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Front Cover – Autumn composition of Landsat images (Australia, Mongolia, United States).

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Editorial

Dear members,

This issue starts with a report on the 35th EARSeL Symposium and the accompanying events, the 2nd EARSeL International Workshop on Temporal Analysis of Satellite Images and the 7th EARSeL Workshop on Remote Sensing of the Coastal Zone which took place in Stockholm last June in the framework of the 35th EARSeL Symposium.

A call for abstract submission for the 36th EARSeL Symposium and 39th General Assembly which will take place in Bonn, Germany on 20 – 24 June 2016 features in the 'News from EARSeL' section.

We extend a warm welcome to the new member registered with EARSeL and we are looking forward to its active participation and contribution to EARSeL. A report on its research activities is also included.

The 'News from other Organisations' section includes a report for the forthcoming conference 'The Capturing Reality Forum Reveals Cutting Edge Conference Programme' which will take place on 23 - 25 November 2015 in Salzburg, Austria.

The Science Article rubric hosts a 35th Symposium Proceedings Reprint about Sentinel data for Urban Ecosystem mapping, written by Jan Haas and Yifang Ban.

The EARSeL eProceedings feature a wealth of new remote sensing research publications, while book releases include two highly respected remote sensing books.

A series of EARSeL SIG events is underway including the 10th EARSeL SIG Forest Fire Workshop in Cyprus, the 5th EARSeL SIG ReSeArCH Workshop in Frascati, the 36th EARSeL Symposium and 39th General Assembly that will be held in Bonn, Germany, the EARSeL: Imaging Spectroscopy in environmental analyses in Prague, Czech Republic, the 2nd Student Workshop on Ecology and Optics of Coastal Zones in Kaliningrad, Russian Federation, the 3rd EARSeL SIG Forestry Workshop in Krakow, Poland and later in 2017 the 10th EARSeL Workshop on Imaging Spectroscopy in Zurich.

A list of conferences, training courses and summer schools to attend in the near future appear towards the end of the Newsletter.

Looking forward to receiving your feedback and your contributions to the EARSeL Newsletter.

Enjoy reading the 103rd issue.

The Editors

News from EARSeL

Report on the 35th EARSeL Symposium 15-18 June 2015, Stockholm, Sweden

Yifang Ban and Jan Haas
KTH Royal Institute of Technology, Stockholm, Sweden

The 35th symposium of the European Association of Remote Sensing Laboratories (EARSeL2015), accompanied by the 2nd International Workshops on Temporal Analysis of Satellite Images and the 7th EARSeL Workshop on Remote Sensing of the Coastal Zone were successfully held at KTH Royal Institute of Technology in Stockholm, Sweden during 15-18 June 2015. The symposium's overarching focus was placed on the contribution of remote sensing for sustainable development in light of progress, challenges and opportunities in Europe and the world. The symposium and workshops brought together over 230 participants from more than 40 countries highlighting its international significance. In total, 167 participants joined the symposium with 127 contributions including 97 oral presentations and 30 posters distributed over the following thematic sessions:

Urban Remote Sensing -1 & -2
Thermal Infrared Remote Sensing -1 & -2
3D Remote Sensing
Disaster Management
Vegetation and Vegetation Dynamics
Image Processing: Optical Data
Multitemporal Analysis and Change Detection
UAVs & Airborne Hyperspectral Remote Sensing
Hyperspectral Remote Sensing and New Instruments
Poster Session
Forestry Remote Sensing -1 & -2
Agriculture Remote Sensing
Cultural Heritage and Education
Land Cover and Validation
Oceans, Coastal Zones & Inland Waters
LiDAR & RADAR Data Processing

The symposium had five plenary sessions with nine excellent keynote speakers covering topics from new satellite missions to challenges and opportunities in change detection, from international initiatives such as GEO and Future Earth to the Swedish Earth Observation Activities and the Swedish Forest Remote Sensing. A joint plenary session between the Symposium and the Temporal Analysis workshop was on Multitemporal Analysis of Vegetation Dynamics in sensitive regions such as Africa and the Arctic.

The symposium covered a broad variety of remote sensing domains including technological advances such as the development of new sensors and algorithms as well as the use of remotely sensed data in various applications in many parts of the world. Most contributions were submitted to the categories of "Change Detection", "Image processing, analysis and classification", "Multitemporal analyses", and "Land use & land cover". This expresses the Symposium's focus on the monitoring of our surrounding environment and finding solutions to questions of how we can address the challenges of a changing world with remote sensing.

Two journal special issues will be devoted to publish high quality papers from the symposium and the workshops. One is International Journal of Remote Sensing - Special issue on "European Remote Sensing: Progress, Challenges and Opportunities', and the other is IEEE Journal of Selected Topics in

Applied Earth Observations and Remote Sensing (JSTARS) - Special issue on "Analysis of Multitemporal Data and Applications".

Below is a brief summary of the sessions.

Urban Remote Sensing

The increasing importance of urban remote sensing is illustrated by the number of contributions to two urban sessions. SAR and optical image fusion and the use of ESA's new Sentinel data as well as very high resolution data were presented. New and improved algorithms for urban land cover mapping were discussed that follow the trend of object-based image analysis techniques. Urban applications in various scales were also presented from extraction of global human settlements to analysis of local urban development trends and environmental impact in terms of ecosystem services.

Forestry Remote Sensing

Forests play a crucial role in global climate studies and are an integral part of economy. As 70% of Sweden is covered by forest, an overview of forestry remote sensing in Sweden was presented at a plenary session. Symposium contributions covered a variety of topics including the assessment of carbon stock changes, the estimation of vertical canopy cover with dense point cloud data from matching of digital aerial photos, the retrieval of biomass and burnt biomass, the assimilation of remote sensing data with forest growth models or the decomposition of multispectral forest signatures of satellite imageries by modelling radiative transfers based on structural data from terrestrial laser scanning. SAR data plays and increasingly important role as other contributions show, e.g. the use of TanDEM-X data for tree height growth analysis, Interferometric and Polarimetric observations of winter forests and multi-temporal pixel trajectories of SAR backscatter and coherence in tropical forests.

Thermal Infrared Remote Sensing

The contributions to the field of thermal infrared remote sensing range from general overviews that summarise the development of the field over the past decades to methodological novelties, e.g. resolution enhancements of thermal images, processing suitability, sensor comparisons, scaling experiments and band calibrations and validation. The application of thermal infrared remote sensing for mapping purposes (mineralogy) and risk assessment with societal impact is also presented e.g. the risk of spontaneous combustion in Belgium mining waste deposits.

Agriculture Remote Sensing

The presentations included the collection of agricultural statistics, the evaluation and prediction of water consumption and classification approaches that attempt to a) delineate different crops and phonological indicators using fuzzy decision trees; b) delimit agricultural parcels through agglomerative segmentation and c) map evapotranspiration without thermal information using RandomForests.

3D Remote Sensing

One part of the session was devoted to the improvement of current digital elevation and digital surface models with new data and through novel software tools. Furthermore Pleiades geometric accuracies and the application of Pleiades images for mapping purposes were discussed.

