



# SPECTRUM



The Official Newsletter of the ISPRS Student Consortium

ADVANCES IN  
REMOTE SENSING &  
SPATIAL INFORMATION  
SCIENCE IN

IFOV:  
Dr. Hussein Farah

The Zanzibar  
Mapping Initiative

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CA

ISPRS Congress  
2020

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**ENGAGE WITH OUR GLOBAL NETWORK OF EXPERTS AND BE EMPOWERED**

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# NEWSLETTER

**ISPRS**  
STUDENT  
CONSORTIUM

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## **DESIGN TEAM**

It is yet again another issue of the SpeCtrum Newsletter. This time, we bring you a special edition focused on Africa and African research and advances in geospatial sciences. Africa has some of the world's fastest-growing economies and a very young population with a median age of 19.4 years. Nelson Mandela once said that "Education is the most powerful weapon which you can use to change the world." That statement holds true for Africa, and if any progress is to be made across the continent, its youth have to be empowered through education and skills training. Such skills include how to carry out research as well as Computing/computer programming and its associated applications, including geospatial sciences. Geospatial information has been identified as a key aspect in achieving sustainable development up to the 2030 horizon. The vision is to advance Africa's sustainable development agenda through sound geospatial information management. To achieve this, different measures - some of which are shared in this edition - have been taken.

Do not miss what happened during the second FOSS4G held in Dar es Salaam, Tanzania, insights on the Zanzibar Mapping Initiative, and the stories of a woman engaged in remote sensing in Africa. We also have an interview with Dr. Hussein Farah, the former Director of the Regional Center for Mapping Resources for Development (RCMRD), where he explains how geospatial applications have been harnessed to achieve the Sustainable Development Goals (SDGs) and discusses the current state and future of geospatial sciences in Africa.

Every year, the ISPRS SC organizes several summer schools and, yet again, we bring you highlights of the summer schools; one on geospatial technologies for natural environment management and monitoring held in Poland and another on introduction to SAR held in Kampala, Uganda. Several summer schools have been also scheduled for this year; you will find the details on how to participate in this issue of the SpeCtrum Newsletter.

We are glad to share with you the opportunities for scholarships, fellowships and job openings in the area of GIS and Remote sensing as well as some of the activities that you should expect during the ISPRS congress 2020 in Nice, France.

We do hope you enjoy reading this special edition of the SpeCtrum Newsletter. We look forward to your feedback regarding every issue we publish. Also, if you wish to participate in some of our activities through volunteering, reach us through our social media pages or visit our web site to check how you can join us.

Enjoy reading this issue of ISPRS SC SpeCtrum Newsletter.



**CHARLES JJUUKO**  
*Vice President*  
**ISPRS Student Consortium**

# LEAVE NO ONE BEHIND



The annual Free and Open Source Software for Geospatial (FOSS4G) conference is the largest community gathering focused on open source geospatial software. FOSS4G brings together developers, users, decision-makers and observers from a broad spectrum of organizations and fields of operation. Through six days of workshops, presentations, discussions, and code sprints, FOSS4G participants, learn, exchange, and create new collaborations, geospatial products, and standards.

In August 2018, FOSS4G returned to Africa since FOSS4G 2008 Cape Town, South Africa in Dar Es Salaam, Tanzania. Dar is the centre of technological innovation, culture and social activities in Tanzania and also at the centre of East Africa, within easy reach of the world. It is a vibrant city of many cultures and warm hospitality and the gateway to African sights, such as safaris, heritage sites, and beaches.

The theme for FOSS4G 2018 was “Leave No-One Behind”. We live in a world where users and developers have the opportunity to make a difference in the lives of everyone, whether it’s those in extreme poverty looking for access to clean water, to those using routing algorithms to calculate the fastest route to work. Location and geography are at the heart of these challenges and FOSS4G had this at its core to invigorate our existing projects, bringing them to new users and developers while supporting and nurturing the existing community.

Our vision was to make FOSS4G as accessible and inclusive as possible, bridging the gaps between the various communities that make us so strong, to make us stronger with the geospatial community as a whole. This was achieved through a Travel Grant Program which enabled economically disadvantaged participants the opportunity to attend, covering travel, lodging, and conference costs. The conference

was attended by 1135 delegates. 71% of the total attendees were from Africa, and 25% of the total were women. 100% of the keynote speakers were women as well.

The 21st QGIS Developer meeting took place in Zanzibar just before the conference, making it the codename for QGIS 3.8 release.

FOSS4G showcased several geo and open data projects across the world and Africa. Some of which in Africa included: growth of OpenStreetMap communities and innovative ways of data collection using mobile phones to drones, Open Cities Africa – making cities resilient through open data and participatory mapping, Ramani Huria - community-based mapping project in Dar Es Salaam creating highly accurate open data on flood prone areas using OpenStreetMap, Crowd2map – mapping to combating female genital mutilation and child marriage, Zanzibar Mapping Initiative, and others.

To deliver on our mission, we built collaborations with various communities, from within the open source geospatial community and beyond. In collaborating with the Humanitarian OpenStreetMap Team (HOT), we hosted HOT summit as a track within the main program and Understanding Risk: Africa, focusing on the use of open geospatial tools like Geoserver, Geonode, and InaSAFE while bringing users and developers together at an extent not done before.

The sounds of FOSS4G in Dar will continue to echo across Africa and the globe. FOSS4G would not have been successful without the generous support from our sponsors, OSGeo and the participants. Asante sana!

FOSS4G Dar 2018  
Local Organizing Committee  
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# ISPRS SC SUMMER SCHOOL IN POLAND: GEOSPATIAL TECHNOLOGIES FOR NATURAL ENVIRONMENT MANAGEMENT AND MONITORING

Mustafa Ustuner, Yildiz Technical University, Turkey | Rebecca Collins, University of Worcester, United Kingdom



The second Summer School of ISPRS for this year was hosted by Wroclaw University of Science and Technology (WUST) in Poland from 26th to 30th August 2019. It was jointly organized by WUST, Forest Research Institute, and ISPRS, with the support of the ISPRS Student Consortium.

This five-day summer school along with a conference covered several lectures, hands-on training, oral/poster presentations, technical visits, social activities, and a guided city tour. Through this well-prepared program, ISPRS Summer School has once again fulfilled its mission to bring young researchers/students together in an engaging and friendly atmosphere for establishing a platform for networking and collaboration as well as fruitful scientific discussion. The lectures covered a wide variety of research areas such as natural resource characterization, 3D spatial city information modelling, urban energy simulations, forest monitoring and management from earth observation satellites to LiDAR. Furthermore, the hands-on training included different implementations of remote sensing/GIS data analysis through commercial software (ENVI, FME) as well as open-source programming language (R programming language)

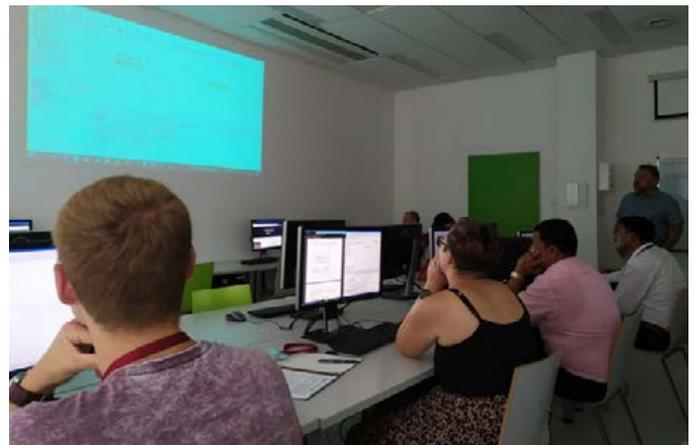
One day before the summer school began, the attendees of the summer school joined the get-together party on August 25 to get to know each other and for an energized start.

