**European Association
of Remote Sensing Laboratories**

**Mediterranean Agronomic
Institute of Chania**

29th EARSeL Symposium

IMAGING Europe

15-18 June 2009

MAICh Conference Center, Chania, Crete – Greece

Symposium Programme
&
Abstract Book

http://earsel29.maich.gr

Editors: Ioannis Manakos, Chariton Kalaitzidis,
Dina Petraki, Nikos Psyllakis

EARSeL, MAICh and the Organizing Committee acknowledge and thank the Sponsors of the Symposium and Workshops for their financial support and in kind contribution.

Symposium Sponsors

Symposium Organisation

SYMPOSIUM CHAIRMEN

Prof. Dr. Rudi Gossens, EARSeL Chairman
Dr. Ioannis Manakos, Environmental Management Programme, MAICh

SCIENTIFIC COMMITTEE

Dr. Ioannis Manakos	MAICh
Dr. Gerard Begni	MEDIAS, France
Dr. Zbigniew Bochenek	IGiK, Warsaw
Prof. Dr. Piero Boccardo	Politechnico of Turin
Dr. Matthias Braun	University of Bonn
Dr. Pietro Alessandro Brivio	CNR-IREA, Milan
Prof. Dr. Amelia M. Budge	Univ. of New Mexico USA
Dr. Ruggero Casacchia	AIT President
Prof. Dr. Emilio Chuvieco	Alcala University
Dr. Claudia Giardino	CNR-IREA, Milan
Dr. Mario A. Gomarasca	CNR-IREA, Milan
Prof. Dr. Fabio Dell'Acqua	University of Pavia
Dr. Mario Hernandez	UNESCO
Dr. Karsten Jacobsen	University of Hannover
Prof. Dr. Casrsten Jurgens	Ruhr University Bochum
Prof. Dr. Lena Halounova	Czech Technical University
Prof.Dr. Derya Maktav	Istanbul Technical University
Dr. Chariton Kalaitzidis	MAICh
Dr. Claudia Kuenzer	DLR
Dr. Rosa Lasaponara	IMAA-CNR
Prof. Dr. Giovanmaria Lechi	Politechnico of Milan
Dr. Andre Marcal	University of Porto
Dr. Keith McCloy	Danish Institute of Agricultural Science
Prof.Dr. Freek van der Meer	ITC & University of Utrecht
Dr. Andreas Mueller	DLR
Prof. Dr. Eberhard Parlow	University of Basel
Prof. Konstantinos Perakis	University of Thessaly
Dr. Rainer Reuter	University of Oldenburg
Prof. Dr. Andrew Skidmore	ITC Enschede
Dr. Uwe Soergel	University of Hannover
Dr. Lucien Wald	Ecole de Mines de Paris
Dr. Stefan Wunderle	University of Bern

ORGANISING COMMITTEE

Mrs. Gesine Boettcher	EARSeL
Dr. Ioannis Manakos	MAICh
Dr. Chariton Kalaitzidis	MAICh
Mrs. Argyro Zervou	MAICh Conference Centre
Mrs. Katerina Karapataki	MAICh Conference Centre
Mrs. Dina Petraki	MAICh

European Association of Remote Sensing Laboratories
EARSeL eProceedings
http://www.eproceedings.org/

EARSeL eProceedings is a free, open access remote sensing journal. It is devoted to high quality scientific publications in all fields of earth observation and remote sensing:

- Land use and land cover
- Geology
- Agriculture and forestry
- Snow and ice
- Atmosphere
- Oceans and coastal zones
- Urban areas
- Developing countries
- New methods: hyperspectral, active/passive, 3-D
- Data fusion
- Time-series analysis
- Environmental risks and hazards
- Modelling studies
- Ground truth methods and measurements.

Benefits by publishing in EARSeL eProceedings:

- High-quality papers due to peer review
- no page charges
- colour figures at no extra cost
- short publication times (max. 6 months)
- free access via a well-known, internationally recognised internet portal
- no subscription fees for users
- registered journal (ISSN 1729-3782)

Submit your manuscript to EARSeL eProceedings
using the style guide on the homepage
to the Editor in Chief
Rainer Reuter
University of Oldenburg
Institute of Physics
D-26111 Oldenburg, Germany
rainer.reuter@eproceedings.org

SYMPOSIUM SCHEDULE

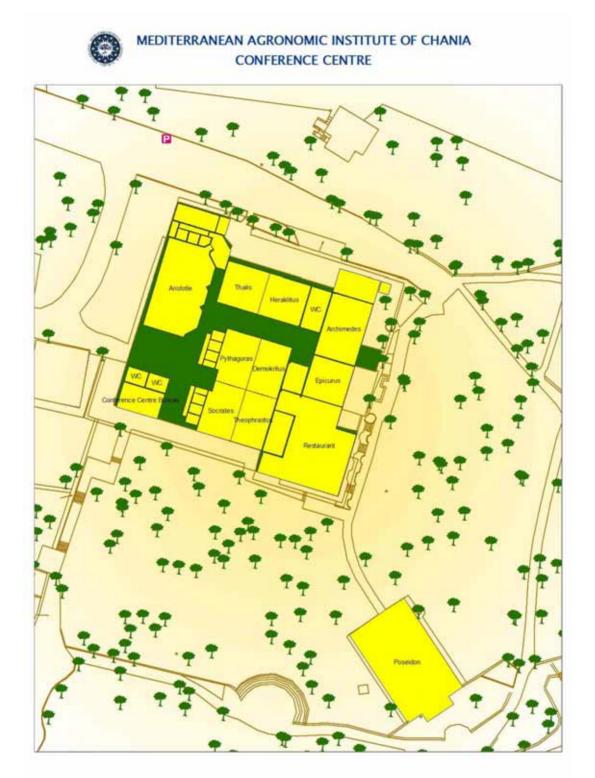| Time	Monday, 15 June	Tuesday, 16 June			Wednesday, 17 June			
08:00	REGISTRATION (all day)	REGISTRATION (all day)			REGISTRATION (all day)			
09:00	Council Meeting (A)	Session 4 (C)	Session 5 (D)	WET* (E) Opening Keynote Session 1	Session 12 (C)	Session 13 (D)	Session 14 (E)	WET (G) Session 5 Closing
10:40	Break	Break			Break			
11:00	Council Meeting (A)	Session 6 (C)	Session 7 (D)	WET (E) Session 2	Cost Action (H)			
11:30					GENERAL ASSEMBLY (H)			
12:40	Lunch	Lunch			Lunch			
13:30		SIG Education & Training Meeting (G)			SIG Meeting (G)			
14:00	Opening 2 Keynote Speakers (B)	Session 8 (C)	Session 9 (D)	WET (E) Session 3	Session 15 (C)	Session 16 (D)	Session 17 (E)	SEOS Meeting (G)
15:40		Break			Break			
16:00	Break	Session 10 (C)	Session 11 (D)	WET (E) Session 4	POSTER SESSION (A&J)			SEOS Meeting (G)
16:30	Session 1 (C)	Session 2 (D)	Session 3 (E)					
17:40								
18:10								
19:30	IceBreaker Party (F)				Symposium Dinner + Dinner E & T + SEOS Dinner (I)			

* WET: Workshop on Education and Training

A	Thales	**H**	Aristotle
B	Poseidon	**I**	Mediterranean Restaurant
C	Pythagoras	**J**	Heraklitus
D	Socrates	**K**	Archimedes (computer room)
E	Demokritus	**L**	Epicurus (sponsors & breaks)
F	KAM	**M**	Tavern outside MAICh premises
G	Theophrastos		

Time	Thursday, 18 June				Friday, 19 June		Saturday, 20 June
08:00	REGISTRATION (all day)				REGISTRATION (all day)		
09:00	Session 18 (C)	Session 19 (D)	Session 20 (E)	RSCZ* (G) Opening Session 1	RSCZ (C) Session 5a	RSCZ (D) Session 5b	RSCZ (C) Session 9 (09:00 – 10:00)
10:40	Break				Break		
11:00	Field Spectroradiometry DEMO (H)				RSCZ (C) Session 6a	RSCZ (D) Session 6b	RSCZ Excursion (10:30 – 15:30)
11:30	TUTORIAL (H)						
12:30	Closing (H)				RSCZ (C) Poster Session 1		
13:00	Lunch				Lunch		
14:00	RSCZ (C) Session 3a	RSCZ (D) Session 3b			RSCZ (C) Session 7: Round table & Poster Session 2		
15:30	Break				Break		
16:00	RSCZ (C) Sessions 4a	RSCZ (D) Session 4b			RSCZ (C) Session 8 (16:00 – 17:00)		
17:30							
18:00							
19:30	RSCZ IceBreaker (F)				RSCZ Dinner (M)		

*RSCZ: Workshop on Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts

A	Thales	**H**	Aristotle
B	Poseidon	**I**	Mediterranean Restaurant
C	Pythagoras	**J**	Heraklitus
D	Socrates	**K**	Archimedes (computer room)
E	Demokritus	**L**	Epicurus (sposnsors & breaks)
F	KAM	**M**	Tavern outside MAICh premises
G	Theophrastos		

MEDITERRANEAN AGRONOMIC INSTITUTE OF CHANIA
CONFERENCE CENTRE

PROGRAMME and CONTENTS

	(1163) The synergy of optical VHR satellite images and TerraSAR-X StripMap data in early and rapid agricultural crops mapping. *MROZ Marek, MLECZKO Magdalena* (poster)	48
	(1325) ENVISAT radar products for the estimation of the water volume variations of Lake Izabal, Guatemala *MEDINA Camilo E., GOMEZ-ENRI Jesus, ALONSO Jose J., VILLARES Pilar* (poster)	49
09:00 – 10:40	**Workshop: Education and Training 1** (Room E)	
10:40 – 11:00	**Break**	
11:00 – 12:40	**Session 6** (Room C) – **Urban Remote Sensing 2 (Chairman: Carsten Juergens)**	51
	(1223) Urban Sprawl Monitoring and Analysis *KOLAR Jan, KUPKOVA Lucie, POTUCKOVA Marketa, STYCH Premysl* (oral)	53
	(1309) Investigating urban sprawl using remote sensing and GIS technology *KUPIDURA Przemyslaw, KUPIDURA Adrianna* (oral)	54
	(1108) Monitoring the urban expansion of North-Western Athens due to the Olympic Games using multitemporal satellite data and GIS techniques *NIKOLAKOPOULOS Konstantinos G., TSOMBOS Panagiotis I.* (oral)	55
	(1324) Satellite Monitoring and Impact Assessment of Urban Land-Cover Change in Stockholm, Sweden between 1986 and 2006 *BAN Yifang, FURBERG Dorothy* (oral)	56
	(1255) Mapping built-up areas using GIS and Remote Sensing imagery: A case study of Sedgefield District, Durham in the UK *MAKATO Belta* (poster)	57
	(1191) Fractal analysis by using Multitemporal and Multisource data: The evolution of Napolitan urban fabric (Iitaly) *FIANI Margherita, GERUNDO Roberto, GRIMALDI Michele, PISTILLO Pasquale* (poster)	58
11:00 – 12:40	**Session 7** (Room D) – **Radar Remote Sensing 2 (Chairman: Uwe Soergel)**	61
	(1018) Image analysis in urban areas from combined very high resolution optical and SAR Imagery *WEGNER Jan Dirk, SOERGEL Uwe* (oral)	63
	(1083) Deformation monitoring in North Bohemia by method of Permanent Scatterers *KNECHTLOVA Barbora, HLAVACOVA Ivana* (oral)	64
	(1057) Identification of western corn rootworm larval damage in cornfield by radar data *NADOR Gizella, FÉNYES Diána, SUREK György, VASAS László* (oral)	65
	(1243) Spaceborne Radar Monitoring of Disaster Oil Spill in Kerch Strait in 2007 *LITOVCHENKO Konstantin, IVANOV Andrei* (oral)	66
	(1504) Potential of TerraSAR-X data for REDD Monitoring in Central Kalimantan (Indonesia) *HEINZEL Vanessa, SIEGERT Florian, ENGELHART Sandra* (oral)	67
11:00 – 12:40	**Workshop: Education & Training 2** (Room E)	
12:40 – 13:30	**Lunch**	

	(1271) Analysis of ASTER multispectral stereo imagery to update DEM and land cover databases for Cyprus island *HADJIMITSIS Diofantos G., CHRYSOULAKIS Nektarios, RETALIS Adrianos* (poster)	169
15:40 – 16:00	**Break**	
16:00 – 17:40	**POSTER SESSION** (Room A & J)	
19:30	**SYMPOSIUM DINNER + DINNER Workshop: Education & Training** (Room I)	

FRIDAY, 19 JUNE 2009

08:00 – 09:00	**Registration (all day)**
09:00 – 10:40	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 5a** (Room C)
09:00 – 10:40	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 5b** (Room D)
10:40 – 11:00	**Break**
11:00 – 12:30	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 6a** (Room C)
11:00 – 12:30	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 6b** (Room D)
12:30 – 13:00	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" Poster Session 1** (Room C)
13:00 – 14:00	**Lunch**
14:00 – 15:00	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 7: Round Table** (Room C)
15:00 – 15:30	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" Poster Session 2** (Room C)
15:30 – 16:00	**Break**
16:00 – 17:00	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 8** (Room C)
19:30	**DINNER – Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts** (Room M)

SATURDAY, 20 JUNE 2009

09:00 – 10:00	**Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts" 9** (Room C) Title: "LEOWorks Applications in the Coastal Zone" Speakers: Francesco Sarti & Steffen Dransfeld, ESA ESRIN, Frascati, Italy
10:30 – 15:30	**EXCURSION - Workshop: Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts"**

WORKSHOPS

4th Workshop

on
Remote Sensing of the Coastal Zone "Coasts and Climate Conflicts"

June 18 - 20, 2009

Chairman: Dr. Rainer **Reuter**

University of Oldenburg

e-mail: rainer.reuter@uni-oldenburg.de

http://www.earsel.org/SIG-CZ/4th_CZ-workshop/

2nd Workshop

on
Education and Training
"Earth Observation: From Research to Teaching in Schools and Universities"

June 16-17, 2009

Chairman: Dr. Rainer **Reuter**

University of Oldenburg

e-mail: rainer.reuter@uni-oldenburg.de

http://www.earsel.org/SIG-ET/2nd-workshop/

SYMPOSIUM ABSTRACTS

SESSION 1 - Forestry (1)

Chairman: Rudi Goosens

Analysis of different methods to estimate forest production

SAVIN Elena
elenas_54@yahoo.com
National Meteorological Administration, Romania

MASELLI Fabio
maselli@ibimet.cnr.it
CNR - Institute of Biometeorology, Firenze, Italy

CHIESI Marta
CNR - Institute of Biometeorology, Firenze, Italy

POENARU Violeta
Romanian Space Agency, Bucharest, Romania

Keywords: gross primary productivity, forest, remote sensing

Abstract: Forest ecosystems are an economic and environmental resource which is widely spread all over the world. One of the reasons for which, owadays, they have such a great importance is linked to their essential role within the global carbon cycle. Plants and animals are approximately 50 percent (by dry weight) carbon.

Carbon in the form of carbon dioxide (CO_2), carbon monoxide (CO) and methane (CH_4) is also a significant contributor to greenhouse gases that trap the sun's energy as it is stored and released as long wave emissions from the earth's surface.

Trees grow (and gain carbon) when the amount of carbon fixed through photosynthesis exceeds the amount of carbon lost from respiring leaves, branches, stems and roots. At the forest ecosystem level, the balance of plant photosynthesis and respiration will determine the net carbon uptake or emission by decomposers.

Flux carbon field measurements are expensive and time consuming, especially when made over large areas and at frequent time intervals. Remote sensing techniques and ecosystem simulation models are therefore seen as an efficient tool to estimate forest fluxes.

In this study forest gross primary production (GPP) obtained by ground measurements, and two methods based on satellite images were analysed for 8 sites located in Italian forest zones. The vegetation types of the sites are: evergreen broadleaf forest, deciduous broadleaf forest and mixed forest. These sites correspond to 8 eddy covariance flux towers included in the FLUXNET project. Monthly GPP sums measured at 8 study sites for the period 1999-2006 were used as reference data. Carbon fluxes were estimated with the C-FIX model modified to include a water stress index. This model was fed with Spot-VGT NDVI images and ground meteorological data taken during the period 1999-2006. Satellite images product MODIS TERRA collection 4.8. MOD17A2 Net Photosynthesis, 8 days syntheses were used to extract the GPP values corresponding to each tower. The monthly GPP estimates produced by the two methods based on satellite images were compared to the ground data of the 8 study sites. Correlation coefficients and root mean square errors were computed to summarize the estimation accuracy for each site. In all cases high correlation coefficients were obtained (always higher than 0.9) and the RMSEs were acceptable.

In conclusion, both modified C-FIX and MODIS product MOD17A2 can be successfully applied to estimate the gross productivity features of different Italian forest types.

Estimating the Forest Fire Damage in Peloponnese (Greece) using MODIS products based on selective PCA

ALEXANDRIS Nikos
nikos.alexandris@felis.uni-freiburg.de
Albert-Ludwig-University Freiburg, Germany

KOUTSIAS Nikos
nkoutsia@cc.uoi.gr
University of Ioannina, Greece

Abstract: In Summer 2007 more than 6000 forest fires ravaged in Greece massive forested areas, agricultural surfaces and a huge number of settlements causing the death of more than 70 people. An emergency-response burned area mapping as soon as the fires are declared out, is essential to support mitigation plans and rehabilitation logistics. Assessing the extent of the damage can be expensive depending mainly on the quality of the remotely sensed data. An alternative to commercial high resolution data is to exploit MODIS public domain satellite imagery.

This study demonstrates an estimation of the damage caused by extensive forest fires in Peloponnese using MODIS products. The method is based on the Principal Component Analysis upon a bi-temporal surface reflectance composite and a contextual supervised image classification of selected Principal Components. The results include the estimation of the total burned area and percentages for each unique land cover/use class as derived from both the CORINE and the Global Land Cover 2000 land data bases. The accuracy of the method was validated using Landsat 7 SLC-OFF imagery according to the Pareto Boundary which is appropriate for dichotomic maps derived from low spatial resolution data.

On the relationship between the differenced Normalised Burn Ratio (dNBR) and the Composite Burn Index (CBI) for assessing fire/burn severity in a Mediterranean environment using Landsat TM data

VERAVERBEKE Sander N.S.
sander.veraverbeke@ugent.be
Ghent University, Belgium

VERSTRAETEN Willem
Katholieke Universiteit Leuven, Netherlands

LHERMITTE Stefaan
Katholieke Universiteit Leuven, Netherlands

GOOSSENS Rudi
Ghent University, Belgium

Keywords: fire severity, burn severity, dNBR, CBI, Landsat TM, Mediterranean, Peloponnese

Abstract: Fire and burn severity are important factors in the post-fire assessment. Many studies focus on the relation between the remotely sensed differenced Normalised Burn Ratio (dNBR) and Composite Burn Index (CBI) field data. Although details on the dNBR-CBI relationship are relatively well known for boreal ecosystems, little is known about the validity of the relationship in a Mediterranean environment. This study evaluates the potential of the combined use of dNBR index values and CBI ground data for assessing fire/burn severity for the case of the severe 2007 Peloponnese (Greece) wildfires. Both an immediate (fire severity) and a one-year post-fire (burn severity) assessment were performed using 160 ground plots. The analysis yielded moderate correlations between dNBR and CBI. Results of the fire and burn severity assessment were quite similar. This research demonstrates the potential of using the dNBR index in conjunction with CBI ground data for effective fire/burn severity mapping in a Mediterranean ecosystem.

Post-fire evaluation using SPOT 4 satellite images

ESEMEN K.
kerem@cscrs.itu.edu.tr
Istanbul Technical University, Turkey

SUNAR F.
fsunar@cscrs.itu.edu.tr
Istanbul Technical University, Turkey

ÖZKAN C.
cozkan@erciyes.edu.tr
Erciyes University, Kayseri, Turkey

Keywords: Antalya, forest fire, Spot 4, multispectral classification

Abstract: Hazard monitoring and evaluation have been a significant issue of remote sensing applications. Forest fires as being the most frequent hazard, are effectively evaluated in terms of damage assessment and regeneration monitoring, by means of remote sensing technology involving mid / high resolution satellites with visible and NIR sensors. The major objective of this paper is to analyze and authenticate the burned area due to the forest fire on dates between July 31 & August 5, 2008 at Manavgat and Serik districts of Antalya, Turkey; using SPOT 4 satellite images and digital feature extraction techniques. Geometric correction and normalized difference vegetation index transformation were applied to the image data sets and supervised / unsupervised classification techniques were used in order to extract the burned and partially damaged forest areas. Besides the Maximum Likelihood classification method Multilayer Perceptron Artificial Neural Network was used in the supervised classification. The classification accuracies were evaluated using a confusion matrix including errors of omission and commission, user's and producer's accuracy percentages and some statistical tests were employed to infer whether the classification results were statistically significant. The results are compared with local forest management data and analyzed within a geographical information system.

A review of multispectral vegetation indices for biomass estimation

KALAITZIDIS Chariton
chariton@maich.gr
MAICH - Mediterranean Agronomic Institute of Chania, Greece

HEINZEL Vanessa
heinzel@rssgmbh.de
RSS - Remote Sensing Solutions GmbH, Germany

ZIANIS Dimitrios
zianis@maich.gr
MAICH - Mediterranean Agronomic Institute of Chania, Greece

Abstract: The use of vegetation indices is a fast and efficient method for vegetation monitoring by the use of remote sensing data. Throughout the years, a large number of multispectral vegetation indices have been formulated, each having variable degrees of efficiency in estimating one or more vegetation parameters such as, health status, nutrient or water deficiency, crop yield, vegetation cover fraction, leaf area index, absorbed photosynthetically active radiation, net primary production and above-ground biomass. Additionally some of them also consider atmospheric effects and/ or the soil background for an enhanced retrieval.

With the production of biofuels appearing as a partial alleviation of global energy problem, accurate methods of estimating potential available biomass could prove invaluable for the energy budgeting at a national or international level. This review is looking back in the past at the vegetation indices that have been used for the estimation of biomass, either directly though empirical relationships or through the estimation of other vegetation parameters such as the Leaf Area Index (LAI) and Absorbed Photosynthetically Active Radiation (APAR).

This review was performed within the framework of the FP7 funded "Classification of European Biomass potential for Bioenergy using terrestrial and earth observations" (CEUBIOM) project.

Intensity of soil erosion by water in preserved and burnt stands of Aleppo pine in Croatia

BUTORAC Lukrecija
lukrecija.butorac@krs.hr
Institute for Adriatic Crops and Karst Reclamation, Split, Croatia

TOPIĆ Vlado
vlado.topic@krs.hr
Institute for Adriatic Crops and Karst Reclamation, Split, Croatia

JELIĆ Goran
gjelic@krs.hr
Institute for Adriatic Crops and Karst Reclamation, Split, Croatia

Keywords: forest ecosystem of Aleppo pine, burnt area of Aleppo pine, preserved stand of Aleppo pine, rainfall, surface runoff, erosion, soil loss

Abstract: The problem of erosion is very prominent in Mediterranean karst area of Croatia, and one of the reasons are the degraded forest ecosystems. The important relationship of soil erosion with the state of vegetation, its degradation stadiums and soil characteristics has been stated. It is widely known that the regression development of vegetation is followed by quick soil erosion, and its progression development causes only normal geologic erosion which is overwhelmed by soil formation.

To state the impact of vegetation influence on the intensity of soil erosion by water in preserved and burned stands of Aleppo pine of the karst area of Croatia a forest experiment was made.

On two experimental plots of 100 m2 (20 x 5 m) during three years, from 2005-2007 the quantity and intensity of rainfall was observed, the surface flow off of rainfall and soil erosion. The results of research of given parameters are shown in this paper.

The first experimental plot was set on the burnt area in forest ecosystem of Aleppo pine, GPS coordinates: N 43 33´, E 16 30´. The plot is set on eroded rendsina on marl, 20 inclination, sea level 212 m.

The second experimental plot was set in the preserved stand of Aleppo pine of complete stand, GPS coordinates N 43 31´, E 16 32´, on inclination 26 and sea level 227 m. The plot is set on brown soil on marl, which is covered by thick layer of needles.

The results show that in the time observed on burnt area 215 rainy days were recorded, out of which the surface flow off and soil erosion were caused in 71 cases. Surface runoff and soil erosion were caused by rainfall from 7.1 mm/m2 to 78.6 mm/m2. The yearly value of erosion alluvium amounted to 0.1 t/ha, surface runoff 11.30 mm/m2, and the coefficient of runoff was between 0.0017 to 0.0824.

In the preserved stand of Aleppo pine out of 215 rainy days, 59 were erodible. Surface runoff and soil erosion were caused by rainfall from 8.5 mm to 78.6 mm. Yearly value of erosion alluvium amounted to 0.015 t/ha, surface runoff 5.59 mm/m2, the coefficient of surface runoff was between 0.0003 to 0.0162.

SESSION 2 – Land Use and Land Cover

Chairman: Eberhard Parlow

CLC2006: Mapping Land Cover of Europe under GMES

BUETTNER George
buttner.gyorgy@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

KOSZTRA Barbara
kosztra.barbara@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

SOUSA Ana
Ana.Sousa@eea.europa.eu
European Environment Agency

STEENMANS Chris
Chris.Steenmans@eea.europa.eu
European Environment Agency

Keywords: CORINE, land cover, Europa, change mapping

Abstract: Strategic discussions among EEA member countries and the main EU institutions responsible for environmental policy, reporting and assessment have underlined an increasing need for quantitative information on the state of the environment based on timely, quality-assured data, concerning in particular land cover and land use.