Cultural Heritage and Education

Regarding culturally valuable heritage objects, the contribution of remote sensing to mapping these sites in different complex landscapes were discussed and it is demonstrated how remotely sensed information and other geomedia can be used to facilitate education about World Heritage Sites. A large share of the session was devoted to education in schools to create an understanding of and promotion of the future use of remote sensing.

Disaster Management

Disaster management was approached in different ways, ranging from the possible solutions for disaster management as well as the analysis of particular disasters. The topics ranged from earthquakes to floods. The presented analyses rely on time series as well as a variety of different sensors.

LiDAR & RADAR Data Processing

Four out of five contributions to the session were devoted to radar data. In terms of radar, both the development of new classification methods is discussed but also the suitability of SAR data use in the cryosphere, for displacement measurements of for iceberg tracking for ship routing purposes is mentioned. In terms of LiDAR methodology, an open source ransac-based plug-in for building roof extraction from LiDAR point clouds was developed and presented.

Image Processing: Optical Data

In this session three topics were covered. The presentation of an unsupervised classification method, based on a new clustering method, the evaluation of strategies aiming for atmospheric correction and an evaluation of the utilization of Rolling Guidance Filter for pan-sharpening.

Multitemporal Analysis and Change Detection

The presentations covered multitemporal analysis methods such as New Methods for Processing of Time Series Data and change detection techniques such as multi-scale and object-based change detection as well as their applications in environmental monitoring in Appalachian Environment in the US, Kruger National Park and Gully erosion in South Africa, wildlife corridor in India and urbanization in China.

Vegetation and Vegetation Dynamics

Different applications for analysing changes as well as snapshots of the natural environment are presented, focused on the production of vegetation as well as on the condition of vegetation. A variety of indices were presented, as well as optical and radar data fusion, in order to champion the addressed issues. The study areas were located in Africa and Europe.

Land Cover and Validation

Within this session the potential of remotely sensed imagery for producing high-accuracy, high-resolution land use and land cover information was discussed. Furthermore, the validation of such land cover data was addressed.

Oceans, Coastal Zones & Inland Waters

This session focused on the information extraction from water and the derivation of river networks from optical and DEM data. The estimation of phosphorus in the Baltic Sea and the radiance coefficient spectrum were also discussed.

UAVs & Airborne Hyperspectral Remote Sensing

This session focused on the application of data acquisition utilizing unmanned aerial vehicles (UAVs). Therefore a summary of the activities in the corresponding domain are given, discussing several different algorithms for data processing as well as different sensor types which can be used with UAVs, such as hyperspectral sensors, as well as typical use cases.

Hyperspectral Remote Sensing and New Instruments

The session addressed the issue of mineral mapping, the processing of 3D data cubes and presented a joint venture program realizing micro satellites. The hyperspectral characteristics of rare earth deposits and EnGeoMap as a potential data source for minerals in Africa are presented.

In addition to the rich conference programme, the participants of the symposium and the workshops also enjoyed a variety of social events including the reception at the Stockholm City Hall and the gala dinner cruise to the Stockholm archipelago.

The KTH Organizing Team

One of the Conference Rooms

Poster Session

Reception at the Stockholm City Hall

Report on the 2nd EARSeL International Workshop on Temporal Analysis of Satellite Images 17-18 June 2015, Stockholm

The 2nd International Workshop on Temporal Analysis of Satellite Images was held at KTH Royal Institute of Technology Stockholm, Sweden from 17-18 June 2015 in conjunction with the 35th EARSeL Symposium. 108 participates from 28 countries joined the workshop with 51 presentations.

The workshop consisted of 10 sessions and focused on important topics such as multitemporal remote sensing, including Image Processing and Temporal Analysis Techniques as well as their applications in many thematic areas such as Urban, Agriculture, Forestry, Landscape and Vegetation Dynamics, Glacier, Ice Sheet and Permafrost, and Land use and Land Cover Change.

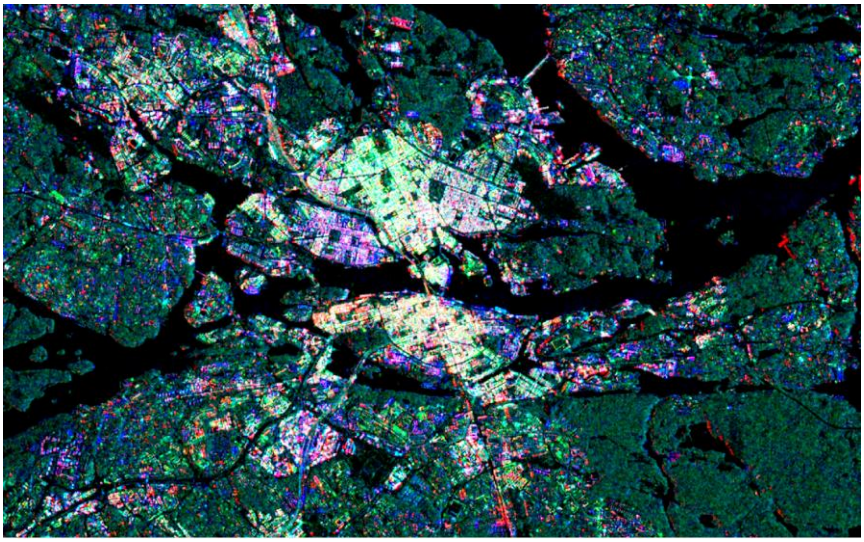
The workshop keynote was given by Prof. Lars Eklundh at Lund University on 'Multitemporal Analysis of Vegetation Dynamics in Different Climate Regions'. The joint session between the workshop and the symposium was devoted to 'Multitemporal Analysis and Change Detection', with 5 presentations. The talks covered multitemporal analysis methods such as New Methods for Processing of Time Series Data and change detection techniques such as multi-scale and object-based change detection as well as their applications in environmental monitoring in Appalachian Environment in the US, Kruger National Park and Gully erosion in South Africa, wildlife corridor in India and urbanization in China.

Session 1 focused on agricultural applications. The presentations covered a wide range of applications e.g., paddy field rice dynamics, agricultural expansion in southern Angola, drought estimation maps. Glaciers and ice sheets were the theme of session 2. Different types of optical images have been used to investigate glacier dynamics and disturbances in different study sites. Session 3 focused on the use of image processing techniques to correct different types of image's distortions. Examples include topographic correction of RapidEye images for land cover mapping, and radiometric normalization of Landsat time series for forest mapping. Session 4 focused on the use of multitemporal images in urban application. The presentations covered urban growth monitoring using different types of remote sensing data.

Session 5 focused on landscape and vegetation dynamics. The presentations covered a wide range of topics including habitat suitability, mapping of invasive saltcedar, analysis of semi-arid natural vegetation, and military training impact on vegetation degradation. Forestry applications were the focus of session 6 and the presentation topics included forest monitoring, monitoring of insect disturbance within forests, and post-war forest dynamics.

Session 7 was devoted to different types of temporal analysis techniques. Examples included temporal compositing of MODIS NDVI products, assessment of the quality of global NDVI time series extracted from PROBA-V, the use of SAR time series for ground subsidence detection, and the use time series for land use mapping. Land use and Land Cover Change was theme of session 8. The presented studies investigated land-Use and land-Cover in different areas of interest, e.g., Campos Amazônicos National Park (Brazil), Mississippi Delta (USA), Yangtze estuarine wetland (China), and Mu Us Sandy Land (China).

