara, 09
Dida, Adrian I., 2F
Dodamani, B. M., 16
Dressel, Martin, 1X
Duarte, L., 2E
Dubovyk, Olena, 0W
Dudai, Mordecai, 1Y
El Moussawi, Ibrahim, 0U
Fella, Sina, 1X
Fernandez-Gallego, Jose A., 0J, 0M
Florentino, Renan Santos, 06
Frassy, Federico, 0T
Frick, Annett, 1V
Fricke, Katharina, 15
Furier, Mykhailo, 0A
Gantumur, Byambakhuu, 1W
Gellens-Meulenberghs, F., 0D
Geraldo Esteves Machado Filho, José, 06
Ghazaryan, Gohar, 0W
Gianinetta, Marco, 0T
Gomes, Marília F., 18, 19
Govedarica, Miro, 0B, 1F
Goyal, Aanchal, 07
Graw, Valerie, 0W
Graziano, Paulo, 0L
Grindbakken, Ole K., 0I
Guha, Supratik, 1D
Guruprasad, Ranjini B., 07, 1D
Gutiérrez, Nieves Aparicio, 0M
Hadi, Sinan Jasim, 0X
Hadjimitsis, Diofantos G., 14
Hamdi, F., 0D
Havrys, A., 0P
Herkommer, Alois, 1X
Hirani, Priyank, 1D
Ho Tong Minh, Dinh, 0U
Hossard, Laure, 0U
Huang, Fang, 0E
Hykkerud, Aleksander, 0I
Iakovenko, Valerii, 0A
Iřiritiphan, Fareda, 1W
Jakovljević, Gordana, 0B, 1F
Janssens, I., 0D
Justina, Diego D. D., 0L
Karabyn, V., 0P
Kazantsev, Taras, 0A
Kefauver, Shawn C., 0J, 0M
Kerfal, Samir, 0J
Kooha, Phalakorn, 08
Kopeika, Natan S., 1Y
Kovács, Ferenc, 1H
Krisanski, Sean, 09
Kufolcor, Bless, 0I

Kumar, Parmanand, 27
 Kuzmenko, Alla S., 1Q
 La Loggia, Goffredo, 1A
 Lamparelli, Rubens Augusto Camargo, 0L
 Larar, Allen M., 1T
 Lee, Dong-Ho, 1N, 1R
 Lee, Kyung-do, 1O, 1P
 Li, Bo, 0E
 Li, Feng, 2I
 Lillemo, Morten, 0I
 Liu, Xu, 1T
 Loulli, Eleni, 14
 Maillard, Phillipe, 06, 18, 19
 Maitra, Sanjit, 24
 Maltese, Antonino, 1A
 Mendes, S., 2E
 Moukomla, Sitthisak, 08
 Müller, Christoph, 1X
 Muller, Jan-Peter, 1A
 Munaa, Tsogtdulam, 1W
 Na, Sang-il, 1O, 1P
 Ndikumana, Emile, 0U
 Nedkov, Roumen, 0G, 0Y
 Nguyen Hai Thu, Dang, 0U
 Nico, Giovanni, 1U
 Niculescu, Simona, 05
 Nieto-Taladriz, Maria Teresa, 0M
 Nontasiri, J., 2K
 Oliveira, Lília M., 18
 Oswald, Sascha E., 1V
 Pandey, Shachi, 1I, 27
 Panwar, Vijendra Pal, 27
 Park, Chan-won, 1O, 1P
 Park, Jin-Ki, 1N, 1R
 Park, Jong-Hwa, 1N, 1R
 Passera, Corrado, 0T
 Pathak, Abhishek A., 16
 Pipitone, Claudia, 1A
 Polinelli, Francesco, 0T
 Popa, Ionel R., 2F
 Póssa, Évelyn M., 18, 19
 Qiu, Qi, 1S
 Radeva, Kameliya, 0Y, 1K
 Randhawa, Sukanya, 1D
 Ravazzani, Giovanni, 0T
 Rheinwalt, Aljoscha, 1C
 Roberts, G., 2K
 Rocha, Jansle Viera, 0L
 Rojas Gutierrez, Lorena Avelina, 06
 Rota Nodari, Francesco, 0T
 Rulli, Maria Cristina, 0T
 Samberg, Andre, 0A, 0P
 Sarig, Shlomo, 1Y
 Savastru, Dan M., 2F
 Schellberg, Jürgen, 0W
 Shainogal, I., 0P
 Shevchenko, Viktor, 0A
 Shin, Heong-Seup, 1N
 Shlevin, Eli, 1Y
 Sholev, Dimitar, 0G
 Silva, Igor Silva Marques, 19
 Siripon, Suramongkon, 08
 So, Kyu-ho, 1O, 1P
 Soncini, Andrea, 0T
 Souza, Gustavo Ferreira de, 06
 Sperl, Anna, 15
 Srestasathiem, Panu, 08
 Srivastava, Prateek, 1I
 Starodub, Y., 0P
 Stoyanov, Andrey, 1K
 Suijker, W., 0Z
 Sun, Wei, 1S
 Sun, Yonghua, 1S
 Talab-Ou-Ali, Halima, 05
 Taskhiri, Mohammad Sadegh, 09
 Teodoro, A. C., 0H, 2E
 Tombul, Mustafa, 0X
 Turner, Paul, 09
 Vandansambuu, Battengel, 1W
 Vargas, Hector, 12
 Vasileva, Tanya, 0G
 Vezzoli, Renata, 0T
 Wagner, Kathrin, 1V
 Wang, Cheng, 2I
 Wang, Ping, 0E
 Wang, Tao, 1S
 Wang, XiaoYong, 2I
 Wang, Yanbing, 1S
 Wasuhiranyrith, Rattawat, 08
 Watanabe, Junyitiro, 0L
 Widayani, Prima, 2H
 Wieneke, S., 0D
 Wu, Falin, 1W
 Xin, Lei, 2I
 Yang, Xue, 2I
 Zhang, Youquan, 1S
 Zhao, Yan, 1W
 Zhao, Yu, 0L
 Zhou, Daniel K., 1T
 Zilberman, Arkadi, 1Y
 Zoran, Maria A., 2F