Based on these requirements EEA is collaborating since 2006 with the European Commission (EC) and the European Space Agency (ESA) on the implementation of a fast track service on land monitoring in line with the communication: "Global Monitoring for Environment and Security (GMES): From Concept to Reality" (COM(2005) 565 final).

CORINE Land Cover 2006 is the third European Land Cover inventory (1990, 2000 and 2006). The number of participating countries is growing, at present being 39. Project covers 5.8 Mkm2. The project is co-financed by the EEA and the member countries. Results will be freely available on the Internet. A Technical Team working under the ETC-LUSI (European Topic Centre Land Use and Spatial Information) is responsible for technical follow-up of the project i.e. training of teams and verification of results.

National teams are using multi-temporal SPOT-4/5 and IRS-P6 imagery to derive the, minimum 5 ha, land cover changes that occurred between 2000 and 2006. Particular emphasis is placed on deriving real land cover changes (i.e. to map real evolution processes). National teams usually have access to recent topographic maps and high-resolution digital orthophotos as ancillary source data for mapping. By combining CLC2000 and CLC-Changes in a GIS environment, CLC2006 is also being produced.

The presentation will address the following issues: project organisation; current status; preliminary results; change examples, country profiles; and major user organisations.

Using AWiFS images for the development of a National Land Cover Map of mainland Portugal: a stratified classification approach

ARAÚJO António
antonio.araujo@igeo.pt
RSU-IGP - Remote Sensing Unit, Portuguese Geographic Institute, Lisbon, Portugal

COSTA Hugo
RSU-IGP - Remote Sensing Unit, Portuguese Geographic Institute, Lisbon, Portugal

CAETANO Mário
mario.caetano@igeo.pt
RSU-IGP - Remote Sensing Unit, Portuguese Geographic Institute, Lisbon, Portugal

Abstract: Nowadays, precise, reliable and up to date information on land cover and land use is of the utmost importance among numerous areas (e.g., environmental studies, scientific applications, decision making support in a wide variety of policies). In Portugal, the development of detailed land cover maps was, until recently, carried out trough the use of visual interpretation methods over high spatial resolution data. Because these methods are expensive and time consuming, maps are not often updated as required by applications. In order to respond to this problem, the Remote Sensing Unit (RSU) of the Portuguese Geographic Institute (IGP) has recently started to develop a methodological approach for the establishment of an operational procedure for regular large-scale land cover mapping in mainland Portugal, using images from the IRS-P6 AWiFS sensor. The method is based on the exploitation of three scenes from three intra-annual time periods. It uses automatic classification procedures over a homogeneous-landscapes stratification of mainland Portugal (13 strata). This stratification corresponds to the result of the integrated analysis of several existent landscape studies for Portugal (e.g., vegetation, geology, geomorphology) and it has the objective of improving results by allowing independent training and classification of more similar areas of land cover. Classification uses a conventional supervised algorithm (e.g., Linear Discriminant Classifier - LDC, Maximum Likelihood Classifier - MLC) so that the methodology can be easily applied. In the end, the main goal of the developed method is the production of a 15-class land cover map for mainland Portugal on a bi-annual basis. Preliminary results corresponding to the classification of one stratum using MLC attained a 69% overall accuracy value estimated using a statistically sound accuracy assessment procedure, based on a stratified random sampling. This result makes us believe that we are on the right path to achieve with success the proposed goal.

A comparison of a Neuro-Fuzzy method with a maximum likelihood classification for land cover classes.

PERAKIS K.
perakis@prd.uth.gr
University of Thessaly, Greece

LALOU A.
National Technical University of Athens, Greece

STATHAKIS D.
dstath@uth.gr
University of Thessaly, Greece

Abstract: Both neural network and fuzzy systems are attempts to bring "human intelligence" into traditional data processing tasks, although the implementation is approached from different perspectives. The description of the aforementioned methods along with their application as classification tools in remote sensing, are presented in this paper. The two above techniques are applied to the satellite image IKONOS taken at the year 2007, and more specifically to the area of Skiathos. The aforementioned images were used for creating the spectrum signatures of the different land coverage categories. Furthermore, both the neural networks and fuzzy systems were applied to those images. The relevant accuracy between the resultant image classifications and the one occured, by applying the maximum likelihood (ML) method, was also tested. The resultant data were compared and several important conclusions were drawn. The need of a system that will combine the advantages of the two above technologies was the most important one. Such a paradigm already exists in the literature and is known as a neuro – fuzzy system.

DeCOVER Phase1 (2006-2008) – Development and demonstration of remote sensing based services to support existing land cover data systems in Germany

BUCK Oliver
oliver.buck@eftas.com
EFTAS - Remote Sensing Transfer of Technology GmbH, Muenster, Germany

BUESCHER Olaf
olaf.buescher@eftas.com
EFTAS - Remote Sensing Transfer of Technology GmbH, Muenster, Germany

Keywords: land cover changes, Inspire,semantic harmonization, geoinformation services, European directives

Abstract: Knowledge about land cover (LC) and land use (LU) changes are fundamental to decision makers to ensure a sustainable use and management of natural resources. This is enforced by recent European directives and initiatives that require spatially explicit information. Such information can be provided in an efficient and harmonized way over large geographic areas using remote sensing methods.
The DeCOVER phase 1 (2006-2008) was initiated as a research project to develop geo-information services at a national scale based on remote sensing. These service developments can be seen as a national extension of the European Global Monitoring for Environment and Security (KOPERNIKUS/GMES) initiative, to provide land cover information adapted to German user needs.
The DeCOVER services were designed to support an integrated data acquisition and continuation of existing LC/LU data systems such as the European CORINE land cover (CLC), the German topographic reference data set (ATKIS/DLM®) or state-wide environmental habitat mapping schemes (e.g. BNTK). This is in line with the national implementation of the INSPIRE process to harmonize geodata access and provide a national geodata infrastructure. Currently these systems on their own are not sufficient to fulfill all user requirements due to thematic and geometric constraints within limited update periods. Furthermore they can not be easily transformed and integrated into each other, for their respective data models are based on different semantic and syntax rules.
To provide semantic interoperability the object catalogues and definitions of ATKIS/DLM®, CLC and BNTK were formalized as far as necessary and possible using ontology models. These models were then utilized to formulate the DeCOVER object catalogue taking into accountprevailing user requirements. To provide methods for a cost-efficient continuation of these data systems a change detection method was developed to focus update efforts to areas of real land cover change.
The DeCOVER service developments were demonstrated over selected test areas in North-Rhine-Westphalia, Saxony and Schleswig-Holstein (all in Germany) and validated by selected user organizations. The final results of the DeCOVER phase 1 will be presented for discussion.
Based on the successful DeCOVER Phase 1 the need for further integration and harmonization (e.g. also considering geometric aspects) of the existing land cover data systems was identified. Currently there are preparations to continue work under a DeCOVER Phase 2.
The focus of the planned Phase 2 will be:
- The integration and exploitation of now operational remote sensing systems RapidEYE and TerraSAR-X based on change detection methods
- Stronger integration and support focus of ATKIS/DLM®, CLC, BNTK and their interactions
- DeCOVER downstream services focusing on the thematic aspects agriculture (crop monitoring, cross compliance) and nature protection (Natura 2000)

A study of the performance of the modified simple vegetation index (MSVI), based on probability theory

NIKOLAKOPOULOS Konstantinos G.
knikolakopoulos@igme.gr
Institue of Geology and Mineral Exploration, Athens, Greece

AIM SKIANIS George
skianis@geol.uoa.gr
University of Athens, Greece

Keywords: SVI, probability theory

Abstract: The Simple Vegetation Index, SVI, which is used in landcover mapping, is defined by:

$$SVI = u = NIR/Red \quad (1)$$

or

$$SVI = u = arctan (NIR/Red) \quad (2)$$

NIR and Red are the reflectances at the Near Infrared and Red band, respectively.

Vaiopoulos et.al. 2004 have proposed a Modified Simple Vegetation Index (MSVI), which is defined by:

$$MSVI = u = arctan (c \times NIR/Red) \quad (3)$$

c is a parameter which may be defined by the potential user and generally it takes values between 0.1 and 10. According to the probabilistic approach on the statistical behaviour of a vegetation index (Vaiopoulos et. al. 2004, Skianis et. al. 2007a, 2007b), changing c produces vegetation index images with different statistical properties and different optical effects.

In the present paper a systematic study of the performance of the MSVI is carried out, in terms of statistical behaviour as well as in terms of the optical effect and efficiency of the MSVI image in land cover mapping.

Statistical parameters such as the mean value, the standard deviation and the entropy of the MSVI histogram are calculated with the aid of probability theory and their dependence on the standard deviations of the NIR and Red bands are examined. The MSVI is also applied on satellite images over various land cover types and the theoretical predictions are compared with real data (statistical parameters of the satellite images). Particular emfasis is given on how the constant c may influence the visibility of various targets of interest. The results and conclusions of this paper may be useful in geological and environmental research (land cover mapping).

References

Vaiopoulos, D. A., Skianis, G. A., Nikolakopoulos, K., 2004 : The contribution of probability theory in assessing the efficiency of two frequently used vegetation indices. International Journal of Remote Sensing, 25(20), 4219-4236.

Skianis, G. Aim., Vaiopoulos, D., and Nikolakopoulos, K., 2007a: A study of the performance of the MSR vegetation index, using probabilistic and geostatistical methods. Proceedings of the 11th International Conference of the Geological Society of Greece, Athens 24-26 May 2007, Part 4, 2048-2059

Skianis, G. Aim., Vaiopoulos, D., Nikolakopoulos, K., 2007b: A Probabilistic Approach to the Problem of Assessing the Efficiency of the Transformed Vegetation Index. Int. J. Sus. Dev. Plann. 2(4), 461-480.

Evaluation of influence of image segmentation parameters and other selected effects on thematic accuracy of object oriented VHRS image analysis

CHMIEL Jerzy
j.chmiel@gik.pw.edu.pl
Warsaw University of Technology, Poland

FIJALKOWSKA Anna
a.fijalkowska@gik.pw.edu.pl
Warsaw University of Technology, Poland

Keywords: segmentation, land cover classification, object-based classification, VHRS

Abstract: Comparing to traditional pixel based methods of land cover identification, the object based approach allows to increase the set of discriminant features, including elements related to texture, size, shape, widely understood spatial and geographical context. This extent has important influence on digital classification efficiency and final accuracy. The thematic and positional accuracy of extracted and identified objects strongly depends on segmentation stage, which is very crucial one for further steps.

The paper presents results from different variants of object based land cover classification with the main aim to test the influence of segmentation methods and their parameters on the accuracy of land cover form identification based on VHR satellite image. The influence of selected filtering effects applied on certain stage of image analysis procedure was also tested. The object oriented approach was realized based on Definiens Professional set of tools. The analysis were done for spatially and spectrally complex terrain. Due to the fact that final comparisons of thematic accuracy concern the classified objects the right procedure of accuracy evaluation was developed and applied in the study.

The results show certain positives and limitations of applied approaches and defined variants, and confirm the importance of proper selection of segmentation procedure and adequate parameters.

Land use changes in the basin of upper Narew river over the past 116 years

NASILOWSKA Sylwia

sylwia.agata.nasilowska@student.uw.edu.pl

Warsaw University of Technology, Poland

Keywords: land use changes, high Narew basin, incoherent data, visual interpretation

Abstract: The goal of this thesis is to demonstrate quantitative multi-temporal analyses using satellite and cartographic data. This paper describes and presenting historical land use and population for the past 116 years (1885-2001). The investigated area is the Upper Narew basin, region witch lay in Poland (5576 km2) and Belarus (603 km2). The natural environment of describing basin is one of the most unique in Europe.

The available datasets for the analyses of land using changes are satellites images and archival topographic maps (for the periods XIX and beginning of XX century). Cartographic and remote sensing data are ambiguous, and for that reason results from study are incoherent for some classes, especially wetlands and country development.

Methodology and precision of area interests was the same as in CORINE Land Cover. The research shows it is possible to obtain coherent land-use maps which can be compared over time based on property created legend.

The results demonstrate that transformations were observed for 13.6 % until 1937, and after Second World War 23.5 % of study area. Forests and arable lands were dominant categories of land use in all periods of research. The biggest increase has been observed in artificial water bodies and urban areas. Natural water bodies mostly vanished. In the same time extinction of swampy grounds were observed. Wetlands have been drain during the past 60 years to create arable lands or pastures and meadows. Urban areas are being increased particularly at the expense of pastures and meadows and arable lands. Urbanization rate increase from 23 to 71 %, density of population rises above 3 times too during 116 years.

Land cover and coast line change detection by using object oriented image processing in Alaçatı, Turkey

GÜÇLÜER Dolunay
dolunaygucluer@gmail.com
Yildiz Teknik Üniversitesi, Turkey

BÜLENT Bayram
bayram@yildiz.edu.tr
Yildiz Teknik Üniversitesi, Turkey

DERYA Maktav
dmaktav@ins.itu.edu.tr
İstanbul Teknik Üniversitesi, Turkey

Abstract: The chosen study area Alaçatı is one of the most significant tourist regions in Turkey. Due to its natural and geographical characteristics it faces different threats, such as coastline changes by moving solid matter or formation of filled areas caused by anthropogenic effects. The detection of the coastline and land cover changes in Alaçatı has been investigated by using multitemporal satellite images, such as CORONA of 1963, LANDSAT of 1987 and 2000, and ASTER of 2007. An object oriented remote sensing software was used. This software is preferred due to its capability of generating fuzzy segmentation and classification by using both texture and reflection attributes of images and also for different types of data. In this study; climate, wind, flow data and bathymetric map were used as base information in order to generate coast model. Thus, the purpose of this study was to establish a basis for planning of preventing Alaçatı region.

The comparison of Filters in speckle reduction for JERS-SAR images

PETROSYAN Azniv
mariamarita2002@yahoo.com
PhD student, National Technical University of Athens, Greece

GITAS Ioannis Z.
igitas@for.auth.gr
Aristotle University of Thessaloniki, Greece

Abstract: Synthetic Aperture Radar (SAR) systems are considered as all-weather remote sensing systems suitable for mapping even under difficult weather conditions since they have the capability to penetrate clouds. However, it is difficult to detect small objects on SAR imagery especially when the backscattering intensity is as strong as the objects and the speckle noise (which is natural to SAR images) is serious. Since speckle noise affects the resolution and contrast of SAR imagery its reduction is extremely significant resulting in better image interpretation. The aim of this work was to investigate the performance of six filters (Average, Median, Gamma, Enh Frost, Kuan and Enh Lee) in the speckle reduction of JERS-SAR imagery.

In this study six JERS-SAR images of the Greek island of Thasos were employed. The SAR level 2.1 images were ortho-corrected with the DEM and the topographic map of the study area prior to the application of the filters. According to the results of the analysis the best filter was Gamma Radar Filter with 7x7 moving window and this is in accordance with what is reported in the literature.

SESSION 3 – Urban Remote Sensing (1)

Chairman: Derya Maktav

Investigation of the potential of multiscopic VHR satellite imagery for DSM extraction of complex urban areas

TACK Frederic
f.tack@ugent.be
Ghent University, Belgium

GOOSSENS Rudi
rudi.goossens@ugent.be
Ghent University, Belgium

BUYUKSALIH Gurcan
gbuyuksalih@yahoo.com
BIMTAS - Istanbul Metropolitan Planning Office (IMP), Turkey

Abstract: The urbanization process in Europe is going ahead with an unprecedented speed. Urban change processes are effecting the human and natural environment. This enlarges the need for more effective urban management approaches based on sustainable development. Because of the necessity of sufficiently detailed information on the urban environment and its dynamics remote sensing imagery has become an important data source. The improved radiometric quality and geometric accuracy of very high resolution sensors like Quickbird and Ikonos has increased the potential for producing photogrammetric products of complex built-up areas.

Objectives of the Belspo research project MAMUD are to improve the extraction of urban land-use information and elevation data from high and medium resolution imagery. Secondly to derive a set of urban spatial metrics from remote sensing data and to use them for the calibration of a spatially-dynamic land-use model. Finally to study the impact of urban growth on the quality of life and environment and the impact on the hydrological cycle. While most remote sensing based studies on urban dynamics only consider two-dimensional structure, in this research also multi-scopic imagery will be used to derive height information, which is obviously important in describing urban morphology and labeling urban objects.

The subject of this treatise will focus mainly on the ongoing and future work of DSM extraction from VHR satellite imagery. Built-up areas are known as being complex for photogrammetric purposes, partly because of the steep changes in elevation caused by buildings and urban features. Investigation is done at different levels of the photogrammetric process to improve the DSM production. In a preprocessing step different radiometric filters are applied to enhance the contrast and global quality of the original imagery. During image matching a combination of several image matching algorithms is used in a coarse-to-fine hierarchical way. The resulting surface model is optimized by the application of different spatial filters and interpolation techniques.

Fusion of ALOS PalSAR and SPOT HRG data for urban land-cover mapping in Stockholm

BAN Yifang
yifang@infra.kth.se
Royal Institute of Technology, KTH, Stockholm, Sweden

WALLIN Johan
SWECO, Stockholm, Sweden

Keywords: fusion, ALOS Pal SAR, SPOT, hierarchical, object-based classification, urban land cover

Abstract: The synergistic effects of synthetic aperture radar (SAR) and optical data have been recognized as important for two reasons. First, the timeliness of SAR fill in the information gaps during over cast. Second, the data from different part of the spectrum often provide complementary information and lead to increased classification accuracy. Due to frequent cloud cover in Stockholm, cloud-free optical data were often unavailable during the critical monitoring cycle. With its all-weather and day/night capability and its unique information content, spaceborne SAR is an attractive data source. Thus the objective of this research is to investigate the synergy of ALOS PALSAR and SPOT HRG data for urban land-cover mapping in Stockholm using object-based hierarchical approach.

Two scenes of ALOS dual-polarization PALSAR data were acquired in June and July, 2007. One scene of SPOT-5 HRG multispectral data was acquired in July 2007 with partial cloud cover. In this research, ALOS PALSAR duel-polarization L-band SAR data were being fused with the SPOT multispectral HRG data. The major urban landuse/land-cover classes are high-density built-up areas, low-density built-up areas, roads, forests, recreational areas, water, and agricultural lands.

The results demonstrated that fusion of ALOS PALSAR & SPOT HRG data improved land-cover classification accuracy compared to PALSAR or HRG alone. With addition of PALSAR, the accuracies of several classes, e.g., forest, agricultural land, low density built-up areas, increased, even though L-band may not be the best for land-cover classification. PALSAR was able to full in the `information gaps'during cloud cover. Further, hierarchical object-based classification increased land-cover classification accuracy with approx. 10% compared to using a pixel-based ANN classification.

An integrated approach to automated building extraction from very high resolution imagery in urban areas

DOXANI Georgia
gdoxani@topo.auth.gr
Aristotle University of Thessaloniki, Greece

SIACHALOU Sofia
ssiacha@topo.auth.gr
Aristotle University of Thessaloniki, Greece

TSAKIRI-STRATI Maria
martsaki@topo.auth.gr
Aristotle University of Thessaloniki, Greece

Abstract: The accurate identification of land cover types in urban areas is still a challenge for the remote sensing researchers. Very high resolution satellite imagery, which is commercially available nowadays, provides detailed information for the complicated urban environment. However the high spatial resolution does not certainly lead to high classification accuracy. A lot of small scale urban elements hamper the precise determination of classes; such elements can be cars, shadows, chimneys, etc.
The aim of this project is the design of an implementation strategy for identifying buildings in urban areas. The proposed method is based on image segmentation and object-oriented classification. An effective rule set is applied to Quickbird pan-sharpened image so as to automatically delineate and label urban areas. Buildings are extracted using spectral, contextual, and structural information of imagery data. A series of morphology algorithms is applied afterwards in order to handle "building" objects. Seed building rectangles are verified and region-grown algorithms define the buildings on the segmented image. An urban region of the city of Thessaloniki is the test site of the classification scheme.

Extracting urban structures for map updating using remotely sensed and lidar data

SIACHALOU Sofia
ssiacha@topo.auth.gr
Aristotle University of Thessaloniki, Greece

DOXANI Georgia
gdoxani@topo.auth.gr
Aristotle University of Thessaloniki, Greece

TSAKIRI-STRATI Maria
martsaki@topo.auth.gr
Aristotle University of Thessaloniki, Greece

Keywords: map updating, lidar, object-oriented, orthoimage, feature extraction

Abstract: Countries with a high development rate focus research on producing up to date accurate maps. High resolution remotely sensed data is an ideal source of up to date geographic data for urban projects. This paper proposes a methodology of detecting the main cartographic features, such as buildings, by using different types of information. The spectral and spatial content of high resolution satellite images has proved to be insufficient in the case of dense urban environment. To assist the extraction of building boundaries additional height information is imported based on the DSM of lidar data. Techniques of image processing and object-oriented classification are used to localize the outline of the building roofs. The results are presented and evaluated visually and statistically according to reference data in order to meet the needs of the mapping specification.

Satellite remote sensing image-based analysis for urban heat island assessment

ZORAN Maria

marianazoran@yahoo.com

National Institute of R&D for Optoelectronics, Bucharest Magurele, Romania

Keywords: biogeophysical parameters, urban heat island, satellite images, Bucharest

Abstract: During last period global warming was intensified because the global mean surface temperature has increased since the late 19th century.As urbanization has become an important contributor for global warming, Urban Heat Island (UHI) effect, will be sure to influence the regional climate, environment, and socio-economic development In this study, Landsat TM and ETM+ , MODIS, IKONOS images over Bucharest metropolitan area from 1989 to 2007 have been selected to etrieve the urban biogeophysical parameters and brightness temperatures n relation with changes of land use/cover types. Our analysis showed that higher temperature in the UHI was located with a scattered pattern, which was related to certain land-cover types. Based on biogeophysical information extracted from satellite data, in order to analyze the relationship between UHI and land-cover changes, this paper attempted to employ a quantitative approach in exploring the relationship between temperature and several indices, including the Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Difference Bareness Index (NDBaI) and Normalized Difference Build-up Index (NDBI). It was found that correlations between NDVI, NDWI, NDBaI and temperature are negative when NDVI is limited in range, but positive correlation is shown between NDBI and temperature.

A flexible alternative for frequent digital orthophoto surving of city areas

KOLEGA Natasa
natasa@harphasea.si
Harpha sea, d.o.o. Koper, Slovenia

GRAHOR Jure
jure@harphasea.si
Harpha sea, d.o.o. Koper, Slovenia

JEKLAR Marko
jackie@harphasea.si
Harpha sea, d.o.o. Koper, Slovenia

Keywords: digital orthophoto, city areas, digital SLR camera

Abstract: City of Koper is a medium sized city in the coastal area of Slovenia. The city is in phase of urban transformation, development and renovation. For purposes of planning, surveying and evaluating this processes we need periodic (every two months) digital ortophoto pictures of the city. At this point we encounter the common problem which is the unacceptable price of ordering the elaboration of new ortophotos produced by Surveying authorities of Republic of Slovenia or other private operators every two months. Thus, we started to develop our own technology and process of creation of aero photography from taking snapshots to post processing that is very flexible and adapted to our needs.
The system consists of a 12 megapixel digital SLR camera, an IMU (inertial measurement unit) sensor, a laptop computer and appropriate software. It is easily portable and adapted for use with the very common aircraft Cessna 172.
The precision and quality of our ortophotos is comparable to the quality of ortophotos made during LIDAR scanning or of those produced by the Surveying authorities of Republic of Slovenia.
The other advantage of proposed method is that we can capture and post process these orthopotos in various ways depending on our specific needs. The ortophotos are also standardized which means they are appropriate for the usual applications of ortophoto pictures.
After our first employment, the relation between the price, the quality and the amount of effort put in is evaluated as positive and appropriate for similar cases elsewhere.

SESSION 4 - Image Processing Techniques

Chairman: Andre Marcal

Land-cover classification and unmixing of hyperion image in area of Anopoli

ELATAWNEH Alata
alataaa@yahoo.com
MAICH - Mediterranean Agronomic Institute of Chania, Greece

MANAKOS Ioannis
manakos@maich.gr
MAICH - Mediterranean Agronomic Institute of Chania, Greece

KALAITZIDIS Chariton
chariton@maich.gr
MAICH - Mediterranean Agronomic Institute of Chania, Greece

SCHNEIDER Thomas
Tomi.Schneider@lrz.tu-muenchen.de
Technische Universität München, Germany

Abstract: Hyperion is unique because it is the only detailed hyperspectral sensor on a satellite platform. The hyperspectral capability of the sensor could potentially allow for classifications of increased accuracy, in comparison to those produced from multispectral data. This study evaluates the capability of Hyperion data for discriminating land-cover classes in the Anopoli region (southwest Crete, Greece), through classification and spectral unmixing procedures.

Preprocessing of Hyperion data is essential before any analysis takes place, and it includes interpolation of the wavelengths to a common set, noise reduction by using the minimum noise fraction, and other commonly applied corrections. Land-cover classifications were performed on the Hyperion satellite data through the Spectral Angle Mapper (SAM) pixel-based technique, as well as the object-oriented technique. The results were evaluated using the ground truth data derived from high spatial resolution imagery (QuickBird) and field data. Both classification results appeared to suffer from the relatively low spatial resolution of the Hyperion sensor. In order to take advantage of the hyperspectral data of Hyperion, and overcome the problem of low spatial resolution, non-linear spectral unmixing approaches were employed, by using artificial neural network ANN. The spectral end-members used in those approaches were constructed from QuickBird data, and the results were evaluated and compared to the classification result. Finally, the advantages and disadvantages of the two classification and unmixing approaches are discussed.