The poster session contained 12 posters. The presented posters covered a wide range of applications e.g., new methods for time series processing, analysis of multitemporal pixel trajectories of SAR backscatter, wet land analysis, urban dynamics and urbanization monitoring, land surface temperature retrieval, and a technique for the determination of optimal acquisition dates for satellite data for crop classification.



Multitemporal Sentinel-1A SAR Composite of Stockholm

Report on the 7th EARSeL Workshop on Remote Sensing of the Coastal Zone
17-18 June 2015, Stockholm

The 7th EARSeL Workshop on Remote Sensing of the Coastal Zone was held at the KTH Royal Institute of Technology Stockholm, Sweden from 17-18 June 2015 in the framework of the 35th EARSeL Symposium.

The workshop focused on the contribution of remote sensing to the monitoring of terrestrial and marine ecosystem status and dynamics in the coastal zone of the European Seas. The priority indicators of the ecosystem state (health) indicated by PICO (Panel for Integrated Coastal Ocean Observations), the coastal module of GOOS (Global Ocean Observing System), are:

- Surface phytoplankton biomass and subsurface oxygen fields.
- Distribution and abundance of waterborne pathogens and toxic phytoplankton.
- Spatial extent of living benthic habitats (coral reefs, sea grass beds, mangrove forests and tidal marshes) and ecological buffers to coastal flooding.
- Distribution and condition of calcareous organisms (cold and warm water corals, coccolithophorids and pteropods).
- Distribution and abundance of exploitable fish stocks.

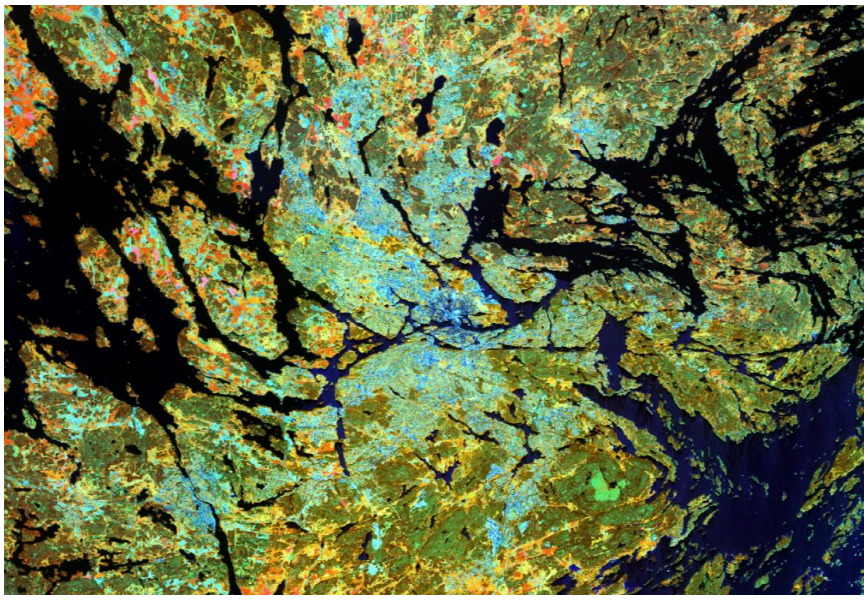
These indicators can be evaluated on the basis of “essential variables”. The list includes both ecosystem state variables such as temperature, salinity or phytoplankton biomass and external pressures such as winds, solar radiation or precipitations. Remote sensing methodologies represent a real opportunity for estimating at least some of these essential variables with increasing precision, starting from basic measured variables such as remote sensing reflectance, emitted radiation, or radar backscattering. Considering this general framework and future challenges for the coastal zone remote sensing community, the 7th Workshop has represented an ideal opportunity for discussing these themes and for planning forthcoming projects and collaborations.

The results, in terms of participants to the Workshop, were very positive: 67 people registered to the Workshop and 40 abstracts were submitted and presented in the following three scientific sessions: Baltic Sea, Land-Sea Interaction and New Technologies and in situ measurements. Considering the

location of the Workshop particular attention was paid to the remote sensing of the Baltic Sea, devoting a full day to this topic. This section was chaired by Dr. Susanne Kratzer who highlighted the role of ocean color remote sensing for monitoring important ecosystem state variables such as underwater light conditions (Secchi depth and diffuse attenuation of light), the productive status of the pelagic ecosystem (chl-a concentration), as well as the concentrations of colored dissolved and particulate matter, both indicating the terrestrial influence and presenting the Swedish operational monitoring system for the Baltic Sea.

The second session was devoted to Land-Sea Interaction. In this context, nutrient enrichment changing the structure and functioning of the marine ecosystem has been considered for the Baltic Sea using a time series of MERIS data. Other studies have presented new approaches to monitor and study lagoon environments and coastal Posidonia using Landsat 8 data with new algorithms, based on the use of MODIS and MERIS data, to estimate absorption components by phytoplankton and detrital matter in the Black Sea has been proposed. Studies on coastal sediments fluxes and morphodynamic based on total suspended matter (TSM) determination from satellite were also part of this section.

The last section of this workshop was dedicated to “new technologies and in situ measurements”. This section presented several new technological solutions based on advanced Lidar systems, both multispectral and hyperspectral, to measure a variety of environmental variables including CDOM, organic pollutants, chlorophyll-a and TSM concentrations.



SPOT Image of Stockholm

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36th EARSeL Symposium and 39th General Assembly
20 – 24 June 2016, Bonn, Germany

Dear colleagues,

We cordially invite you to participate in the **"36th EARSeL Symposium and 39th General Assembly"** to be held in **Bonn (Germany), 20 - 24 June 2016.**
The symposium will comprise Special Interest Group (SIG) sessions on Developing Countries, Urban & 3D, Geological Applications, RPAS, Cultural and Natural Heritage, Education & Training. Additionally, we especially invite the students to the EARSeL Young Scientist Days.

The **deadline** for the receipt of **abstracts** is **30 November 2015.**

Keep in mind: this time, we will offer a special registration package including full accommodation, symposium dinner, and symposium fees.

For further details, abstract submission, and registration we kindly refer to the conference website: http://www.earsel.org/symposia/2016-symposium-Bonn/.

If you have any additional questions, please don't hesitate to contact us. Feel free to forward this information to any interested person.

We are looking forward to welcoming you in Bonn next summer.

Best regards

Gunter Menz and Klaus Greve
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New EARSeL Members

We extend a warm welcome to the new member registered with EARSeL. We are looking forward to their active participation and contribution to EARSeL, and in collaboration with other members, in this long-established network of scientific research laboratories.

Headwall BVBA in Belgium is a European subsidiary of Headwall Photonics, a global leader in the design of integrated multispectral and hyperspectral sensors for applications ranging from airborne remote sensing and advanced process vision to biotechnology. These are applications where 'a new set of eyes' is fundamentally critical to solve challenges and spot trends.