The following day, the summer school was opened by Dr. Pawel Boguslawski through his warm welcoming talk where he shared some practical information about the summer school and introduced the first lecturer, Prof. Jörg Bendorf from TU Bergakademie Freiberg, Germany. Prof. Bendorf gave his lecture titled "Geostatistics for natural resource characterization" where he focused on the statistical analytics such as normal and exploration

statistics for mining and geological applications in terms of earth observation data.

After the coffee break, the first hands-on training was carried out by Sylwester Kulik & Piotr Koszelak from TaxusIT about the practical use of mobile technologies for forest monitoring. In this activity, the summer school attendees collected field survey data (points, line etc.) through the mobile devices and processed these collected data in the computer lab through an online platform provided by TaxusIT. After lunch, the first technical visit was held at the "Wroclaw Centre for Networking and Supercomputing (WCSS)" where the supercomputing facilities of the WUST were introduced to the attendees. Information about the GPU-based data processing and the storage of big data was also provided. At the end of the day, we visited the Wroclaw Fountain Light and Music Show where we enjoyed the sunset and the fascinating dance of water with colorful lights.

On the second day of the conference, there were two different lectures, one hands-on training and one social event. The first lecture, titled "Urban energy simulations for climate protection", was given by Prof. Volker Coors from HfT Stuttgart (Hochschule für Technik Stuttgart). In this lecture, Prof. Coors provided important details about CityGML, CAD-BIM integration and 3D-DLM (3D Digitales Landschaftsmodell) in particular with the practices in German cities. Following the first lecture and coffee break, the second lecture of the day titled "3D Spatial City Information Modelling" was given by Dr. Eng. Stanisław Biernat from SHH. After the lunch, the hands-on training about "ETL Processing using FME" was carried out by Adrian Baranowski from SHH. Once the lectures and hands-on training ended, we joined the BBQ Party on the ship and enjoyed the Odra River trip.



This social event increased the engagement and friendship among the summer school participants.

The third day of the summer school began with an educational trip to the Seismological Observatory and Geodynamic Laboratory of Polish Academy of Sciences in Książ Castle in Walbrzych. We visited the underground Geodynamic Laboratory at Książ. During this trip, Prof. Jurand Wojewoda from the Department of Structural Geology & Geological Mapping of Wrocław University demonstrated to us the geological maps of the region and provided us the technical and historical background of the excavations underground.

After this education trip, we turned back to the Geocentrum (building L-1) of WUST where the summer school and the conference took place. We also had our lunch. Following the lunch, the poster session was started. There were four posters presented in this session. The first poster titled “Very high resolution change detection- a comparison of four techniques for monitoring riverbank change” was presented by Rebecca Collins from University of Worcester, UK. Following Rebecca’s presentation, the second poster titled “Spatial Gap-filling of ESA CCI Satellite-Derived soil moisture based linear Geostatistics” was presented by Ricardo M Llamas from University of Delaware, USA. The third poster presentation titled “Floodplain delineation based on analysis of digital elevation model, soil maps and occurrence of quaternary formation” was made by Alexandra Kozłowska from Wrocław University of Science and Technology. The last

poster presentation titled “Polarimetric SAR and LightGBM for Crop Classification” was done by Mustafa Ustuner from Yildiz Technical University, Turkey. At the end of every poster presentation, there was a Q&A session to discuss further about the research. Mustafa attended this summer school on behalf of ISPRS Student Consortium and did his presentation about the recent activities as well as updates of ISPRS SC. This presentation covered the travel grants, membership, ISPRS Congress 2020, newsletter, summer schools, and webinars as well as how to get involved in the activities of ISPRS SC. At the end of the presentation, we discussed some issues about the SC membership as well as how to be a candidate organizer for upcoming ISPRS summer schools. Following my presentation, Dr. Paweł Bogusławski introduced the Technical Commission IV, Working group IV/1: Multi-dimensional Modelling and presented the activities of Working group IV/1 where he serves as the one of the co-chair along with Dr. Umit Isikdag, Turkey. After the session ended, we walked approximately 15 minutes to reach the place where we started the “GIS City Game”. It was a geocaching activity using mobile devices (Google Maps) to find the hidden objects. That was super exciting and challenging at the same time. We enjoyed it a lot.

The fourth day of the summer school was started with the lecture titled “Remote sensing data analysis in ENVI” by Michał Domański from ESRI Poland. He demonstrated the functionalities



of ENVI as well as provided some introductory information about remote sensing in his lecture as some technical terms needed to be explained before the hands-on training. After the lecture, we had the coffee break. Following the coffee break, we got to the computer lab for the hands-on training of the remote sensing data analysis through ENVI software. In this training, we performed spectral analysis, image visualization and supervised/unsupervised image classification on optical images. We also got a cookbook from ESRI Poland for this training. The session for oral presentation was started after lunch, where six presentations were successfully completed in a wide range of topics from cultural heritage documentation to ground water analysis.

The last day of the summer school was started with the lecture titled "Forest Monitoring and Management" by Dr hab. Eng. Krzysztof Sterenczak from Forest Research Institute. Dr. Sterenczak demonstrated the interesting implementations of remote sensing data for forest areas such as tree species classification, single tree modelling, and tree height estimation. He also provided some technical information about the projects completed by his research group (Forest Research Institute, Department of Geomatic). After the lecture, we had the coffee break. Following the coffee break, we got to the computer lab for the hands-on training titled "Open Software and programming in R" given by Dr. Bartłomiej Kraszewski from Forest Research Institute. This training was consisted of

two parts. In the first part, we learned the basics of R programming on RStudio. In the second part, we processed the LiDAR data in terms of tree type (species) classification using machine learning algorithm (random forest) and also visualized the trees based on different data characteristics. The data was specifically prepared for this training by Forest Research Institute. At the end of the training, we received our certificate of participation and get to the meeting point for the guided city tour.

This five-day summer school in Wrocław satisfied more than our expectations in terms of scientific and social activities. What was more amazing was the great hospitality of Polish friends as well as the unbelievably quick forming of friendship among summer school participants. The organization was perfect and those guys made it: Special thanks go to Dr. Paweł Bogusławski, Anna Kopeć, Dariusz Głąbicki, Gabriela Wojciechowska and Dr. Wajns Jarosław. Furthermore we would also like to thank to all participants and lecturers who made this summer school a great and memorable experience.

We also thank ISPRS for organizing this summer school and strongly encourage any student studying in the field of photogrammetry and remote sensing to attend ISPRS Summer School, to enjoy the kind of experience we had and meet other people working in the area. Thank you so much!

# REPORT ON THE ADVANCES IN GEOMATICS RESEARCH CONFERENCE (AGRC2019)



The Department of Geomatics and Land Management at Makerere University in Kampala, Uganda hosts a biennial conference series on Advances in Geomatics Research. This conference is motivated by the need to promote Geomatics Scholarship, build professional networks, and to keep abreast with the state of the art in the country and region at large. This year, we were privileged to host the 5th edition of the conference from the 1st - 2nd August 2019 with the theme 'Geomatics for Development'. The conference was participated in by students, academicians, professionals in industry, and both local and international sponsors. The conference was preceded by 5 pre-conferences on SAR, Humanitarian Mapping, Land Degradation Monitoring and Assessment Using Earth Observation, QGIS and Mobile data collection, and GNSS applications.

The SAR remote sensing workshop was carried out in conjunction with the International Society

for Photogrammetry and Remote Sensing who sponsored the travel of Prof. Dr. Mahdi Motagh of the Institute of Photogrammetry and GeoInformation (ISPRS), Leibniz University in Hannover, Germany. The Humanitarian Mapping workshop, on the other hand, was run in conjunction with the Uganda Red Cross Society (URCS). The Land Degradation Monitoring and Assessment Workshop was conducted by the Regional Center for Mapping of Resources for Development (RCMRD) based in Nairobi, Kenya. This workshop was conducted under the auspices of the GMES and Africa project. The Introduction to QGIS and Mobile Data Collection and Global Navigation Satellite System (GNSS) Application workshops were conducted by staff in the Department of Geomatics and Land Management. The participants of the training workshops were drawn from industry, government agencies, civil society, other universities in Uganda, and both Makerere University graduate and undergraduate students.



