

PROCEEDINGS OF SPIE

Remote Sensing for Agriculture, Ecosystems, and Hydrology XXVI

**Christopher M. Neale
Antonino Maltese
Charles R. Bostater Jr.
Caroline Nichol**
Editors

**16–19 September 2024
Edinburgh, United Kingdom**

Sponsored by
SPIE

Event Sponsor
Leonardo MW Ltd. (United Kingdom)

General Sponsors
HGH Infrared Systems (France) • Photon Lines Ltd. (United Kingdom) • Pro-Lite Technology Ltd. (United Kingdom)
Thales (United Kingdom)

Cooperating Organisations
Cranfield University (United Kingdom) • Quantum Security and Defense Working Group (United Kingdom)
CENSIS (United Kingdom) • Innovate UK (United Kingdom) • Optoelectronics Research Centre (United Kingdom)
Photonics21 (Germany) • Technology Scotland (United Kingdom) • Science and Technology Facilities Council
(United Kingdom) • UKQuantum (United Kingdom) • Visit Britain (United Kingdom)

Published by
SPIE

Volume 13191

Proceedings of SPIE 0277-786X, V. 13191

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

Remote Sensing for Agriculture, Ecosystems, and Hydrology XXVI, edited by Christopher M. U. Neale,
Antonino Maltese, Charles R. Bostater, Caroline Nichol, Proc. of SPIE Vol. 13191, 1319101
© 2024 SPIE · 0277-786X · doi: 10.1117/12.3057295

Proc. of SPIE Vol. 13191 1319101-1

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 XXVI*, edited by Christopher M. Neale, Antonino Maltese, Charles R. Bostater Jr., Caroline Nichol, Proc. of SPIE 13191, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

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

ISBN: 9781510680906
ISBN: 9781510680913 (electronic)

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time)
SPIE.org
Copyright © 2024 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center 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.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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

SPIE. DIGITAL LIBRARY
SPIDigitalLibrary.org

Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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 *Conference Committee*

ix *Introduction*

MARINE WATERS SENSING I

13191 02 **Identifying marine oil spills with thermal and hyperspectral UAV imagery: capabilities and challenges (Invited Paper)** [13191-1]

MARINE WATERS SENSING II

13191 03 **Remote sensing of evaporating gases from chemical spills at sea using multispectral thermal infrared camera (Invited Paper)** [13191-5]

MARINE WATERS SENSING III

13191 04 **A multiplexed reconfigurable modular FBG-based sensor platform for flow and temperature measurements in the North Sea (Invited Paper)** [13191-10]

13191 05 **Comparison of bathymetry estimated from multibeam echosounder and optical data** [13191-11]

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

13191 06 **Invariant learning as a pathway to robust potato yield prediction** [13191-20]

13191 07 **A comparative analysis of machine learning and vegetation index-based modeling approaches for durum wheat yield assessment using Sentinel-2 imagery (Best Student Paper Award)** [13191-21]

13191 0A **Surface water extraction from remote sensing images of arid regions in Africa using a deep learning approach combining multiscale information** [13191-65]

UAV APPLICATIONS

13191 0B **Image analysis system for unmanned aerial spraying system performance evaluation** [13191-24]

13191 0C **Spectral discrimination and separability analysis of beach macroplastic litter from high-resolution RPAS images** [13191-27]

SURFACE ENERGY BALANCE AND MICROMETEOROLOGY

- 13191 OE **Evaluation of the effects of direct solar radiation on fiber-based distributed temperature sensing** [13191-30]

SAR-BASED FLOOD AND VEGETATION MAPPING: JOINT SESSION

- 13191 OF **Monitoring of climate-change-induced floods and impact analysis on agricultural systems in the Mojana region of Colombia through automatic change detection and machine learning** [13191-33]
- 13191 OG **SAR-FM: SAR-based flood rapid mapping using multi-modal data fusion** [13191-34]

MONITORING SURFACE- AND GROUNDWATER HYDROLOGY

- 13191 OH **Satellite-based monitoring of groundwater utilization for irrigation: a case study in Southern Italy** [13191-35]
- 13191 OI **Spatio-temporal analysis of wetlands status: a case study for Bulgaria** [13191-36]
- 13191 OJ **Assessing riverine transformations impacted by barrages and dams in the Mahanadi Basin** [13191-37]
- 13191 OK **Detecting algal scum in an inland river using Planet and Sentinel-2 multispectral imagery** [13191-38]

HYPERSPECTRAL REMOTE SENSING AND SPECTROSCOPY

- 13191 OM **Assessment of vis-NIR spectroscopy capabilities for the classification of olive cultivars** [13191-40]
- 13191 ON **Three-dimensional reconstruction model rendered with hyperspectral images: biomarker monitoring as an example** [13191-41]
- 13191 OO **Linking hyperspectral PRISMA data with ecosystem functional properties at ICOS sites** [13191-42]
- 13191 OP **Mapping stress in submerged aquatic vegetation using multispectral imagery and structure from motion photogrammetry** [13191-43]