Headwall BVBA takes a leadership position in the field of precision agriculture. For example, hyperspectral imaging in the Visible-Near-Infrared (VNIR) range from 400-1000nm allows crop scientists to determine whether the early signs of invasive diseases are present on the canopy of trees. Armed with the spectral signature of the disease based on its chemical fingerprint, the sensor can be trained to detect its presence anywhere within the field of view. Research and exploratory efforts like these are well within the reach of more scientists around the globe because the instruments themselves are smaller, lighter, and more affordable than ever and so too are the UAVs.

Hyperspectral imaging lends itself to this sort of effort because motion is fundamental to the creation of hyperspectral data cubes...a slice-by-slice rendering of everything seen within the field of view. The hyperspectral data cubes thus contain all the spectral data for every pixel in the scene as the sensor moves along its flight path. The data cubes can be many gigabytes in size, but orthorectified later can provide scientists with an exceptionally crisp view of the ground below.

Whether multi-rotor or fixed-wing, Headwall's objective is to deliver integrated airborne packages comprising of both a hyperspectral payload and a UAV matched to the mission. It is important for users to recognize that simply acquiring a hyperspectral sensor and bolting it onto any UAV is a recipe for certain disappointment. There are many aspects of the integration process that call for

higher levels of expertise, to assure not only excellent imaging performance but also adherence to local aviation laws and regulations. Obviously the first criteria is to make sure the chosen UAV is 'mission-appropriate.' Can it lift the payload and then fly the prescribed mission? Crucially, the 'payload' is usually more than just the sensor. Many times a GPS/IMU is involved, as is LiDAR. Cabling and any type of 'data-processing' hardware adds weight to the overall payload, also changing the aerodynamic performance of the craft. Headwall has made a strategic decision to help customers with the wide range of integration issues that normally arise, which saves both time and money while getting users in the air more quickly.

On the ground, Headwall's hyperspectral imaging sensors are used in advanced machine vision systems for the inspection of specialty crops, poultry, and seafood. Since hyperspectral imaging requires motion to occur, these sensors are essentially 'silent sentinels' that can pick out anomalies along a high-speed inspection line. They can help 'grade' fruits such as berries and grapes based on spectral characteristics and they can detect disease conditions in poultry or histamine levels in seafood.

As the demand for higher quality food products increases, the use of hyperspectral imaging represents a 'new tool' that helps processing companies meet more stringent regulatory guidelines while giving them a leg up on the competition in terms of overall quality.

HEADWALL Photonics BVBA

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News from Other Organisations

The Capturing Reality Forum Reveals Cutting Edge Conference Programme

Salzburg, Austria, 23 - 25 November 2015

Formed by combining the best of SPAR Europe and ELMF into a single event, Capturing Reality Forum focuses on the technologies of laser scanning, LiDAR, 3D data capture and modelling, to bring inspiration and growth to this rapidly developing industry.
The conference committee are delighted to report a staggering response to its call for papers. The committee received over 110 abstracts from industry leaders across the globe. With so much support from the industry, the conference programme covers a wide range of topics including a paper from Arno Buecken, Group Head, RWTH Aachen University, Germany on 'Modelling of forest landscapes from remote sensing LiDAR data and aerial photos' and various papers covering project examples and advances in UAVs such as 'Capturing the rock faces of a gorge with sUAVs' by Thomas Geisler, Engineer, GRID-IT Gesellschaft fur angewandte Geoinformatik, Austria.
For the full conference programme please visit
www.capturingrealityforum.com/conference/programme

The Capturing Reality Forum will be supported by an exhibition of 40 stands displaying the world's leading manufacturers, software developers and service providers of 3D imaging, laser scanning and LiDAR products. As an extra benefit to delegates, many of the exhibiting companies will host workshops; providing an opportunity for further discussion of technology.

The Forum takes place at the Salzburg Congress in Salzburg, Austria, from 23-25 November 2015. Visitors are asked to register online in advance at: **www.CapturingRealityForum.com/register**. **Register before 15th October 2015 for early bird rates.**

For more information on the Capturing Reality Forum, please visit www.CapturingRealityForum.com, follow us on twitter @CRealityForum #capturingreality and join our LinkedIn group Capturing Reality Forum.

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Science Article – 35th Symposium Proceedings Reprint

Synergies of Sentinel-1A SAR and Sentinel-2A MSI Data for Urban Ecosystem Service Mapping

Jan Haas, Yifang Ban

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Abstract

The objective of the study is to evaluate the potential use and synergetic effects of novel ESA Sentinel-1A C-band SAR and Sentinel-2A MSI data for mapping of ecologically important urban and peri-urban space. Image resolutions between 5 m and 20 m provided by the Sentinel satellites introduce a new relevant spatial scale in-between high and medium resolution data at which not only urban areas but also their important hinterlands are expected to be effectively and efficiently mapped. The fusion of Sentinel-1/2 facilitates both the capture of ecologically relevant details but at the same time also enables large-scale urban analyses that draw surrounding regions into consideration. The combined use of Sentinel-1A SAR in Interferometric Wide Swath mode and simulated Sentinel-2A MSI (APEX) data is being evaluated in classification of a metropolitan area over Zürich, Switzerland. The SAR image was pre-processed using Range-Doppler terrain correction. A 5x5 adaptive Lee speckle filter was applied to the VH and VV intensity bands before co-registration to the simulated Sentinel-2 image. After radiometric and spatial resampling, the fused images were segmented by the KTH-SEG algorithm before being classified by SVM. After reclassification under masks and sieve-filtering, the resulting landscape patches were investigated in terms of spatial characteristics and topological relations that are deemed to be influential for ecosystem service provision. Based on the classification result, ecosystem service supply and demand values that account for spatial and topological patch characteristics were attributed to 14 different land cover classes. The method and underlying data were found suitable for urban land-cover and ecosystem service mapping. The introduction of spatial aspects into ecosystem service providing areas is believed to add another important aspect in currently existing valuation approaches.

Introduction

It is well-known that a continuous increase in urban population and growing cities can be expected in the future (1), leading to deteriorated living conditions if environmental issues that further urban growth raises are not integrated adequately into urban planning and policies. Remote sensing has the capability to efficiently and readily deliver reliable information about urban land cover, where in-situ data collection is labour-intensive and time-consuming and where there is currently a lack of well-established standardized methods to evaluate the quantity and quality of urban eco-space (2). The new Sentinel mission series is one component of the GMES (Global Monitoring for Environment and Security) programme by the European Union (EU) with the goal of providing us with reliable and timely information on land, ocean and atmosphere for energetic, climatological and security related topics (3). The Sentinel missions are expected to provide us with a global view of environmental parameters with high spatial and temporal resolutions crucial for climate and environmental research (4). Thus, one aspect and objective of this study to evaluate the recently launched Sentinel-1 C-band SAR satellite and a simulated Sentinel-2 multispectral image product regarding their combined suitability for the classification of ecologically important urban and peri-urban space.