Evaluation of multi-spectral image segmentation algorithms using the Synthetic Image TEsting Framework (SITEF)

MARCAL André R.S.
andre.marcal@fc.up.pt
University of Porto, Portugal

RODRIGUES Arlete
dr.arlete@gmail.com
University of Porto, Portugal

Keywords: image processing, object based image analysis, image segmentation, similarity indics

Abstract: Over the last decade an alternative approach to the standard per-pixel analysis has evolved, to extract meaningful information from multi-spectral satellite images. Instead of focusing on individual image pixels, the object-based image analysis approach consists of partitioning an image into meaningful image-objects. The main reasons for the development of object-based methods has been the increase in commercially available high resolution satellite imagery, and also it has been recognised that the image pixel is not a "natural" element of an image scene.
One of the most critical points of object based image analysis is the initial segmentation stage. If the segmentation fails to identify as an object a given element present in the image, the subsequent stages will generally be unable to recognise or to classify this element. An evaluation of the abilities and limitations of the segmentation algorithms used is therefore an important aspect of any object based image analysis system.
The purpose of this work is to present the Synthetic Image TEsting Framework (SITEF), a tool to evaluate the performance of segmentation algorithms on multi-spectral images. The general methodologies used to produce synthetic images and to evaluate segmentation results are initially presented. The system is then used to evaluate four segmentation algorithms available in the Definiens 7 software, with a set of test satellite images from SPOT HRG, Landsat TM and ASTER.
The synthetic test images are used as input to the segmentation algorithms being tested. The segmentations produced are then compared with a reference image, using the Hammoude metric and the Rand and Jaccard internal similarity indices.

A comparison Study on Pan-sharpening Algorithms and its Quality Assessment

KHALDOUN SALMAN ABU ALHIN

abual@student.tu-freiberg.de

TU Bergakademie Freiberg, Institute for Mine-Surveying and Geodesy, Germany

NIEMEYER IRMGARD

irmgard.niemeyer@tu-freiberg.de

TU Bergakademie Freiberg, Institute for Mine-Surveying and Geodesy, Germany

Keywords: pan-sharpening algorithms, quality index, quality assessment

Abstract: There is an increased use of image processing techniques to combine multispectral images with higher spatial resolution panchromatic images to produce a so-called pan-sharpened image that has both high spatial and spectral resolution. Different pan-sharpening techniques have been developed in the past. At the same time, variety methods have been used to evaluate the quality of the pan-sharpening algorithms, either spectral or spatially.

In this study four different pan-sharpening algorithms have been tested based on a set of three ETM Landsat images. Many factors affect the quality of pan-sharpening, such as geometric and radiometric distortion. Thus, in order to reduce the effect of these factors, an accurate image-to-image registration was performed. Moreover, the three multispectral images were fused with the corresponding panchromatic image from the same acquisition time.

The objective of this study is to evaluate the performance of the following pan-sharpening algorithms: i) Discrete wavelet transformation (DWT), ii) À trous wavelet transforms fusion (ATWT), iii) Gram-Schmidt spectral sharpening and iv) Principal Component (PC) spectral sharpening. Different methods of quality assessment have been used to evaluate the quality of the different pan-sharpening algorithms: Universal Image Quality Index (UIQI), Correlation Coefficient (CC). UIQI has been calculated for different land cover classes (agricultural area, urban, and mixed area). Additionally, the texture occurrence filter has been used to produce variance image for the panchromatic and the pan-sharpened image. The difference of the two variance images has been used to estimate the spatial quality of the sharpened images. Moreover, the quality was assessed based on the comparison of classification of the multispectral and the pan-sharpened image.

According to the variance difference images, the ATWT pan-sharpening algorithms obtained the best results followed by PC and GS. The results confirm the results based on CC, where DWT has obtained the poorest spatial quality. UIQI provides different quality results for the given land cover classes: For agricultural land cover and urban subset DWT obtain the best results in all bands followed by Gram-Schmidt, ATWT and PC spectral respectively, and this applies for all three Landsat datasets.

For the comparison of classification, the percentage of classification changes between the original multispectral image and pan-sharpened image was calculated per class. The percentage of changed classes shows that the wavelet-based algorithms (ATWT& DWT) obtained the best results (minimum changed percentage) compared to PC spectral and Gram-Schmidt. Therefore the wavelet-based techniques seem to better save the spectral values of the multispectral bands, whereas PC spectral and Gram-Schmidt Pan-sharpening come along with a larger modification of the spectral values.

Data fusion: taking into account the modulation transfer function in ARSIS-based pansharpening methods

PIERRE Massip P.
pierre.massip@mines-paristech.fr
Ecole des Mines de Paris, France

BLANC Ph. Philippe
philippe.blanc@mines-paristech.fr
Ecole des Mines de Paris, France

WALD L. Lucien
lucien.wald@mines-paristech.fr
Ecole des Mines de Paris, France

Keywords: fusion, pansharpening, multispectral (MS) images, panchromatic (PAN) images, PSF, MTF, ARSIS, remote sensing

Abstract: Current earth observation satellites deliver two types of images that have different characteristics. One type deliver high spatial resolution in a panchromatic spectral range (Pan), whereas the multispectral type provides a good spectral resolution but with a coarser spatial resolution (MS). Therefore, there is complementary information contained in both types of images and the interest of fusing both types of images has been demonstrated since long. Pansharpening is a particular case of data fusion which aims at merging both spectral and spatial information.

Fusion methods are often divided in three families: projection substitution, relative spectral contribution and ARSIS concept. Recent published works demonstrate that, among the three families, the methods based on the ARSIS concept better synthesize high resolution images with respect to spectral properties. However, the need to refine the spatial/geometrical quality of synthesized image is often underlined.

An imaging system can be considered as a low pass filter. For optical instrument the filter is characterized by the Point Spread Function (PSF). The Modulation Function Transfer (MTF) is the modulus of the Fourier Transform of the PSF. MS and Pan images have different spatial resolutions and the two MTFs differ. This difference must be taken into account if we want to create a MS that could have been observed by a high resolution multi-modal sensor. The ARSIS-based algorithms presenting the best performances take into account the MTF when performing the multiresolution analysis.

We propose a new way to treat the MTF of multispectral images. Our solution is i) to model the MTF in a more accurate way than a simple Gaussian function, and ii) to transform the MTF of MS images to gain more control on the MTF of the synthesized image. Synthesized MS images should have a MTF close to the MTF of images at high resolution. With this process, the contrast representation in the synthesized image is closer to the ideal case. This approach is applied to methods based on the ARSIS concept for fusion, but could be applied to methods based on other concepts.

In this work, images used are simulation of the PLEIADES images. Simulations allow a good knowledge and control of the MTF of each image. The original MS images at high resolution are reference to compare synthesized images with.

The transformation of the MTF of the MS image starts by a deconvolution. Then, a resampling is performed as it is necessary for practical reasons in pansharpening. Finally, new MS images at the sample step of the panchromatic images are convoluted with a MTF of MS image but at high resolution to provide the expected synthesized image. This technique is applied to existing ARSIS-based methods and an improvement of the performances is observed. The quality budget is improved for almost all of the quality criteria.

Classifiers vs. input variables – the drivers in image classification for land cover mapping

HEINL Michael
michael.heinl@uibk.ac.at
Institute of Ecology, Innsbruck, Austria

TAPPEINER Ulrike
ulrike.tappeiner@uibk.ac.at
Institute of Ecology, Innsbruck, Austria

Keywords: classification, land cover, land use,maximum likelihood,discriminant analysis, artificial neural network, multi-temporal data, Landsat

Abstract: The performance of image classifiers for large-scale land cover mapping and the relevance of input variables for classification accuracy are investigated in order to assess and to quantify the importance of these components in image classification. Specifically tested are the performance of maximum likelihood classification, artificial neural networks and discriminant analysis for a 3500 km2 study area in the alpine region. DEM-derived ancillary data and radiometric modifications of spectral data (Landsat ETM+) are incorporated step-wise into the classifications to document and discuss the relevance of these input data. Including ancillary data did show a much larger potential for increasing classification accuracy than the selection of the classifier. Multi-temporal spectral information further increased classification accuracy, despite seasonal variations in snow cover of the different land cover types. Specific assessments of 'winter images' and snow covered pixels demonstrate their ability to enhance land cover classification accuracies.

Multi-scale Change Detection Based on Fractal Analysis

LILLO-SAAVEDRA Mario
malillo@udec.cl
University of Concepción, Chillan, Chile

GONZALO Consuelo
chelo@fi.upm.es
Universidad Politecnica de Madrid, Spain

Keywords: change detection, multi-scale, fractal dimension

Abstract: Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times [1]. Most existing multi-temporal change detection methods use the spectral information alone. However, the inclusion of spatial information in change detection increase the accuracy of this process [2].

On the other hand, if accurate registration between images were not achieved, false differences are evaluated instead of real changes at the same location.

In this work, the authors propose a novel methodology in order to detecte the spectral and morphological changes into a temporal sequence of images over the same geographical area. This methodology is based on arithmetic operations between fractal maps, calculated by the box-counting algorithm, of the images under analyzes.

Two multispectral Spot5 images has been used to evaluate the performances of the proposed methodology and the results obtained have been compared with widely used methods. From the results it can be concluded that the new method presents two main advantages against the other method, that increase the changes detection accuracy: the capability of multi-scale change detection and low sensitivity to misregistration.

[1] Liu, T., Gigli, G. and Lampropoulus, G., 2008, Change Detection Methodology Based on Region Classification Fusion.

[2] Li, P., Cheng, T., Moser, G., Serpico, S., 2007, Multitemporal Change Detection by Spectral and Multivariate Texture Information.

Fuzzy classification and Analysis hierarchy Process of remotely sensed indices and compare them by climate drought indicators for analyzing drought in Kashan district

SHAMSIPOUR Ali Akbar
akbarshamsipour@gmail.com
University of Tehran, Iran

ALAVIPANAH Seyed Kazem
salavipa@ut.ac.ir
University of Tehran, Iran

MATINFAR Hamid Reza
matinfar44@gmail.com
College of Agriculture, University of Lorestan, Iran

ADLI Saeid Nazari
Iran

KHODAEE Zahra
Iran

Abstract: Image classification of historical satellite images is very useful for the study of drought, and combination of indicators and variable. To determining the quality of information derived from the classification process, accuracy assessment of the classification is implemented. The aim of this paper is detection of correlation relationship of remotely sensed and meteorological indicators in the analysis of drought phenomenon at the north-west of the Iranian desert (Dasht-e-kavir). The average topographical height of the area is about 1987 mASL, where thin and sparse vegetation covers over sand dunes and bare lands. In this survey by fuzzy logic and analysis hierarchy process (AHP), remote sensing indicators under investigation were classified, weighted, and scaled base on the priorities. Concerning the climate drought indicators of Z square, seasonal (March to May) raining, relative humidity and temperature was tested by correlation and evaluation test. The methodology of study based on preparation, and processing of 129 satellite images NOAA-AVHRR in the April and may of years 1998 to 2004 and data of atmosphere elements of temperature , raining and monthly partial humidity in 12 aerology stations.
According to the results, drought classification of fuzzy model –AHP in May 2002 shows the highest amount of correlation relation with meteorological drought indicators. Among aerology indicators, Z normal indicator of partial humidity shows the most implication by layers out of model. In years 1998 and 2002 relation between models layers and indicator have high level of implication (0.02 and 0.01). Generally, Z square of raining mean criteria, three-month partial humidity has reverse relation, and air temperature has direct relation with classification yielded by model.

Automatic cloud and cloud shadow detecton from Landsat imagery

PEKKARINEN Anssi
anssi.pekkarinen@metla.fi
METLA – Finnish Forest Research Institute, Helsinki, Finland

STROBL Peter
peter.strobl@jrc.it
JRC - Joint Research Centre, Ispra, Italy

Keywords: Landsat, cloud detection, morphological image analysis

Abstract: Clouds and cloud shadows, both commonly present in optical remote sensing imagery, pose a challenge for an automated land cover classification for two reasons. First, thick clouds completely prevent the sensor from seeing the underlying land surface. Second, thin clouds and cloud shadows reduce the intensity and change the spectral properties of the irradiance reaching the ground. Therefore, it is often necessary to exclude cloud and cloud shadows from the actual image analysis.

Depending on the instrument the identification of clouds and their shadows is an exercise of varying complexity. However, in many cases an exact delineation of clouds and cloud shadows is less crucial than their reliable exclusion from further analysis. In this paper a simple, fast, and robust methodology is presented which aims at deriving reliable cloud and cloud shadow exclusion mask. The methodology consists of two steps: 1) cloud and shadow detection and 2) composition of the exclusion mask. During the first step, potential cloud and cloud shadows are detected on the basis of their spectral (and thermal) properties. In the second step, a number of morphological image processing functions are applied to meliorate the most frequent deficiencies of the step 1.

The paper presents the method and illustrates the masking results with a number of examples from Landsat TM and ETM+ images. Furthermore, the paper thoroughly discusses the performance and limitations of the proposed method.

Anomaly detection in hyperspectral images of complex scenes

BORGHYS Dirk C.
dirk.borghys@rma.ac.be
Royal Military Academy, Brussels, Belgium

SHIMONI Michal
mshimoni@elec.rma.ac.be
Royal Military Academy, Brussels, Belgium

PERNEEL Christiaan
Christiaan.Perneel@rma.ac.be
Royal Military Academy, Brussels, Belgium

Keywords: anomaly detection, hyperspectral, imaging spectroscopy, urban, segmentation

Abstract: The aim of anomaly detection in hyperspectral image processing is to
detect pixels in the hyperspectral datacube that exhibit spectral signatures that are exceptional in the investigated scene. The current paper investigates the detection of anomalies in complex environments, i.e. urban and industrial scenes. The classical anomaly detection consists of a local measurement of differences between the spectral signature of the pixel and the average spectral signature of its surroundings. In complex environments such an approach is not adequate because of the high spatial variation of the background spectral features.

Approaches based on segmentation have already been proposed in literature. The approach proposed here is based on a determination of characteristic spectra in a scanning window.

At each position of the scanning window a few characteristic spectra are determined. This is done either by spectral clustering or end-member selection methods. Then the image tile is classified using the determined spectra and the spectra that correspond to a given percentage of the image tile are stored. At the end of the process the collected set of spectra is clustered and the image is classified w.r.t. the found cluster centres, using a distance classifier.

The method is tested and evaluated on datasets from 4 different hyperspectral airborne instruments. Hymap data over an airfield, Rosis data over a city, AHS160 over a commercial harbour and Hyspex data over a small rural village are used. The proposed methods based on local clustering and end-member selection are compared to a classical full-image segmentation approach.

SESSION 5 – Radar Remote Sensing (1)

Chairman: Jan Wegner

Investigation of the Stereo-Radargrammetric Mapping Potential of TERRASAR-X

RAGGAM Hannes
hannes.raggam@joanneum.at
Joanneum Research, Institute of Digital Image Processing, Graz, Austria

GUTJAHR Karlheinz
karlheinz.gutjahr@joanneum.at
Joanneum Research, Institute of Digital Image Processing, Graz, Austria

PERKO Roland
roland.perko@joanneum.at
Joanneum Research, Institute of Digital Image Processing, Graz, Austria

Keywords: TerraSAR, stereo mapping, interferometry, digital surface model

Abstract: The first German space mission TerraSAR-X was launched on June 15th, 2007. Within the TerraSAR-X science program of the German Aerospace Center (DLR), the Institute of Digital Image Processing of Joanneum Research (JR-DIB) has gained a principal investigator status with respect to the assessment of the mapping potential of TerraSAR-X data using radargrammetric as well as interferometric techniques.

With respect to topographic mapping, TerraSAR has initiated a new generation of high-resolution spaceborne SAR sensors, as it provides SAR images at very high resolution down to 1 meter and at variable and selectable off-nadir looking angles. Thus, high resolution SAR stereo image pairs can be acquired at optimized imaging conditions, stimulating the tradional stereo mapping approach to be used for 3D mapping, either in parallel with or as an alternative to SAR interferometry as the evolving mapping technique of the last decade.

In order to assess the potential of TerraSAR-X for 2D and 3D mapping applications, stereo-radargrammetric as well as interferometric techniques are investigated. Various types of underlying topography and terrain, like alpine, rural and urban areas, are considered. In particular, TerraSAR-X image data acquired in Stripmap mode are used for alpine terrain, while image data acquired in high resolution Spotlight mode are used for urban and rural areas. Thus, the mapping performance is analysed for alpine topographic characteristics and for ground cover features like trees and buildings as well.

With respect to urban and rural areas it is analysed, whether and at which accuracy buildings and forest stands can be extracted by means of stereoscopic and/or intereferometric mapping techniques. The analysis further refers to the best suited incidence angles to be used for stereo mapping in order to achieve optimum accuracy. Surface models and vegetation height models are generated for the individual test sites and by means of various processing workflows, i.e. stereo data as well as INSAR data processing.

The quality of the achieved surface models is evaluated by a comparative analysis including reference ortho-images and reference surface models, e.g. being acquired by laser scanning, or being generated from stereo processing of high-resolution optical image pairs. The results of the investigations devoted to radargrammetric and interferometric mapping techniques are presented in the paper.

Additional Benefit of Image Fusion Method from combined High Resolution TerraSAR-X and Multispectral SPOT Data for Classification

KLONUS Sascha
sklonus@igf.uni-osnabrueck.de
Institute for Geoinformatics & Remote Sensing, University of Osnabrueck, Germany

EHLERS Manfred
mehlers@igf.uni-osnabrueck.de
Institute for Geoinformatics & Remote Sensing, University of Osnabrueck, Germany

Keywords: Fusion, Radar/multispectral image integration, pansharpening, color preservation, classification, segmentation

Abstract: In Image fusion the objective is generally to combine the spatial structure of a high resolution panchromatic image with the spectral information of a low resolution multispectral image to produce a high resolution multispectral image. The fused image should preserve the spectral characteristics of the multispectral image during the process and only the spatial structure of the panchromatic image should be inserted into the fused image. As a substitute for the panchromatic input we used image data of the German RADAR satellite TerraSAR-X in this study. In the spotlight mode, the satellite is able to record data with one meter spatial resolution. The RADAR image data was combined with SPOT multispectral data in a region in northern Spain. In this study we investigated if such an image fusion method could improve the results of a multispectral classification using unfiltered RADAR image data as input for classification. Usually this would lead to worse classification results, because of its inherent speckle noise. This is especially true if the multispectral and the RADAR image are from different dates. Therefore, only the highpass filtered information of the TerraSAR-X image is used during the fusion process. Use was made of the Ehlers Fusion, a fusion technique that was developed for preserving maximum spectral information. It has already proven its superiority over standard pansharpening techniques such as IHS, PC, Brovey, multiplicative fusion and Wavelet fusion methods. The Ehlers fusion is based on an IHS transformation combined with filtering in the Fourier domain and was developed for fusing panchromatic and multispectral electro-optical data. The Ehlers Fusion was then modified to integrate radar data with optical data. Different classification algorithms were applied to show that the pansharpening method could improve the results, but this depends on the chosen classification algorithm.

COSMO-SkyMed Mission: Status and Results

BATTAZZA Fabrizio
fabrizio.battazza@asi.it
ASI - Agenzia Spaziale Italiana, Rome, Italy

COLETTA Alessandro
alessandro.coletta@asi.it
ASI - Agenzia Spaziale Italiana, Rome, Italy

MANONI Gemma
gemma.manoni@asi.it
ASI - Agenzia Spaziale Italiana, Rome, Italy

VALENTINI Giovanni
giovanni.valentini@asi.it
ASI - Agenzia Spaziale Italiana, Rome, Italy

Keywords: SAR, constellation, earth observation

Abstract: In 2007 and 2008 ASI (Agenzia Spaziale Italiana/Italian Space Agency) launched three out of four X-band SAR satellites of the COSMO-SkyMed (COnstellation of small Satellites for Mediterranean basin Observation) Mission, making available to the users a unique SAR constellation dedicated to the Earth Observation.
The constellation will be completed with the launch of the forth satellites in the first half of 2010.
COSMO-SkyMed is the largest Italian investment in Space Systems for Earth Observation, commissioned and funded by Italian Space Agency (ASI) and Italian Ministry of Defense (MoD). COSMO-SkyMed is a Dual-Use (Civilian and Defence) end-to-end Earth Observation System aimed to establish a global service supplying provision of data, products and services relevant to a wide range of applications, such as Risk Management, Scientific and Commercial Applications and Defence/Intelligence Applications.
The system consists of a constellation of four Low Earth Orbit mid-sized satellites, each equipped with a multi-mode high-resolution Synthetic Aperture Radar (SAR) operating at X-band. The system is completed by dedicated full featured Ground infrastructures for managing the constellation and granting ad-hoc services for collection, archiving and distribution of acquired remote sensing data.
The first and second COSMO-SkyMed satellites are in the operational phase while the third one is completing its commissioning phase.
The results coming from the utilisation of the two first satellites, after the first year of life, revealing an excellent performance of the X-band SAR and the importance of a fast response time in several application as risk and emergency management (i.e.: China's earthquake, Myanmar and Haiti flood), ice monitoring (reduction of the glaciers, Wilkins Ice Shelf disintegration), multi-temporal acquisition for agriculture monitoring, ship detection, interferometry, landslides monitoring, maritime surveillance and security, rapid mapping.
A further step forward will be realised when COSMO-SkyMed 3 will be operative, since the third satellite is positioned in the so-called "one-day interferometry configuration", it will allow the constellation to detect interferometric acquisitions with a de-correlation time equal to one day.
The first COSMO-SkyMed Announcement of Opportunity for scientific data exploitation will give the chance to achieve innovative and valuable results .using the COSMO-SkyMed data, products and services.

Classification of Agricultural Sites using Time-series of High-resolution dual-polarisation TerraSAR – X Spotlight images

LOHMANN Peter
lohmann@ipi.uni-hannover.de
Institute of Photogrammetry & GeoInformation, Leibniz University of Hannover, Germany

SOERGEL Uwe
soergel@ipi.uni-hannover.de
Institute of Photogrammetry & GeoInformation, Leibniz University of Hannover, Germany

FARGHALY D.
dalia_amer@yahoo.com
Student, Egypt

Keywords: multitemporal land-use classification, cropping calender, speckle filtering

Abstract: Increasing demands for lasting and environmentally conscious use of natural resources together with a cost effective and restrictive use of fertilizers and pesticides require the employment of new technologies in agriculture. The preliminary results presented here consist in the automatic land use classification of agricultural fields based on multi-temporal TerraSAR-X images in dual polarization obtained in the high resolution Spotlight mode of the satellite. The classified data in turn can be used to enhance and validate existing models on ground water quality as a function of agricultural usage and soil treatment.

Within the past years investigations using ENVISAT ASAR data for environmental mapping of the same area showed some deficiencies mainly because of the spatial resolution of the data, which was too coarse for many cultivations and could not reflect agricultural treatments sufficiently. However, a proper selection of images out of a time series according to the crop-calendar of that region proved beneficial and gave more accurate results than using all images. This is due to the fact that some fields are covered by different types of crops during the year and such sequence is often hard to model because it is usually governed by phenologic, ecologic, and economic reasons, which often results from sudden change of global or national economic constraints (e.g., oil prize, taxes, and subsidies) or strategies of individual farmers. In this paper, results obtained from multi-temporal classifications of TerraSAR-X image pairs (HH and VV) covering a whole season (11 images from March to November) are presented. Even though the temporal grid was irregular (revisit time was nine times 22 days and once 44 days) in every month at least one pair was available.

The investigations and results are based on standard pixel based Maximum Likelihood classification techniques, which were amended by applying regional crop calendar conditions and rules accounting for seasonal crop rotation. Results obtained have been compared to ground truth, which has been carried out in-situ to the satellite measurements.

It can be shown that even when using all images of the year a considerable classification accuracy of more than 75% can be achieved. This accuracy can be improved by different types of pre-processing (i.e., filtering) and best accuracy is obtained by using sub-sets of images from the time-series according to the crop calendar. Some remaining discrepancies in some species can be explained by investigating the structural behaviour of the plants on ground as compared to close range photos being taken during ground truth.

As could be demonstrated the use of time-series of images from TerraSAR-X despite of frequent cloud cover offers an excellent tool for monitoring crops and serve as indicator for the estimation of the amount of fertilizers used within that area. Using this information, farmers could improve their efforts in establishing good agricultural practice, as being claimed by recent legal and environmental jurisdiction. In future work other modern classification techniques shall be applied, such as support vector machine.

Study on Synthetic Aperture Radar potential for direct biomass assessment

BOCHENEK Zbigniew
zbigniew.bochenek@igik.edu.pl
Institute of Geodesy and Cartography, Warsaw, Poland

DABROWSKA-ZIELINSKA Katarzyna
katarzyna.dabrowska-zielinska@igik.edu.pl
Institute of Geodesy and Cartography, Warsaw, Poland

KOWALIK Wanda
wanda.kowalik@igik.edu.pl
Institute of Geodesy and Cartography, Warsaw, Poland

Abstract: Earth Observation data give high potential to assess the biomass of vegetation. Initially, methods of deriving information on vegetation growth conditions and biomass were based on optical data, collected by environmental satellites with sensors of different resolutions (low and high-resolution satellite images). However due to frequent clouds cover, the application of multitemporal SAR data proved to be very useful for classification of vegetation and application for biomass assessment.

