It gives me great pleasure to welcome and thank all the keynote speakers, speakers and participants to the IEEE Workshop on Geoscience and Remote Sensing 2020 (IWGRS2020). This is the 6th series of our yearly workshop with an aim to provide an intellectual platform for the IEEE Geoscience & Remote Sensing (GRSS) members as well as other participants and students to share knowledge and experience on recent developments and advancement in geosciences and remote sensing technologies. In this era of rapid technological development, it is important to bring up the awareness of sustainable development and remote sensing is a key technology in providing such capability for monitoring earth natural terrain and resources at large scale. This year, the theme of IWGRS2020 is “Remote sensing for Health and the Environment” which is timely when the world is facing the challenges of COVID-19. Due to that, this workshop is held online for the first time and I hope that this new approach will let us explore and develop new way of sharing and communication of latest research outcome and knowledge. I would like to take this opportunity to also thank the organizing committee members as well as all co-organizing universities and organizations of this workshop for your dedicated work and strong support. Finally, I would like to wish you all the best for participating in this workshop and do stay safe and stay healthy.

Prof. Ir. Dr. Ewe Hong Tat
Chair, IEEE Geoscience and Remote Sensing Society Malaysia Chapter
DAY 1 (NOVEMBER 24th, 2020)
OPENING CEREMONY AND KEYNOTE ADDRESS
Chairperson: Prof. Ir. Dr. Koo Voon Chet

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<tr>
<td>8.00-9.00 am</td>
<td>Speakers and participants log in to the Zoom meeting</td>
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<td>9.00 am</td>
<td>Welcoming speech by Emcee</td>
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<tr>
<td>9.05 am</td>
<td>Welcome Address by Organising Committee Chairperson</td>
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<td>Dr. Zafri Baharuddin (UNITEN, Malaysia)</td>
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<tr>
<td>9.10 am</td>
<td>Opening address by IEEE GRSS Malaysia Chairman</td>
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<td>Prof. Ir. Dr. Ewe Hong Tat (UTAR, Malaysia)</td>
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<tr>
<td>9.20 am</td>
<td>Keynote Address by Malaysian Space Agency (MYSA) Director General</td>
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<td></td>
<td>Tuan Haji Azlikamil Napiah (MYSA, Malaysia)</td>
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<td></td>
<td>Topic: Malaysian Space Science and Remote Sensing Programme – A Way Forward</td>
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<tr>
<td>9.50 am</td>
<td>Keynote Address by IEEE GRSS Distinguish Lecturer</td>
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<td>Professor Dr. B. S. Daya Sagar (ISIBC, India)</td>
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<td>Topic: Mathematical Morphology in Geoscience, Remote Sensing and Geospatial Data Science: An Overview</td>
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<td>10:20 am</td>
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### ORAL SESSION 1
(10 min Video Presentation, 5 min Q&A)
Chairperson: Ir. Dr. Chan Yee Kit

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<td>10.25 am</td>
<td>Session Briefing</td>
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| 10.30 am   | **Paper 1 (Invited Paper):**
             | High-Performance Computing-based Independent Data Structure using 
             | CUDA Refactoring for Fluvial Flood Estimation |
             | Chin-Pin Ko, Praveen Kumar Chittem, Chiang-An Hsu, Min-Yu Huang, and 
             | Yang-Lang Chang (NTUT, Taiwan) |
| 10.45 am   | **Paper 2:**
             | Evaluation of the Vulnerabilities of Unmanned Aerial Vehicles (UAVs) to 
             | Global Positioning System (GPS) Jamming and Spoofing |
             | Dinesh Sathyamoorthy (STRIDE, Malaysia) |
| 11.00 am   | **Paper 3:**
             | Far Field Earthquake Epicenter Location Estimation Using GPS Derived 
             | Seismic Signals |
             | Ahmad Zuri Shaameri, Wan Anom Wan Aris, Shahidatul Sadiah Abdul Manan 
             | and Tajul Ariffin Musa (UTM, Malaysia) |
| 11.15 am   | **Paper 4:**
             | GNSS Interference Environment in Malaysia: A case study |
             | Ooi Wei Han, Shahrizal Ide Moslin and Wan Aminullah Wan Abdul Aziz 
             | (MYSA, Malaysia) |
| 11.30 am   | End of Oral Session 1, 5 min break |
## ORAL SESSION 2
### (10 min Video Presentation, 5 min Q&A)