(5) discuss and categorize the potential use of the new sentinel missions for scientific observations. In the land surface variable category, the use of both Sentinel-1 and Sentinel-2 data for ecosystem relevant land cover mapping is summarized. One emerging concept that has been growing in popularity over the past decades to express both the importance as well as the quality of our natural capital around the globe is the one of ecosystem services. Having been an instrument of awareness raising for conservational measured in the beginning (6), the concept has been constantly further developed (7) resulting in one recent study (8) that presented an alternative relative ecosystem service valuation approach as opposed to traditional monetary valuation approaches (9,10) that are considered problematic (11). The promising approach of (8) was originally developed for regional assessments based on the CORINE land cover classification scheme (12). The second objective of this study is, based on the land cover classification result, to extend the concept of measuring ecosystem service supply by integrating spatial components into the valuation scheme.

Study area and data

To exemplify the proposed method, Zürich as the largest city in Switzerland with an increasing urban population of over 400,000 inhabitants and about 1.8 million people residing in the metropolitan area has been chosen. Zürich's living quality is considered high with noticeable progress in terms of environmental quality over the past two decades. Major urban classes are continuous and discontinuous urban fabric, industrial/commercial areas, the infrastructural road/railroad network including Zürich airport, construction sites, green urban spaces, sports/leisure facilities and allotments. The urban hinterland is characterized by Lake Zürich, agricultural land and forest. Agriculture is predominately defined through crops (51%), pasture (24%) and natural grasslands (20%). Vineyards and orchards play a subordinate role. A 16x22 km^2 Sentinel-2A scene, simulated with high-resolution airborne imaging spectrometer (APEX) data and including all spatial and spectral characteristics corresponding to a Sentinel-2 level 1c product dating from 2011-06-26 was used in combination with Sentinel-1A C-band SAR IW mode dual polarisation (VV+VH) data as a Level-1 GRD product from 2015-03-16. The Level-1 GRD product consists of focussed detected, multi-looked SAR data projected to an Earth ellipsoid. The ellipsoid is corrected using the terrain height specified in the product general annotation. Figure 1 shows the Sentinel-2 image to the left and the Sentinel-1 image to the right.

Figure 1: RGB true-colour-composite of the Sentinel-2A APEX scene from June 2011 (left) and the Sentinel-1A 5x5 adaptive Lee speckle filtered intensity data from March 2015 (VV-VH-VV) (right).

Methods

The main methodological steps involve image pre-processing and coregistration, image segmentation and classification, accuracy assessment, post-classification, spatial patch analysis and ecosystem service budget modeling as shown in Figure 2.

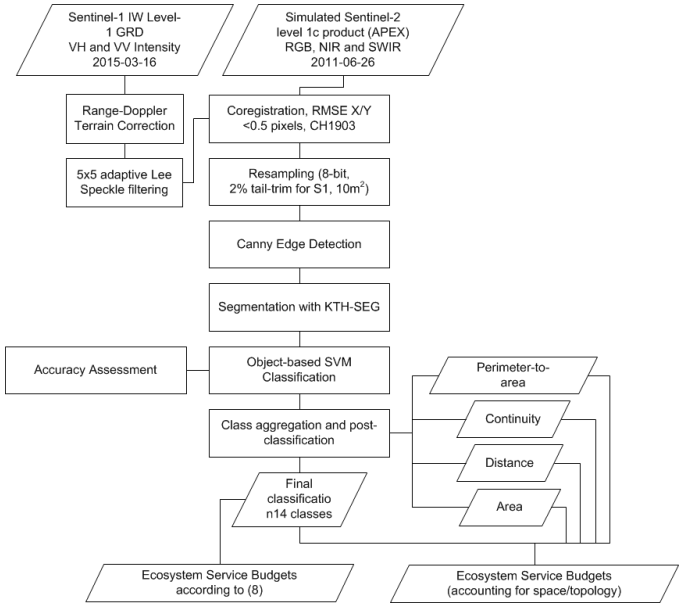

Figure 2: Methodology flowchart.

An extensive description of the simulated Sentinel-2 scene can be found in (16). After coregistration, the filtered Sentinel-1 bands and the Sentinel-2 RGB, NIR and two SWIR bands were resampled to a 10 m spatial and to 8-bit radiometric resolution with a 2% tail trim.

Image segmentation was then performed with KTH-SEG, an edge-aware region growing and merging algorithm (17). By creating an edge/no-edge decision layer using an enhanced Canny edge detector, segment growing is divided off-edges and along edges. The homogeneity criteria for both growing and merging are defined by a weighted sum of change in mean and change in standard deviation. Merging is performed using a mutual best neighbour approach, followed by threshold merging. Growing is limited to the minimum segment size and merging to the maximum segment size. For the segmentations in this study, the following parameters were empirically determined and were found to generate the most suitable result: Canny threshold: 0.1-0.2; grow 0.5/0.5, merge 0.5/0.5, minimum and maximum segment sizes were chosen from 5 and 100 pixels.

The segment type was then determined by object-based Support Vector Machine (SVM) classification (18,19) into initially 19 spectrally different classes that were aggregated into 12 contextually coherent land use and land cover classes. After accuracy assessment, the classification result was sieved to remove small segments that are regarded as misclassifications. Forest and agricultural areas were reclassified into urban green spaces and urban forests under an urban mask. From the final classification, 4 spatial characteristics of natural green and blue land cover patches that are believed to influence ecosystem service provision capacities were derived under these following assumptions:

Distance: An increased ecosystem service provision of patches close to urban dwellers is expected. A Euclidean distance map from urban classes into natural land cover patches was generated. The closer the natural land cover patches are to the edge of urban areas, the higher their value.

Perimeter-to-area-ratio: The lower the ratio, the higher the service provision because less edge is shared with other classes (that might negatively affect the patch in question) and patch centres are considered more pristine. Perimeter-to-area ratios were calculated on a patch level.

Area: Larger patches are capable of providing more services. The area in hectare was calculated for all patches.

Contiguity: High patch connectivity and less fragmented landscapes are considered beneficent in several ways, e.g. for species dispersal or recreational purposes. Contiguity values were calculated for all land cover patches.

These four factor maps were all linearly scaled in a way that the lowest value in the map was set as 0.5 and the highest value as 1.5. As a final step two ecosystem service budget maps were derived. The first map was created by attributing the original ecosystem service demand and supply scores as presented in (8) to each land cover patch. A second supply and demand map was generated with modified service values. For this, each original per patch score from (8) was multiplied by each of the four factor maps, that through the scaling from 0.5 to 1.5 either decrease or increase the provisional value by a maximum of 50%. The 4 resulting values per patch were then averaged by summation and division by 4.

Results

In total, 182,432 segments were generated by KTH-SEG that were then classified and aggregated into 12 classes. Table 1 below shows the classification confusion matrix. The classification into urban and peri-urban classes resulted in an overall accuracy of 79.81% with a Kappa coefficient of 0.78. Largest confusions occurred between construction sites and industrial/commercial areas and between the built-up classes discontinuous urban fabric, sport and leisure facilities and between airport runways and roads.

Table 1: Confusion matrix (C1=Water bodies; C2=Water courses; C3=Mixed forest; C4=Construction sites; C5=Discontinuous urban; C6=Airport; C7=Road/railroad network; C8 Industrial/commercial; C9=Agriculture and natural vegetation; C10=Continuous urban; C11=Sport/leisure facilities; C12=Allotment gardens.