The presented paper gives an overview of the state-of-the art in the field of radar applications for vegetation studies with the special emphasis put to evaluation of biomass. Applications of different types of SAR sensors are presented for two types of vegetation relevant for biomass production: agricultural crops and forests. As far as forests are concerned, multiple approaches are presented, which apply various radar wavelengths (C-band, L-band, P-band) and different wave polarizations (VV, HH, HV). Results from regression analyses with forest variables: biomass, height, dbh (diameter-breast-height) and total stem number were demonstrated with conclusions concerning optimal choice of radar band and polarization for assessment of these variables with high accuracy. Usefulness of various radar techniques was tested, like PPD (Polarization Phased Difference), or semi-empirical algorithms based on a two layer radar backscatter model. Also applicability of special indices, useful for better assessment of forest biomass, like BCI (Biomass Consolidation Index), which is the combination of biomass density (t/ha) and stand consolidation (amount of trees per ha), was presented.

Analogous analysis of recent achievements was done for SAR applications related to agricultural crops. Conclusions concerning optimal SAR wavelengths and polarizations for crop type mapping were presented, including own Author's experience in crop classification based on various SAR sensors (X and L bands). Results concerning interactions of a backscatter signal with soil and vegetation were demonstrated, with their implications on accuracy of biomass assessment. Methods incorporating multifrequency polarimetric SAR into the crop canopy models aimed at obtaining physical parameters related to biomass, as Leaf Area Index and crop height, were discussed. Finally, the summary table, presenting possibilities of applications and ordering data from different sensors (past and present), wavelengths, polarizations, spatial resolutions for assessment of various vegetation parameters, with the special emphasis put to biomass, was created as a result of the study.

The synergy of optical VHR satellite images and TerraSAR-X StripMap data in early and rapid agricultural crops mapping.

MROZ Marek
marek.mroz@uwm.edu.pl
University of Warmia and Mazury, Olsztyn, Poland

MLECZKO Magdalena
macia-m@o2.pl
University of Warmia and Mazury, Olsztyn, Poland

Keywords: TerraSAR-X, Ikonos, crops mapping, optical radar synergy

Abstract: The paper presents the methodology and results of early agricultural crops mapping achieved with TerraSAR-X StripMap images acquired at single and dual polarization mode, during spring and summer 2008 over test site Malbork in Northern Poland. Two types of images in time sequence were ordered and acquired: stripNear_013R, VV/VH and strip_007R, VV, both in Radiometric Enhancement resolution variant. The first TSX observations and Rapid Field Visits started at the moment just after spring cereals have been emerging over the soil but not yet influencing radar backscattered signal coming from soil. Two short-time TSX series were analyzed from crops identification's point of view regarding differences of: viewing angles between strips R013 and R007, radiometric and speckle characteristics of VV channel in single and dual pol. mode, significance of cross polarization component. The development stages and variability (evolution) in time of plants' parts were documented in order to analyze their influence on power of backscattering ("spectral" signature). The methodology of data analyses was subordinated to CAP/JRC/CwRS requirements demanding the maximum reliability and accuracy in crops mapping before the harvest. In this perspective TSX dataset was supported by optical IKONOS image taken the same day as the first TXS image (25.04.2008) and three input dataset were created for automatic classification purposes: 1) TSX images only, 2) TSX + "native" IKONOS data and 3) merged radar-optical "product". The results of classification are the main output from this methodological approach.

ENVISAT radar products for the estimation of the water volume variations of Lake Izabal, Guatemala

MEDINA Camilo E.
camilomedi@gmail.com
University of Cádiz, Spain

GOMEZ-ENRI Jesus
jesus.gomez@uca.es
University of Cádiz, Spain

ALONSO Jose J.
josejuan.alonso@uca.es
University of Cádiz, Spain

VILLARES Pilar
pilar.villares@uca.es
University of Cádiz, Spain

Keywords: altimetry, SAR, water volumes, Lake Izabal

Abstract: The water stored in a lake is the result of the balance between water entries and outlets from the ecosystem. The water volume variations are determined by a complex interaction among climate over the catchment and the lake's area, surface and ground waters. It is considered that the knowledge of the water volume variations of any given lake is important from hydrological, social and climate points of view. Traditionally, the lake's water volume is calculated by the combination of in situ level gauges and accurate bathymetry maps. However, there is a lack of information of natural lakes water volumes. This study describes a methodology based on remote sensing data, which could be used to derive water volume variations of ungauged natural lakes. The research was focused on Lake Izabal, the biggest one of Guatemala. Since the predominant climate conditions in the region are cloudy and rainy, the best suited data products are radar products (active sensors), as they can be acquired regardless the weather conditions. The water volume variations of Lake Izabal were obtained combining lake levels changes and inundated area variations. The Radar Altimeter (RA-2) was used to derive lake levels, whereas the Advanced Synthetic Aperture Radar (ASAR) was used to extract the lake coastline and to compute the inundated area. Both sensors flight onboard the ENVISAT satellite. We found strong relationships between RA-2 derived and in situ gauged lake levels ($r2 = 0.83$), and between ASAR inundated area estimations and in situ gauged levels ($r2 = 0.9$). Our estimations indicate that the Lake Izabal water volume varies from 8271×106 m3 (17th December 2005) to 9018×106 m3 (15th July 2006). The results obtained here would improve the knowledge about the Lake Izabal water budget, and enrich the radar remote sensing hydrologic applications.

SESSION 6 – Urban Remote Sensing (2)

Chairman: Carsten Juergens

Urban Sprawl Monitoring and Analysis

KOLAR Jan
jkolar@natur.cuni.cz
Charles University, Prague, Czech Republic

KUPKOVA Lucie
kupkova@tiscali.cz
Charles University, Prague, Czech Republic

POTUCKOVA Marketa
mpot@natur.cuni.cz
Charles University, Prague, Czech Republic

STYCH Premysl
stych@natur.cuni.cz
Charles University, Prague, Czech Republic

Keywords: urban expansion, land cover changes, urban classes, QuickBird, air photo interpretation, object-oriented classification

Abstract: Monitoring of urban areas is of great importance for a public governance on each level. The paper presents methodical approach to satellite and aerial imagery processing aimed to information enabling the municipalities, regional, national and European authorities to address efficiently the urban strategic planning with a focus on environmental and social issues.

Information obtained is primarily dependent on the nomenclature of classes. Definition of classes considered a user requirements for planned outputs which includes high resolution land use maps, change detection maps, hot spot identification of new constructions. Main classes includes separation of continuous and discontinuous urban fabric, as well as isolated buildings. Besides residential areas the effort was given to differentiate several non-residential artificial surfaces (industrial, transport, commercial, parks, recreational etc.). To keep integrity of the resultant map, vegetation an water areas out of the urban zones have been classified as well.

Multispectral Spot 5 imagery together with VHR QuickBird scenes of suburban area of the city of Prague have been processed using both spectral and spatial features. Urban sprawl during last 20 years has been mapped using archived aerial photos. Determination of the builded areas was done in three time horizons. Here, an automated classification and segmentation to differentiate basic land cover classes has been used. As various sources of data have been used, the fulfilling of unified processing rules was essential. The extraction results from the different information sources are combined after independent extraction. Independent processing tools used were object-oriented Definiens and image processing Geomatica softwares, respectively.

The results of this case study show that remotely sensed data can be a powerful way to monitor urban environment development and helpful in understanding associated human activities.

Investigating urban sprawl using remote sensing and GIS technology

KUPIDURA Przemyslaw
p.kupidura@gik.pw.edu.pl
Warsaw University of Technology, Poland

KUPIDURA Adrianna
adrp@o2.pl
Warsaw University of Technology, Poland

Keywords: remoe sensing, GIS, urban sprawl, rural-urban fringe, soil sealing

Abstract: The paper concerns the analysis of an urban sprawl. The presented example of Lomianki – a municipality situated in the neighbourhood of Warsaw – capital city of Poland, shows dynamic changes of rural-urban fringe, called sub-urbanization. This kind of process is characterized by incoherence of spatial structure, disproportions between development of built-up areas and transport network, underdevelopment of service built-up areas and public spaces and mixing of urban and rural structures. Such a dynamic development leads also to an increasing of area of sealed (impermeable) zones, what is very important due to water economics. The multi-temporal dataset of aerial and satellite images from 1977 to 2007 has been used for the extraction of zones of different land use classes and for determining of sealed areas. The dynamics of these processes: increase of built-up areas and sealed areas has been showed using remote sensing and GIS technology.

Monitoring the urban expansion of North-Western Athens due to the Olympic Games using multitemporal satellite data and GIS techniques

NIKOLAKOPOULOS Konstantinos G.
knikolakopoulos@igme.gr
Institue of Geology and Mineral Exploration, Athens, Greece

TSOMBOS Panagiotis I.
ptsombos@igme.gr
Institue of Geology and Mineral Exploration, Athens, Greece

Keywords: urban expansion, multitemporal data, GIS

Abstract: During the last fifty years the capital of Greece has suffered from an enormous internal immigration. Its population has overpassed the five millions and today almost the half population of Greece is squeezed in Athens metropolitan area. Because of the significant increase of population, the urban expansion in the basin of Athens was also excessive and in some cases catastrophic. Buildings have covered all the free places, new roads have been constructed, the drainage networks have been covered or disappeared and a lot of changes have been occurred to the landforms.

Additionally, a lot of new roads, athletic facilities and two settlements were constructed for the needs of the 2004 Olympic Games. The first settlement, the Athletic Olympic Village was built in Thrakomakedones area near to Parnitha Mountain. After the Games the houses were donated to beneficiaries and the Olympic Village was populated creating a new commercial and urban pole at the western part of Athens. In addition some public services were also moved in the area increasing the traffic and the demand for new houses. The aim of this study was to detect and map all the changes that occurred in that area, estimate the urban expansion rate and the human interferences in the natural landscape, using remote sensing data and GIS techniques.

Multitemporal and multiresolution satellite data covering the period 1975-2007 and topographic maps of 1:5.000 scale were used for the urban growth mapping. The spatial resolution of all the satellite images ranges from 1 to 10 meters. The Corine Land Cover 2000 classification was also used in order to detect possible changes to the land uses.

Finally the qualitative and quantitative results of this study are presented in this paper.

Satellite Monitoring and Impact Assessment of Urban Land-Cover Change in Stockholm, Sweden between 1986 and 2006

BAN Yifang
yifang@infra.kth.se
Royal Institute of Technology, KTH, Stockholm, Sweden

FURBERG Dorothy
slepyan@infra.kth.se
Royal Institute of Technology, KTH, Stockholm, Sweden

Keywords: SPOT images, urban growth, change detection, environmental impact assessment

Abstract: Over the past few decades, there has been substantial urban growth in Stockholm, Sweden, now the largest city in Scandinavia. Growth in the area is due mainly to the area's increasing population, which rose by 18% between 1986 and 2006. While urban growth in Sweden to all appearances continues to hold to the Nordic model, with its emphasis on green spaces within the urban core, the environment in and around Stockholm may be in the process of becoming more fragmented. Therefore, it is important to map urban land-cover changes and assess the impact of these changes on the environment in a timely and accurate manner.

This objective of this research is to investigate the extent of land-cover change in Stockholm during 1986 to 2006 and the nature of the resulting landscape fragmentation with a particular focus on the possible environmental consequences. Two scenes of SPOT imagery were acquired on 13 June 1986 and 5 August 2006 respectively. Various image processing, and classification algorithms are being tested and compared. For example, texture measures and other ancillary data may be used as inputs to the classification of the SPOT images. Several change detection techniques will be evaluated and the best change detection results will be used for assessing spatial-temporal patterns of urban land-cover change in Stockholm. Landscape fragmentation will be evaluated using spatial metrics and urban growth will be evaluated with various spatial indicators, such as urban compactness and dispersion.

Results are expected to reveal where specific land-cover changes have occurred and in what manner the city is expanding, in relation to fragmentation and aggregation of land-cover types as well as if the urban expansion is occurring in a sustainable manner with regard to the surrounding natural resources, protected areas and national/municipal environmental goals.

Mapping built-up areas using GIS and Remote Sensing imagery: A case study of Sedgefield district, Durham in the UK

MAKATO Belta
kole08267@alumni.itc.nl
Kenyatta University, Nairobi, Kenya

Abstract: This study used GIS and remote sensing technologies to map urban change detection in Sedgefield district, Durham,The UK. The advantages of remote sensing in the provision of up-dated information and frequently are well acknowledged and so is the GIS tools and their capability to process vast data with ease. The accuracy level was calculated and found to be quite low.
These two technologies were applied in a case study in Sedgefield District in England. Although the results obtained might not be useful in the area of high income and well planned development, the procedure is useful in low income economies. Urban change detection is a major issue especially in low income economies because of lack of up-date information and the rapidly increase of population due to migration to the cities for a better life from the rural poor.

Fractal analysis by using multitemporal and multisource data: The evolution of Napolitan urban fabric (Italy)

FIANI Margherita
m.fiani@unisa.it
DICIV, Università di Salerno, Italy

GERUNDO Roberto
r.gerundo@unisa.it
DICIV, Università di Salerno, Italy

GRIMALDI Michele
grimic77@libero.it
DICIV, Università di Salerno, Italy

PISTILLO Pasquale
ppistill@unisa.it
DICIV, Università di Salerno, Italy

Keywords: urban, mapping, analysis, model, multitemporal, QuickBird

Abstract: Looking at the cities in terms of their morphogenesis, we note that the urban space has greatly grown, fragmented, dispersed. Over the years the compact historic city turned into increasingly branched settlements which are scattered across the territory. We therefore attend a change in the traditional dynamics of urban growth with a consequent increase in the number of people who live in suburbs. The urban tissue nowadays looks amorphous and irregular, devoid of any apparent organization. However, whereas the causes of the phenomenon and its effects in terms of costs are well known, the extension of the phenomenon, known as urban sprawl has not yet been measured.
In this experimentation we present a quantitative analysis of the phenomenon that will be based on fractal analysis. Such analysis constitutes a viable alternative to the classical studies on urban morphology that does not well adapt to the new urban shape. Our approach make use of some algorithms such as the Analysis of Expansion and Correlation and Radial Analysis. The fractality is evident in the discontinuity between built-up areas and non built-up ones, both observing the city at small and at large scale. Starting from this preliminary assumption, our goal is to analyze the urban form through the fractal dimension and its spatial variability and even its temporal evolution, comparing their values in different historic periods.
Our analysis has been carried out on different typologies of cartographic data including raster maps at a scale of 1:25000 provided by the Italian Military Geographic Institute (IGM), vector Technical Regional Maps (CTR) at a scale of 1:5000 and also Quickbird Standard OrthoReady satellite imagery both multispectral and panchromatic. Staring from these satellite images we have produced new orthophotos of the areas of interest by combining the high resolution (0.70m/pixel) panchromatic data with multispectral ones, using Data Fusion technique, Once we obtained the cartographic sub-layer, we have gone on with our analysis according to the following methodological scheme:
- extraction of the building;
- comprehensive analysis at different historical periods;
- local tests in correspondence of some points.
With regard to the first point, we have implemented a semi assisted decision model able to extract both the contours of the individual buildings and non urbanized areas, so to obtain vector files comparable with the same kind of data sources. We used as input data the raster maps (from satellite and IGM) and we made use of dedicated software (Idrisi, Focus, ENVI), which provide analysis tools and decision support.

One of the main problems encountered in the training of the decision support system was to identify the correct building boundaries, by distinguishing them from the surrounding urban tissue composed of roads, gardens, service areas, and so on. In our analysis, the use of multispectral data allowed to increase the success rate of the decision model. However, in highly urbanized areas, in order to achieve a good level of accuracy, it would be necessary to reiterate the calculus many times in addition to an intensive manual operator intervention.

For subsequent phases of analysis, both global and local, we have used the Fractalyse 2.4 software, which was developed by Besançon university (France).

Testing was carried out on Naples (Italy) urban area and its hinterland, which are a good example of territory characterized by a strong urban development, verified in recent decades.

SESSION 7 – Radar Remote Sensing (2)

Chairman: Uwe Soergel

Image analysis in urban areas from combined very high resolution optical and SAR imagery

WEGNER Jan Dirk

wegner@ipi.uni-hannover.de

Institute of Photogrammetry & Geoinformation, Leibniz University of Hannover, Germany

SOERGEL Uwe

soergel@ipi.uni-hannover.de

Institute of Photogrammetry & Geoinformation, Leibniz University of Hannover, Germany

Keywords: SAR, high resolution, fusion, infrastructure, detection, reconstruction, urban

Abstract: Today's very high resolution space borne SAR sensors like TerraSAR-X and Cosmo-SkyMed are capable of providing imagery with a geometric resolution of one meter. Hence buildings and bridges in urban scenes become visible in detail. However, SAR typical effects like layover, foreshortening and shadowing hamper the interpretability of such data. This drawback can be partly overcome by using complementary information from maps or optical data. The focus of this paper will be on the combined analysis of one SAR image and one optical image since optical images are widely available. Even in the case of development countries high resolution optical images can be provided since they are used for national mapping purposes. The focus is on bridges and on buildings because they play key roles in urban scenes. Algorithms already demonstrated in [1] are further developed and new ideas are presented. Furthermore, a concept for
estimating bridge heights and building heights by means of combined optical and SAR imagery is shown [2], [3]. The idea is that an elevated object appears differently in corresponding optical and SAR images due to the different viewing geometries of the sensors. Overlaying a SAR image and an optical image thus will lead to misalignments of such objects. These misalignments can be used for the extraction of height information. In the case of gable-roofed buildings [4], three different height hypotheses can be estimated for the same building. First ideas for the layout of an integrated classification and height estimation framework for urban areas from one SAR image and one optical are presented.
Finally, preliminary results of our approach are demonstrated using a TerraSAR-X image with one meter resolution and an aerial image acquired over the city of Hanover.

[1] Soergel, U.; Thiele, A.; Cadario, E.; Thoennessen, U., 2007. Fusion of High-Resolution InSAR Data and optical Imagery in Scenes with Bridges over water for 3D Visualization and Interpretation. Proceedings of Urban Remote Sensing Joint Event 2007, URBAN, 6 p.

[2] Inglada, J.; Giros, A., 2004. On the possibility of automatic multisensor image registration. IEEE Transactions on Geoscience and Remote Sensing, vol. 42, no. 10, pp. 2104 – 2120

[3] Wegner, J.D.; Soergel, U., 2008. Bridge height estimation from combined high-resolution optical and SAR imagery. IntArchPhRS, vol.XXXVII, no. B7-3, Beijing, pp. 1071-1076

[4] Thiele, A.; Cadario, E.; Schulz, K.; Thoennessen, U.; Soergel, U.,
2007. Feature Extraction of Gable-Roofed Buildings from Multi-Aspect
High-Resolution InSAR Data. Geoscience and Remote Sensing Symposium,
IGARSS 2007, pp. 262-265

Deformation monitoring in North Bohemia by method of Permanent Scatterers

KNECHTLOVA Barbora
barbora.knechtlova@fsv.cvut.cz
Prague Technical University, Czech Republic

HLAVACOVA Ivana
hlavacova@insar.cz
Czech Republic

Keywords: InSAR, permanent scatterers, mining, North Bohemia, Subsidence

Abstract: North-Bohemian coal basin is a largely unstable area with very old mining sites, which are potentially dangerous for people living there. Mining has been performed for several centuries; deep mines were active in the past (the surface above is not expected to subside any more), and currently open-pit mines are used for exploitation. Most of them are later reclaimed to forests, lakes, agriculture fields etc. Land slides and subsidence occur in these areas and they need to be monitored. In addition to classical levelling methods new methods are being used for detection of possibly dangerous areas.

One of them is radar interferometry. It allows for Earth-crust deformation mapping with the use of satellite images, without the necessity of expensive on-site measurements. Its accuracy may even reach several mm/yr in the theoretical case. This method is usable in areas with no vegetation and for objects, which are not expected to change their spectral characteristics during monitoring. This applies to artificial objects (buildings, roads, railways), which are of most interest to public (centres of villages, cultural monuments, communications and industrial areas). A significant limitation of standard InSAR processing is the impact of atmosphere, which shows strong spatial correlation and is uncorrelated in time, whereas target motion is usually correlated in time. Therefore the method of Permanent Scatterers is used in order to deal with this atmospheric effect. To improve the method, corner reflectors are installed in the neighbourhood of the area of interest. That usually is in village centres, next to cultural monuments and water reservoirs and some in industrial areas.

Identification of western corn rootworm larval damage in cornfield by radar data

NADOR Gizella
nador.gizella@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapest, Hungary

FÉNYES Diána
fenyes.diana@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

SUREK György
surek@mlog.hu
MLOG Ltd, Hungary

VASAS László
Vasas.Laszlo@bekes.ontsz.hu
Agricultural Office of County Békés, Hungary

Keywords: western corn rootworm, Diabrotica virgifera, agriculture, remote sensing, polarimetric radar satellite data, ALOS PALSAR

Abstract: The structure of a healthy, WCR free maize field shows straight rows in a clear order and upstanding maize stalks. The WCR infection causes wilted broken corn-stalks lying randomly on the ground. That means the damage itself causes physical and visible disorder in the maize field. Our goal is to assess and identify the disorder and structural changes caused by WCR using polarimetic radar images (ALOS PALSAR). We used 3 different individual features (Monoculture-feature, Optical-feature, Radar-feature) derived from remote sensing data to identify WCR larval damage. The integrated assessment of the 3 features can give more accurate WCR damage identification than to assess features separately one-by-one. We carried out retrospective examinations and operational regional assessment in 2008 to test the efficiency of our remote sensing methodology. As a result of the retrospective examinations the accuracy of damage identification was 57-70% with the one-by-one evaluation of the remote sensing features. The accuracy of damage identification is higher than 80% with the integrated evaluation of the 3 features. The results of these examinations were presented on poster for the 28th EARSeL Symposium, Istanbul.
In the operational regional assessment we could identify total of 1085 ha (175 spots) WCR damaged corn field by this remote sensing methodology. We double-checked on the ground 10 spots out of those. As a result of the ground control only 1 spot was WCR free and without damage, 5 spots showed low infection, 1 spot presented middle and 3 spots strong damage. The results of these assessments will be presented on poster for the 29th EARSeL Symposium, Chania.
This project demonstrate the potential in the integrated assessment of optical and radar satellite images to assess and identify the disorder and structural changes caused by WCR larvae as well as other agricultural damages. Based on the presented results, introduction of polarimetric radar technique significantly increased the accuracy. Using more radar images created the possibility to accomplish a more accurate damage identification system. By the successful development, this project can effectively contribute to the WCR identification, spread-monitoring and control in Hungary as well as in the European Union.
This project was implemented in 2008 in the framework of our successful tender called by the Hungarian Space Office and with the support of the Ministry of Environment and Water. The ALOS PALSAR data were provided by ESA (ESA EO CAT-1 5162) and FÖMI. The reference data collection and the field control were carried out by the experts of the Central Agricultural Office of Békés County.

Spaceborne Radar Monitoring of Disaster Oil Spill in Kerch Strait in 2007

LITOVCHENKO Konstantin
konlit@mail.ru
Space Research Institute RAS, Moscow, Russia

IVANOV Andrei
ivanoff@ocean.ru
P.P. Shirshov Institute of Oceanology RAS, Moscow, Russia

Keywords: oil spill, black oil, SAR imagery, numerical modelling

Abstract: The emergency black oil spill took place in the Kerch Strait on 11 November 2007. The radar monitoring of the consequences of this event during few months were conducted by means Radarsat-1, Envisat and TerraSAR-X satellites.

Analysis of spatial distribution of oil pollution visible on the synthetic aperture radar (SAR) images has shown that majority of oil spills were formed as a result of accident of the tanker "Volgoneft-139" during severe storm. In order to evaluate the drift of oil spill under action of wind and current the numerical modelling was performed. The comparison of SAR image series, meteo data, distribution of black oil remains observed on the coast and results of modelling showed in whole a good correspondence. It is concluded that the operative and timely radar surveying of such disasters would allow to icrease the efficiency of consequences liquidation measures.

Potential of TerraSAR-X data for REDD Monitoring in Central Kalimantan (Indonesia)

HEINZEL Vanessa
heinzel@rssgmbh.de
RSS - Remote Sensing Solutions GmbH, Germany

SIEGERT Florian
RSS - Remote Sensing Solutions GmbH, Germany

ENGELHART Sandra
RSS - Remote Sensing Solutions GmbH, Germany

Abstract: Deforestation, forest fires and selective logging of tropical rainforests are major problems in SE-Asia. Indonesia exhibits one of the highest deforestation rates worldwide. The function of tropical forests as one of the major CO_2 sinks is accredited and also stressed in the Kyoto protocol. In this context REDD (Reducing Emissions from Deforestation and Forest Degradation in developing countries) is an important issue, even if it is not accepted so fare for creditable emission reductions under the Kyoto Protocol.

Monitoring deforestation and illegal selective logging in Indonesia for REDD initiatives are challenging issues, as in-situ control is very time consuming and optical remote sensing data acquisitions are regularly hampered by cloud coverage. The potential of the new TerraSAR-X sensor and it´s different modes will therefore be assessed in this study. Main point of interest hereby is, if by using high resolution Spotlight data single tree logging or any other kind of illegal logging activity is detectable. By using expert knowledge, LIDAR and high resolution orthopictures as a reference, this will be analyzed. Additionally different SAR filter options (varying window sizes, different filters, multi-temporal filtering) will be tested to enhance the results. Primary results so fare indicate that there is no clear tree pattern within the SAR data.