Chairperson: Dr. Nurul Hazrina Idris

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<td>11.35 am</td>
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<td><strong>Paper 5:</strong> Validation of Waveform Retracking Analyses with Fuzzy Logic on Altimetry Satellite Data: A Case Study in Halmahera Sea, Indonesia</td>
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<td>11.40 am</td>
<td>Maya Eria Sinurat, Bisman Nababan, Jonson Lumban-Gaol, Henry Munandar Manik, Nurul Hazrina Idris and Rizki Dimas Permana (IPB University, Indonesia)</td>
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<tr>
<td>11.55 am</td>
<td><strong>Paper 6:</strong> Cravings: An Open Source Web GIS Application for Multi Attribute Decision Making</td>
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<td>Qudsia Gulzar, Burhan Khalid and Muhammad Hamid Chaudhry (Punjab University, Pakistan)</td>
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<tr>
<td>12.10 pm</td>
<td><strong>Paper 7:</strong> Towards the Development of Bloom Index specific for the Estimation and Identification of Phytoplankton Biomass in Manila Bay, Philippines</td>
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<td>Edgardo Gubatanga and Ariel Blanco (University of the Philippines, Philippines)</td>
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<td>12.25 pm</td>
<td><strong>Paper 8:</strong> Application of eMODIS Time Series NDVI Data in Mapping the Vegetations’ Annual Net Primary Production Distribution of an Semiarid Environment</td>
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<td>Kuok Choy Lam (UKM, Malaysia)</td>
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<td>12.40 pm</td>
<td>End of Oral Session 2, 5 min break</td>
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# ORAL SESSION 3  
**10 min Video Presentation, 5 min Q&A**  
Chairperson: Prof. Gs. Dr. Kasturi Devi Kanniah

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<td>12.45 pm</td>
<td>Session Briefing</td>
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| 12.50 pm | **Paper 9:** Unhealthy Plant Detection Using RGN-Webcam Modification and Regression  
Muliady Muliady, Tien Sze Lim, Voon Chet Koo and Thomas Taufan  
(Universitas Kristen Maranatha, Indonesia; MMU, Malaysia) |
| 13.05 pm | **Paper 10:** Development of Video Data Post-Processing Technique: Generating Consumer Drone Full Motion Video (FMV) Data for Intelligence, Surveillance and Reconnaissance (ISR)  
Muhammad Akmal Asraf Mohamad Sharom, Mohd Fazuwan Ahmad Fauzi and Colonel Abd Razak Sipit (MYSA, Malaysia) |
| 13.20 pm | End of Oral Session 3, 40 min break                                    |
# ORAL SESSION 4
(10 min Video Presentation, 5 min Q&A)
Chairperson: Dr. Dinesh Sathyamoorthy

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<td>14.00 pm</td>
<td>Session Briefing</td>
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<tr>
<td>14.05 pm</td>
<td><strong>Paper 13:</strong> Application and Evolution of Airborne LiDAR Technology for Topographic Data Acquisition Practice in the Department of Survey and Mapping</td>
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<td>Hazri Hassan and Syed Ahmad Fadhli Syed Abdul Rahman (Department of Survey and Mapping Malaysia)</td>
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<tr>
<td>14.20 pm</td>
<td><strong>Paper 14:</strong> Identification of the Vulnerable Watershed for Flood Mitigation in Mullaitivu District in Sri Lanka Using Geo-Informatics Techniques</td>
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<td>Nadarajapillai Thasarathan (UKM, Malaysia)</td>
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<td>14.35 pm</td>
<td><strong>Paper 15:</strong> Advancing Landslide Risk Register Via Geospatial Metamodel Approach</td>
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<td>Mohammad Sahrul Akmal Abd Sahrin and Mohd Faisal Abdul Khanan (UTM, Malaysia)</td>
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<td>14.50 pm</td>
<td><strong>Paper 16:</strong> Geospatial Detection of Hidden Lithologies along Taiping to Ipoh Highway in Malaysia</td>
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<td>Idris Bello Yamusa, Mohd Suhaili Ismail and Abdulwaheed Tella (UTP, Malaysia)</td>
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<td>15.05 pm</td>
<td>End of Oral Session 4, 5 min break</td>
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# ORAL SESSION 5  
(10 min Video Presentation, 5 min Q&A)

**Chairperson:** Prof. Dr. Zulkiflee Abd Latif

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<td>15.10 pm</td>
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| 15.15 pm| **Paper 17:**  
Model Computation with Second-Order Radiative Transfer Equation for Snow and Ice Media using coupled Finite Element Method and Method of Moment Method  
Hamsalekha A Kumaresan, Hong Tat Ewe, Gobi Vetharatnam and Syabeela Syahali (UTAR, Malaysia) |
| 15.30 pm| **Paper 18:**  
A Study On Thickness Retrieval for Saline Ice Using a Radiative Transfer Inverse Scattering Model with Simulated Annealing  
Yu Jen Lee, Kee Choon Yeong and Hong Tat Ewe (UTAR, Malaysia) |
| 15.45 pm| **Paper 19:**  
Miniature UWB Radar for Object Detection  
Syh Ren Tan, Voon Chet Koo and Yee Kit Chan (MMU, Malaysia) |
| 16.00 pm| **Paper 20:**  
Prediction of Ambient PM10 Concentration in Malaysian Cities Using Geostatistical Analysis  
Abdulwaheed Tella and Abdul-Lateef Balogun (UTP, Malaysia) |
| 16.15 pm| End of Oral Session 5, 5 min break                                      |
## ORAL SESSION 6
(10 min Video Presentation, 5 min Q&A)
Chairperson: Dr. Mohd Nadzri Md Reba