IRRIGATION MONITORING AND YIELD ESTIMATION

- 13191 0Q **Assessing silage maize yield and quality variability using NIRS, Sentinel-2, and PlanetScope multispectral imagery: a precision agriculture approach** [13191-44]
- 13191 0R **Modernization of technological tools for crop monitoring and water use efficiency in LAC agriculture (Invited Paper)** [13191-47]

MONITORING AGRICULTURE AND LAND-USE CHANGE

- 13191 0T **The impact of climate change on LULUCF reporting in Bulgaria based on Copernicus data** [13191-49]

POSTER SESSION

- 13191 0U **Cloud filling of oceanic chlorophyll-a concentration remote sensing products by DINEOF methodology** [13191-8]
- 13191 0V **Assessment of mosses in Antarctica based on remote sensing and chlorophyll fluorescence** [13191-12]
- 13191 0X **Land cover classification using data fusion to support sustainable coffee certification processes** [13191-56]
- 13191 0Y **LIBS: a rapid nutrition monitoring tool for hydroponic crops and nutrient supply** [13191-58]
- 13191 0Z **Application of satellite data for monitoring eutrophication in glacial lakes of Rila mountain, Bulgaria** [13191-60]
- 13191 10 **Monitoring of plant leaf growth based on 3D point cloud data** [13191-61]
- 13191 11 **Exploring the correlation between NDVI and agronomic parameters in banana crops: a case study in Tenerife, Canary Islands** [13191-62]
- 13191 12 **Exploring colloidal stability and migration dynamics through integrated photonic into aqueous black carbon dispersion** [13191-64]

Conference Committee

Symposium Chair

Lorenzo Bruzzone, Università degli Studi di Trento (Italy)

Symposium Co-chair

Claudia Notarnicola, Eurac Research (Italy)

Conference Chairs

Christopher M. U. Neale, University of Nebraska Lincoln (United States)

Antonino Malfese, Università degli Studi di Palermo (Italy)

Charles R. Bostater Jr., Florida Institute of Technology (United States)

Caroline Nichol, The University of Edinburgh (United Kingdom)

Conference Program Committee

Alessandra Capolupo, Politecnico di Bari (Italy)

José L. Chávez, Colorado State University (United States)

Monica Garcia, Consejo Superior de Investigaciones Científicas
(Spain)

María Patrocinio González-Dugo, Instituto de Investigación y
Formación Agraria y Pesquera (Spain)

Enrico B. Mondino, Università degli Studi di Torino (Italy)

Saleh Taghvaeian, Utah State University (United States)

Introduction

This proceedings volume contains papers presented during the “Remote Sensing for Agriculture, Ecosystems, and Hydrology XXVI” conference chaired by Christopher M. U. Neale and Antonino Maltese, and those presented during the conference “Remote Sensing of the Ocean, Sea Ice, Coastal Waters, and Large Water Regions 2024” chaired by Charles R. Bostater Jr. and Caroline Nichol.

These conferences were part of the SPIE Sensors + Imaging symposium, which is a fusion of two of Europe’s premier photonics conferences: SPIE Remote Sensing and SPIE Security + Defence.

The symposium took place at the Edinburgh International Conference Centre, Edinburgh, Scotland, United Kingdom, from the 16th to the 19th of September 2024.

The conferences this year featured approximately 45 presentations, encompassing a wide array of topics related to the application of remote sensing in environmental science and 31 of those will be published within the proceedings.

The conference was structured into 12 sessions, each focusing on a specific theme. These themes included, Marine Waters Sensing (3 sessions), Machine Learning and Artificial Intelligence, UAV Applications, Surface Energy Balance and Micrometeorology, SAR-based Flood and Vegetation Mapping (Joint Session), Monitoring Surface and Groundwater Hydrology, Hyperspectral Remote Sensing and Spectroscopy, Irrigation Monitoring and Yield Estimation, Monitoring Agriculture and Land-Use Change. There was also a Poster Session that included some of these topics. The Joint session was organized in cooperation with the “Microwave Remote Sensing: Data Processing and Applications II” conference.

The conference's Best Student Paper Award was given to the paper, “A comparative analysis of machine learning and vegetation index-based modelling approaches for durum wheat yield assessment using Sentinel-2 imagery”, by Maria Bebie and Aris Kyparissis from the University of Thessaly (Greece).

We extend our heartfelt thanks to the presenters for sharing their research and to the attendees for their thought-provoking questions and discussions. We also express our gratitude to the SPIE for providing an exceptional venue, and to the SPIE Europe Manager, Program Coordinators and Proceedings Coordinator for their unwavering support before, during, and after the symposium.

We look forward to an even more successful conference in 2025 in Madrid, Spain.

Christopher M. U. Neale
Antonino Maltese
Charles R. Bostater Jr.
Caroline Nichol