	C1	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*C9*	*C10*	*C11*	*C12*	**UA**
C1	100	0	0	0	0	0	0	0	0	0	0	0	**100**
C2	0.6	91.8	3.6	0	1.5	0	0.6	0.1	1.8	0	0.1	0	**91.7**
C3	0	0	95.4	0	0	0	0	0	4.6	0	0	0	**95.4**
C4	0	0	0	79.9	0.3	0	1.2	14.1	0	0	0.4	4.1	**79.9**
C5	0	0	1.2	0.7	81	0	1.9	4	0.5	4.1	1	5.5	**81.1**
C6	0	0	0	0	0	72.4	0.7	12.8	13.5	0	0.6	0.1	**72.4**
C7	0	0	0	0	6.4	0.1	86.9	1.7	2.1	0	0.3	2.5	**87**
C8	0	0	0	39.3	0.8	2.1	10.7	31.8	4	5.2	5.8	0.4	**31.8**
C9	0	0	0	0	1.1	2.4	0	0	95.1	0	0	1.4	**45.9**
C10	0	0	1.8	0	12.1	0	5.1	1	0	80	0	0	**80**
C11	0	0	0	3.7	13.8	0.5	0.9	1.6	14.8	0.5	51.1	13.2	**51.1**
C12	0	0	0	0	13	0	0	0	6.6	0	0	80.4	**80.4**
PA	**99.4**	**100**	**93.8**	**65.3**	**66.1**	**93.8**	**41.7**	**47.4**	**68.7**	**89.4**	**79.7**	**77.9**	**99.4**

Figure 3 shows the classification result after post-classification and sieving (left) a map displaying the combined topological and spatial influence of natural land cover patches on the provision of ecosystem services. The adjusted provision and demand scores are presented in the right map.

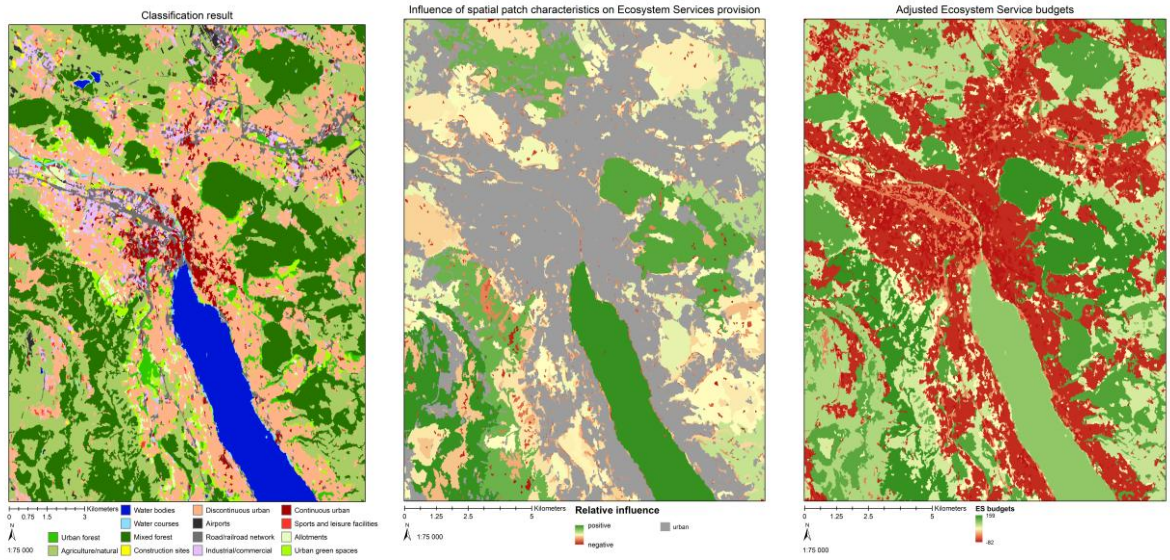

Figure 3: Classification result after sieving and reclassification (left), patch characteristics influence on ecosystem service provision (centre) and ecosystem service budgets map (right).

The scaling and weighting of spatial metrics and the choice of metric define the degree of influence on service provision. In this study, the importance of spatio-topological patch characteristics was considered equal. A more refined weighting process to mirror the influence of a particular factor or on a specific underlying ecological function or in respect to a distinct land cover class is believed to give a very different budget outcome. Thus, the service provision value should not be relied on as such, but they should rather be seen as an example of how spatial attributes or topological relations influence ecosystem services and how these aspects can be expressed and integrated.

Conclusions

Classification accuracies of ca. 80% suggest the suitability of the method and data for urban land cover mapping and classification of ecological important space and further use of the datasets in this application domain is recommended. The concept of expressing ecosystem service budgets according to (8) has been extended to include spatial properties and topological relations of landscape elements. The magnitude of influences these aspects have on service scores need however further reflections, i.e. each underlying function that is the base for the relative supply and demand values should be considered instead of applying the same adjustment factor to the aggregated score. This and further thoughts of how additional spatio-topological patch aspects might influence ecosystem service provision and also demands are suggested for future interdisciplinary research where valuable inputs from landscape ecologists would be an asset.

Acknowledgements

This study is supported by a grant from FORMAS. The research is also part of the project “Satellite Monitoring of Urbanization for Sustainable Urban Development” within the European Space Agency (ESA) and the Chinese Ministry of Science and Technology (MOST) Dragon III program.

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Volume 14, Special Issue: 1st Student Workshop on Ecology and Optics of the White Sea, 2014

Hydrological and spectrophotometry research on Kislo-Sladkoye Lake

Dmitrii Vinogradov, Sergei Varlamov, Nadezda Volovich, Vladislav Kuznetsov, Anastasia Grigoryeva, Maria Mardashova, and Elena Krasnova

Abstract Read full paper online: http://www.eproceedings.org

In this work, a description of the hydrological features of the lake Kislo-Sladkoye is given. The present work is a part of complex research on bottom topography, hydrological characteristics, water light absorption spectra at different depths, benthos communities, and ecological features of macrobenthic and terrestrial organisms. Vertical profiles of coloured layers, illumination, temperature, salinity, redox potential, acidity and oxygen content were analysed in August 2014 at different positions in the lake. According to the analysis of data, the water column is divided into strata: (a) zone of wind mixing (0 - 0.5 m); (b) halocline (0.5 - 1.5 m); (c) area with high oxygen concentration (1 - 1.5 m); (d) thermocline (1.5 - 3 m); (e) hydrosulfuric zone (2.5 m to the bottom).

Phytoplankton is dominated by cryptophyte flagellates Rhodomonas sp. and green-coloured cocci. In the coloured layers, the following pigments were detected by spectrophotometry: chlorophyll a, chlorophyll b, bacteriochlorophyll c or g, and phycoerythrin. Therefore, the presence of cryptophytae algae (genus Rhodomonas), unicellular phototrophic organisms containing chlorophyll b, and green sulfur bacteria is shown. The distribution of the layers: 0 - 1.7 m: organisms are virtually absent; 1.7- 2.2 m: cyanobacteria; 2.2 - 2.4 m: light absorption peaks corresponding to phycoerythrin and chlorophyll a and b appear, a large number of cryptophytae algae (genus Rhodomonas) and unicellular green algae. 2.4 - 2.7 m: concentration of pigments decline, a small amount of cells with chlorophyll b and cryptophytae algae; 2.7 - 4 m: green sulfur bacteria.