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<td>16.20 pm</td>
<td><strong>Session Briefing</strong></td>
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| 16.25 pm| **Paper 21:** Study and Validation on Backscattering Mechanism of Oil Palm Tree with ALOS-PALSAR 2  
           Chia Ming Toh, Seng Heng Tey, Hong Tat Ewe and Gobi Vetharatnam (UTAR, Malaysia) |
| 16.40 pm| **Paper 22:** Assessment of Pine Forest Condition towards Monitoring and Early Detection of Stress through a Synergistic Use of Sentinel-1 and Sentinel-2 Imagery  
           Margaux Elijah Neri, Bernadette Anne Recto, Ariel Blanco and Roseanne Ramos (University of the Philippines, Philippines) |
| 16.55 pm| **Paper 23:** Rice Planting Area Mapping using Sentinel-SAR in Northwest Region of Malaysia  
           Kuok Choy Lam and Hui Xin Lim (UKM, Malaysia) |
| 17.10 pm| End of Oral Session 6, 15 min break                                    |
CLOSING REMARK

17.25 pm  **Closing Remark by Organising Committee Chairperson**
Dr. Zafri Baharuddin (UNITEN, Malaysia)

17.30 pm  **Announcement of BEST PAPER AWARDS**
Dr. Gobi Vetharatnam (UTAR, Malaysia), Dr. Lim Tien Sze (MMU, Malaysia)

17:45 pm  **End of Programme**
Paper Abstracts

Chin-Pin Ko, Praveen Kumar Chittem, Chiang-An Hsu, Min-Yu Huang, and Yang-Lang Chang (NTUT, Taiwan)

Motivated by the drastic effects caused by the floods towards the mankind, we try to propose a model to estimate the water flow caused by the floods even before they occur. We have used a computer package called SWFS2DUG, integrated by a two-dimensional hydrodynamic model to propagate the flooding simulation model, and to solve these equations, both explicit Runge-Kutta schemes and implicit LUSSOR/LUSGS schemes are used. This package was originally compiled using a general-purpose, high level, serial programming language called FORTRAN. As this numerical method is related to the finite difference method, it allows us to apply a parallel programming technique, named Compute Unified Device Architecture (CUDA), a High-Performance Computing (HPC) technique provided by NVIDIA Graphics Processing Unit (GPU) to speed up the computations. After examining all the modules in the whole package SWFS2DUG by profiling, it is figured that the module named iFlux is the major part of the package and consumes maximum time when compared to the other modules. We have transformed the iFlux module to another high-level language called C and later applied parallel programming. Original logic exhibits a problem called Data Dependency, which does not allow the model to be parallelized. This data dependency problem is solved by CUDA refactoring technique as it exposes the inherited parallelism of the original model. On a single GeForce-generation NVIDIA® GeForce RTX 2080 SUPER, we have obtained about 14× speedup with the output result at each time step compared to the original C code of iFlux module compiled on Intel® Core™ i7-8700, CPU @ 3.20GHZ processor.

**Paper 2: Evaluation of the Vulnerabilities of Unmanned Aerial Vehicles (UAVs) to Global Positioning System (GPS) Jamming and Spoofing**
Dinesh Sathyamoorthy (STRIDE, Malaysia)

This study is aimed at evaluating the vulnerabilities of unmanned aerial vehicles (UAVs) to Global Positioning System (GPS) jamming and spoofing. It is conducted for two commercial UAVs: Osman X28 (UAV A) and CSJ S167 (UAV B). The results obtained demonstrate that UAVs are susceptible to GPS jamming and spoofing even at relatively low power levels of interference / spoofing signals. Given the increasing proliferation of UAVs in various applications, attention should be given to addressing the security vulnerabilities of UAVs.
Paper Abstracts

Paper 3: Far Field Earthquake Epicenter Location Estimation Using GPS Derived Seismic Signals
Ahmad Zuri Shaameri, Wan Anom Wan Aris, Shahidatul Sadiah Abdul Manan and Tajul Ariffin Musa (UTM, Malaysia)

Estimating an earthquake epicenter and its magnitude will assist governments to develop geo-hazard maps and plan for future infrastructure development in areas that are susceptible to intense seismic activities. Traditionally, seismometers are the primary instrument for measuring seismic waves suitable for this purpose. GPS technology could provide an alternative means due to its availability and lower acquisition cost. Conversion from positional data into time series allows GPS derived seismic signals to be analyzed the same way as signals acquired from seismometers. Despite its advantages, the analysis of GPS derived seismic signals using time-frequency analysis has shown that only the surface wave is present and the not body waves specifically in a far field situation where the epicenter is of significant distance from the receiving station (beyond 300 km). Thus, it is not possible to estimate by triangulation the epicenter location from multiple spatially located GPS continuously operating receiving station (CORS).

The inability to represent the body waves in a GPS derived seismic signal can be attributed by its low intensity compare to the surface wave. Also, the practice of installing GPS CORS high above the ground for quality satellite signal results in reduced sensitivity to pick up weak seismic signals. Thus, an alternative method based on multilateration has to be adopted using the surface wave which is available at a reasonable magnitude. Unlike using the time-difference between the P-wave and S-wave of the body wave, multilateration utilizes the time difference of arrival (TDOA) of the surface wave measured from multiple spatially located GPS CORS. For this study, the 2004 Sumatran Andaman earthquake is utilized using data sampled at every one second from GPS CORS located in Langkawi, Pangkor, Ipoh and Melaka. The signal quality based on signal to noise ratio (SNR) is reasonable at about 15 dB. Comparison with the epicenter location obtained from the United States Geological Survey (USGS) has shown that the error is 0.0572 degrees in latitude (6.3 km) and 0.2848 degrees in longitude (31.3 km). The result obtained is comparable to recent work by Lin and Chang for near field earthquakes within Taiwan. Further improvement can be achieved through averaging using other GPS CORS located within Peninsular Malaysia. Reliability of multilateration for epicenter location estimation can be substantiated using GPS derived seismic signals from other major far field earthquakes within the South East Asia region such as the 2012 Northern Sumatra and the 2018 Lombok earthquakes.
Paper Abstracts