The conference received about 30 abstracts from Austria, Kenya, Sudan, Rwanda, South Africa, Senegal, Ethiopia, Morocco, the Netherlands, and Uganda. The topics of interest covered included Adoption of Drone Technology, Artificial Intelligence, CORS Networks, GIS Modeling, GNSS Applications, Land Administration and Management, Ontologies, Open data, Remote Sensing Applications, and SAR. The keynote speakers were Professor Tony Oyana from the College of Computing and Information Systems at Makerere University, where he is a Professor of Geoinformation; Ms. Milly Mbuliro, a Remote Sensing Specialist at the Nile Basin Initiative (NBI), a regional intergovernmental agency spanning the River Nile Basin; Prof. Dr. Mathias Schardt from Graz University of Technology in Austria; and Dr. Emmanuel Nkurunziza the Director General at the Regional Center for Mapping of Resources for Development (RCMRD) in Nairobi Kenya.

We are grateful to all sponsors whose support went a long way in making this conference a success. We acknowledge the various authors who submitted their abstracts. We are also appreciative of all the participants who made time to come to Kampala, Uganda for the conference.

*Associate Professor and Conference Convener*

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**DR. ANTHONY GIDUDU**  
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# ISPRS SC SUMMER SCHOOL IN UGANDA: INTRODUCTION TO SAR DATA MAKERERE UNIVERSITY KAMPALA

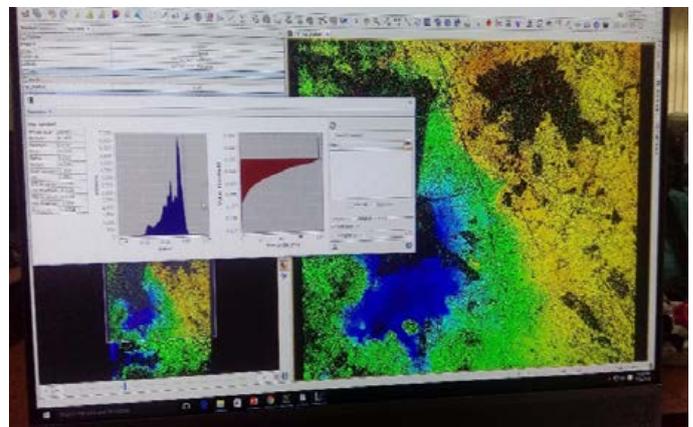
The summer school took place on 22<sup>nd</sup> to 24<sup>th</sup> July 2019 at the GIS Center of the College of Engineering, Design, Art and Technology, Makerere University, Kampala, Uganda. The summer school was attended by about 25 participants from different institutions around Uganda. It was facilitated by Prof Mahdi Motagh from Leibniz University, Germany who gave a series of lectures on the use and acquisition of SAR data.

The first day of the summer school focused on general introduction and theory on SAR data and its acquisition. Participants were introduced to different data sets and platforms where SAR data can be obtained for free. These included ESA Spot 1-5 Archive, RapidEye ESA Archive, WorldView-2 EU cities dataset, Envisat MERIS RR and FRS.



The second day involved practical sessions on the analysis and interpretation of SAR data. The participants worked with two data sets for two cities: the city of Bam in Iran where an earthquake had occurred, and Mexico City in Mexico where the ground was deformed due to ground water abstraction. From the analysis, participants generated their first interferograms.

The third day was a continuation of the second day with participants extracting ground deformation from SAR data and interpreting the interferograms generated.



The summer school was different from the usual ISPRS SC summer schools since it was held for only three days. It concluded with each participant being awarded a certificate of attendance by Professor Madhi Motagh.



# PHOEBE ODUOR

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## THEMATIC LEAD

Land Use, Land Cover, and Greenhouse Gases (GHG) Inventory

## RESEARCH INTERESTS AND EXPERTISE:

Land Cover Mapping and Monitoring using optical, Radar and LIDAR data, Google Earth Engine, Statistical Estimations, Biomass Estimations, GHG Accounting for the AFOLU sector, GIS, Cartography, Project Management and Coordination.

Phoebe Oduor works at the RCMRD (Regional Centre for Mapping of Resources for Development) as the thematic lead. She is a member of the REDD+ Kenya working group and The Technical Advisory Group for Land Cover through AfriGEO and Kenya. She has a Masters of Science in Climate Change Adaptation and Bachelor of Science in Geospatial Engineering from the University of Nairobi.

Can you briefly tell us what you are currently working on?

I'm employed by RCMRD for the SERVIR Eastern and Southern Africa (E&SA) project. SERVIR is a joint implementation program for USAID and NASA. It's a global program with 5 implementing centers around the globe. SERVIR E&SA covers the Eastern and Southern Africa region, SERVIR West Africa covers the western Africa region, SERVIR Mekong covers the Mekong and South West Asia region, SERVIR Hindu Kush Himalaya (HKH) covers the Himalayan region and SERVIR Amazonia covers the Central America Region. We also have a NASA Science and Coordination unit based in Huntsville, Alabama. At NASA HQ in Washington DC, we have a department that covers the capacity building programs for SERVIR Global and at USAID office, Washington DC another department that supports the Global program from the USAID side. SERVIR works in four thematic service areas: Water and Hydro-related Disasters, Weather and Climate, Land Use Land Cover and Ecosystems, and Agriculture and Food Security. We provide needs-oriented services that utilize space technology.

RCMRD, our host institution, was formed in 1975 through the auspices of the then OAU (Organization of the African Union), today African Union (AU), and the UN-ECA (United Nations Economic Commission for Africa). It is an inter-governmental organization with 20 Contracting Member States: Botswana, Burundi, Comoros, Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Somali, South Africa, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe in the Eastern and Southern Africa region. RCMRD's main mission is to strengthen the member States and stakeholders' capacity through generation, application and dissemination of Geo-information and Allied Technologies for sustainable development.

I currently work on multiple activities. We've been working on a 3-year project since 2016 to Enable Annual Land Cover Monitoring for 7 countries: Kenya, Uganda, Tanzania, Ethiopia, Malawi, Rwanda, and Zambia. This particular project was done together with US Research collaborators from US-FS as the Principal Investigator, SilvaCarbon and Google Inc. We just released the preliminary results of this project.

In Rwanda we have developed a Land Use Decision Support System (LUDSS) to help the country in identify priority areas for landscape restoration. The system is anchored on the Google Earth Engine and utilizes data on Landslide Susceptibility obtained from the country, Land Cover change through previous works done in Rwanda, Land Degradation from the EU- funded MESA project, and Deforestation data that we generated to identify the most vulnerable lands.

Additionally, I'm also supporting the AfriGEO secretariat as the point of contact. AfriGEO is a regional GEO (Group on Earth Observations) for Africa that coordinates efforts of all GEO initiatives to ensure African institutions are well represented and are contributing towards the achievement of the GEO priority areas that address the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disasters.

What is your long-term career goal?

How would you like to achieve it?

My long term goal is to be a policy influencer and a mentor for women in STEM (Science, Technology, Engineering and Mathematics). I want the region to gain confidence in the solutions that we provide in addressing sustainable development and having these solutions lead to policies that better human lives.

Further, as a career woman, a mother of two kids, and a wife, I want to encourage young women and girls to know that the world is theirs to take and that it's all

“

*...As a career woman, a mother of two kids, and a wife, I want to encourage young women and girls to know that the world is theirs to take and that it's all possible*

”

possible. I want to encourage as many women as I can to join STEM fields. This is still a challenge for many African girls with a patriarchal society that favors boy child education and early marriages for the girls, but the numbers are building up and we have so many role models now to look up to. I want to count as one of their models in my own small way. I have been participating in WISCI (Women in Science), which is a camp organized by the US Department of State, World Learning and GirlUp where African girls are encouraged to join STEM fields. At the camp, the organizers use Public-Private Partnerships to bring experts from different organizations to train and show the girls snippets of how their technologies are helping to solve everyday problems. We (RCMRD/SERVIR) teach them how Earth Observation data can contribute to solving flooding issues, food security challenges and address climate change, just to mention a few.