The second point of interest within the REDD context is the actual biomass assessment and thus the carbon storage of the various tropical forest types. Multi-temporal StripMap data with different polarizations will be analyzed in order to figure out which acquisition times and polarizations or combinations give the best and most stable results. Auxiliary data like precipitation, a detailed forest classification, based on TerraSAR-X data using an object-based approach, and two large ground truth campaigns (forest inventories) are therefore available. Various single and multiple regressions will be used for finding the optimal relationship. Biomass estimation results will finally be compared with the extracted biomass values based on LIDAR data and an indirect retrieval approach based on a classification, area estimates and biomass figures given in the IPCC (Tier 1).

SESSION 8 – Vegetation & Agriculture (1)

Chairman: Chariton Kalaitzidis

Estimating grapevine hydric status within heterogeneous Mediterranean vineyards from high spatial resolution optical remote sensing.

GALLEGUILLOS Mauricio H.
gallegui@supagro.inra.fr
INRA – National Institute for Agricultural Research, Montpellier, France

JACOB Frédéric
frederic.jacob@supagro.inra.fr
INRA – National Institute for Agricultural Research, Montpellier, France

PRÉVOT Laurent
laurent.prevot@supagro.inra.fr
INRA – National Institute for Agricultural Research, Montpellier, France

LAGACHERIE Philippe
lagache@supagro.inra.fr
INRA – National Institute for Agricultural Research, Montpellier, France

Keywords: hydric status, thermal domain, vineyard, spatialization, remote sensing

Abstract: Water balance is an important component of crop functioning within Mediterranean vineyards, given it directly influences grape quality and yield. Due to the landscape structures, mostly including small fields, the use of remote sensing has not been extensively investigated, apart from airborne observations. Space borne ASTER data, collected with high spatial resolutions over the optical domain, is of strong interest for the mapping of vineyard crop hydric status in relation with surface and soil properties, provided vegetation thermal and hydric status are strongly linked.

The objective of this study is to assess the performances of different approaches that estimate instantaneous energy fluxes from solar remote sensing. These methods differ by the way they describe the composite surface in terms of soil and vegetation, as well as by the way they use the spatial information captured over the solar and thermal domains. First, land surface can be described as a composite one-layer structure through the excess resistance approach, or as a two-layer structure through the discrimination of soil evaporation and vegetation transpiration. Second, the spatial information can be characterized through the temperature – albedo diagram that is controlled by radiative and evaporative processes, or through the temperature – vegetation index triangle that is controlled by soil moisture. Such approaches have been widely used over various landscapes, but their relevance over vineyard remains questionable.

The current study is conducted within the La Peyne basin, a 70-km² watershed located in southern France which includes vineyards by more than 70%. For each ASTER data acquisition, maps of evapotranspiration and hydric status indicators are computed and intercompared. Additionally, validations are performed against 1/ eddy covariance measurements over two contrasted sites and 2/ water balance estimates deduced from neutron probe data within nine fields. Hydric status indicators are next compared against 1/ pedological based water availability, land use and agricultural practices in terms of spatial patterns, and 2/ ground based measurements of grape Δ13C content in terms of temporal accumulation. The study emphasizes large spatial contrasts of radiometric temperature, from 25 to 45 C. Although results from the different approaches may differ, we observe well-pronounced spatial correlations between remotely sensed hydric indicators and pedological based water availability.

A comparative study of satellilte
and ground-based vineyard phenology

CUNHA Mario
mcunha@mail.icav.up.pt
University of Porto, Portugal

MARCAL André R.S.
andre.marcal@fc.up.pt
University of Porto, Portugal

SILVA Lisa
silva.lisa@gmail.com
University of Porto, Portugal

Keywords: Phenology, smoothed vegetation indices, grapevine, remote sensing, NDVI, VEGETATION

Abstract: Premium wine production is limited to regions climatically conducive to potential growing grape-variety with balanced composition and varietal typicity and with opportune well vineyard management. For these intricate fusion of climate, genetics, viticulture and enology, a phenological observations has been using by Vintners, in some regions, since the Medium Age (1370).

Phenological events have traditionally been ground based, with observations mainly providing information concerning grape varieties over a limited spatial area and few in-season observations. These measurements, generally performed by technical institutions or farmers are subjective, pre-disposed to errors as well as time consuming. Time-series analyses of satellite data can provide an objective view of vineyard vegetation dynamics by measuring surface reflectance at regular time intervals that may be used for vineyard management strategies.

The purpose of this work, which is still undergoing, is to establish relationships between remote sensing data and a number of phenology observations recorded on the ground. Normalized Difference Vegetation Index (NDVI) time-series obtained by SPOT-VEGETATION satellite images over the period 1998-2008 were used for 4 tests sites located in the main wine regions in Portugal: Sado, Douro (2 sites), Vinhos Verdes and Alentejo. The CORINE Land Cover maps from 2000 were used to select a suitable test site for these wine regions, with almost 3x3 km pixels with 70% or more of its area occupied by vineyards. To examine the decadal response of satellite information to vineyard phenology variability, a number of different NDVI metrics were obtained through different Smoothed Vegetation Indices (ex. double logistic, asymmetric Gaussian, Stravisky-golay and Woltering) adjusted for each wine region with 11 year NDVI data. These multi-sites satellite-derived phenological metrics were compared with traditional ground phenological observations for the years 1998–2008.

The main advantages and disadvantages of each smoothing Smoothed Vegetation Indices for vineyard phenology are discussed. Preliminary results suggested a great sensibility of satellite-derived phenological metrics for the strong regional and inter-annual variability in vineyard phenology. Satellite data provides an efficient procedure to assess at grape phenology since it is less time consuming, and leads to fewer errors than the traditional phenological observations actually used in viticulture. An operational phenological tool based on remote sensing data can be implemented for decision support in vineyard management.

Pre-operational production of remote sensing drought indicators in the European Drought Observatory

ROSSI Simone
simone.rossi@jrc.it
JRC - Joint Research Centre, Ispra, Italy

NIEMEYER Stefan
stefan.niemeyer@jrc.it
JRC - Joint Research Centre, Ispra, Italy

WEISSTEINER Christof J.
mail@weissteiner.eu
Agro- & Geoconsulting, Bonn, Germany

Abstract: Droughts are a common and recurrent natural phenomenon with potentially devastating effects on human activities. Due to the increased need for information on droughts at the continental scale, the European Commission Joint Research Centre (JRC) is developing the prototype of the European Drought Observatory (EDO, http://edo.jrc.ec.europa.eu), aimed at forecasting, detecting, and monitoring droughts over Europe. Droughts can be defined in different ways according to the disciplinary perspective, and it is not possible to identify a unique drought indicator. A multidisciplinary set of indicators has therefore been developed within EDO to constantly monitor the various environmental components potentially affected by this hazard (soil, vegetation, etc.) in order to obtain a comprehensive and updated picture of the situation.

As for Remote Sensing, the regular production of two indicators has been implemented so far: the fAPAR (Fraction of Absorbed Photosynthetic Active Radiation) and the NDWI (Normalized Difference Water Index). The fAPAR is an indicator of the state and photosynthetic activity of vegetation. fAPAR estimations are produced by the European Space Agency (ESA) from MERIS (Medium Resolution Imaging Spectroradiometer) data by means of the MERIS Global Vegetation Index (MGVI) algorithm developed at the JRC. 10-day fAPAR composites are delivered regularly by ESA. In order to produce fAPAR anomalies, the MERIS fAPAR time series has been extended with fAPAR estimations obtained from the NASA SeaWiFS (Sea-viewing Wide Field-of-view Sensor) sensor with an algorithm fully compatible with the MGVI. Our evaluation of the potential of MERIS-SeaWiFS fAPAR for drought monitoring shows that fAPAR anomalies have a capacity to detect droughts, being correlated with the other drought indicators within EDO and with the soil moisture estimations from radar produced by the University of Vienna. fAPAR offers an enhanced performance compared to NDVI (Normalized Difference Vegetation Index) anomalies, an indicator already used for drought detection. The NDWI is a spectral index which reflects changes in the water content of vegetation canopies. 10-day NDWI composites are produced on a daily basis from MODIS (Moderate Resolution Imaging Spectroradiometer) data. Other drought indicators are regularly produced within EDO. In particular, the monthly Standardized Precipitation Index (SPI), calculated at 1, 3, 6, 9 and 12 months averaging periods, shows the general precipitation status with respect to its climatology. Soil moisture estimations are produced daily by the LISFLOOD hydrological model, along with their anomalies and seven days forecasts. All the indicators are available for visualization on the EDO Mapserver.

Probability satellite imagery based maps for substituting tobacco with energy plants

PERAKIS Konstantinos
perakis@uth.gr
University of Thessaly, Greece

FARASLIS Ioannis
faraslis@uth.gr
University of Thessaly, Greece

ROZAKIS Stelios
s.rozakis@aua.gr
Agricultural University of Athens, Greece

STATHAKIS Demetris
dstath@uth.gr
University of Thessaly, Greece

Keywords: remote sensing, gis, energy plants, agriculture

Abstract: The recent shift of the European Commission's agricultural policy resulted in the abandonment of tobacco in Central and Western Greece. Energy plantations especially those producing solid biomass may be a viable alternative to tobacco. Detailed study is required to estimate biomass supply as well as raw material cost for energy conversion units. In this context, the objective of this paper is to spatially delineate high production areas with respect to the artichoke energy plant, within ex-tobacco producing zones. A number of spatial factors, such as environmental, agricultural, socio-economical and cultivation-specific ones, are taken into consideration. The concurrent evaluation of these factors can only be achieved by the combination of a vast amount of diversified data, exploiting the synergy of remote sensing and geographical information systems and science.
In the present study, eleven administrative units of the finest available resolution in Hellas, i.e. sub-municipal divisions (Dimotika Diamerismata), have been studied up to the year 2005 in the prefecture of Karditsa. The goal is to identify tobacco cultivating zones and subsequently produce maps of ranked suitability for the cultivation of energy plants. The exact identification of the tobacco fields based on the satellite imagery has been implemented via classification techniques as well as by the use of auxiliary data, including field surveys and digital layers (road network, hydrographic network, e.t.c.).
The construction of ranked suitability maps for the artichoke energy plant has been achieved by the construction of the probability digital map for each factor, including altitude, slope, PH, drainage and others. The probability maps are presented in this paper along with the most interesting findings as well as direction for future research.

Current status and potential applications of the LSA SAF suite of vegetation

GARCIA-HARO Francisco Javier
j.garcia.haro@uv.es
Universitat de Valencia, Spain

CAMACHO Fernando
EOLAB - Earth Observation Laboratory, Spain

VERGER Aleixandre
Universitat de Valencia, Spain

MELIÁ Joaquín
Universitat de Valencia, Spain

Abstract: The scope of the Satellite Application Facility on Land Surface Analysis (LSA SAF) is the development and implementation of algorithms, which take full advantage of remotely sensed data from EUMETSAT geostationary (MSG, Meteosat 8-10) and polar orbiting (MetOp series) satellites. The LSA SAF SEVIRI vegetation products include the fractional vegetation cover (FVC), the leaf area index (LAI) and the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR). Individual error estimates and quality flags fields are also provided in the data products. The error estimates provides reliable information about the accuracy level of products and is also a good indicator of the exiting uncertainty among different satellite products. Large uncertainties are generally found in areas where the BRDF reliability is poor (e.g., wintertime at northern Europe). The products are spatially and temporally consistent and present practically no missing data except for areas which are usually covered by snow.
Multiple validation techniques have been performed to develop uncertainty information on vegetation products. Results have shown that LSA SAF vegetation products are generally consistent spatially and temporally with equivalent MODIS and MERIS products. The observed deviations between LSA SAF and MODIS and MERIS products are in the order of 0.10-0.15 for FVC, 0.5-0.8 for LAI and about 0.1 for FAPAR. Similar or slightly higher deviations are often found between the respective products. The suite of LSA SAF vegetation products have reached enough level of maturity to be released to the user community. The user may access via the LSA SAF web page [http:\\landsaf.meteo.pt] to daily estimates of these parameters, generated on a pixel-by pixel basis at the SEVIRI/MSG resolution over Europe, Africa, the Middle East, and parts of South America since January 2006. The products are also disseminated via EUMETCast since July 2008, particularly for the benefit of African and European users. This work presents the current status of the LSA SAF vegetation products. Further insights about the utility of products-derived phenology for understanding the land cover dynamics are also provided.

Multi-temporal analysis for vegetation dynamics assessment in the Iberian Peninsula using MODIS-NDVI data

PEREZ-HOYOS Ana
ana.perez-hoyos@uv.es
University of Valencia, Spain

MARTINEZ Beatriz
University of Valencia, Spain

GILABERT M. Amparo
University of Valencia, Spain

GARCIA-HARO F. Javier
j.garcia.haro@uv.es
University of Valencia, Spain

Keywords: vegetation dynamics, MODIS-NDVI data, wavelet transform

Abstract: Terrestrial ecosystems are permanently changing at a variety of spatial and temporal scales as a consequence of natural and/or anthropogenic causes. Quantifying the magnitude of land-cover change is crucial to understand the ecosystem dynamics. Moreover, MODIS-NDVI data have shown a good dynamic range and sensitivity for monitoring and assessing spatial and temporal variations in vegetation amount and conditions.

The aim of this study is to characterize the vegetation dynamics of the Iberian Peninsula using monthly MODIS-NDVI time series. For this purpose, NDVI profiles are analyzed using the original data and filtered data derived from a spectral technique, a multi-resolution analysis (MRA) based on the wavelet transform (WT). The MRA analysis results in an additive decomposition that expresses a time series as the sum of several components, each of which can be associated with variations on a particular temporal scale. Thus, depending on the temporal scale selected the WT allows us addressing questions about the inter-annual or intra-annual components of vegetation dynamics.

Several metrics linked to key phenological events were derived from the seasonal NDVI curve obtained from the original and filtered data for an averaged year and for each cover type. These variables, which have been reported to capture important features and patterns of temperate ecosystem functioning, include annual relative range (RREL), annual integral (NDVI-I), and month of the absolute maximum (MMAX) and minimum NDVI (MMIN). In addition, a trend analysis of the series was performed in order to detect potential losses of vegetation cover associated to land degradation processes.

Land-cover classes with similar ecological structures and climatic conditions were defined from coincident pixels extracted from different datasets, particularly, CORINE land-cover 2000 and Global land-cover 2000. Vegetation dynamics was evaluated in zones belonging to these homogeneous classes.

Early diagnosis of plant-pathogen interaction by imaging chlorophyll fluorescence

SIGHICELLI Maria
sighicel@frascati.enea.it
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

MANAR Hassan
NILES - National Institute of Laser Enhanced Science, Giza, Egypt

VALENTE Francesco
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

LAI Antonia
lai@frascati.enea.it
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

Keywords: chlorophyll fluorescence, imaging-PAM

Abstract: The plant response to biotic and abiotic stress involves morphological and physiological alterations included with changes in chloroplast structure and function. Several studies show that the photochemical efficiency of photosystem II (PSII) decreases with stress and the energy unused in photosynthesis and dissipated by nonphotochemical processes increases. Imaging technique is useful for the study of both plant--pathogen and heavy metal interaction, where the plant metabolism is already affected at the first stage of stress.

The analysis and monitoring of fungi disease caused by Phoma lingam on broccoli (Brassica olearacea var. italica) and lead accumulation in geranium (Pelargonium zonale) plants were investigated. The plant photosynthetic performance was monitored by the portable Imaging-PAM Chlorophyll Fluorescence fluorometer (Walz, Germany). Photochemical parameters analysis and chlorophyll fluorescence emission at different days after inoculations in plants infected with fungi and lead, compared with uninfected plants, were carried out.

Imaging analysis have been suited to visualize heterogeneity in plant response. The monitoring of biotic stress was confirmed. In fact, even if the symptoms are not evident, the photochemical parameters changes in broccoli plants were observed. Further areas of infection, corresponding to disease development, were evident only in imaging analysis. The analysis of photochemical parameters in geranium plants shows differences both in response times and in the capability to tolerate different lead concentration.

Therefore, imaging PAM fluorometer allows the mapping and the physiological study of stress.

SESSION 9 – Natural and Cultural Heritage

Chairman: Mario Hernandez

A study in the application of remote sensing and GIS for the archaeology of the hinterland of medieval Constantinople/Istanbul

MAKTAV Derya et. al.
maktavd@itu.edu.tr
Istanbul Technical University, Turkey

Keywords: archeaeology, Istanbul, GIS, remote sensing, water supply

Abstract: The western hinterland of the modern city of Istanbul contains some of the most remarkable monuments of ancient and medieval hydraulic engineering dating from the fourth to the twelfth centuries AD, including lines of aqueduct channels and bridges extending up to 336 km to the west of the modern city. Until recently fieldwork has been limited and only within the last two decades have there been serious attempts to map the complexity of the monuments and water lines. The dense forest which covers much of the northern hills of Thrace is a major factor restricting fieldwork and survey, yet at the same time the woodland ensures the preservation of much of the system. Two previous studies of the water supply system have been able to identify the major spring sources, to map the line of the water supply channels and to record and locate over sixty bridges which are a key component of the system. However these studies have been constrained as they are not able to integrate adequately this survey data.

The new research programme between Istanbul Technical and Edinburgh Universities commenced in 2007 and includes all existing GPS data and archaeological observations to be incorporated as part of a modern GIS combining the topographical and hydraulic information available from 1/25,000 digital maps with a wide range of high and medium resolution remotely sensed data. Further surface GPS based archaeological survey has been undertaken over the past two years and has been able document a significant number of the extant channels and bridges. Using high resolution IKONOS images and orthophotos it has been possible to create a textured land surface of forests and fields for the Thracian digital surface model (DSM) in which to situate the various monfuments and channels of the water supply system. This digital resource is now capable of providing the basis for future archaeological documentation and analysis and two case studies are given. Integrated with multi-spectral data this gives the opportunity to view the system in its wider setting and also to identify major urban and landscape changes impacting on the long-term conservation and management of the ancient remains.

Automatic detection of archaeological sites using a hybrid process of Remote Sensing, Gis techniques and a shape detection algorithm

DI IORIO Alessio Adi
adi@rovsing.dk
Rovsing A/S, Skovlunde, Denmark

SØRENSEN Mikael Kamp
gras@gras.dk
G.R.A.S. Sound & Vibration A/S, Holte, Denmark

Keywords: archeological site detection, gis, remote sensing, automatic shape detection

Abstract: A method is presented for the automatic identification of lost or undiscovered archaeological sites in Egypt by using shape detection techniques on satellite imagery superposed in a GIS environment. For an area of interest, the EO data available from various satellites is pre-processed and from historical plans a shape file of the archaeological structure of interest is produced. A shape detection algorithm employing a shape matched operator is applied to the EO image to produce a detection image identifying the most probable location of the archaeological structure of interest. The shape-matched operator employed is the derivative of double exponential (DODE) operator. The final product is a GIS data set assembled as a list of required features and layers, all converted and processed in the same Geographical Reference System.

Factors that affect the recording and exploration of archaeological sites using Remote Sensing and GIS techniques

PERAKIS Konstantinos
perakis@uth.gr
University of Thessaly, Greece

MOYSIADIS Athanasios
moysiadis@prd.uth.gr
University of Thessaly, Greece

Abstract: This study aims to register existing archaeological sites and the most probable localisation of new ones by means of Remote Sensing and GIS techniques. Archaeological sites have to be recorded in all phases of an archaeological dig, not only for coordinating the dig itself but also for monitoring and protection purposes. The factors such as environmental, historical and geological that justify the existence and contribute to the discovery of an archaeological site are analysed. Suitable land use zones that are most indicative for the existence of a site can be defined. An existing archaeological site can be recorded by means of aerial and satellite imagery. The limi-tations and advantages of each are examined. The registration of land use and land cover around archaeological remains support the environmental impact assessment. The analysis of the aforementioned factors is initially realised by geo-referencing the factors in a projection system. Scaling the resulting thematic maps into probability ones leads to the application of the "orthogonal sum" operation between them. The final resulting probability map, incorpo-rating all the existing information, shows the most probable locations of the existence of archaeo-logical sites. The same methodological chain can be applied in other regions of the same area in order to define the probabilities of existence of other archaeological sites.

Gökçeada (Imbros) island (Turkey), a noteworthy site for archaeological and paleo-environmental studies based on satellite data

POSCOLIERI Maurizio
maurizio.poscolieri@idac.rm.cnr.it
CNR Istituto di Acoustica "O.M.Corbino", Rome, Italy

PARCHARIDIS Issaak
parchar@hua.gr
Harokopio University of Athens, Greece

PAVLOPOULOS Kosmas
kpavlop@hua.gr
Harokopio University of Athens, Greece

KOURKOULI Penelope
penelope.kourkouli@gmail.com
Harokopio University of Athens, Greece

Keywords: Imbros island, archaeology, paleo-environment, VHR satellite data, satellite image time-series, filterin, image analysis

Abstract: Gökçeada (Imbros) is a Turkish island, seated in the North-eastern Aegean Sea off the tip of the Dardanelles. The present study deals with the archaeological findings and geomorphologic changes determined in the eastern side of the island by analyzing different satellite images. These data incorporate a very high resolution QuickBird (VHR) pan-sharpened scene, a Landsat +ETM scene, Corona images acquired during '60s and '70s and an ASTER image to be used for DEM generation.

Geologically the broader area is constituted by volcanic rocks, Paleogene and Neogene sediments as well as by Quaternary deposits. The Gökçeada Island exhibits a history of uninterrupted occupation

dating back to the Bronze Age. Ancient relics include: Bronze Age mounds, Classical period fortifications, Hellenistic sites, and the foundations of early Christian and Byzantine basilicas. The island is under the Turkey administration since the Treaty of Lausanne; only a few of formerly Greek inhabitants remain.

The archaeological investigation carried out in this study concerns a site, Yenibademli Höyük, only recently partially excavated by the Turkish archaeologist H. Huryılmaz. It dates back to the Early Bronze age and is located at the northern part of the island, in an alluvial plain with small morphological slopes, probably covered by flooding deposits of an old river channel, the traces of which can be distinguished close to the excavated archaeological site. In antiquity the site was on an estuary but it is nowadays 1.5 km inland. Seven architectural levels have been identified, with the first containing Cyclopean stonework and some Mycenaean pottery.

The main purposes of this study were to:

•   present a case study, such as that of Imbros island, showing how Quickbird satellite imagery could support archaeological surveys, and inspecting the potential of this sensor in identifying relevant surface features associated to buried structures.

•   develop, apply and compare appropriate methodologies of image analysis of VHR data to obtain by-products suitable to facilitate the archaeological interpretation.

Furthermore, a paleo-environmenal analysis has been carried out, on the basis of aforementioned satellite images time-series, on a coastal area placed in the south-eastern side of Imbros Island, where five main geomorphologic units can be discriminated:

•   the lagoon in the southern part,

•   the river with west-east flow direction,

- the river alluvial plain and the estuaries at the eastern side in Kefalaz bay (Quaternary deposits),
- the semi-mountainous area of volcanic rocks (westwards) and Paleogene-Neogene deposits (easternly),
- the beaches in the north-eastern (Kefalaz bay) and southern (salt lake Aydincik) parts.

The geomorphologic processes prevailing in the study area are coastal, fluvial, human and, in a smaller extent, aeolian and slope mass movements due to gravity. The major coastal processes are represented by coastal erosion mainly in the gulf of Kefalaz, and in relatively more stable coastline in the Aydincik salt lake. The recent mouth of the river is located in the northern part of the gulf of Kefalaz. Three ancient abandoned river channels were located south of the recently active river channel. These channels some centuries ago had probably their mouths in the northern part of the Aydincik lagoon. Assuming that the sea level was lower by roughly -1m 2000 years BP, -2m 3000 years BP and -4m 5000 years BP, according to the glacio-hydro-isostatic model of Lambeck and Purcel (2005), considering the broader area of Imbros Island and the intensive depositional processes by the main river, there exists the possibility that the Kefalaz peninsula, located on the south-eastern side of Imbros, was an island separated by the sea some thousands years Before Present.

REFERENCES.

De Laet V., Paulissen E. and Waelkens M., (2007). Methods for the extraction of archaeological features from very high-resolution Ikonos-2 remote sensing imagery, Hisar (southwest Turkey). Journal of Archaeological Science, 34, pp. 830-841

Hüryılmaz H., (2006a). Gökçeada-Yenibademli Höyük 2004 Yılı Kazıları. 27. Kazı Sonuçları Toplantısı, 1, pp. 261- 272.

Hüryılmaz H., (2006b). Gökçeada-Yenibademli Toplulugu'nun Erken Bronz Çagı'nda Karma Besin Ekonomisi", A. Erkanal et al. (eds.), Hayat Erkanal'a Armagan, Kültürlerin Yansıması. Studies in Honor of Hayat Erkanal, Cultural Reflections, Istanbul. pp. 430-439.

Lambeck K. and Purcell A., (2005). Sea level change in the Mediterranean Sea, since the LGM: model predictions for tectonically stable areas. Quat. Sci. Rev., 24, pp.1969-1988.

Pavlopoulos K., Triantaphyllou M., Karymbalis E., Karkanas P., Kouli K., Tsourou, Th., (2007). Landscape evolution recorded in the embayment of Palamari (Skyros Island, Greece) from the beginning of the Bronze Age until recent times, Geomorphologie, 1, pp.37-48.