Paper 4: GNSS Interference Environment in Malaysia: A case study
Ooi Wei Han, Shahrizal Ide Moslin and Wan Aminullah Wan Abdul Aziz (MYSA, Malaysia)

Global Navigation Satellite Systems or GNSS is a space technology that has become an essential element nowadays for positioning, navigation & timing (PNT) with wide range of applications in many civilian sectors as well as across military. The reliability, accuracy and availability of GNSS are highly important especially for critical and precise positioning applications. However, the signals from space are weak and it can be easily blocked, interrupted or compromised by several threats including intentional and unintentional interferences or jamming. GPS jammer is widely available off the shelf with an affordable price and capable of interfering the GPS signal, and many authorities worldwide have risen up concerns and a lot of efforts and research have been put in place to mitigate the threats. In Malaysia, understanding and countering threats to GNSS/GPS based applications will be a new and unfamiliar discipline for public and organizations. This study intended to provide an analysis of the GNSS interferences environment in a local study area, in terms of interference type and numbers, pattern of activity that were detected. A prototype system called DETECTOR which originally developed by collaborator has been used in this study. The result showed that significant interference events happened in the study area and some of the high power interferences may impact GNSS tracking and precision of the positioning output. The role objective of having this done is to create a public awareness regarding the threat of GNSS interferences to the local users. The content also includes the proposed initiative on overcoming the issue.

Paper 5: Validation of Waveform Retracking Analyses with Fuzzy Logic on Altimetry Satellite Data: A Case Study in Halmahera Sea, Indonesia
Maya Eria Sinurat, Bisman Nababan, Jonson Lumban-Gaol, Henry Munandar Manik, Nurul Hazrina Idris and Rizki Dimas Permana (IPB University, Indonesia)

This paper presents the validation of waveform retracking analyses with Fuzzy Logic that was previously developed to optimize the sea surface height (SSHs) estimation especially in coastal areas. The fuzzy logic system was applied and validated over the complex ocean at Halmahera Sea, Indonesia, where altimetry waveforms were varies depending on water conditions. Validation was performed by comparing the waveform retracking result of Jason-3 data with in-situ tide gauge data. The validation results showed that the retracking with Fuzzy Logic have the value of correlations exceeding 0.75, and Root Mean Square Error (RMSE) smaller than 22 cm at a distance of 0-20 km from the land. Retracking with Fuzzy Logic consistently produces best correlation (up to 0.87) and best RMSE (up to 16 cm) than various single retracker. The results demonstrate that retracking with Fuzzy logic could have potential to be applied to complex oceans elsewhere.
Human beings are endeavoring to make decisions, set criteria and evaluate alternatives. All such activities also involve mental maps as well. With increasing access to smart devices, information technology and computing has formalized this routine of humans. What to eat and where to eat is a routine planning matter nowadays. This research is formalizing such routine planning matter into multi attribute decision model incorporating user specified criteria to make a choice among available alternatives. This application developed as a web page in order to be more responsive to multiple devices. This model uses open source data and tools to have a speedy processing. The entire processing involves JavaScript, Html, PHP and CSS languages, Apache server, MySQL database, AHP technique, Google Map Api and Arc Map functionalities. The output includes maps with three selected food outlets ranked as per their weight, specification of shortest and alternative roots to those food outlets with current traffic situations. Up to best of our Knowledge, this is one of the first web GIS based decision model for making a choice of alternatives by incorporating user preferences. Although it is being developed for Lahore, but it can be customized for any part of the world.
Paper Abstracts

Paper 7: Towards the Development of Bloom Index specific for the Estimation and Identification of Phytoplankton Biomass in Manila Bay, Philippines
Edgardo Gubatanga and Ariel Blanco (University of the Philippines, Philippines)

The Manila Bay is at risk of algal blooms due to large amounts of phytoplankton biomass present in the water. Run-offs from the watershed deliver nutrients such as nitrate to Manila Bay and may trigger eutrophication. Aside from the existing phytoplankton species, shipping activities within the bay may introduce foreign phytoplankton species due to ballast water exchange in ships. Eutrophication and the presence of diverse phytoplankton species in the bay may trigger algal blooms that could be detrimental to the fishing activities in the area and to the welfare of the adjacent communities. Various research indicate that different species of diatoms dominate the phytoplankton biomass in Manila Bay. However, harmful algal blooms occurring from 1988 to 1998 are attributed to Pyrodinium bahamense var. compressum, a dinoflagellate. Succeeding algal blooms are later attributed to other dinoflagellate species such as Nocticula scintillans and Alexandrium minitum. Therefore, there is a need to quantify and discriminate various phytoplankton types present in Manila Bay to provide an effective risk assessment on algal blooms. Remote sensing can be utilized as an efficient monitoring tool for estimating the quantity of the phytoplankton biomass and identifying various phytoplankton species comprising it. MODIS images have been widely used for this purpose while Sentinel-3 hyperspectral images are seen to have potential to further improve algal bloom monitoring. The existing spectral slope ratio approach, which utilizes 4 reflectance bands from MODIS-Aqua images to compute for the bloom index, is initially applied to Manila Bay for March 2020 when there is an observed algal bloom along the coastline. A threshold of 0.3 for the bloom index is used to discriminate diatoms from dinoflagellates. The computed bloom indices for Manila Bay are below 0.3 which indicates that the March 2020 algal bloom is caused by dinoflagellates. This is consistent with the research papers attributing algal blooms in Manila Bay to dinoflagellates. This implies that spectral slope ratio approach can be a good template for the bloom index algorithm specific to Manila Bay. Incoming in-situ measurements paired with utilization of Sentinel-3 images will be incorporated to help develop bloom index capable of detecting potential algal blooms in Manila Bay.
Paper Abstracts