**Who or what inspired you to become a leader in science? What do you think are the current opportunities and challenges for women scientists in Africa?**

Growing up as a child, I have always loved science and science-related fields. I come from a very humble background, so I knew from a very young age that only I could change my circumstances. I've also had very good mentors who expected nothing but the best from me and they taught me to reach for the sky. My former boss, now departed, Mr. Eric Khamala encouraged me to pursue great challenges with no expectation of failure. I guess having people who believe in your ability pushes you to give your very best. The former DG of RCMRD, Dr. Hussein Farah, was also very supportive. He would stand by you in success and failure. I attribute my success to being given an opportunity and taking it. I've had great teams that worked effortlessly with me in making these achievements. I acknowledge them all. It's not all me but the faith and the support my teams gave me.

**What is your message for the young African women who shows passion for science, particularly in the fields of remote sensing and geospatial information sciences?**

I'd say go for it. I find the challenges in geospatial sciences very motivating. They solve issues we can relate with so you work knowing your best efforts are not in futility. The field is very wide, it can be applied almost everywhere so the opportunities are many.

I'd also tell the African woman that you have to work twice, maybe three times as hard, but it's all possible. Set your goals and focus. Don't be swayed midway.

**In your opinion, what is needed to encourage the engagement of more women in a scientific community?**

We need mentorship programs from a very young age. At RCMRD we have the Space Challenge through SERVIR-E&A that encourages students at primary school level.

We need to have gender-focused initiatives that ensure that women are not left behind. We are just now trying to include gender integration within RCMRD as an institution to ensure more and more women are considered. And we want women leadership not just at the middle level management but also at top level management. I always look up to Nancy Searby at NASA HQ and Jenny Frankel Reed at USAID. These are women leaders we have in the program, top management, and they motivate me to be in those positions one day. They almost seem to be superwomen just looking at the work they do and they are very well educated career women and mothers too.

“

*we need to have gender-focused initiatives that ensure that women are not left behind*

”



# DR. HUSSEIN FARAH

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**ASSOCIATE PROFESSOR**  
Technical University of Kenya

**RESEARCH INTERESTS AND EXPERTISE:**  
Applications of geo-information for natural resources management and water resource surveys and modeling

Dr. Farah holds a Bachelor's Degree in Surveying and Photogrammetry, a Master's Degree in Geography, and a Ph.D. degree in Water Resources Surveys. He has more than twenty five years experience in applications of geo-information and has worked in the Public, Academic and Private Sectors. He is currently an Associate Professor in the School of Geospatial Engineering at the Technical University of Kenya. He is also the Deputy President of the Institution of Surveyors of Kenya and ISPRS Regional Representative for Africa.

You became the Director General of Regional Centre for Mapping of Resources for Development (RCMRD) in Africa for several years, can you briefly tell us about this organization? What are its mission and its activities? Can you give us some of the most important projects and endeavors of this organization?

The Regional Centre for Mapping of Resources for Development (RCMRD) was established in 1975 under the auspices of the United Nations Economic Commission for Africa (UNECA) and the African Union (AU). It is an inter-governmental organization and currently has contracting Member States in the Eastern and Southern Africa Regions.

The mission of RCMRD is to promote sustainable development through the generation, application, and dissemination of Geo-Information and allied Information Communication Technology services and products in the Member States and beyond. Its main activities are capacity development, training, project and advisory services, and research.

RCMRD programmes use earth observation and geospatial technologies to benefit society in the areas of agriculture, biodiversity, climate change, disasters, ecosystems, health, water, and weather. Some of the most important programmes are land use and cover change mapping, land degradation monitoring and assessment, disaster and risk management, flood forecasting, and wetlands monitoring and assessment.

What did you find the most interesting and the most challenging in this project? How do you think the project contributed to the progress or development in Africa?

The project which I feel had great impact is the land cover change mapping to support greenhouse gas inventories in nine African countries. The aim of the

project was to develop a robust and credible system for estimating land-based emissions and to build a comprehensive account of the land sector in each of the nine countries. It brought together data from a range of sources including forest cover and growth rates, soil data and measurements of carbon emissions resulting from various land-use regimes, and climate and meteorological data. Remote sensing data was used to delineate the country into various land cover types and measurements of carbon emissions associated with various crop and plant types.

The most interesting thing in the project was the building of the capacity of the countries to enable them do their greenhouse gas inventories themselves, a requirement of the United Nations climate conventions. This involved building up institutional and human capabilities and the development of systems and procedures. One of the main challenges was forging an agreement among the stakeholders on the number and types of land cover classes to be adapted at the national level. This was because there were many stakeholders with varied interests.

What do you think are the roles of geospatial technologies in achieving of Sustainable Development Goals (SDGs) in Africa? Which among the SDGs are the main priorities for your region?

The main uses of geospatial information to achieve Sustainable Development Goals are to support the implementation and to track and monitor the progress that we are making in achieving the goals in our countries. African countries have agreed to implement all 17 goals and they all very important. However, I think goals on eliminating poverty and hunger, quality education, good health, climate action, sustainable cities and communities and life on earth are very critical in our region.

*In your opinion, what are the challenges that African scientists and students face in their research careers, particularly in environmental mapping and management? Can you give us some advice on how to overcome such challenges?*

*The challenges faced by African researchers and students are many. The main ones are the lack of mentorship, of hardware and software capacities, and of access to latest literature and earth observation data.*

*These challenges are being mitigated through the training of researchers and students on proposal writing, their exposure to different organizations that support research nationally and internationally, and convincing African countries to provide more funding to research in universities.*



*... I wish to see Earth Observation used routinely on a daily basis by institutions to support decision-making*



*How would you like to see Africa in ten years' time? What would be the roles of the youth in this vision?*

*Ten years from now, I wish to see earth observation used routinely on a daily basis by institutions to support decision-making across all sectors of development and societal benefit areas.*

*What are you most passionate about? How did you end up becoming a leader in your career? What is your advice for students and young researchers, especially in Africa, who are aspiring to be leaders in their profession?*

*I am passionate about mainstreaming the use of earth observation and geospatial technology in all sectors of development in Africa. In particular, to build the capacity of institutions and governments to integrate earth observation in decision-making.*

# THE ZANZIBAR MAPPING INITIATIVE



In 2016, the Zanzibar Commission for Land came up with the idea of using unmanned aerial vehicles (UAVs) to update the map of the Zanzibar islands from 2012. The project aimed to provide high-resolution maps of Zanzibar using UAVs as well as conduct capacity building activities for the students and instructors of the State University of Zanzibar. It was a good opportunity for me to join in this new remote sensing technology project called the Zanzibar Mapping Initiative. Through this project, I learned how to operate and fly drones for the data collection, how to process aerial images using open source platforms, and how to conduct scientific analysis of geospatial data. It was a very exciting project for me while I completed my degree in Information Technology and Application Management.

UAV mapping can provide mosaic images and the digital surface model of the area being scanned. Unlike satellite imagery, drone images are not affected by cloud cover because of the flexibility in planning the data acquisition. Also, drones produce ultra-high resolution images, which can be used for many applications such as city planning, environmental monitoring, disease control, forest management, and precision agriculture.

I never dreamed of having a passion for UAVs and GIS, but the Zanzibar Mapping Initiative has changed my perception. I became known as the “Queen of Drones” in Tanzania. During the years of being involved in the drone mapping projects, I have been so proud to demonstrate what this technology can provide, especially in disaster management. I learned that we should help one another and use technology in positive ways for the betterment of society. In the future, I would like to continue my studies in the fields of remote sensing and geospatial information science because I know that my community needs experts in these fields for better city planning and I would like to be part of it.