Poscolieri M. and Parcharidis I., (2007), Application of new image analysis methods to VHR satellite imagery for archaeological features detection", Proceedings of the 27th Annual Symposium of the European Association of Remote Sensing Laboratories (EARSeL), Bolzano (Italy), 4-7 June 2007, Gomarasca M.A. (ed.), Millpress pub., pp. 649-656.

Applications of Remote Sensing in Archaeology: Research in Surface and Sub-Surface Feature Detection in UNESCO World Heritage Sites and Archaeological Sites in Italy using Optical and Radar Data

DORE Nicole
nicole.dore@inwind.it
Università degli Studi di Roma "La Sapienza", Italy

PATRUNO Jolanda
jolanda.patruno@libero.it
Università degli Studi di Roma "La Sapienza", Italy

RUESCAS ORIENT Ana Belen
Ana.Belen. Ruescas.Orient@esa.int
ESA-ESRIN - European Space Agency, Frascati, Italy

SARTI Francesco
Francesco.Sarti@esa.int
ESA-ESRIN - European Space Agency, Frascati, Italy

HERNÀNDEZ Mario
Ma.Hernandez@unesco.org
UNESCO, Paris, France

Keywords: archaeology, radar data, optical data

Abstract: The purpose of this research is to understand the optical and radar response to different archaeological structures on the Earth's surface and sub-surface. Optical remote sensing has been a subject of study since the early 1900's, and after pioneering attempts by balloon and aerial photography were made, for example by the RAF (Royal Air Force) acquisition flights during World War II over Italy, this technique was later applied for scientific purposes. Scientific applications included archaeology, where airborne imagery has been used to locate and investigate archaeological sites all over Europe. Archaeological features singled out from aerial photographs have been confirmed by excavations subsequently carried out in situ.

High-resolution (metric) optical sensors, like Ikonos and Quickbird, have been very useful for archaeological purposes because they are able to recognize patterns of buried archaeological structures. However, optical sensors can penetrate neither the ground nor clouds, as opposed to microwave sensors, which can penetrated both. With the use of radar imagery, a new era has started in archaeological research. Satellite radar acquisitions, mainly Synthetic Aperture Radar (SAR), can supply 24-hour observations all the time (independently from sun illumination and meteorological conditions), providing additional information concerning electromagnetic properties of the target. The principal limitation of available spaceborne radar sensors is their lower spatial resolution (ALOS PALSAR: 10 m). For that reason, radar analysis should always be complemented by high-resolution optical observations since archaeological structures are generally smaller than 10 m (walls, buildings, mounds).

The selected test sites are located in Italy and in other countries of the world under the aegis of UNESCO. The selected Italian sites (Vulci and Arpi), are archaeologically well known thanks to aerial photographs and photogrammetric restitution, which we used as a basis for the matching and critical comparative analysis between optical and radar images, as well as for the identification of archaeological features. We then analyzed some UNESCO sites located in landscapes characterized by different geomorphologic features, land use and meteorological conditions in order to understand the changes of radar responses in different contexts. These sites are:

Calakmul (Mexico), Machu Picchu (Peru), Gebel Barkal (Sudan), Cyrene (Lybia), Troia and Hierapolis (Turkey).

We used optical data sets of ALOS-PRISM, AVNIR 2, KOMPSAT-2 and IKONOS, and radar sets with dual- and quad-polarisation images from ALOS PALSAR. This radar sensor can potentially discriminate the backscatter response as a function of the morphological features of each site. Estimates of moisture content are also useful for detecting archaeological features of sub-surface structures, that may be detected under given conditions because they influence regular growth of vegetation roots.

The SW data processing package PolSARpro for polarimetric radar, developed and distributed by ESA, was applied in order to perform different types of analysis over the selected sites and with the available radar datasets. Validation has been carried out using ancillary information and in situ observation, where possible.

Results are encouraging for some cases but more work will be necessary in order to increase the synergetic use of optical and radar data for these multidisciplinary applications.

Evaluating change detection of archaeological sites by multiscale and multitemporal remote sensed imagery

LASAPONARA Rosa
lasaponara@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

LANORTE Antonio
alanorte@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

COLUZZI Rosa
coluzzi@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

MASINI Nicola
n.masini@ibam.cnr.it
IBAM-CNR (Istituto per i Beni Archeologici e Monumentali), Tito Scalo, Italy

Abstract: The systematic monitoring of cultural and natural heritage is a basic step for its conservation. Monitoring strategies should constitute an integral component of policies relating to land use, development, and planning. To this aim remote sensing technologies can be used profitably. This paper deals with the use of multitemporal, multisensors, and multiscale satellite data for assessing and monitoring changes affecting cultural landscapes and archaeological sites. The discussion is focused on some significant test cases selected in Peru (South America). Artifacts, unearthed sites, and marks of buried remains have been investigated by using multitemporal aerial and satellite data, such as Quickbird ASTER, Landsat MSS and TM.
Two test sites were selected in the basin of Rio Grande, southern Peru, close to Nasca,. The drainage basin of Rio Grande has been populated by sedentary groups at least since the Formative Period (Initial Period, 1800-800 BC; Paracas culture, 800-200 BC). In the Early Intermediate Period (200 BC-600 AD) the region flourished under the Nasca, who were one of the most important and evolved precolombine civilizations.
The first test area was selected from inside the archaeological area of Cahuachi, which was built by the Nasca. as were the "Nasca lines" which are now inscribed in the UNESCO world heritage list. The second test area was selected from within the Nasca Lines.

On the capability of VHR satellite and high resolution magnetic surveys for detecting buried archaeological adobe structures

MASINI Nicola
n.masini@ibam.cnr.it
IBAM-CNR (Istituto per i Beni Archeologici e Monumentali), Tito Scalo, Italy

RIZZO Enzo
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

LASAPONARA Rosa
lasaponara@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

ORIFICI Giuseppe
CEAP (Centro de Estudios Arqueológicos Precolombinos), Nasca, Peru, Italy

Abstract: This paper is focused on the evaluation of the capability of satellite Quickbird (QB) images and magnetic surveys in detecting buried adobe structures.

The detection of archaeological adobe structures is particularly complex to be performed from any type of remote sensing techniques. This is mainly due to the subtle contrast that generally exists between the archaeological features and the surrounding areas. The high scientific, technical and archaeological interest in this issue is driven from the fact that for several thousand years, adobe had been widely used throughout the world. The possibility of using remote sensing technologies could open new perspective in archaeological research of adobe settlements.

In this paper we investigated three significant test areas located in the Ceremonial Centre of Cahuachi (in the Nasca territory, Southern Peru) dating back from 6th century B.C. to 4th century A.D. Results obtained from both QB and high resolution magnetic survey, were confirmed by ground and excavation proof, and provided valuable indications for unearthing precious ancient remains. Our preliminary analyses pointed out the high potentiality of both satellite and magnetic surveys for locating and mapping spatial features linked to existing archaeological adobe structures.

Remote Sensing and Non-Invasive Methods
for Cultural Heritage Monitoring

MUNZER Jahjah
munzer@psm.uniroma1.it
University of Rome, Italy

Keywords: GIS, classification, pattern recognition, mathematic morphology

Abstract: The documentation has long been recognized as an important tool for cultural resources management and the conservation of cultural heritage sites and artifacts. The information provided here is designed to assist those who are interested in or need decision support tool about preserving and managing archaeological aspect over the long term.

Conventional methods of archaeological field research tend to be both time-consuming and labour-intensive and produce a patchy and inconsistent record which reflects varying site visibility rather than poor research. If we are to preserve, or at least mitigate against damage to, this resource successfully, or even to undertake realistic landscapes assessment and management we need to re-assess the methods of site identification.

The archaeological site study, considered in its totality, from the land morphology to the monumental pre-existences, needs a documentation that, though using different non invasive technologies, makes it possible to create an information integrated system. Such system allows us to get to know the cultural heritage in all its dimensional and typological aspects and, according to the tools used, facilitates the monitoring and the divulgation of the relevant data (WebGIS). Remote sensing and GIS supply the synoptic instrument to the real knowledge of the land geography and for the operational management of any project. The availability of high resolution remotely sensed data (IKONOS, QUICKBIRD) and digital image processing techniques (Classification, pattern recognition) could be considered, taking as an example the Babylon site after the second Gulf war, as non invasive methods of documentation and site conservation / protection. The remote sensing data and WebGIS could be useful for professionals who want to know more about the archaeological site landscape changes. Policy makers and managers who make important decisions about the care of archaeological site will also find these techniques very useful.

The objective of this work is to document that the Integration of new methods and technologies in the archaeological field has evidence the huge contribution in organizing, manipulating and updating data.

SESSION 10 – New Sensors and Instruments & Projects

Chairman: Steffen Kuntz

Sustainable global monitoring for GMES:
two new 20-metre satellites join the DMC constellation to significantly expand capacity.

STEPHENS J. Paul
p.stephens@dmcii.com
DMCii Ltd, Guildford, UK

MACKIN Stephen
s.mackin@dmcii.com
DMCii Ltd, Guildford, UK

CROWLEY Gary
g.crowley@dmcii.com
DMCii Ltd, Guildford, UK

Abstract: Two new 20-metre class satellites, UK-DMC 2 and Deimos-1, launched into the Disaster Monitoring Constellation (DMC) in Spring 2009, add more than 10 million sqkm per day of enhanced imaging capacity to the constellation, increasing its overall capacity by a factor of four. The additional capacity and enhanced resolution of the wide swath optical sensors greatly extends the service offered through DMC International Imaging Ltd (DMCii) for disaster response and commercial imaging campaigns.

The improved SLIM-6 imagers maintain the 650km wide swath of the 1st generation DMC 32 metre gsd satellites, but achieve approximately double the pixel density. The addition of X-band downlink and increased on-board power and data storage enable imaging to be carried out on almost every orbit, resulting in a much greater coverage. Together with the existing 4 DMC satellites the constellation has the capacity to deliver "leaf-on leaf-off" global monitoring.

The DMC constellation is effective at providing timely high resolution imaging of large areas within short timescales. In 2007 DMCii delivered the first 30-metre class Europe38 coverage, with data acquired on time within the acquisition windows specified by each nation. The data set commissioned by ESA is made freely available for scientific researchers, and to the national agencies working in the LAND Fast Track GSE programme.

The paper discusses how the enhanced constellation provides a practical resource for annual and seasonal monitoring programmes on a continental scale. The constellation is also actively meeting the challenging requirements of precision agriculture, and is regularly used by agencies monitoring major rainforests including the Amazon Basin and Congo for the active detection of deforestation.

This paper presents the in-orbit results from the new sensors, and their application in agriculture, forestry, land cover mapping as well as disaster response.

GMES Fast Track Service geoland 2 - Status and Perspectives

KUNTZ Steffen
steffen.kuntz@infoterra-global.com
Infoterra GmbH, Immenstaad, Germany

TINZ Marek
marek.tinz@infoterra-global.com
Infoterra GmbH, Friedrichshafen, Germany

Abstract: After more than a decade since the first steps towards a harmonized European strategy how to benefit from spaced based Earth observation capabilities were made, the recent Communication by the European Commission on "Global Monitoring for Environment and Security (GMES) paves the way for the implementation of operational spaceborne geo-information services for the benefit of Europe, the Member States and even the European citizens. From the next multi-annual financial framework of the EU onwards, funding for the generation and provision of Core Services and for the support of the integration of GMES services into the tasks of the Member States or European Regions (so-called downstream services) shall be made available.

To reach this demanding goal, currently the results of pre-operational GMES services from previous projects are refined and transferred into operational readiness. For "land" related applications the Land Monitoring Core Service (LMCS) is addressed by geoland2; a project co-funded by the 7th Research Framework Programme of the European Commission, which started in November 2008.

geoland2 focuses on the technical implementation of mature services for land monitoring on global, continental and local level. Three processing lines will be implemented: (1) Bio-physical parameters on global level to be provided in near real-time. (2) Seasonal vegetation monitoring of continents Europe and Africa by medium-resolution imagery in combination with an area frame sampling scheme. (3) Continental (wall-to-wall) mapping of Europe using high resolution data and local mapping of larger European cities (Urban Atlas). In addition, service evolution has to improve the thematic content and the quality of the services increasing the efficiency and reliability of the processing lines.

The resulting mapping products will be validated under operational conditions in various test sites in- and outside Europe by the so-called Core Information Services on agri-environment, forestry, spatial planning, carbon cycle, global agriculture monitoring and African environmental monitoring. They will serve major European and international user groups adding value to the LMCS mapping products by generating environmental indicators and services for European end-users. Together with more than 80 committed user organisations they will carry out an extensive utility assessment of GMES land services.

For the continental LMCS - which is considered as the future European land cover / land use data base - its thematic content and the respective data model is under discussion. It is expected that most probably this discussion will lead to a compromise among the European stakeholders (i.e. DG Agri, DG Env, DG Regio, the EEA and the member states). The presentation will reflect on the current discussion status and will show the response of the European service providers, i.e. a modular approach for land cover / land cover change mapping, which is highly flexible but still allows efficient production.

Use of HUT-2D Airborne Interferometric Radiometer Data to Support the SMOS Mission

HALLIKAINEN Martti
Martti.hallikainen@tkk.fi
Helsinki University of Technology, Finland

KAINULAINEN Juha
Helsinki University of Technology, Finland

SEPPÄNEN Jaakko
Helsinki University of Technology, Finland

RAUTIAINEN Kimmo
Helsinki University of Technology, Finland

LEMMETYINEN Juha
Helsinki University of Technology, Finland

MÄKYNEN Marko
Helsinki University of Technology, Finland

Abstaract: The goal of the ESA SMOS (Soil Moisture and Ocean Salinity) mission is to provide accurate global soil moisture and ocean salinity data on a regular basis. The satellite is scheduled for launch in 2009 and its only instrument is the MIRAS (Microwave Imaging Radiometer by Aperture Synthesis) sensor. It operates at a frequency of 1.4 GHz (L-band) and employs interferometry for producing two-dimensional brightness temperature images of the Earth with a spatial resolution of 30 to 50 km. These images are transformed into soil moisture and ocean salinity maps using recently developed algorithms. The soil moisture algorithms shall be used for various land-use categories including forests and mixed pixels (non-homogeneous pixels with several land-use categories). The ocean salinity algorithms need to be able to compute salinity variations from small changes in the brightness temperature, eliminating the effects of water temperature and wind vector variations.

Interferometry is a well-established technique in radio astronomy, but the MIRAS instrument is the first interferometric radiometer for Earth observation. In order to support the SMOS mission, an airborne 1.4 GHz interferometric radiometer HUT-2D has been developed, constructed and tested by Helsinki University of Technology. The HUT-2D sensor is accommodated onboard the University's remote sensing aircraft. The main technical parameters of HUT-2D are similar to those of MIRAS; hence, HUT-2D can be used to produce multi-angular data sets needed for the validation of SMOS algorithms.

An extensive airborne campaign was carried out in August 2007 in southern and northern Finland in order to test the feasibility of the HUT-2D radiometer for soil moisture measurement. Data sets were collected over test sites with various land-cover conditions ranging from bare and crop-covered agricultural fields to boreal forests and bogs. Ground truth data were acquired at the test sites to allow modeling of the brightness temperature and generation of soil moisture maps for the test sites. Comparison of experimental results with theoretical values shows that soil moisture retrieval was successful for agricultural fields, but agreement between measured and modeled soil moisture for forested sites was somewhat lower.

Airborne measurements were carried out with HUT-2D in 2007 to test its capability to detect a salinity gradient occurring in the coastal area in southern Finland. Reference data were collected along the test line for salinity and water temperature. Forward modeling of the brightness temperature of saline water was done using a well-established model. Based on the model, detection of the change of 3.4 psu in salinity over the test line requires both good stability from a radiometer and successful elimination of any disturbing phenomena.

The results from the soil moisture campaign and sea surface salinity campaign are discussed in the presentation.

A Framework for Spatial Data Harmonisation in Europe: HUMBOLDT project Status and Challenges

VILLA Paolo
villa.p@irea.cnr.it
IREA - National Research Council, Milano, Italy

REITZ Thorsten
Fraunhofer‐ Institut für Graphische Datenverarbeitung IGD, Germany

GOMARASCA Mario A.
IREA - National Research Council, Milano, Italy

Abstract: The issue of spatial information sharing and harmonisation has become of the uttermost importance in the European context, with the European Community strongly engaged not only in political and economic changes and integration, but more and more tackling technical and scientific problems. In the field of geospatial information, the need for harmonised and interoperable data is now a key topic both for users and producers of geodata. This has brought the initiatives related to the INSPIRE Directive, recently entered into force and soon to be receipted by national legislative frameworks, and to the GMES programme, now entered into its operational phase, both of them oriented to enable cross-border and cross-sector usage of geoinformation, aiming at the realization of the future European Spatial Data Infrastructure (ESDI).

The HUMBOLDT project, started in October 2006, is supported by the European Community through the 6th Framework Programme and has the aim of bring together a variety of scientific, technical, economic and policy driven points of view with the aim of implementing a Framework for harmonisation of data and services in geoinformation domain.

The two-pronged approach of HUMBOLDT comprises a technical side of framework development and an application side of scenario testing and validation, through an iterative refinement of the harmonisation solutions provided within the project.

The Architecture of the HUMBOLDT Framework has been based on an approach which comprises as the fundamental part a Mediator Proxy able to support standard interfaces. More specialized interfaces are also integrated in the Framework Architecture, as:

- A Workflow Definition and Construction Service;
- A Context Service;
- A Model and Mapping Repository;
- An Information Grounding Service;
- A set of Transformer Services.

The transformation and harmonisation process and its feasibility and efficiency, strongly depends on the availability of the description of transformation rules from the viewpoint of the conceptual schema level. All those aspects and issues are being tackled within the HUMBOLDT project environment, and will be the core of the project until its official ending and beyond, towards the establishment of an ESDI.

Archive and catalogue system for receiving satellite data as a part of academic SDI

GRILL Stanislav
grillst@natur.cuni.cz
Charles University in Prague, Czech Republic

BAYER Tomas
bayertom@natur.cuni.cz
Charles University in Prague, Czech Republic

SCHNEIDER Michal
schneider.michal@gmail.com
Czech Republic

JEDLIČKA Jan
jan_jedlicka@centrum.cz
Czech Republic

Keywords: SDI, spatial data, data storage, Geonetwork

Abstract: Storing a huge amount of the remote sensing data represents an usual task in scientific and business area. Department of applied geoinformatics and cartography has been established a receiving station acquiring continuously data from the following satellite systems: Envisat (Meris), MSG second generation, NOAA and Metop. The process of data acquisition is represented by a large amount of daily transferred data. This data should be organized not only because of practical reasons (easy access, fast searching), but also for educational purposes.

This paper describes a process of data storage and data integration into department's Spatial Data Infrastructure (SDI). SDI has been proposed with an emphasis on a gateway providing access to the spatial geodata at the Faculty of science. Acquired data are of different types: satellite data, vector databases, tabular and statistical data, cartographic outputs, etc. It is necessary to ensure a common access and allow searching, viewing, editing this data. Features implemented in SDI have to fulfill the following tasks: search based on a location, search based on a resolution, search based on descriptive metadata, etc.

Preprocessing raster datasets in sense of getting information for SDI will be described and some outputs for users will be shown. In this context, for all satellite sources, there are implemented the same methods: reading data, selecting appropriate data to store (using automatic filter or user-defined selection), creating of footprints inserted in a spatial geodatabase, creating of metadata.

The final part of this paper describes the usage of Geonetwork open-source software for the metadata management and a proposal of the user interface between researchers, teachers and students.

Multilingual glossary in remote sensing and geoinformatics

KANCHEVA Rumiana
rumik@abv.bg
Bulgarian Academy of Sciences, Sofia, Bulgaria

NIKOLOV Hristo
hristo@stil.bas.bg
Bulgarian Academy of Sciences, Sofia, Bulgaria

TISHCHENKO Yuri
tishchen@sunclass.ire.rssi
Institute of Radio-Engineering and Electronics - Moscow Power Engineering Institute (Technical University),
Russia

Keywords: dictionary, remote sensing,geoinformatics

Abstract: In our rapidly changing technological world new terms emerge almost every day. For people working in such advanced fields as remote sensing and geoinformatics it is crucial to keep up with the latest and quantitative and qualitative developments and novelties of the terminology. This refers as well to experts in many disciplines who handle and use remote sensing data and information products. Researchers, professionals, students and decision makers of different nationalities should fully understand, interpret and translate into their native languages any term, definition or acronym found in English (in articles, books, proceedings, specifications, documentation, etc.). This issue is directly connected with the world-wide polices for knowledge dissemination, experience exchange and international cooperation in scientific, research and application areas putting a particular accent on Earth Observations and environmental problems of global significance. It is not less important that users of remote sensing products have to be well familiarized with the relevant terms and definitions so that, for instance, the correct questions can be asked about the nature of a data set and any processing it has undergone.

With this motivation, considering the importance of the problem and believing that the mfore and more growing remote sensing community is an essential part of the today's information society, we intend to launch the idea for the creation of a specialized Multilingual Glossary in Remote Sensing and Geoinformatics and draw the EARSeL attention on the necessity and usefulness of such an instrument specifically at a time when many international teams have been or will be involved in joined programes and projects. We are going to present our vision about the working principles, structure, updating process and web-based access to the Multilingual Glossary but first of all to make contacts and discuss the idea with representatives of different EARSeL members and non-members.

The above initiative will build upon previous national and international attempts (including the multilingual "Glossary of Terms and Definitions on Earth Remote Sensing" prepared and issued in 1985 in the frameworks of the space program 'Intercosmos'). It shall also make use of the on-going activities within the IAA but focusing on Earth Observation technologies (tools and methods, sensors, data sources, data processing and applications, etc.). Such a glossary will, in our opinion, be a more feasible, efficient and easy to use tool than different and not always accessible Space relevant thesauri. The initiative will rely on the experience of international teams in the elaboration of suchlike materials with the aim to collect, update and proliferate available and future terms in this specific field of human knowledge and expertise. As an action plan our suggestion and appeal is to establish an international network of collaborators and to operate through forums, specialized websites, workshops and etc. At last but not least, this initiative could search and apply for financial support from national and international funds and programs.

Airborne remote sensing and UAV's for marine mammal monitoring

GRENZDOERFFER Goerres J.
goerres.grenzdoerffer@uni-rostock.de
Rostock University, Germany

DÄHNE Michael
michael.daehne@meeresmuseum.de
German Oceanographic Museum Stralsund, Katharinenberg, Germany

Keywords: UAV, pattern recognition, airborne remote sensing

Abstract: The assessment of abundance of marine mammals and seabirds is an essential part of the plans to carry out a future Marine Protected Areas (MPAs) monitoring as well as for marine mammal and avifauna research. The most commonly used techniques such as standard line transect surveys on ships or planes are costly, heavily influenced by weather conditions and can state statistically proven results only in larger areas. This makes it necessary to think about new methods to assess at least some species. One possible solution for these specific problems could be the increased usage of remote sensing technologies to reduce the cost and logistic effort. Thereby small UAV's are of special interest, because they offer several advantages for marine mammal and sea bird detection, such as:
• Transparent, reviewable procedure
• Near-Online opportunity: first quality control directly after the flight
• Independent system, no coordination with aircraft charterer and observers necessary
• Efficient (cost) for small areas, long strips
• Quiet (with e-motor), e.g. for bird observations
• Lower weather dependency than conventional aircraft, can fly below the clouds
Despite the above mentioned advantages the use of UAV's is very challenging. In the feasibility study REMPLANE the following questions had to be answered:
• What are the necessary optics, flying heights and image quality parameters for the detection of harbor porpoises and other animals?
• What is the minimum ground resolution?
• How many overlapping images are necessary for a save mammal or harbor porpoise recognition ?
• Do the aerial measurements and the image analysis coincide with the common visual approach ?
• What are the special requirements of a UAV for the monitoring of harbor porpoises and other marine mammals ?
To answer the above noted questions a query on small consumer digital cameras was conducted. The selected Canon Powershot G9 was intensively calibrated, geometrically and radiometrically. Compared to a high end medium format camera the SNR of the Canon Powershot G9 is lower and the colour noise is much higher, especially under low light conditions.
In several test flights with a medium format camera system PFIFF images with a GSD of 2 – 3 cm GSD were collected. Special and rare weather conditions are necessary to acquire water images without sun glitter and wave reflections.
Due to the high GSD common image classification procedures were carried out. In order to automatically detect and count birds and marine mammals the image analysis of the data was done with the HALCON 8.0.2 software. With the developed signatures especially sea birds and seals could be determinate with a high degree of accuracy and reliability

A Spatially-Enabled Wiki Utilizing WebGIS Technologies

STREVINAS Dimitrios
voas_acc@yahoo.com
Technical University of Crete, Chania, Greece

SAMOLADAS Vasilis
vsam@softnet.tuc.gr
Technical University of Crete, Chania, Greece

MANAKOS Ioannis
manakos@maich.gr
MAICH - Mediterranean Agronomic Institute of Chania, Greece

Abstract: Wikis are web-based collaborative authoring systems where the final document is a rich combination of hypertext and multimedia. The most prominent wiki system is Wikipedia, an encyclopedia authored by tens of thousands of authors worldwide, and providing a rich source of information to millions of people daily. Despite the flexibility of current wiki systems, most do not provide capabilities for the integration and manipulation of spatial/geographic content, except in the most rudimentary form, e.g., as static images.