For the first time, a theoretical explanation of changes in the lake Kislo-Sladkoye following a spring tide is given. Densities of seawater and lake water were calculated and the results show that seawater penetrated the lake at a depth of 1.55 m during the spring tide.

Macrobenthos composition at the shoreline of Kislo-Sladkoye Lake, separating from the White Sea

Semen Buvalyy, Sanzhima Garmaeva, Maria Mardashova, Elena Krasnova, and Larisa Menshenina

Abstract Read full paper online: http://www.eproceedings.org

Kislo-Sladkoye Lake is a unique model reservoir separating from the White Sea, which requires careful comprehensive interdisciplinary study of all characteristics. The lake is a subject of systematic hydrological and hydrochemical surveys. An integral qualitative study of the macrozoobenthos at the shoreline of the lake has been conducted for the first time. Fourteen invertebrate macrozoobenthic taxa were found. Mass species distribution boundaries were determined. Such marine animals as Mytilus edulis, Semibalanus balanoides, Littorina saxatilis, are only found at the marine side beyond

the lake rapid. Brackish species show three distribution patterns: Gammarus duebeni, chionomids, Haliplus apicalis are met around the lake; Hydrobia ulvae, Chironomus salinarius, Enochrus halophilus are absent near the lake rapid; diptera larvae Setacera aurata are only found on slightly sloping coast parts.

The collected data allowed us to map the lake zonation based on the species composition. Three zones are allocated: Marine fauna zone on the east near the rapid; brackish fauna around the lake and enriched muddy shallows in the northern part.

New Publications in Vol. 14 (1), 2015

A compact Doppler wind lidar for controlling the operation of wind turbines

Paul Gerke Hofmeister, Christoph Bollig, Sarah Fayed, Martin Kunze, and Rainer Reuter

Abstract Read full paper online: http://www.eproceedings.org

A robust and compact lidar for wind field detection has been developed for operation in the nacelle of wind turbines. The lidar measures wind speed along the line-of-sight of the laser beam with a 15 m range resolution along distances of 100 to 400 m depending on atmospheric aerosol content. An inclined orientation with respect to the rotor axis results in a conical scan of the incoming wind field, from which range-resolved data of the average wind velocity over the scanned cross-section are calculated. Application of the instrument aims at an improved turbine control by optimizing the pitch angle of rotor blades based on remotely sensed data, instead of reacting to wind field fluctuations which have already caused changes in rotational speed or loads. A predictive knowledge of wind conditions also allows for a precise evaluation of turbine power performance. The data are particularly useful for reducing high loads from gusts which otherwise cannot be detected in time.

In this paper, the conceptual layout of Whirlwind 1 is described. Wind speed data are derived from the Doppler shift of backscattered laser radiation from aerosols which is interferometrically detected. Laser source is a diode laser pumped fibre amplifier seeded by a single-frequency diode laser emitting eye-safe radiation at 1.5 µm wavelength. The Doppler shifted laser frequency is detected with a Fast Fourier Transform of the signal return and converted to wind speeds in 37 range gates, each of 30 m length with a 50% overlap. The compact aluminium casing includes all components, i.e., the fibre laser, the signal detector, a Field Programmable Gate Array for fast data processing, a 3-axes accelerometer, and a compact industrial PC. First results of wind field measurements obtained with the prototype are presented.

Deriving a DTM from a DSM by uniform regions and context

Charles Beumier, and Mahamadou Idrissa

Abstract Read full paper online: http://www.eproceedings.org

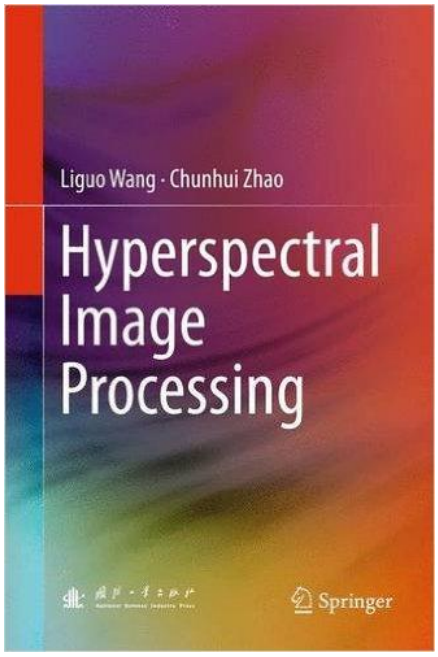
A Digital Terrain Model (DTM) is typically used in applications such as environment planning, flood risk evaluation and building detection. A Digital Surface Model (DSM) is usually acquired by LASER scanning or from stereoscopic pairs of aerial or satellite images. By contrast, a direct DTM acquisition traditionally requires more effort on the terrain or for scene object classification and the automatic derivation of a DTM from a DSM still faces difficulties.

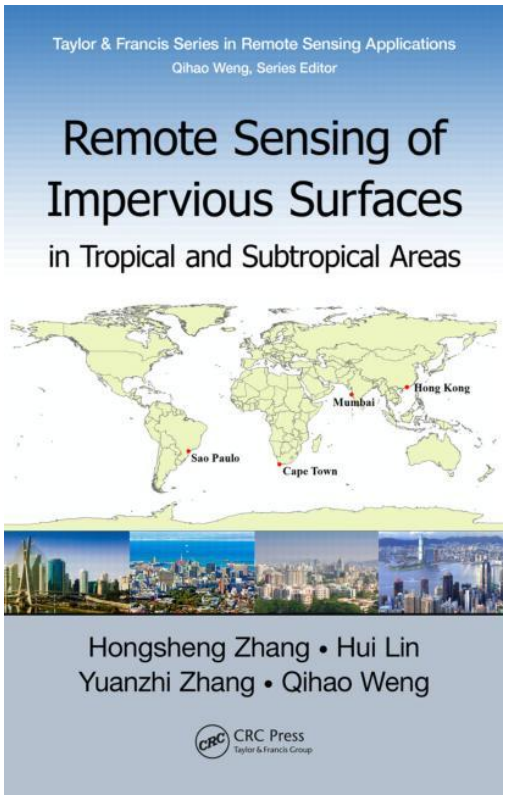
We propose in this paper a new DTM from DSM approach that consists of three steps: DSM region segmentation, region selection and height interpolation. First the DSM is segmented into regions of limited slope. A gradient filter is applied to the DSM raster to highlight height transitions. A connected component algorithm labels the different regions separated by those transitions. Secondly, regions whose perimeter is on the average higher than their surrounding are discarded. Finally, a hierarchical interpolation procedure fills the holes in the DSM due to high gradients or discarded regions.

The proposed algorithm developed for urban areas has been applied to the Vaihingen dataset of the ISPRS benchmark and qualitatively validated by the results of its independent evaluation procedure for building detection. In the context of change detection for database revision, this new DTM extraction was applied to an area in Brussels for which digital aerial imagery and LIDAR measurements are available. This reference data allowed for some quantitative evaluation of the DTM errors.