In my opinion, the challenges that African scientists and students face in their research careers include the lack of or low funding and few opportunities to showcase their skills and abilities. There are times that young researchers are being disregarded because of their lack of professional experience. Also, international researchers are often given more opportunities to conduct research than local researchers. In the next ten years, I would like to see African young researchers and students working together as a part of innovation and development for a smart and better life in the country.

*Khadija Abdulla Ali is a geospatial and UAV consultant based in Tanzania. A native of Zanzibar Island, she drew her inspiration from the experiences of Tanzanian and other African mapping and cargo delivery projects. She became known as the “Queen of Drones” during her service in a World Bank project called the Zanzibar Mapping Initiative. Her work had been inspired by her personal spiritual vision and her passion to work for humanitarian projects.*

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# REMOTE SENSING FOR ASSESSMENT OF LARGE-SCALE IRRIGATION SCHEMES PERFORMANCE IN THE NILE BASIN

Policy makers adopt irrigated agriculture for food security since irrigation doubles crop production. The development of large irrigation systems has a long history in many places worldwide. In Africa, dams and large-scale irrigation schemes were designed and constructed in the British Empire territories, namely the Nile Delta in Egypt and the Gezira Scheme in Sudan, to increase agricultural productivity at the end of the nineteenth century (Bastiaanssen and Perry, 2009). Nowadays, the total irrigated area in the Nile Basin, including large- and small-scale traditional types, is about 7.5 million hectares (FAO, 2011). While irrigation can enhance food production through higher yield, the crop productivity of the main crops in most of the Nile Basin's irrigated farming systems, except the Egyptian Nile Delta, is still very low (Karimi et al., 2012). For example, Al Zayed et al. (2015) reported that the Water Use Efficiency (WUE) in kg/m<sup>3</sup> for irrigated wheat system in the Nile Delta is three times higher than in the Gezira Scheme. The poor irrigation performance of large-scale irrigation

systems is generally due to a lack of effective evaluation and monitoring (FAO, 2011). The evaluation is the most significant step in providing information about how the system is performing. Data acquisition for a large area is always difficult, but Remote Sensing (RS) technology makes it possible for the retrieval of data across extensive areas (Wu et al., 2013). This article demonstrates the power of using RS to assess, evaluate and monitor large-scale irrigation systems by taking the Gezira Scheme as a case study. With an area of 8,000 km<sup>2</sup>, the Gezira Scheme is the largest irrigation scheme - not only in the Nile Basin but also in the world - under single management. Two different approaches via RS, namely the Normalized Difference Vegetation Index (NDVI) and Actual Evapotranspiration (ETa), show the capability of using RS as a water management tool. The Modified Vegetation Condition Index (MVCI), derived from the NDVI and provided by Al Zayed et al. (2015), can be used to allow a qualitative spatio-temporal assessment of

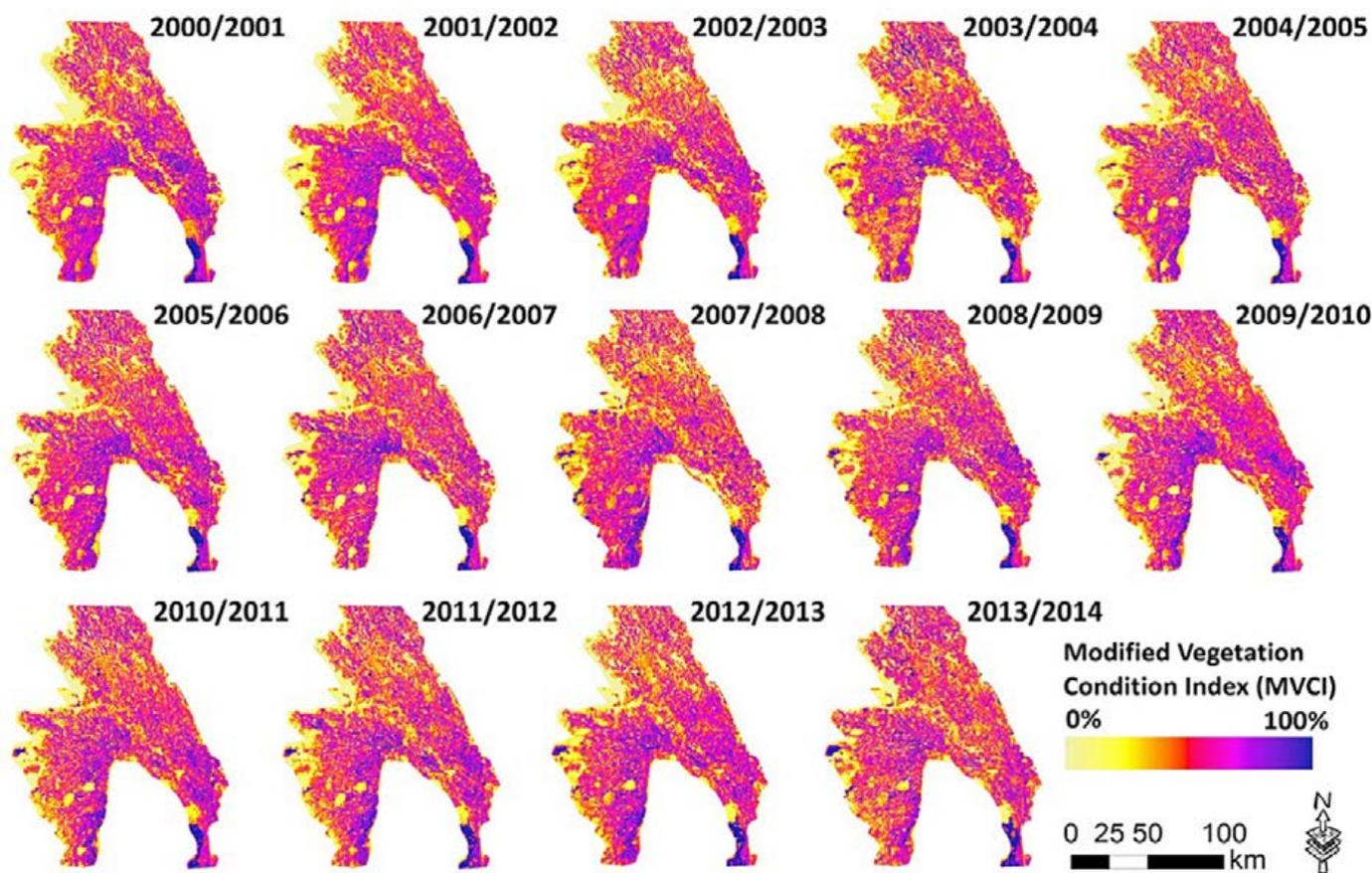


Figure 1: Spatial irrigation supply assessment for the summer crop season. Source: Al Zayed et al. (2015)

irrigation efficiency. Figure 1 shows a spatial assessment of drought areas using the MVCI index for the summer crop season for the Gezira Scheme. The results indicated that the northern part of the scheme experienced characteristic drought. These outcomes can help to conserve water by improving efficiency and water productivity. Although MVCI can be considered a monitoring tool, the index does not observe the water problem in the scheme that is causing the drought symptoms. Therefore, understanding the spatio-temporal variability of ETa is important to identify the water problems in the scheme. The Simplified Surface Energy Balance (SSEB) was found operationally more applicable to estimate ETa for the Gezira Scheme (Al Zayed et al., 2016). In order to overcome possible uncertainty in the ETa values estimated using SSEB, the Crop Water Consumption Index (CWCi) was introduced by Al Zayed and Elagib (2017) which can be utilized to conduct long-term assessment of the efficiency of such a large-scale agricultural scheme. Furthermore, it is possible to use values of ETa and NDVI to identify channels with spillover problems and detect wastage of water. As can be seen from Figure 2, around 80 irrigation channels were identified as having water spillover problems for the 2013/14 crop season in the Gezira Scheme. In conclusion, RS analysis by utilizing SSEB model and NDVI presented the water distribution monitoring in order to deal with the irrigation inefficiency of the scheme. MVCI takes into account crop response to water availability, while ETa indicates whether water is used as intended.