Paper 8: Application of eMODIS Time Series NDVI Data in Mapping the Vegetations’ Annual Net Primary Production Distribution of an Semiarid Environment
Kuok Choy Lam (UKM, Malaysia)

This study seeks to develop predictive vegetation species distribution modeling using bioclimatic and remote sensing predictors. Two spatial predictor sets were developed using rainfall and remotely sensed variables to map the distribution of semiarid vegetation species in the Jornada basin. A set of generalized simple linear regression model data was created to model the annual ANPP-rainfall relationship and applied to the spatially interpolated rainfall of various years to model the temporal and spatial distribution of the main vegetation species. Remote sensing approach was used to estimate the biomass production by using Normalised Different Vegetation Index (NDVI) as surrogates of annual net primary productivity (ANPP). The NDVI approach was successful in mapping the vegetation species within the Jornada basin and was used as validation for the Rainfall-ANPP predicted ANPP distribution. A simple regression analysis of the predicted ANPP production results from the Rainfall-ANPP model showed no significant relationship compared to the NDVI-ANPP predicted results for all three vegetation species over the study period. In most years, the Rainfall-ANPP model under-predicts the biomass production for all species, whereas the NDVI-ANPP estimates were relatively close for blackgrama and creosote, but over estimate the production in mesquite. Compared to the field plot data, the performance of the NDVI-ANPP model was better than the Rainfall-ANPP model. When compared to the annual rainfall, the ANPP was found to have weak correlation for the entire study period. The weak relationship could be attributed to the time lag effects of the plant response to rainfall. These results seem to suggest that the accuracy of the Rainfall-ANPP and NDVI-ANPP model were species- and location-depandant. Given the considerable variation in estimates of ANPP among the two ANPP estimation models and vegetation species, it is difficult to assess the absolute accuracy of the ANPP production estimates at this time. Result of this study has also highlighted one important aspect of the response of ANPP to inter-annual rainfall fluctuations where time lags affect ANPP production considerably.

Paper 9: Unhealthy Plant Detection Using RGN-Webcam Modification and Regression
Muliady Muliady, Tien Sze Lim, Voon Chet Koo and Thomas Taufan (Universitas Kristen Maranatha, Indonesia; MMU, Malaysia)

An early detection of an unhealthy condition of a plant will be very helpful for farmers to allocate and take a needed action to save their plants. One of the vegetation indices that primarily use to analyze the plant's condition is Normalized Difference Vegetation Index (NDVI). This value is calculated from the data of a multispectral image. The expensive price of a multispectral camera makes it unaffordable for the farmers in the middle-low income countries. The objective of this research is to modify a webcam that is more affordable than a multispectral camera into a Red Green Near Infrared (RGN) camera and provide an algorithm to calculate the NDVI value. After modifying a Logitech C920 webcam by replacing the IR cut off filter with a red filter, the work is continued with mapping the NDVI value based on MAPIR SURVEY3 OCN camera using sets of data obtained from several plants. The regression polynomial shows a nonlinear relation between these two types of cameras with the coefficient of determination value 0.99. The system was tested with 23 sets of data testing and gives the root mean square error of 7.11% for NDVI value between 0-0.4. The problem is the lag of images with NDVI value greater than 0.4. The modify webcam only can response to NDVI value less than 0.4. Further work is needed to evaluate the modification method or appropriate filter is used in this research.
Paper Abstracts

Paper 10: Development of Video Data Post-Processing Technique: Generating Consumer Drone Full Motion Video (FMV) Data for Intelligence, Surveillance and Reconnaissance (ISR)
Muhammad Akmal Asraf Mohamad Sharom, Mohd Fazuwan Ahmad Fauzi, Colonel Abd Razak Sipit and Mohamad Zulkhaibri Mat Azmi (MYSA, Malaysia)