GeoMoin is a WebGIS system integrated within a wiki platform, specializing in the collection, management, dissemination and integration of spatial information with other wiki-based documents (hypertext and multimedia). GeoMoin's prominent features include support for publication of spatial data in multiple formats, combination of this data in the creation of digital maps, the ability to dynamically combine on-line data from OGC services (WMS, WFS) with published content, embedding maps within wiki documents, and interoperability with prominent WebGIS on-line services (e.g., Google Maps). In addition to the above, GeoMoin allows authors to define new annotation layers that can be combined with maps.

In true wiki fashion, annotations can be edited collaboratively, they can include hypertext as well as multimedia (images, video etc) and they can act as hyperlinks to other wiki content/pages. Furthermore, maps created by GeoMoin are available online as OGC services (WMS, WFS) to other applications, including other wiki systems, desktop GIS systems (e.g. ArcGIS) and GIS mashups.

GeoMoin is a powerful tool, targeted to those application domains requiring collaborative creation and presentation of spatial data, including but not limited to education, social web, scientific collaboration and dissemination of results, collaborative planning and decision support, environmental monitoring, and spatially enabled e-commerce portals. This demo will focus on the innovative features of WebGIS, and on its capacity to make spatial data accessible to users of varying levels of technical expertise.

SESSION 11 – Atmosphere

Chairman: Lucien Wald

Solar surface irradiance from new meteorological satellite data

OUMBE Armel
armel.oumbe@mines-paristech.fr
Mines ParisTech - Center for Energy and Processes, Sophia Antipolis, France

BLANC Philippe
philippe.blanc@mines-paristech.fr
Mines ParisTech - Center for Energy and Processes, Sophia Antipolis, France

WALD Lucien
lucien.wald@mines-paristech.fr
Mines ParisTech - Center for Energy and Processes, Sophia Antipolis, France

SCHROEDTER-HOMSCHEIDT Marion
Marion.Schroedter-Homscheidt@dlr.de
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

Abstract: Accurate estimating solar surface irradiance (SSI) is necessary for an efficient planning and harnessing solar energy to produce electricity or heat. It is also important to assess the radiative forcing of the climate system. SSI is measured by ground networks, but measurements are punctual and scattered. For compensating these lacks of measurements, numerous operational methods have been developed in the past years to assess SSI from images taken by satellites. Most current methods are inverse, i.e. the inputs are satellite images whose digital counts result from the ensemble of interactions of radiation with the atmosphere and the ground during the downward and upward paths of the radiation. Solar radiation may also be assessed by a direct method. In this approach, the various processes occurring during the path of the light from the outer space towards the ground can be modelled by the means of a radiative transfer model (RTM) in 2D or 3D. RTMs take into account a large number of inputs: optical properties including spectral aspects of gases, aerosols, clouds and ground reflectance, types of interactions, mathematical solving methods.

 Nowadays, recent meteorological satellites combined with recent data assimilation techniques into atmospheric modelling offer a favourable context for the design and exploitation of a method based on a direct modelling. This approach would permit to deliver knowledge on direct, diffuse components and spectral distribution, which is seldom offered by current methods. Despite noticeable advances in the operational assessment of optical properties of the atmosphere at any location, we do not have enough information for 3D RTM. The available atmospheric information is typically 2D. Even so, many of the inputs are unknown or limited in their availability. Some are known every ¼ h (clouds), others every day (ozone, water vapour) and others only from times to times (aerosols, ground albedo).

In this work, we design a direct method called Heliosat-4. Heliosat-4 is based on the RTM libRadtran and benefits from advanced products derived from recent Earth Observation missions. It will provide direct and diffuse components and spectral distribution of SSI every 3 km and ¼ h over Europe and Africa. With sensitivity analysis on atmospheric parameters, we identify the necessary inputs of the method and establish that the SSI for a cloudy atmosphere can be considered as equal to the product of the irradiance obtained under a clear sky and a function of the cloud extinction and ground albedo contribution. For clear-sky part, we use libRadtran and parameterizations of vertical profile and diurnal variation of SSI. We use delta-Eddington's approximation for cloud extinction and consider that occur infinite series of reflection between ground and atmosphere for ground albedo contribution.

The inputs to the Heliosat-4 method are ozone and water vapour contents, aerosol and clouds parameters, which come from routine processing undertaken at DLR. We compare the method outcomes with ground measurements. These comparisons are done for hourly global irradiation for seven stations in Europe and one in Northern Africa.

Aerosol optical thickness determination over Cyprus using satellite remote sensing and ground measurements

HADJIMITSIS Diofantos G.
d.hadjimitsis@cut.ac.cy
Cyprus University of Technology, Lemesos, Cyprus

THEMISTOCLEOUS Kyriacos
kt33@cytanet.com.cy
Cyprus University of Technology, Lemesos, Cyprus

Keywords: aerosol optical thickness, atmospheric correction

Abstract: The critical parameter for applying an efficient atmospheric correction to the satellite remotely sensed imagery is the aerosol optical thickness (AOT). Indeed, AOT is also used to monitor and assess the atmospheric pollution. Several researchers highlighted the importance of assessing the effectiveness of the available atmospheric correction algorithms using ground measurements. This project which is supported from the Cyprus University of Technology, Department of Civil Engineering & Geomatics-Remote Sensing Laboratory aims to support such task. This project consists both processing (pre and post processing) as well ground measurements. During the satellite overpass the following ground measurements have been obtained: (a) Spectral measurements of several calibration targets using field spectro-radiometers (GER 1500, SVC NR 1024). (b) Sun-photometer measurements so as to determine the aerosol optical thickness using both: manual track sun-photometers (MICROTOPS II) and automatic scan tracking sun-photometers. (c) Meteorological data such as visibility, relative humidity, atmospheric pressure (using measurements from the nearby meteorological stations or from the mobile meteorological stations). (d) Air pollution data. Landsat TM/ETM+ images of Cyprus have been used. Preliminary results are presented in this paper.

Chemicomorphological characterization of Etna's Plume by atmospheric lidar, satellite radiometers and in-situ measurements

FIORANI Luca
fiorani@frascati.enea.it
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy
,
AIUPPA Alessandro
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

COLAO Francesco
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

DEL BUGARO Dino
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

FANTONI Roberta
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

GIUDICE Gaetano
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

GIUFFRIDA Giovanni
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

GUIDA Roberto
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

YU KATAEV Mikhail
Tomsk State University of Control Systems and Radioelectronics, Russia

KATAEV Sergey G.
Tomsk State University of Control Systems and Radioelectronics, Russia

LIUZZO Marco
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

LONCHIN Alexey V.
Tomsk State University of Control Systems and Radioelectronics, Russia

PALUCCI Antonio
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

SPINETTI Claudia
INGV - Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy

SYKHANOV Alexander Ya
Tomsk State University of Control Systems and Radioelectronics, Russia

Keywords: remote sensing of volcanic plumes, extinction coefficient, volcanic aerosol, volcanic gases, Mount Etna, atmospheric lidar, lidar simulation, NASA-MODIS, NASA-OMI

Abstract: Understanding the chemical and physical properties of the volcanic plume persistently emitted by Mount Etna volcano, in southern Italy, brings significant implications for volcano monitoring, and for the assessment and mitigation of volcanic, environmental and civil aviation hazards in eastern Sicily. Detecting and investigating the composition, shape, height and optical properties of Etna's plume is challenging, however, and requires the combination of in-situ and

ground-based and/or satellite-based remote sensing techniques. Here we report on a multidisciplinary characterization of Etna's plume, which integrates measurements from several simultaneously used techniques. Measurements were carried out in July 2008, when the volcano was characterized by quiescent degassing through its summit open vents, and by mild-explosive and effusive activity from a fracture field on its upper eastern flank. In situ MultiGAS measurements performed at the main summit crater's vent (Aiuppa et al., 2008, GRL), combined with the spectroscopically sensed SO_2 flux (by DOAS), has allowed estimating the fluxes of the three main volcanogenic gases, which we evaluate at ~42,000 t/d of H_2O, ~25,000 t/d of CO_2 and ~3,500 t/d of SO_2. At the same time, a CO_2 laser-based lidar has been used to profile the volcanic plume of Mount Etna, with a focus on volcanic aerosols detection. The lidar technique has only occasionally been used in the volcanic context, and only once previously at Mount Etna for the measurement of the SO_2 flux (Edner et al., 1994, JGR). Due to the transmitted wavelength, the used lidar system is practically insensitive to air molecules while it detects aerosol load, and thus the path attenuation of the laser beam is heavily affected by volcanic particulate. Vertical profiles of extinction coefficient were retrieved up to a range of 5000 m and the experimental signal was compared to a numerical model. The lidar was able to accurately track the spatiotemporal evolution of the volcanic plume thanks to a spatial resolution of 15 m and a temporal resolution of 1 minute. Contemporaneous to ground measurements the radiometers NASA-MODIS, onboard Terra and Aqua spacecrafts, have acquired two multispectral images. A retrieval technique has been applied to the data in the visible spectral range in order to map the aerosol optical thickness of the volcanic plume. The spatial distribution of the volcanic plume has been obtained and compared with the lidar-derived optical thickness, obtaining 3D information of the particles composing the volcanic plume. Moreover, the radiometer NASA-OMI, onboard Aura satellite, acquired contemporaneous data and derived the SO_2 content, well identifying the volcanic plume and showing a maximum of 1.87 Du.

Evaluaton of an operational method to minimise reflectance anisotropy on multi-swath airborne imagery

CHOI Kyu Young
choi@atm.ox.ac.uk
University of Oxford, U.K.

MILTON Edward J.
ejm@soton.ac.uk
University of Oxford, U.K.

Keywords: airborne, image spectroscopy, anisotropy, mosaic

Abstract: Determining accurate spectral reflectance data from ground targets is one of the fundamental steps in the quantitative analysis of remotely sensed data. When making such measurements from an aircraft, the main sources of radiometric distortion are atmospheric interaction and the reflectance anisotropy of the target, as represented by its bidirectional reflectance distribution function (brdf). The effect of the atmosphere upon the signal is relatively well known, and many different methods of correction are available with various levels of accuracy. In contrast, bidirectional reflectance algorithms are not easy to deal with for practical use in operational airborne remote sensing.

Conventional approaches require either too many input parameters or require ancillary data, such as sensing geometry and directional optical characteristics of each target. Several experiments have been made to obtain surface reflectance anisotropy using multi-view sensor or multi-directional datasets. Despite successful measurement of directional reflectance changes, such research-oriented experiments have limited operational application.

In this study, multi-angle remote sensing data were acquired by using images from adjacent flightlines. Generally, at the survey planning stage, flightlines are designed to have around 30% overlap in order to make sure there is no gap between them. Although such duplicated areas tend to be wasted in the final product, they could be an excellent dataset for operational bidirectional reflectance correction. The method used in this paper is,

1. To obtain view angles for each duplicate pixel using navigation data (with or without digital elevation model),
2. To compare stereo (polar) plots of pixel values at spectral band n (with or without classification), and
3. To use the data from (1) and (2) to compute an anisotropy correction factor.

The main limitations of this method compared with research-oriented approaches are the smaller number of directional observations of each pixel, and the need for more stringent geometric registration. In practice, the fine resolution of airborne data means that this is possible, unlike with multi-angle satellite data. The method has the big advantage that no extra data acquisition is necessary.

Validation of this method is determined by radiative transfer model using in situ ground measurements collected during the flight campaign organised by the Network for Calibration and Validation of Earth Observation data (NCAVEO) in June 2006. The results show good agreement with the reference dataset, which gives not just visual but also spectral matches with image from adjacent flightline. With this correction, the composite mosaic can be used as a single image for later quantititaive analysis.

SESSION 12 – Thermal Remote Sensing (1)

Chairmen: Claudia Kuenzer, Chris Hecker

Testing thermal sharpening techniques for land surface temperature retrieval in support of urban and suburban area mapping

ESSA Wiesam A.A.
wiesam.essa@vub.ac.be
PhD Student, Vrije Universiteit Brussel, Belgium

VERBEIREN Boud M.G.
bverbeir@vub.ac.be
Vrije Universiteit Brussel, Belgium

BATELAAN Okke
batelaanvub.ac.be
Vrije Universiteit Brussel, Belgium

Keywords: Thermal remote sensing, thermal sharpening, land surface temperature, urban area mapping, evapotranspiration estimation

Abstract: Remotely sensed thermal infrared data (TIR) contains information on emitted radiation that is complementary to that in the visible (VIS) and near infrared (NIR) spectrum. Despite the unique radiometric properties of thermal bands, applications using TIR data has been rather limited. The main reason lies in the coarser spatial resolution of these bands, which often do not suffice for highly heterogeneous (sub)urban areas. We aim at a line of research in which we focus on algorithms and techniques to improve land surface temperature retrieval, urban land-use/land-cover mapping and evapotranspiration estimation using TIR data. A first objective of our research is to sharpen the thermal information. Thermal sharpening refers to the use of information of other bands with a higher spatial resolution to refine the spatial resolution of the thermal band. These other bands can be the VNIR/PAN bands from the same sensor or from another sensor.

Several thermal sharpening techniques will be tested to obtain sharpened thermal information and examine the effectiveness of integrating high(er) resolution TIR data as complementary information. During the past years a number of sharpening methods have been developed. Examples are TsHARP, an algorithm for sharpening thermal imagery based on the assumption that a unique relationship between radiometric surface temperature and vegetation index exists at multiple resolutions, and MMT, a multi-sensor multi-resolution technique based on unmixing and fusion algorithms.

In this study, different sharpening methods will be applied on the thermal band of a Landsat/ETM+ image (2001) for the city of Dublin and surroundings. For the higher spatial resolution data the VNIR/Pan bands of the same Landsat/ETM+ image and a Quickbird image (2003) will be used. It is expected that the sharpened thermal band will not only result in a more accurate estimation of the land surface temperature, but also in improved land use/land cover mapping accuracies and evapotranspiration estimates in (sub)urban areas.

Preliminary Performance Assessment of Space-based Observations of Hot-spot Events using Microbolometers

RAHNAMA Peyman
peyman.rahnama@comdev.ca
COM DEV Ltd., Cambridge, Canada

MARCHESE Linda
INO, Quebec Canada

CHATEAUNEUF François
INO, Quebec, Canada

HACKETT John
COM DEV Ltd., Cambridge, Canada

LYNHAM Tim
Natural Resources Canada, Ottawa, Canada

WOOSTER Martin
King's College London, U.K.

Keywords: performance model, thermal imaging, satellite instruments, microbolometer, simulation, retrieval, hot-spot events, fire monitoring, biomass burning

Abstract: Satellite instruments dedicated to observations of hot-spot events in Earth have numerous direct benefits to life on Earth. Such instruments would focus on one or more of the following areas: fire detection/monitoring, volcanic activities, biomass burning, carbon emissions, land cover change monitoring and climate change.

This paper discusses a preliminary performance assessment of space-based observations of hot-spot events using an imager employing microbolometer technology.

A performance model has been developed to allow the simulation and retrieval of satellite imagery for a thermal imaging system to be used to detect and monitor hot events on the Earth with an emphasis on forest fire observation applications. Using the performance model, a preliminary performance assessment has been performed.

This paper presents a conceptual instrument design, sample simulation results, trade-off studies and sample performance analysis results. The suitability of microbolometer detector technology for forest fire observations is discussed.

The capability of MODIS diurnal thermal bands observatons

KUENZER Claudia
claudia.kuenzer@dlr.de
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

HECKER Chris
ITC - International Institute for Geo-Information Science and Earth Observation, Netherlands

SCHMIDT Michael
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

MEHL Harald
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

DECH Stefan
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

Keywords: MODIS, diurnal thermal data, thermal anomalies, hot spots

Abstract: Thermal remote sensing over land has always been a discipline with a relatively small analyst and user community compared to fields such as multispectral remote sensing, or even radar remote sensing. Typical fields of application for thermal remote sensing over land are: large scale land surface temperature (LST) mapping for model input in fields of vegetation monitoring, agriculture, climatology or hydrology, analyses of thermal heat island- and heat sink patterns in urban areas, urban area climatology, volcano observation, geothermal analyses, forest fire-, peat fire-, and burned area detection, observation of industrial areas, investigation of coal fire areas and mining areas worldwide, security applications such as pipeline monitoring, the retrieval of soil moisture, and rock type- and mineral discrimination. Despite the limited number of thermal remote sensing scientists and a relatively narrow choice of space borne thermal sensors the above listing of fields of application already indicates a large potential for quantitative analyses and product generation, which should not be underestimated.

Currently, the number of sensors for thermal analyses is very limited. After the failure of Landsat-7 ETM+ (120m resolution in thermal band) there is no sensor in orbit, which delivers thermal data at a better resolution, except ASTER, with five thermal bands and 90m resolution. However, ASTER – even though inexpensive – does not cover the complete globe, but scenes have to be specifically scheduled and acquired. Here competition with other users occurs. A sensor often neglected for regional thermal analyses is MODIS with a resolution of 1km. In this paper we present MODIS' great potential for hot spot detection and the detection of thermally anomalous areas as well as for the classification of these anomalies with respect to temperature intensity. This is due to two great advantages of MODIS. Firstly, data is acquired up to five times a day for an area, since the sensor is available on the platforms AQUA and TERRA. Thus, for an area of interest it is possible to acquire morning-, afternoon-, evening-, night- and pre-dawn data on the same day or within the range of only a few days. This allows the analyses of thermal imagery with varying background temperature conditions, which allows for precise anomaly extraction. Furthermore, MODIS has several thermal bands – located in the mid-infrared as well as in the thermal infrared. The analyses of these individual bands as well as the investigation of artificially created ratio bands allows for the separation of relatively warm anomalies against outstanding hot spots. For anomaly extraction we employ an automated histogram based algorithm for anomaly extraction, which grants unbiased and repeatable results. Our results demonstrate that is possible to detect subtle thermal anomalies even in low resolution thermal MODIS data. Furthermore, anomalies can be grouped into "normal" warm anomalies as well as outstanding hot spots.

Accurate remote sensing assessment of land surface thermal emissivity

MIRA Maria
maria.mira@uv.es
University of Valencia, Burjassot, Spain

CASELLES Vicente
University of Valencia, Burjassot, Spain

VALOR Enric
University of Valencia, Burjassot, Spain

COLL César
University of Valencia, Burjassot, Spain

Keywords: thermal remote sensing, emissivity, soil moisture, land surface temperature

Abstract: The emissivity of natural surfaces is a required parameter in high accuracy land surface temperature (LST) determinations. Then, it is of a great importance to know how thermal infrared (TIR) emissivity changes with the different factors. Soil type influence on emissivity is well known from experimental studies, whereas the effect of soil moisture (SM) on emissivity is one of the pending issues in thermal remote sensing. It is seen that the SM variation may cause a high systematic error in emissivity, e.g., about +0.1 in emissivity for an increase from 0.04 to 0.10 g/cm3 in SM for sandy soils. In agreement with Mira et al. (2007), this study reveals a common emissivity increase with soil water content, higher for larger sand content and in the 8 to 9 µm range, but always significant considering the experimental uncertainty ($\delta\varepsilon\sim\pm0.5\%$). The emissivity increase is understood because of both the quartz contribution to decrease the emissivity of the material chiefly between 7.7 and 9.7 µm, and the decrease of the reflectivity by the water film on the soil particles. The study proves that the soil moisture effect on TIR emissivities should be considered in atmospheric and emissivity correction algorithms to avoid significant LST systematic errors. Emissivity-soil moisture relationships were obtained with the aim of using them together with SM estimates from remotely sense data in order to improve the TIR emissivity estimations an thus, the LST determination. The next step in our analysis is to explore the feasibility of this approach using Soil Moisture and Ocean Salinity (SMOS) data, a new sensor that is scheduled for launch in 2009.

Determination of land surface temperature (LST) model of Lut Desert (Iran) based on NOAA-AVHRR and MODIS data and ground measurements

ALAVIPANAH Seyed Kazem
salavipa@ut.ac.ir
University of Tehran, Iran

SARAJIAN Mohammad Reza
sarajian@ut.ac.ir
University of Tehran, Iran

HAMZEH Mohammad
Student, University of Tehran, Iran

Keywords: LST, AVHRR, LUT Desert, Temperature

Abstract: The maximum land surface temperature related to hot and dry climatic condition, Clear sky causes that the highest radiation reaches to the land surface and land surface warms up fast during day time. Lut Desert seems ideal condition for studying and determining land surface temperature and model development. Therefore in this study, 12 NOAA-AVHRR and MODIS data and air temperature data were used to evaluate the model of land surface temperature of Yardang region in Lut Desert. To study the LST model, 8 ground measurements as ground truth were used. From the results obtained from this research. We concluded that in spite of some difficulties in estimating land surface temperatures, we can extract valuable information from surface features. We may also conclude that accurate emissivities are necessary to study surface features and soils and to monitor surface changes.

SESSION 13 – Vegetation and Agriculture (2)

Chairman: George Petropoulos

Estimating Evapotranspiration using Remote Sensing Techniques for the sustainable use of irrigation water in Agriculture

HADJIMITSIS Diofantos G., PAPADAVID Giorgos
d.hadjimitsis@cut.ac.cy
Cyprus University of Technology, Lemesos, Cyprus

Abstract: Water scarcity has always been a severe problem for agricultural purposes in Cyprus. Meteorological data refer to the problem since their existence. The authorities, responsible for this environmental, social and economic constraint, have managed a great development and deployment of a dam's network in order to save water from losses and use it during low rainfall years. Lately, Cyprus is facing a period with very low rainfall which has caused curtailments to irrigation water schedule, which in turn has resulted to very low or no yield for the seasonal and multiannual crops. On one hand, water scarcity is impugned through a series of public projects but on the other hand irrigation water management, which absorbs more than 65% of total water consumption, is quite inefficient since the data regarding the actual Evapotranspiration is limited. The monitoring of agricultural areas in Cyprus provides important data for efficient water supply plans and for avoiding unnecessary water lost due to inefficient irrigation. Thus, the monitoring through Satellite Remote Sensing is an essential and useful tool to provide irrigation data for water demand management. It is vital to understand how much water is being used by the crops indifferent areas of an irrigation project to establish irrigation efficiency so as to achieve sustainable and improved water use efficiency. There is a need for an effective method of establishing crop water use in large irrigation projects so that crop demand can be accurately met by supply in order to eliminate problems such as lack of up to date information on the cropped area, evaporative demand in the agricultural fields and water supply. Field spectro-radiometric measurements using SVC-HR 1024 and GER 1500 were undertaken to determine the spectral signature of different types of crops so as to assist our classification techniques. Final crop maps using Landsat TM and ETM+ can be produced and the optimal amount of irrigation demand required for certain types of crops can be determined in order to avoid any non-effective water management. The project aims to the sustainable use of irrigation water from both the competent authorities and the producers. The wise and sustainable use of irrigation water will result to higher efficiency and will increase the water reserve funds for the future generations. Sustainable use of irrigation water will preserve the agricultural activity alive. The purpose of this paper is to present the methodology of how actual Evapotranspiration can be determined for purposes of efficient water management using satellite remote sensing to retrieve input parameters which characterize surface properties such as albedo, emissivity or Leaf Area Index, in-situ spectro-radiometric measurements, energy balance models and wireless micro-sensor technology for collecting automatically data for the different meteorological parameters.

Environmental effects of drouth on Guilan Province's Rivers in Iran

BAGHERZADEH Asan
asan43@yahoo.com
Guilan Regional Water, Rasht, Iran

Keywords: agricultural lands, discharge, rainfall, rivers, water pollutants

Abstract: Guilan province in the north of Iran is near the Caspian Sea. Annual rain is around 1800 mm in normal rate. There are more than 50 main rivers in Guilan, but the main of them are Shafaroud in west, Sefidroud in center and Polroud in east of Guilan that, our agricultural land exactly rice field directly depend on them. But science September 2007 until August 2008 (the time for agriculture activities) the rainfall decrease 40% than last year and also the rivers discharge decrease same. By this reason many of agricultural lands damaged and the rivers life are endangered.
Environmental effects:
1. Increase of density the pesticide and fertilizer in aquatic lands
2. Increase of density the no treated domestic waste water pollutants in aquatic lands
3. Increase of density the no treated industrial waste water pollutants in aquatic lands
4. Increase of density the no treated hospital waste water pollutants in aquatic lands
5. Increase of density the no treated leached of solid waste pollutants in aquatic lands
6. Decrease of water quality for aquatic life
For pass this critical year we had successfully experiment with chemical method (AgI) for rainy cloud.
But in next year we predict will have same situation and we should have new plan in future.

Evaluation of LSA SAF leaf area index retrieval algorithm using VEGETATION and MODIS data

VERGER Aleixandre,
aleixandre.verger@uv.es
Universitat de Valencia, Burjassot, Spain

CAMACHO Fernado
EOLAB - Earth Observation Laboratory, Spain

JAVIER GARCÍA-HARO Francisco
Universitat de Valencia, Burjassot, Spain

MELIÁ Joaquín
Universitat de Valencia, Burjassot, Spain

Abstract: The Satellite Application Facility on Land Surface Analysis (LSA SAF) project aims to provide land surface variables to the meteorological and environmental science communities from EUMETSAT satellites. Since AVHRR/MetOp and SEVIRI/MSG merged data is foreseen until 2012, prototyping LSA SAF algorithms to other sensor data appears useful for algorithm validation and improvement. This paper evaluates the performance of the LSA SAF Leaf Area Index (LAI) retrieval algorithm when prototyped to VEGETATION/CYCLOPES and MODIS normalized reflectance data over Europe for the 2001-2003 period.