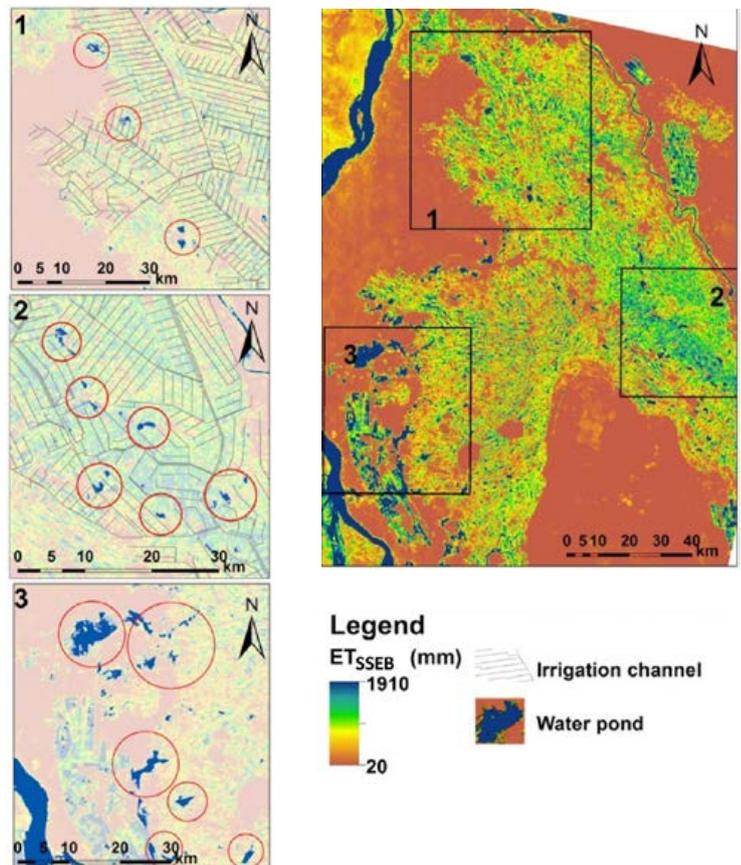


Figure 2: Water spillover from the irrigation channels in Gezira Scheme for the summer irrigation season of 2013/14 identified using actual evapotranspiration from the Simplified Surface Energy Balance (SSEB). Source: Al Zayed and Elagib (2017).



*Dr. Islam Sabry Al Zayed is a researcher of hydrology and senior technical officer at the National Water Research Center, Egypt. In November 2019, he started his postdoctoral position at TH Köln/Cologne University of Applied Sciences, Germany. He believes that achieving clean water and improving water use efficiency are crucial elements of development and poverty alleviation in developing countries.*

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# MONITORING VEGETATION DYNAMICS USING REMOTE SENSING IN THE NGORONGORO CONSERVATION AREA, TANZANIA



Vegetation is an important component of the terrestrial ecosystem serving as a medium for energy transfer, water cycle, and biogeochemical cycle. In the Ngorongoro Conservation Area (NCA), the pressure from rapidly increasing livestock grazing and fast-growing human population poses challenges to the co-existence of wildlife and Maasai pastoralists within the 8292 km<sup>2</sup> premises. In order to ensure the sustainability of this world-renowned wildlife protected area, it is important to understand the magnitude and changes in vegetation cover for effective management of its environments. Through the integration of satellite and climate data and field observations, we analyzed a long-term change of the savanna grasslands, which is vital for supporting both wildlife and livestock.

The Ngorongoro Conservation Area was categorized as a UNESCO World Heritage Site in 1979 due to its spectacular landscape and exceptional concentration of wildlife. The area is named after the Ngorongoro Crater, a large volcanic caldera within the area. It forms the south-eastern part of the Greater Serengeti-Mara ecosystem which is home to over 2 million migrating wildebeests. The initial purpose of its creation was to support a small population of semi-nomadic Maasai pastoralists and wildlife conservation, with the assumption that these two land uses are compatible. However, with time, the pastoralists' population has grown exponentially causing competition from livestock

grazing which destroys and reduces the habitat and forage for wildlife.

This study used satellite imagery time series that were produced from measurements of the Moderate Resolution Imaging Spectroradiometer (MODIS), a sensor onboard two observation satellites, Terra and Aqua. To investigate land cover changes and vegetation dynamics, MODIS product MOD13Q1 level 6, which provides vegetation indices after every 16 days at a spatial resolution of 250 m per pixel, was employed. The temporal resolution and scale of these images coupled with auxiliary climatic data successfully told a story of vegetation changes in the NCA landscape, which was later verified through field observation and ground truthing.

The major challenge in monitoring wildlife protected areas in Africa is the availability of data. Remote sensing with the help of ground observations allows for the rapid monitoring of large areas, the assessment of effectiveness of management and quality of natural habitat, and the mapping of human-wildlife conflicts hotspots. Additionally, to the absence of data resources in places where data are available, there is the lack of a network for data sharing infrastructure among the protected areas that could contribute to better estimation of available natural habitat for sustainable wildlife conservation.



*Atupelye Weston Komba is a Ph.D. candidate in Laboratory of Environmental Geography, Graduate School of Environmental Science, Hokkaido University, Japan. Her current research is on the development of remote sensing-based indicators to support decision making on land management in conservation areas.*

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# COMPARISON OF VV & VH SENTINEL-1 SAR IMAGERY IN FLOOD DELINEATION

<sup>1</sup>Benjamin Kato, <sup>1</sup>Brian Makabayi | <sup>1</sup>Makerere University – Department of Geomatics & Land Management

**Abstract:** A change detection and thresholding (CDAT) methodology has been adapted from previous studies to determine flood extent using 2 space-borne radar images obtained from Sentinel-1 SAR with one acquired before the flood and another after the flood. Both polarizations available VV and VH have been processed to allow for a comparison of their respective accuracy for delineating surface water and flooded areas. Results have been validated against a Sentinel-2 optical image, with both polarizations producing total accuracies of 89.0% and 93.8 %, with Cohen’s kappa coefficient ( $\kappa$ ) of 0.778 and 0.799 for VV and VH, respectively. Mapped results have been compared to an already generated flood map from the NASA NRT Global Flood Mapping.

**Main Objective:** Investigating the accuracy of VV and VH polarization on flood delineation. Specific: To delineate flood areas using VV and VH Sentinel-1 IW SAR imagery and Validation of VV and VH delineated flood areas with MNDWI for Sentinel-2 imagery

The image pre-processing steps of sub setting, calibration, and speckle filtering, among others, were applied to each Sentinel-1 IW GRD (Ground Range Detected) dataset in order to reduce orbital errors, speckle noise, and geometric distortion.

During the image processing stage, a change detection and thresholding (CDAT) methodology was used to determine the extent of flooding. The pair of SAR images obtained from Sentinel-1C-band comprises an image during the flood (Flood Image-FI) and another one before the flood event (Reference Image-RI). In order to distinguish the flooded area, two different methods were followed. The first method applied thresholding and used only the “flood image” to determine whether a given raster pixel is flooded or not. The second method dealt with the separation of water from non-water areas by comparing the “reference image” with the “flood image”, making use of a change detection technique.

**Results:** For the threshold method, VH extracted a greater number of pixels with water than VV. The essence of this method was to evaluate ability of both polarizations in extracting surface water. MNDWI was calculated for a sentinel-2 image and the water extent derived was compared to both VV and VH SAR image water extents.