FMV is a digital video data format where the spatial information are embedded in the video file and fully compatible to be exploit in standard GIS environment. FMV also known as ‘georeferenced video’ which is initially one of the military technology. However, it has started to be used in commercial drone systems nowadays. Typically, in order to generate video data in FMV format, a drone system needs to have high-end technical specification in hardware and software programming capabilities. Therefore, only high-end industrial and expensive drone systems can be equipped with FMV technology. Through FMV capabilities, video data can be directly integrate and analyse with other spatial data such as digital cartographic maps, remote sensing satellite images and other GIS layers. The FMV adds a fourth dimension to imagery analysis where the video footprint can view directly on top of maps to provides excellent event fidelity, seamless event progression and a full context regarding the nature of the location and activities being viewed on the earth surface. Therefore, the rough estimate of length, area and coordinate of the target can be directly extract from the FMV data. In addition, target charting process as regularly performed on a normal 2D map also can be done on the FMV data which later on it can be shared and utilise by the third parties. Apparently, FMV has many advantages and privileges, especially in providing critical information which can not be obtained from other sources. This is the reason why FMV has become a game changer in the world of tactical information nowadays. Therefore, this study aims to research and develop a scientific methods to allow capabilities of FMV technology can be applied into standard video data format which is captures using consumer drone systems. Consumer drones are the most extensively used drone system nowadays by the private sector, research institutions and even government bodies due to their competitive pricing and easy to operate. At the end of the study, a post-processing technique to generate FMV data for standard video data format captured using DJI Mavic 2 Enterprise system has been successfully developed and tested in ISR applications.

Paper 13: Application and Evolution of Airborne LiDAR Technology for Topographic Data Acquisition Practice in the Department of Survey and Mapping Malaysia
Hazri Hassan and Syed Ahmad Fadhli Syed Abdul Rahman (Department of Survey and Mapping Malaysia, Malaysia)

The mapping industry is one of the areas that is always given attention to balance the rapid development of current technology. The application of Light Detection and Ranging (LiDAR) technology in the mapping industry opens up a wide dimension of discussion involving industry users as well as academics. LiDAR technology is now a common method for faster and higher quality topographic data collection than conventional topographic data collection methods. Observation data that is generally in the form of high-density point (point cloud) can also be applied in various uses, especially in the field of mapping and terrain analysis. Therefore, this paper will discuss related LiDAR technology including basic information or principles of LiDAR technology, the latest developments of LiDAR methods and work processes involved from the point of view of the Department of Survey and Mapping Malaysia (JUPEM).
Paper Abstracts

Nadarajapillai Thasarathan, Lam Kuok Choy, Kadaruddin Bin Aiyub (UKM, Malaysia)

Flooding is the most common hazard in Sri Lanka. Due to the excessive rainfall within a short period of time which resulting large volume of surface runoff and increases the flood. Flood which causes to damage to both life and property. Mullaitivu is one of the coastal districts in Sri Lanka and it receives heavy rainfall in the North–East monsoon period, which causes to the highest flood. This study discloses that the absence of research studies carried out related to the identification of the vulnerable watershed based on geo-informatics techniques for mitigation activities. Therefore, two specific objectives were carried out as follows: delineation of the inlet and watershed boundaries of Mullaitivu district that require for better flood mitigation activities and identifying the most vulnerable watershed basin based on the 2011, 2016 and 2019 flood incidents. This study was based on the primary and secondary data. Land use and land cover data have collected from the Department of Survey and flood inundation maps for 2011, 2016 and 2019 which were collected from Disaster Management Centre (DMC), Mullaitivu. Further, for better elevation data, DEM of PALSAR of ALOS has been downloaded from the website. After delineated the watersheds the flood inundation maps were overlaid to identify the most vulnerable watershed for the future flood mitigation activities. Based on the above methods Per Aru and Churiyan Aru basins which are considered the vulnerable watersheds further, the following watersheds also have been identified as critical basins: Kodalikallu Aru, Mandaikal Aru, and Akkarayan Aru. The continuous study of watershed modeling will be more prefer to develop a better flood mitigation based on the geo-informatics techniques in future to Mullaitivu District.

Paper 15: Advancing Landslide Risk Register Via Geospatial Metamodel Approach
Mohammad Sahrul Akmal Abd Sahrin and Mohd Faisal Abdul Khanan (UTM, Malaysia)

Malaysia indicates high risk high exposure however low vulnerability to natural disasters according to United Nations (UN) World Risk Index 2019. This is due to its location within the edge of Pacific Ring of Fire which is generally considered safe from any seismic disaster and volcanic activity. Alas, large scale landslide still occurs mostly during monsoon season. Landslide disaster in Malaysia are managed by Public Work Department (JKR) and Department of Mineral and Geoscience (JMG) where each entity has their own landslide disaster management practice such as National Slope Master Plan (NSMP 2009 – 2023) and National Geospatial Terrain and Slope Information System (NaTSIS) respectively. Therefore, National Agency of Disaster Management Malaysia (NADMA) is responsible for coordinating those different practices by ensuring the entire standard operating procedure (SOP) is implemented. With due respect, however, some issues for instance weak documentation, decentralization of standard of procedure (SOP) and data availability still happens. This paper highlights the implementation review of current landslide risk register with focus given on the geospatial metamodel approach. Initially, preliminary studies are conducted to identify the current practice of landslide disaster management in Malaysia. This includes the collection of geospatial data such as LiDAR, aerial photography, existing landslide inventory map, and the SOP for landslide preparedness practice. Risk register is an active document that list down all identified hazards in the region and decision taken to monitor and manage them. Geospatial metamodel consist of concept and relation that describes the domain with additional of geospatial element. To conclude, risk register by using geospatial metamodel approach facilitates NADMA in monitoring and coordinate the landslide disaster management process in effective way.
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Paper 16: Geospatial Detection of Hidden Lithologies along Taiping to Ipoh Highway in Malaysia
Idris Bello Yamusa, Mohd Suhaili Ismail and Abdulwaheed Tella (UTP, Malaysia)