Book Releases

Hyperspectral Image Processing (Springer) is a book written by Liguo Wang and Chunhui Zhao. Based on the authors' research, this book introduces the main processing techniques in hyperspectral imaging. In this context, SVM-based classification, distance comparison-based endmember extraction, SVM-based spectral unmixing, spatial attraction model-based sub-pixel mapping and MAP/POCS-based super-resolution reconstruction are discussed in depth. Readers will gain a comprehensive understanding of these cutting-edge hyperspectral imaging techniques. Researchers and graduate students in fields such as remote sensing, surveying and mapping, geosciences and information systems will benefit from this valuable resource.





Remote Sensing of Impervious Surfaces in Tropical and Subtropical Areas (CRC Press) offers a complete and thorough system for using optical and synthetic aperture radar (SAR) remote sensing data for improving impervious surface estimation (ISE). Highlighting tropical and subtropical areas where there is significant cloud occurrence and varying phenology, the book addresses the challenges impacting impervious surfaces in tropical and subtropical zones. It examines the potential for estimating urban impervious surfaces in a rainy and cloudy environment, considers the difficulties encountered when using optical remote sensing in this type of climate, and assesses existing methods employing remote sensing data for accurate ISE in tropical and subtropical regions. Using the results of comparative studies conducted during the four seasons and in six different cities (Guangzhou, Shenzhen, Hong Kong, Mumbai, Sao Paulo, and Cape Town), the authors develop a framework for ISE using optical and SAR image data. They address the advantages and disadvantages of optical and SAR data, consider fusion strategies for combining optical and SAR data, and examine different feature extractions for optical and SAR data. They also detail the limitations of the research, suggest possible topics for future analysis, and cover previous findings on the synergistic use of optical and SAR data.

Forthcoming EARSeL Conferences

10th EARSeL SIG Forest Fire Workshop

Organised by EARSeL, Cyprus Remote Sensing Society, Cyprus University of Technology and Aristotle University of Thessaloniki

2 – 5 November 2015, Limassol, Cyprus **More info**

Further information can be found at the Workshop website at: http://www.ffsig2015.com/node/8

5th EARSeL SIG ReSeArCH Workshop

Organised by EARSeL SIG ReSeArCH (Dr. Rosa Lasaponara)

12 – 13 November 2015, Frascati (Rome), Italy **More info**

Further information can be found at: http://congrexprojects.com/2015-events/15m38/introduction

36th EARSeL Symposium and 39th General Assembly

Organised by the University of Bonn, (Gunter Menz)

20 – 24 June 2016, Bonn, Germany **More info**

Further information can be found at: http://www.earsel.org/symposia/2016-symposium-Bonn/ and at the 'News from EARSeL' section.

EARSeL: Imaging Spectroscopy in environmental analyses

A Special Session within the ISPRS XXIII Congress

12 – 19 July 2016, Prague, Czech Republic. **More info**

Further information can be found at: http://www.isprs2016-prague.com/program/scientific-program-sessions/special-sessions#sps17

2nd Student Workshop on Ecology and Optics of Coastal Zones

Jointly organised by: EARSeL's Special Interest Group Education & Training, Faculty of Physics, Lomonosov Moscow State University, Russia, Institute of Physics, University of Oldenburg, Germany and the Museum of the World Ocean, Kaliningrad, Russia.

19 – 22 July 2016, Museum of the World Ocean, Kaliningrad, Russian Federation. **More info**

Further information can be found at: http://www.earsel.org/SIG/ET/2nd-student-workshop/index.php

3rd EARSeL SIG Forestry Workshop

Organised by the University of Agriculture in Krakow, Faculty of Forestry, Institute of Forest Resources Management

15 – 16 September 2016, Krakow, Poland **More info**

Further information can be found at: http://sigforestry2016.eu/

10th EARSeL Workshop on Imaging Spectroscopy

2017, Zurich, Switzerland

Further information on the 10th EARSeL Workshop on Imaging Spectroscopy will be provided at the forthcoming issues of the EARSeL Newsletter.

Other Conferences

11-13 October, 2015: Geodesign Summit Europe
Salzburg, Austria

12-14 October, 2015: Earth Observation Science 2.0
Frascati, Italy

14-16 October, 2015: Esri European User Conference
Salzburg, Austria

15-16 October, 2015: Sentinel open-source Toolbox Hackathon
Frascati, Italy

19-20 October, 2015: EuroSDR/ISPRS Workshop on "Oblique cameras and dense image matching"
Southampton, United Kingdom

19-23 October, 2015: ACRS 2015 - The 36th Asian Conference on Remote Sensing
Quezon City, Philippines

20-23 October, 2015: Earth Observation for Water Cycle Science
Frascati, Italy

21-22 October, 2015: International conference of Geospatial Techniques in Geosciences
Taza, Morocco

23-24 October, 2015: International Conference on Intelligent Earth Observing and Applications
Guilin, China

26-29 October, 2015: 15th International Scientific and Technical Conference - From imagery to map: digital photogrammetric technologies
Cancun, Mexico

28-30 October, 2015: Joint International Geoinformation Conference
Kuala Lumpur, Malaysia

29 October, 2015: Workshop on Big Data in the Geosciences
Santa Clara, California USA

29 October - 1 November, 2015: Workshop on Data and Computational Science Technologies for Earth Science Research

Santa Clara, California USA

3-6 November, 2015: International Conference on Advances in Geographic Information Systems
Seattle, United States

4-5 November, 2015: Mapping Urban Areas from Space (MUAS) 2015 Conference
Frascati, Italy

4-6 November, 2015: Esri Ocean GIS Forum: Collect, Collaborate, Transform
Redlands, California USA

9-10 November, 2015: Horizon 2020 Space Information Days
Brussels, Belgium

9-13 November, 2015: 6th Asia/Oceania Meteorological Satellite Users' Conference
Tokyo, Japan

10-12 November, 2015: EuroCarto 2015 - the 1st ICA European Symposium on Cartography
Vienna, Austria

11-13 November, 2015: International Land Use Symposium (ILUS)
Dresden, Germany

16-19 November, 2015: International Symposium on GNSS
Kyoto, Japan

16-19 November, 2015: Pacific Islands GIS\RS User Conference
Suva, Fiji Islands

1-3 December, 2015: International Conference on Remote Sensing and Development
Auckland, New Zealand

3-5 December, 2015: IEEE International Conference on Aerospace Electronics and Remote Sensing Technology
Bali, Indonesia

Summer Schools and Advanced Courses

Satellite Remote Sensing of Particulate Matter Air Quality: Data, Tools, Methods and Applications (AOD-PM)
1-22 October 2015, NASA Webinar, United States
Registration closed.

Water Resources Management Using NASA Earth Science Data
13 October - 27 November 2015, NASA Webinar, United States
Registration deadline: **1 October 2015**

ESA-MOST DRAGON 3 COOPERATION - Advanced Training Course on Land Remote Sensing
16-21 November 2015, College of Urban and Environmental Sciences, Tianjin Normal University, Tianjin, China
Registration closed.

Back Cover – Autumn composition of Landsat images (Australia, Mongolia, United States).

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