For the change detection method, a resultant gray scale image of single band continuous data was generated from the subtraction of reference and flood images of both polarizations. VH image identified more dark pixels of decreased reflectance than VV image which corresponded to flooded areas. VV image however identified some brighter pixels of increased reflectance in the corresponding dark areas in the VH image.

VH SAR image results from both methods related more with the Sentinel-2 optical image results and identified more pixels as flooded. The derived flood extents from both polarization images have been validated with the MNDWI water extent of the Sentinel-2 optical image. The overall total accuracies for VV and VH were 89.0% and 93.8% respectively.

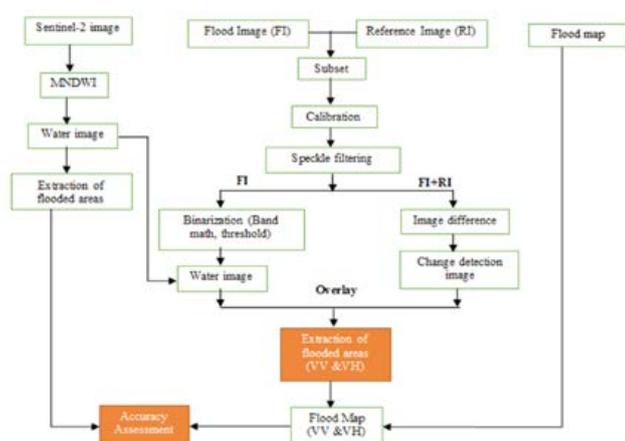


Figure 1: Research Design

**Methodology:** The dataset used in this project incorporates space-borne images including two Sentinel-1 SAR images provided by the European Space Agency (ESA) covering the study area to be utilized for flood mapping. A cloud-free satellite optical image collected by Sentinel-2 after the Sentinel-1 pass was used. The lack of in situ data to act as a reference means the Sentinel-2 image will be used to validate the SAR flood extents. These results were supported with the comparison of SAR flood extent to the existing flood map.

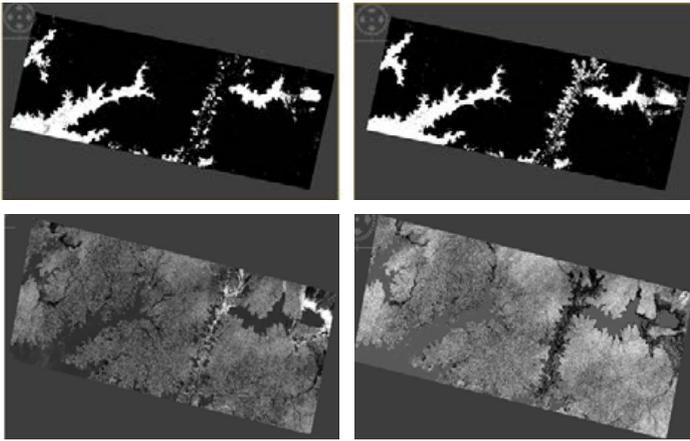


Figure 2: Surface water extracts from threshold method for VV SAR image (Top Left), VH SAR image (Top Right) with the water areas appearing in white and the non-water areas appearing black. Figure 3: Change detection images for VV (Bottom Left) and VH ( Bottom Right) SAR imagery in gray scale.

Using the reference and flood images for both polarizations in an RGB composite, specific areas of change were highlighted with color red corresponding to flood areas, cyan corresponding to change due to ground cover and is not related to floods. Grey indicates areas of little or no change, black corresponds to areas of permanent water bodies.

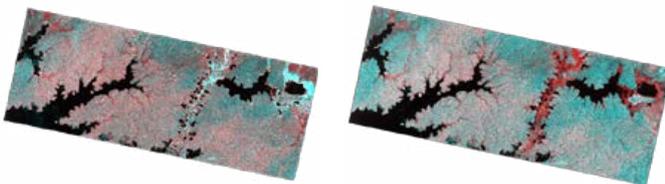


Figure 4: Extracted flood areas using RGB composites for VV SAR image (Left) and VH SAR image (Right)

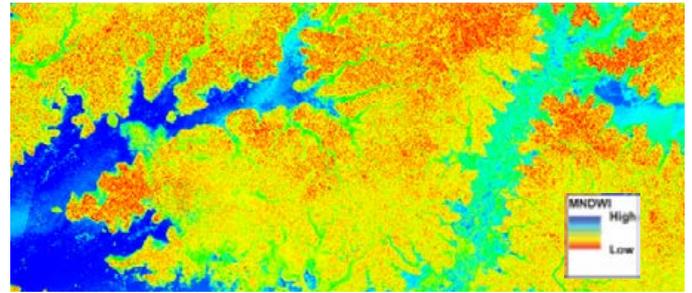


Figure 5: Sentinel-2 MNDWI image from which flood extents used to validate the SAR flood extents was extracted.

**Conclusion:** From this study, results showed that VH extracted more flood areas than VV with a greater accuracy. VH provides a wide range of backscatter values in vegetated land areas as compared to VV. In addition, VV underestimates the flood areas due to wind roughening of the water surface.

The accuracy between the two polarizations will however vary depending on the different environments of the study area such as the chemical characteristics and varying wind conditions therefore systematic assessment is required in different environments to determine environments best fit for both the polarizations.



*I have recently concluded my Bachelor of Science degree in Land Surveying & Geomatics at Makerere University. My research interests are in the field of remote sensing, particularly Radar and I am currently applying this knowledge in the Agricultural sector. I look forward to applying this technique in the other various sectors.*

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2020

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14-20 JUNE 2020

## keydates



OCTOBER 2019	Opening of registration platform
OCTOBER 1, 2019	Deadline for Thematic Sessions and Tutorials
NOVEMBER 15, 2019	Deadline for <i>very early bird</i> Registrations Notification of applicants: Thematic Sessions and Tutorials
DECEMBER 15, 2019	Opening of abstract and paper submission platform
JANUARY 31, 2020	Deadline for submission to grants
FEBRUARY 03, 2020	Deadline for abstracts & full papers: technical sessions and young investigators
MARCH 02, 2020	Notification of authors for abstracts: technical sessions and young investigators
MARCH 30, 2020	Notification of authors for full papers: technical sessions, young investigators
APRIL 13, 2020	Deadline for <i>early bird</i> registrations Deadline for registration payment for papers to be included in proceedings Deadline for camera ready papers
MAY 04, 2020	Final program release
JUNE 02, 2020	Deadline for regular registrations

Start of **Abstract** and **Full Paper** submissions:

**DECEMBER 15**



### The ISPRS SC **Excellence Award**

This award is given annually to the best paper demonstrating state-of-the-art applications and innovative ideas in the fields of photogrammetry, remote sensing and spatial information science.

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### The ISPRS SC **Service Award**

This award recognizes an individual who has rendered exceptional contributions to the Consortium during an ISPRS Congress term.

Visit <http://sc.isprs.org/> for more information.

# ANNOUNCEMENT

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The ISPRS SC board would like to announce that the new Statutes of the organization was approved by the ISPRS Council last August 2019, effective immediately. Please visit <http://sc.isprs.org/about/isprs-sc/statutes.html> for details and to read about the changes.

We are also pleased to announce that the ISPRS SC will be giving two new awards every year – the Excellence and Service Awards. The Excellence Award commends students and young researchers for publishing outstanding papers in any ISPRS publication, such as journals, Annals, and Archives. The award is given annually to the best paper demonstrating state-of-the-art applications and innovative ideas in the fields of photogrammetry, remote sensing and spatial information science. The Excellence Award is presented at the ISPRS Congress, the Geospatial Week, and at a selected Technical Commission Midterm Symposium in the subsequent calendar year.