The highway which is an important link to major cities is prone to different geological hazards. The first step to tackling this problem is to identify the type of lithologies underneath the bedrock of the region. Although detecting lithologies in a tropical rainforest area such as Malaysia may be tasking and intricate due to inaccessibility to some areas. However, the application of remote sensing to lithological and structural mapping has made it easy and less expensive compare to the conventional method. Thus, band rationing was performed on the surface reflectance band of Landsat 8 OLI in the GIS environment. Four different band ratios were generated in the ENVI 5.3 software, while the composite bands were generated in ArcGIS 10.7. The band ratios considered for this study are 6/5 7/6 4/7, 5/4 6/5 7/6, 6/7 4/2 5/4, 6/5 6/7 4/2. The band ratios 4/2 is used to map iron oxides due to its absorption capability in the blue region and high reflectance capability in the red region. The band ratio 6/7 is used for the lithological mapping of clay minerals and kaolinite, due to the high and low reflectance in band 6 and 7 respectively. While band ration 5/4 is used for Alteration minerals, and ratio 6/5 is suitable for ferrous minerals. The generated outcome shows that the granitic region showed vividly, the metasediments and limestones region were also well discriminated within the nooks of the study area. A new up-to-date lithologic map of the Taiping to Ipoh area is proposed based on the interpretation of image results and field verification work. It is concluded that the proposed methods have great potential for lithological mapping of tropical regions. Thus, this technique is recommended for mapping different types of granitic rocks which is the most abundant rock underlying the study area along the highway.

Paper 17: Model Computation with Second-Order Radiative Transfer Equation for Snow and Ice Media using coupled Finite Element Method and Method of Moment Method
Hamsalekha A Kumaresan, Hong Tat Ewe, Gobi Vetharatnam and Syabeela Syahali (UTAR, Malaysia)

Active microwave remote sensing is essential to monitor the conditions of the environment by analysing the microwave returns from the earth terrain. Various Computational Electromagnetics (CEM) techniques are implemented to study the backscattering coefficient of numerous earth terrains such as vegetation and snow ice medium. In this paper, a theoretical model on second order radiative transfer equation is investigated by incorporating the scattering calculation from FEKO software for five arbitrary shapes of scatterers representing the ice particles in the snow ice medium. These mentioned shapes are cylinder, peanut, droxtal, hexagonal column and ellipsoid. The numerical solution for scattering calculation of scatterers that is applied in this computation is Finite Element Method (FEM) coupled with Method of Moment (MoM) and it is used to investigate the effect of various incident angles, frequencies, volume fraction and layer thickness on the backscattering mechanism. These results are compared with analytical solution and ground truth measurement to analyse the validation of the model.
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Paper 18: A Study On Thickness Retrieval for Saline Ice Using a Radiative Transfer Inverse Scattering Model with Simulated Annealing
Yu Jen Lee, Kee Choon Yeong and Hong Tat Ewe (UTAR, Malaysia)

In this paper, the work done for a modified sea ice inverse scattering model, the Radiative Transfer Inverse Scattering Model with Simulated Annealing (RTISM-SA) is presented. The study utilizes data measured and reported during the CRRELEX’93 experiments to verify the performance from the inverse model. The results for the retrieval of saline ice thickness using both single and multi-polarization radar backscatter data shall be discussed. The results show that retrieval of sea ice thickness using the inverse model is possible and that the use of multi-polarization data improves the accuracy.

Paper 19: Miniature UWB Radar for Object Detection
Syh Ren Tan, Voon Chet Koo and Yee Kit Chan (MMU, Malaysia)

In this paper, we present a design of miniature ultra wideband (UWB) radar for object detection purpose. With an UWB impulse radar transceiver system on chip (SoC) as its core along side with other essential functional blocks such as low noise amplifier (LNA), antennas, microcontroller and personal computer (PC), a fully functional miniature UWB radar was developed. The design and development of the miniature UWB radar from software and hardware aspects are described.

Paper 20: Prediction of Ambient PM10 Concentration in Malaysian Cities Using Geostatistical Analysis
Abdulwaheed Tella and Abdul-Lateef Balogun (UTP, Malaysia)