Conference Committee

Symposium Chair

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

Symposium Co-chair

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

Conference Chairs

Christopher M. U. Neale, University of Nebraska-Lincoln (United States)
Antonino Maltese, Università degli Studi di Palermo (Italy)

Conference Programme Committee

Wim G. M. Bastiaansen, UNESCO-IHE Institute for Water Education
(France)
Antonino Maltese, Università degli Studi di Palermo (Italy)
Christopher M. U. Neale, University of Nebraska Lincoln (United States)

Session Chairs

- 1 Sentinel Applications
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)
- 2 UAV Applications
Antonino Maltese, Università degli Studi di Palermo
- 3 Rainfall and Evapotranspiration
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)
- 4 Precision Farming and Smart Agricultural Solutions
Antonino Maltese, Università degli Studi di Palermo
- 5 Soil Moisture
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)
- 6 Vegetation Monitoring
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)

- 7 Temporal and Spatial Analyses
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)
- 8 Hydrological Sciences Applications I
Antonino Maltese, Università degli Studi di Palermo (Italy)
- 9 Hydrological Sciences Applications II
Antonino Maltese, Università degli Studi di Palermo (Italy)
- 10 Wildfire Monitoring
Antonino Maltese, Università degli Studi di Palermo (Italy)
- 11 Forest Monitoring
Christopher M. U. Neale, University of Nebraska-Lincoln (United States)

Introduction

This proceedings volume contains papers presented during the Remote Sensing for Agriculture, Ecosystems, and Hydrology Conference. The Conference was part of the International Symposium on Remote Sensing sponsored by SPIE—The International Society for Optics and Photonics. The Symposium was held at the ESTREL Congress Centre, Berlin, Germany, from 10th to 13th of September 2018.

Approximately 40+ oral and 20 poster papers were presented during this year's conference, covering a broad range of topics in the field of remote sensing applications for environmental science.

The program was organized into 10 sessions according to major themes, namely Sentinel Applications, UAV Applications, Rainfall and Evapotranspiration, Precision Farming and Smart Agricultural Solutions, Soil Moisture, Vegetation Monitoring, Temporal and Spatial Analyses, Hydrological Sciences Applications (2) and Forest Monitoring.

The conference Best Student Paper Award was given to the paper "Automatic wheat ear counting in field conditions, simulation and implications of lower resolution images" by Fernandez-Gallego *et al.*, presented by Jose A. Fernandez-Gallego (Univ. de Barcelona, Spain, and Univ. de Ibagué, Colombia).

The poster presentations also had good representation from the above-mentioned session themes. The presentations described both fundamental and applications-based research activities including modelling, laboratory and field experiments, and operational applications.

Our appreciation and gratitude goes also to the presenters for their efforts and to the participants for their insightful questions and discussions. Special thanks are also due to the host city for the excellent venue and to all the SPIE organizational staff for their support prior to, during, and after the symposium. We look forward to an even more successful conference in 2019 in Strasbourg, France.

Christopher M. U. Neale
Antonino Maltese