The Service Award recognizes individuals who have rendered exceptional contributions to the Consortium during an ISPRS Congress term. This award is presented to individuals who have provided exceptional services and/or significantly contributed to the organization of activities and/or the various efforts of the Consortium. Follow this link for more information: <http://sc.isprs.org/index-the-isprs-SC-awards.html>



ISPRS SC NEW STATUTES



ISPRS SC AWARDS

# OPPORTUNITIES

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## PHD SCHOLARSHIPS AND FELLOWSHIPS

### **PhD position in image sequence analysis at Technische Universität Dresden, Germany**

*Deadline: 13th December 2019*

*<https://bit.ly/2MYKVP6>*

### **Doctor of Philosophy in Atmospheric Science (PhD)**

*Deadline: 1st January 2020*

*<https://www.grad.ubc.ca/prospective-students/graduate-degree-programs/phd-atmospheric-science>*

## MASTER SCHOLARSHIP

### **Graduate student position available in Earth System Modeling at the University of Georgia**

*Deadline: 1st December 2019*

*<https://findajob.agu.org/job/8011387/graduate-student-position-in-earth-system-modeling-at-the-university-of-georgia/>*

## JOB OPPORTUNITY

### **Hydrology Assistantship in Yellowstone National Park**

**Deadline: 12th January 2020**

*[https://rock.geosociety.org/eo/GeoCorpsJobDescriptions\\_gip.asp#gipguestscientistpositions](https://rock.geosociety.org/eo/GeoCorpsJobDescriptions_gip.asp#gipguestscientistpositions)*

# IN THE HORIZON

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## 18-20 MARCH 2020

### **GIS Ostrava 2020, UAV in Smart City and Smart Region**

*Site: Ostrava,, CZECH REPUBLIC*

*Contact: Michal Kačmařík, [michal.kacmarik@vsb.cz](mailto:michal.kacmarik@vsb.cz)*

*Website: <http://gis.vsb.cz/gisostrava/>*

## 23-27 MARCH 2020

### **LAGIRS 2020 - the Latin America GRSS & ISPRS Remote Sensing Conference**

*Site: Santiago de Chile, CHILE*

*Contact: Héctor Jaime Hernández Palma, [jhernand@uchile.cl](mailto:jhernand@uchile.cl)*

*Website: <https://2020.lagirs.org/>*

## 20-22 APRIL 2020

### **SpaceTimeAI 2020**

#### **First International Symposium on Spatio-Temporal Artificial Intelligence**

*Site: London, UK*

*Contact: James Haworth, [conference@spacetimeai.org](mailto:conference@spacetimeai.org)*

*Website: <http://spacetimeai.org/>*

## 03-05 JUNE 2020

### **27<sup>th</sup> International Conference on Systems, Signals and Image Processing IWSSIP 2020**

*Site: Niteroi - Rio de Janeiro, BRASIL*

*Contact: Aura Conci, [aconci@ic.uff.br](mailto:aconci@ic.uff.br)*

*Website: <http://iwSSIP2020.ic.uff.br/>*

## 14-20 JUNE 2020

### **XXIV<sup>th</sup> ISPRS Congress**

*Site: Nice, France*

*Contact: [contact@isprs2020-nice.science](mailto:contact@isprs2020-nice.science)*

*Website: <http://www.isprs2020-nice.com>*

## 20-22 OCTOBER 2020

### **TeanGeo 2020**

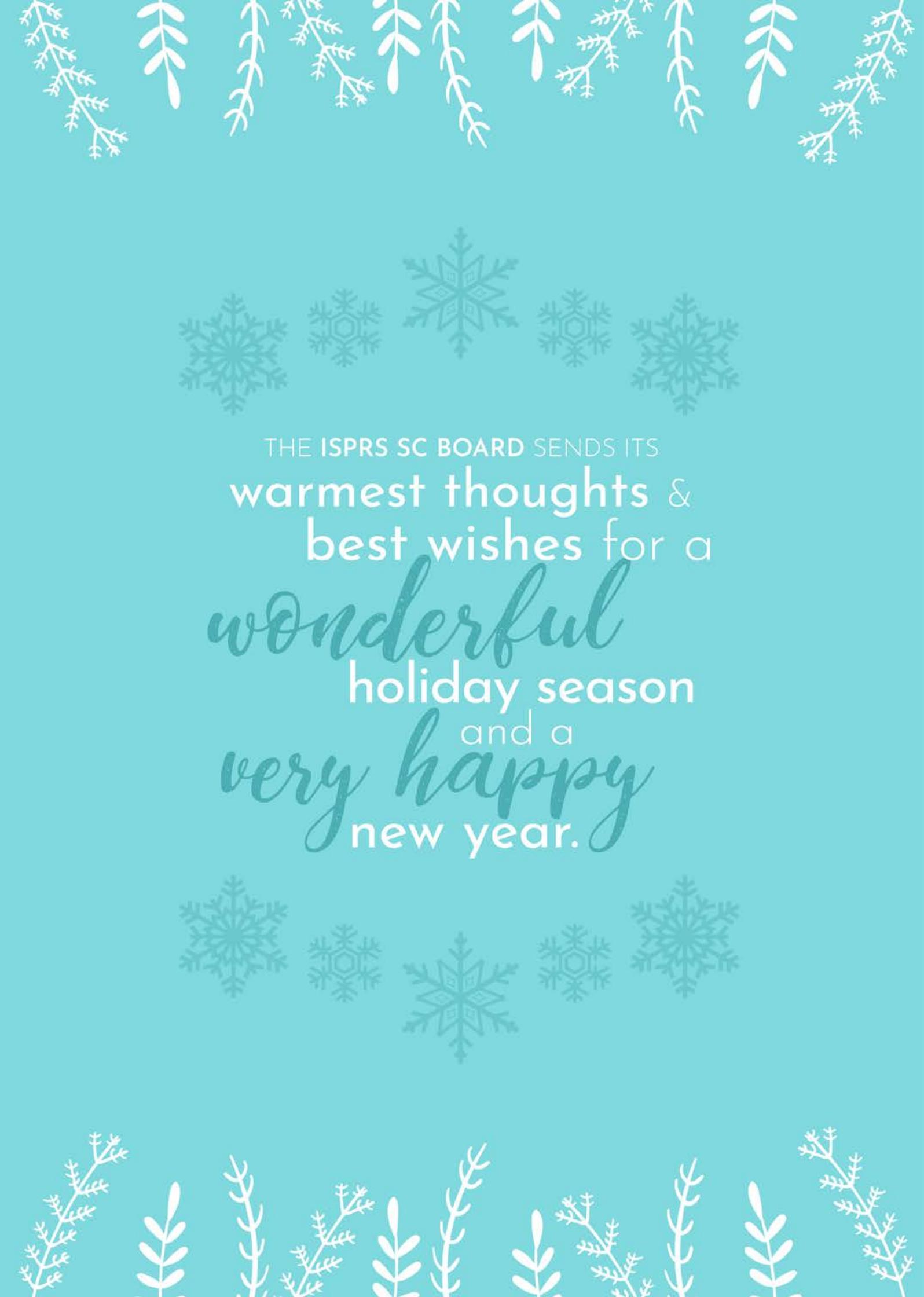
#### **3<sup>rd</sup> International Conference & Exhibition**

#### **Advanced Geospatial Science & Technology**

*Site: Tunis, TUNISIA*

*Contact: El Hadi GASHUT, [crtean.gashut@yahoo.com](mailto:crtean.gashut@yahoo.com)*

*Website: <http://www.teangeo.org/>*



THE ISPRS SC BOARD SENDS ITS  
warmest thoughts &  
best wishes for a  
*wonderful*  
holiday season  
and a  
*very happy*  
new year.

# ACKNOWLEDGEMENT

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The ISPRS SC and the Newsletter team would like to thank all the contributors of the featured articles in this issue who shared their knowledge and research experiences with us.

Also, we would like to acknowledge all the organizers, volunteers, and participants of the ISPRS SC Summer Schools held in Poland and in Uganda for the successful conduct of activities for the students and young professionals.

Finally, our great appreciation to all the Consortium members and to everyone who contributed to the activities of the organization this year!