The recent global urbanization and industrialization have brought the atmosphere to a poor state thereby affecting human health and the environment. Malaysia is one of the southeastern Asian countries seriously battling with air pollution. It is noteworthy that some measure has been taken to monitor the air pollutants’ level. However, there are limited monitoring stations to cater to all the areas in the country thereby leaving some areas unmeasured and unmonitored. Spatial interpolation is an essential model to capture some regions that are unmanned for a better mitigation strategy towards the reduction of air pollution in urban cities. PM10, a major air pollutant in Malaysia is used to predict and indicate the air pollutants for some locations that are unmeasured. Spatial interpolation models, a geostatistical analysis, such as ordinary kriging, universal kriging, and inverse distance weighting is used to predict and assess the distribution of PM10 to other regions for better exposure assessment and mitigation measures.
Remote sensing in oil palm plantations has garnered much interest over recent years especially in the context of both airborne and space-borne synthetic aperture radar (SAR) sensor platforms. This paper aims to understand the mechanism of microwave backscattering involving an oil palm tree in L band operating frequency. This was done with the use of a scattering model based radiative transfer (RT) theory modified for oil palm tree. 2 sets of ground truth data collected in different years (2017 and 2019) were used in this study so we can validate the findings via cross-referencing. The ground truth data were obtained via in-situ measurements in the oil palm fields which are also used as input parameters for the RT model. Backscattering coefficient of the oil palm tree is then simulated with the RT model and then compared to the averaged backscattering coefficient obtained from satellite images of ALOS-PALSAR 2. It was found that there was a good agreement between simulated results and measured data of both years. Likewise, both sets of data observed a similar trend with respect to the increasing age of oil palm trees. This is further validated by the breakdown of backscatter contribution by various components of the oil palm tree where both sets of results managed to achieve good coherence.
Paper 22: Assessment of Pine Forest Condition towards Monitoring and Early Detection of Stress through a Synergistic Use of Sentinel-1 and Sentinel-2 Imagery
Margaux Elijah Neri, Bernadette Anne Recto, Ariel Blanco and Roseanne Ramos (University of the Philippines, Philippines)

An integrated use of Sentinel-1 Synthetic Aperture Radar (SAR) and Sentinel-2 multispectral imagery is implemented in this study for the assessment of pine forest condition in Camp John Hay, Baguio City, Philippines. These assessments include: (1) the inspection of distribution of dead trees, (2) trends analysis of Sentinel-derived products, and (3) the generation of anomaly maps. Dead trees were identified using Google Earth Pro imagery— the trees were classified as such if they manifest brown or gray foliage with evident foliage loss. The products used for succeeding analyses are Sigma VH and Sigma VV backscatter derived from Sentinel-1, Sentinel-2 bands 2, 3, 4, 5, 6, 7, 8, 8a, 11, and 12, as well as Sentinel-2 derived vegetation indices S2REP (Sentinel-2 Red-Edge Position Index), NDWI (Normalized Difference Water Index), NDVI (Normalized Difference Vegetation Index), NDII (Normalized Difference Infrared Index), MSI (Moisture Stress Index), IRECI (Inverted Red-Edge Chlorophyll Index), GNDVI (Green Normalized Difference Water Index), and EVI (Enhanced Vegetation Index). Trends in these products were backtracked to identify patterns they exhibit in the dying phase of trees, and to determine which are most robust for early detection of stress in pine trees. From the analysis of slope decline against time, and their corresponding R-squared statistic, Sentinel-2 products found to be robust for early stress detection are band 5, followed simultaneously by GNDVI, NDII, MSI, and bands 2, 3, and 4, then NDVI. A synergistic analysis of Sentinel-1 and Sentinel-2 products showed that NDVI is well-correlated with VV backscatter; hence, they exhibit concurrent decline in trends due to stress. Among Sentinel-1 products, a delayed decline in VH backscatter occurs compared with VV backscatter. These patterns are manifested in three-month intervals. A map of at-risk and stable forest areas was generated from the overall average of negative and positive anomalies of vegetation indices. Of the dead trees, 58.77% were in the vicinity of at-risk areas while 32.02% were in stable areas. The relative reliability of the map of at-risk vegetation areas was computed based on the count of layer values with valid data per cell, resulting in a maximum relative reliability of 65.78%. This study shows that the integration of Sentinel-1 SAR and Sentinel-2 multispectral imagery is a promising approach in the comprehensive assessment of pine forest condition towards the monitoring and early detection of stress.
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**Paper 23: Rice Planting Area Mapping using Sentinel-SAR in Northwest Region of Malaysia**

Kuok Choy Lam and Hui Xin Lim (UKM, Malaysia)

Rice is the most important agriculture crops in the world, especially in developing countries. Accurate rice mapping and monitoring is a prerequisite for the crop management and food security. Therefore, there is a need to use appropriate remote sensing data for mapping the paddy area and predict crop yield. Malaysia is a tropical country with a lot of cloud cover during the raining season, therefore the Synthetic Aperture Radar (SAR) is used in this study. Sentinel-1 SAR works in all weather conditions and with higher spatial resolution and temporal resolution compared to other microwave sensors. The purpose of this study is to map rice planting areas using SAR data in Kedah, Malaysia. The methodology of this study used basic processing techniques on Sentinel-1A data using ESA SNAP software. Sentinel-1A data acquired on 1 November 2019 and 12 January 2020 were used to demonstrate the results of Sentinel-1A polarization. Backscattering values is low for VV and VH polarization during the transplanting stage, while backscattering values for VV and VH polarization increases at peak vegetation stage. VV polarization shows higher temporal backscattering value than VH polarization in both time period. VH polarization was the better discriminating rice crop from others land cover. Comparison between the four type of band math data, polarization VH-VV shows the optimal result in estimating the rice crop area and others land cover. The accuracy assessment test using high resolution Google Earth image showed that the overall accuracy Sentinel-1A was 92% with a kappa coefficient of 0.83. Compared with the Sentinel-2A data, Sentinel-1A data shows the better results in mapping paddy and non-paddy area. Therefore, Sentinel-1 SAR data is particularly useful in monitoring paddy and non paddy area in Kedah. In conclusion, SAR data have potential in identifying agriculture crops, in particular the rice crop and suitable to use in tropical area such as in Malaysia.
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