The results provide further evidences of the versatility of LSA SAF algorithms to retrieve consistent LAI estimates from multiple remotely sensed imagery even when input reflectances present systematic differences. High spatial and temporal consistencies between our estimates and CYCLOPES and MODIS LAI products are found. Differences in LAI between CYCLOPES products and LSA SAF estimates are lower than their expected uncertainties, i.e. 0.5 LAI units. Larger discrepancies are found when compared LSA SAF prototyped estimates against MODIS products due, in part, to differences in radiative transfer formulation of each retrieval approach and LAI definitions (RMSE ranging from 0.2 up to 1 with an underestimation of LSA SAF compared to MODIS for forest canopies and an overestimation for grasses and crops). Direct validation indicates that LSA SAF estimates from CYCLOPES and MODIS reflectances achieve similar performances (0.7 and 0.5, respectively) as CYCLOPES and MODIS LAI products. This exercise constitutes thus a step forward for the validation and consolidation of LSA SAF LAI retrieval algorithm.

Suitability of VHR PAN-only data for large scale rural mapping
Subtitle: Can very high resolution optical sensors, with single panchromatic spectral channels (VHR PAN), be used for large scale mapping of rural areas under the CAP?

MILENOV Pavel K.
pavel.milenov@jrc.it
JRC - Joint Research Centre, Ispra, Italy

KAY Simon A.W.
simon.kay@jrc.it
JRC - Joint Research Centre, Ispra, Italy

KERDILES Herve L
herve.kerdiles@jrc.it
JRC - Joint Research Centre, Ispra, Italy

Keywords: VHR PAN, spectral resolution, large-scale rural mapping, CAP, radiometry

Abstract: In last two years, the remote sensing community has witnessed the operational deployment of very-high resolution (VHR) satellites with ground sampling distance (GSD) of less than one meter, for example, EROS B with GSD of 0.7 meters at nadir and Worldview-1 with GSD of 0.5 meters at nadir respectively. These spaceborne sensors designed to acquire as panchromatic only, have a radiometric range which covers both the visible and near infrared part of the electromagnetic spectrum.

The potential use of these sensors for large-scale mapping is obvious, even though the lack of a multispectral component might place some limitations for certain applications. Although the geometric accuracy is expected to be in line at least with the mapping standards at a scale 1:10 000, certain testing and validation of the information content is necessary to ensure compliance suitability with large scale mapping.

This is especially relevant in the domain of agriculture and environmental monitoring, where the representation of the reflectance data in several spectral bands is usually considered important, or even essential.

The GeoCAP team of the European Commission Joint Research Centre initiated a technical study to assess the suitability of the VHR PAN sensors as primary source of data for the control of area based subsidies in the frame of the EU Common Agriculture Policy (CAP). The study deals with the question of whether mapping information usually obtained from VHR pan-sharpened multispectral optical imagery can also be derived from VHR pan-only data with a comparable quality. Up to now, for the measurement of agriculture parcels and the detection of landscape features, VHR pan-sharpened data has been used. However the capacity of such sensors has been close to saturation in the last campaign. It is therefore important to evaluate to what extent VHR PAN only sensors can substitute VHR multispectral sensors for CAP controls.

Surface Reflectance Retrieval from Satellite Images for Monitoring Irrigation Demand in Cyprus

HADJIMITSIS Diofantos G.
d.hadjimitsis@cut.ac.cy
Cyprus University of Technology, Lemesos, Cyprus

AGAPIOU Athos
athosagapiou@yahoo.gr
Cyprus University of Technology, Lemesos, Cyprus

PAPADAVID Giorgos
Greece

Keywords: vegetation indices, irrigation demand, reflectance, atmospheric correction

Abstract: Shortage of rainfall and surface water in Cyprus, the last few years, has caused its strong dependence on groundwater. On-farm water application rates in Cyprus are high and irrigation practice has a low efficiency. Apart from the losses, the major part of the losses is at farm level via evaporation, due to inefficient irrigation practices (surface irrigation methods) and percolation to the shallow aquifers. An assessment of the available methods found in the literature for determining irrigation demand using satellite remotely sensed and other auxiliary data is firstly presented. Then the methodology of the project is described. An irrigated area near the Asprokremmos dam, at Paphos District (Cyprus), is used as a pilot study in this project. For this area both multi – spectral and time series satellite images have been used.

This paper presents the results found by applying several vegetation indices in this area for satellite images acquired in 2008/09 in which spectro-radiometric and sun-photometer data were available. The retrieval of surface reflectance for each classified crop has been estimated after the removal of atmospheric effects.

Retrievals of land surface energy fluxes and soil surface water content from the combined use of a land surface process model with ASTER imagery analysis

PETROPOULOS George
george.petropoulos@bristol.ac.uk
University of Bristol, U.K.

WOOSTER, M. J.
King's College London, U.K.

CARLSON T. N.
Pennsylvania State University, U.S.A.

DRAKE N.
King's College London, U.K.

Keywords: surface heat fluxes, soil moisture content, ASTER, SimSphere, CarboEurope

Abstract: Estimation of land-atmosphere fluxes and related land surface parameters is of key importance in many disciplines including hydrology, meteorology and agriculture. Remote sensing alone or often combined with land surface simulation process models, such as Soil Vegetation Atmosphere Transfer (SVAT) models, has generally shown a promising avenue in the estimation of these parameters from space.

The present study investigates in a European setting the use of one such scheme which is based on the combined use of SimSphere one-dimensional SVAT model with multispectral satellite data from the Advanced Spaceborne Thermal Emission and Reflection Scanning Radiometer (ASTER). The ability of the studied method to resolve for the land surface energy fluxes and of soil surface moisture content is verified using validated ground observations obtained from selected days collected from nine CARBOEUROPE sites representing a variety of climatic, topographic and environmental conditions. Results indicated a close agreement between the compared parameters both spatially and temporally with accuracies comparable to those obtained in similar experiments with high spatial resolution data. Overall performance of the examined here methodology was also found to be affected by the model initialisation conditions representative of the test site environment, predominantly the atmospheric conditions required in the SVAT model initial conditions.

This study represents the first comprehensive evaluation of the performance of this particular methodological implementation at a European setting using the SimSphere model with the ASTER data. In addition, it is very timely, given that a variation of the examined here methodology has been proposed for the operational retrieval of the soil surface moisture content by National Polar-orbiting Operational Environmental Satellite System (NPOESS), in a series of satellite platforms due to be launched from 2016.

The first four years of the remote sensing based ragween monitoring and control system

CSORNAI Gábor
csornai.gabor@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

MIKUS Gábor
mikus.gabor@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

NÁDOR Gizelle
nador.gizella@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

HUBIK Irén
hubik.iren@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

LÁSZLÓ István
laszlo.istvan@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

SUBA Zsuzsanna
suba.zsuzsanna@fomi.hu
FÖMI, Institute of Geodesy, Cartography and Remote Sensing, Budapeste, Hungary

Abstract: The ragweed pollen allergy has gradually become an important issue in Hungary. The number of pollen allergic people had been increasing so much that there was an imperative need for a National Ragweed Control Program (NRCP) which integrated several governmental authorities. Some 500000 – 700000 hectare area is estimated as seriously contaminated by ragweed. Some 60 – 100 M €/year is spent for medication and medical visits, tests because of the allergenic effect of ragweed. About 80% of ragweed area can be pinpointed by remote sensing on arable land. To ensure the efficiency of this priority program, the government amended the plant protection law in 2005. Institute of Geodesy, Cartography and Remote Sensing (FÖMI) has supported the nationwide NRCP by its own developed remote sensing and GIS methodology to monitor and map the main ragweed infected areas. This development basically relied on FÖMI's previous Crop Monitoring and Production Forecast program (CROPMON 1997-2003) knowledge and experience.
FÖMI produces countrywide ragweed risk maps focusing on the most heavily infected arable fields. The most important categories are non-cultivated arable lands and cereal stubbles. These ragweed risk maps are derived from time series of medium (IRS P6 AWiFS) and high-resolution (Landsat TM, IRS LISS, SPOT XS/Xi) satellite images. Based on the characteristics of weeds and the HR images, the ragweed delineation focuses to the spots larger than 1-2 hectares (depending on the available satellite images) where the most significant pollen production comes from. The major factor in the efficiency of the system is the high reconnaissance performance and accuracy (90% in optimum case) of the spots independently from the terrain, location and environment. The image processing technology is continuously evolving; for example, new vegetation indices are introduced to better characterise the development of ragweed and to distinguish it from other crop species.
The countrywide ragweed maps delineating the ragweed infected spots are utilised by the organizations that participate in the prevention (Land Offices, Plant Protection and Soil

Conservation Directorate of Central Agricultural Office) in the planning and optimisation of on site control. Ground data collection is managed by the Land Office Network of the Ministry of Agriculture and Rural Development, with the use of a GPS based integrated ground data collection system over the country. Ragweed risk maps and spatial statistics are publicly available via FÖMI's website (www.fomi.hu).

FÖMI has developed the Central Ragweed Server and Information System. This ensures the fast data exchange among the authorities and stores information about the infected spots. The central server synchronizes the activity of 300 officials during the most critical ragweed-growing period (from July to September).

Both the remote sensing based ragweed risk map and the Central Ragweed Server and Information System contribute to the successful ragweed control in Hungary. The introductions of four high tech components (RS+GPS+GIS+WEB system) were inevitable to adjust the ragweed control system for a better and a more efficient performance. Beyond the operational application in Hungary, this system is a typical example of multi-disciplinary project, comparable to Integrated Applications Programme of ESA.

Measuring pigments distribution in blood oranges during post-harvest by spectroscopy technique

SIGHICELLI Maria
sighicel@frascati.enea.it
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

PATSAEVA Svetlana
spatsaeva@mail.ru
Moscow State University, Russia

LAI Antonia
lai@frascati.enea.it
ENEA - Italian National Agency for New Technologies, Energy and the Environment, Frascati, Italy

Keywords: red pigments, blood oranges, post-harvest, spectroscopy technique

Abstract: The plant pigments are closely related to the physiological condition of fruit and are considered as indicators to monitor fruit quality. Blood orange (Citrus sinensis (L) Obseck, cv Moro and cv Sanguinello) contain red pigments that determine peel (anthocyanins and carotenoids) and juice (anthocyanins) colour and appearance of fruit. The presence of these antioxidant compounds increase interest in blood orange as functional food due to positive effects on human health. In recent years many optical methods have been employed to evaluate the fruit quality in postharvest period. The optical properties of pigments allow to estimate concentration. Spectroscopy technique is a useful tool for analysing composition and measuring content of plant pigments.The application of reflectance and absorption spectroscopy for the red pigments detection is described. Diffuse reflectance spectra of the fruit peel samples were registered with the Perkin Elmer Lambda 25 spectrophotometer equipped with an integrating sphere attachment. The results obtained in reflectance were compared with the absorption spectra of pigment concentration determined quantitatively in methanol extractions of flavedo and juice. The extractions were prepared from the same samples used for reflectance measurements. 2D spectral reflectance imaging, a non-destructive method, was carried out on the whole citrus fruit by using the spectral scanner ImSpector (spectral range 400-1000 nm). The different content of red pigments in skin and flesh in post-harvest was observed. The potential monitoring by non-destructive optical measurements of red pigments on citrus fruit is discussed.

SESSION 14 – 3D Spatial Analysis (1)

Chairman: Karsten Jacobsen

Mapping with WorldView-1 Imagery

JACOBSEN Karsten

jacobsen@ipi.uni-hannover.de

Leibniz University of Hannover, Institute of Photogrammetry and GeoInformation, Hannover, Germany

BUYUKSALIH Gurcan

gbuyuksalih@yahoo.com

BİMTAŞ, Istanbul, Turkey

Keywords: satellite image, WorldView-1, mapping, filtering

Abstract: With the new very high resolution optical satellites WorldView-1 and GeoEye-1 images with 0.5m ground sampling distance (GSD) are available. By the rule of thumb of required 0.1mm GSD in the presentation scale of a topographic data base, it should be possible to generate topographic maps up to the scale 1:5000 with such satellite imagery. The orientation of WorldView-1 images is possible with sub-pixel accuracy – totally satisfying for topographic data acquisition. More difficult as before is the required accuracy of digital elevation models for the generation of ortho images if the data acquisition shall be done by on-screen digitizing of ortho images.

A WorldView-1 scene, covering the city area of Istanbul, has been used for acquisition of topographic data and compared with available reference data. The mentioned rule of thumb has been confirmed – it is possible to get the details required for topographic mapping in the scale 1:5000. Istanbul partially is mountainous. Together with the incidence angle of the WorldView-1 scene of 31.5 , in the build up areas larger shadow regions cannot be avoided. On the screen the shadow areas are very dark and do not allow the identification of objects even if the brightness is optimized. By Wallis filtering with a floating window of just 19² pixels a lot of details can be seen with satisfying contrast, which could not be recognized without filtering.

The ASTER Global Topographic Data Set

ABRAMS Michael
michael.j.abrams@jpl.nasa.gov
NASA/Jet Propulsion, Pasadena, USA

BAILEY G. Bryan
U.S. Geological Survey Center for EROS, U.S.A.

TSU Hiroji
ERSDAC - Earth Remote Sensing Data Analysis Center, Tokyo, Japan

Keywords: DEM, ASTER, topography

Abstract: The availability of an up-to-date, high resolution global digital elevation model (DEM) has been a priority of the Earth observation community for a long time. Such a data set does not exist in the public domain. Currently underway is an effort, led by Japan's Ministry of Economy, Trade, and Industry (METI) and the United States National Aeronautics and Space Administration (NASA), to produce a 30-m global DEM from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data. ASTER is an imaging instrument built by METI and operating on the NASA Terra platform. ASTER has a backward- looking stereo band, producing stereo pairs; from these, 30 m DEMs are produced. The joint US/Japan ASTER Project is completing a project to produce a global DEM (GDEM). The ASTER GDEM is being created by stereo-correlating the entire 1,400,000-scene ASTER archive; stacking and averaging the individual DEMs; cloud screening; filling voids or holes using SRTM 100m data; and validating the GDEM against higher resolution DEMS worldwide. The ASTER GDEM will be offered at no charge to users worldwide. It will be packaged in 1 -by-1 tiles, and will cover land surfaces between 83 N and 83 S with estimated accuracies of 20 m for vertical data and 30 m for horizontal data. The ASTER GDEM should be available in the late
spring of 2009.

Land cover characterization by combining multispectral, angular and 3D infomation from the ALOS optical instruments

SCHNEIDER Thomas
tomi.schneider@lrz.tum.de
Technischen Universität München, Germany

BUCHHORN Marcel
marcel.buchhorn@googlemail.com
DBFZ - Deutsches BiomasseForschungsZentrum gemeinnützige GmbH, Germany

DÖLLERER Martin
Doellerer@wzw.tum.de
Technischen Universität München, Germany

Keywords: ALOS Prism, AVNIR-2, angular signature, spectral signature, DSM

Abstract: The ALOS optical instrument configuration and data take schedule offers the unique opportunity to investigate different assessment strategies by combining spectral, angular and bi-seasonal features with 3 D information, all derived from ALOS instruments. The AVNIR-2 spectral characteristics are well explored by a couple of precursors. New approaches are possible by evaluating data of the Prism instrument. First, the derivation of precision digital surface models (DSM) which redraw and characterize objects of thematic interest like forest height classes, surface roughness classes, single trees, buildings, etc. which offset topography. Second, the extraction of angular signatures, by relating the backscatter differences of forward and backward looking stereo bands. Rooted in the basic object property of surface anisotropy, angular signatures are of completely different nature compared to the well explored spectral signature and can be considered as an independent variable in modelling processes. Angular signatures complement the information from spectral signatures by information on surface structure.

The presentation is first introducing the concept of "angular signature" extraction from multidirectional data sets and briefly discus limitations. In the second step the value adding effect of combining all information layers from ALOS optical data in a rule data set controlled by existing thematic GIS information is demonstrated. The work flow is based on ALOS AVNIR-2 level 1b2 and ALOS/Prism level 1b1 data sets. Starting from a very precise ortho-rectification using the digital surface model derived from Prism, spectral and angular signatures are extracted from data sets from two different vegetation periods. The hierarchical evaluation process starts from the spectral signature, assumed to contribute most to the characterisation of objects. The angular signature is used to refine the classification. The final step is the bi-temporal characterization of the objects and object classes, delivering a change profile. The results are discussed on base of ground inspection data.

Quality assessment and comparison of DSMs extracted from WorldView-1 stereo pair

CRESPI Mattia
maattia.crespi@uniroma1.it
Università di Roma "La Sapienza", Italy

COLOSIMO Gabriele
gabriele.colosimo@uniroma1.it
Università di Roma "La Sapienza", Italy

DE VENDICTIS Laura
l.devendictis@eurimage.com
Eurimage S.p.A., Italy

JACOBSEN Karsten
jacobsen@ipi.uni-hannover.de
Leibniz University Hannover, Germany

MASTRACCI Federica
federica.mastracci@telespazio.com
Telespazio S.p.A., Italy

VOLPE Fabio
volpe@eurimage.com
Eurimage S.p.A., Italy

Keywords: HRSI, WorldView-1, DSM, extraction, quality assessment

Abstract: The goal of the work is to evaluate the accuracy of Digital Surface Models (DSMs) extracted from a WorldView-1 in-track Basic Stereo imagery. WorldView-1, launched September of 2007, allows to acquire in-track panchromatic stereo with a resolution of 50 cm.
The investigation has been carried out on a stereo pair acquired over the Augusta area (Siracusa, Southern Italy) on 20 June 2008.
The orientation and the image matching have been performed with commercial (PCI Geomatics and ERDAS Imagine) and scientific Hannover program system BLUH. The corresponding DSMs were interpolated and their accuracy was evaluated by sample comparisons, based on a significant number (more than 4500) of Independent Check Points (ICP) with a mean 3D accuracy of 0.3-0.5 m, collected by kinematic GPS surveys to assess both mean accuracy and its dependency on morphology and land cover types.
The DSMs generated were compared also to the DSM extracted in a previous investigation by Quickbird stereo panchromatic model (Basic Stereo Products type, resolution 60 cm) covering the same area.
The analysis of the results are shown in detail.

Determining of some basin characteristics using topographical maps and digital elevation model

OZDEMIR Yasemin
ozdemiry@marmara.edu.tr
Marmara University, Istanbul, Turkey

AKAR Irfan
irfanakar@gmail.com
M.Sc. Student, Marmara University, Istanbul, Turkey

Keywords: drainage network, Kazandere Stream Basin, GIS, DEM, topographical map

Abstract: In basin researches, quantitative data available from Topographical maps and Digital Elevation Model (DEM) make significant contributions to researchers in line with database created making use of Geographical Information Systems (GIS). Technological developments in the last 10 years, in particular, rendered GIS and Remote Sensing methods fit-for-use to achieve the objectives in geology-related applications. To identify applications of GIS in relation to basin researches, we selected the basin of the Kazandere Stream Basin of the castle located in Marmara Region as the field of study. In this study, we generated drainage network features of the basin using Arcinfo 9.2 GIS software from streams on 1/25000 scaled topographical map and from 10 m grid spaced DEM. We used Archydro Tool in line with the objectives of study. We obtained parameters in relation to stream directory analyses such as branching rate, drainage density and stream frequency of the field of study making use of topographical maps. And for DEM-related applications, we obtained information about sub-basins by way of Flow Accumulation and Flow Direction model. DEM's are a general source of data for field analyses and 3-dimensional applications. Such basin characteristics as basin field, sub-basin fields, water running directions, drainage networks, catchment centreoid etc., are easily generated through DEM. Stream morphometric features found using such two data sources provide reliable information on drainage characteristics of the stream basin and its lower branches. Analyses and applications conducted within the framework of database created on GIS environment indicated that GIS could be used for multi-purposes under scope of geographical researches.

A three dimensional scenario for area on fire

MURCHIO Gabriele
gabriele.murchio@telespazio.com
Telespazio, Rome, Italy

VOLPE Fabio
volpe@eurimage.com
Eurimage S.p.A,, Italy

ROSSI Livio
rossi@eurimage.com
Eurimage S.p.A., Italy

BISCONTINI Daniele
daniele.biscontini@telespazio.com
Telespazio, Rome, Italy

Abstract: This paper describes a new service offered by Telespazio dedicated to organisations involved in prevention and putting down blazes. It offers the use of a three-dimensional objects' library within a web platform GIS based on informative and 3d layers.
Information is therefore used for mapping (2d/3d) and describing in details and in 3 dimension the areas sensitive to blaze as well as the possible obstacles (or ways of intervention) that the operators will meet during the process of putting out the blaze or drawing perimeter of damage .
The system is composed of:
• High resolution Orthophoto
• DSM a 2 m di ps (va 2m)
• Objects library in 2d/3d (trees,pylons,obstacles,trails)

About the accuracy of area calculation from georeferenced digital images: conditioning factors and possible solutions

BORGOGNO MONDINO Enrico
enrico.borgogno@unito.it
University of Torino, Italy

Keywords: area measurement, accuracy, reliability, maps

Abstract: Many scientific fields are used to base their considerations on measurements coming from remote sensed data as digital satellite or aerial images. Area computation is one of the most common operations that such applications require; consider, for example, those scientists, or users, facing the problem of the snow cover mapping (even multitemporal) or those dealing with deforestation. Unfortunately, their interesting works too often disregard the problem of the accuracy of the referred measurements, forgetting about the operational consequences that such behaviour can produce. The potential users of their results (hydrologists, engineers, etc.) should be informed about the accuracy of measurements they are going to use in their computations, in order to make them able to take their own precautions. According to the traditional definition, every measurement should be stated as a couple of numbers: the estimated value of the measurement itself and of its precision. In this work, just considering the problem of the area computation performed on georeferenced satellite images, an investigation regarding the potential accuracy of this measurement is done. The proposed approach considers the computation of the area of a polygon, recognized and vectorized from satellite digital images, as and indirect measurement, whose accuracy can be estimated through the so called Variance Propagation Law. Direct measurements, whose variance (accuracy) must be propagated, are the coordinates of the polygon vertices and the height of each cell belonging to the polygon itself. Coordinate accuracy is the one resulting from the Root Mean Squared Error of the georeferencing process (calculated respect to the Check Points); height accuracy is the one declared for the adopted Digital Elevation Model (DEM). Statistical treatment of these variables permits to define reasonable estimations of the accuracy of the indirect measurement (polygon area)

SESSION 15 – Thermal Remote Sensing (2)

Chairmen: Claudia Kuenzer, Chris Hecker

The Effects of Rainfall on Thermal Infrared Land Surface Emissivity Measurements from MODIS, ASTER and AIRS

HULLEY Glynn C.
glynn.hulley@jpl.nasa.gov
Jet Propulsion Laboratory, Pasadena, U.S.A.

HOOK Simon J.
Jet Propulsion Laboratory, Pasadena, U.S.A.

Abstract: Accurate knowledge of the emissivity in the thermal infrared (TIR) region is critical for recovering the Land Surface Temperature (LST) from spaceborne measurements. Emissivity variations for most natural surfaces occur due to changes in soil moisture, vegetation cover, and surface roughness. There has been limited research on the influence of soil moisture on remote sensing TIR emissivity measurements in the past.

Laboratory measurements which have shown that emissivity in the 8-9 μm range can increase by as much as 16% in sandy soils with high water content. This study looks in depth at the effects of soil moisture on TIR emissivity measurements from MODIS v4, AIRS v5, and ASTER data for rainfall events at two invariant sand dune sites. The first site over the Namib Desert in Namibia had an anomalous rainfall event from 16-22 April 2006 where 100 mm of rain was recorded within one week at Luderitz, about six times the annual rainfall. The second site at Coral Pink Sand Dunes in Utah, USA is used to investigate the effects of two rainfall events on ASTER emissivities. The results at both sites indicate that AMSR-E soil moisture, and TRMM rainfall data were directly correlated with increases in MODIS, ASTER and AIRS emissivity at 8.6 μm. All three sensors showed emissivity increases of between 10-15% soon after the rainfall events, in agreement with laboratory measurements using in-situ sand collected at both dune sites.

Comparison of in situ and remotely sensed radiation and heat fluxes of the megacity of Cairo/Egypt

FREY Corinne
corinne.frey@unibas.ch
University of Basel, Switzerland

PARLOW Eberhard
eberhard.parlow@unibas.ch
University of Basel, Switzerland

VOGT Roland
roland.vogt@unibas.ch
University of Basel, Switzerland

WAHAB Magdy
magdy_wahab@yahoo.com
Cairo University, Egypt

Keywords: thermal infrared, urban climate, mega-cities, ASTER, climate modelling

Abstract: This research is dedicated to examine the possibilities in deducting urban surface radiation and heat fluxes from a remote area using ASTER satellite data. For comparison a micrometeorological field campaign was conducted from early November 2007 to late February 2008 in Cairo, Egypt. Three flux towers, measuring all major terms of the energy balance in and around Cairo were installed.

The pre-processing of the ASTER data showed that air pollution was a major factor by complicating the determination of the spatially distributed radiation fluxes. The air pollution was made visible by comparison of the in situ measured incoming shortwave radiation, where significant differences in and outside Cairo occurred. The longwave emission was estimated with an average difference of 10Wm-2, the agreement of the shortwave broadband albedo differed about 3%, due to some local factors. Ground heat flux and sensible heat flux were estimated using different methods (Vegetation-Indices, S-SEBI, LUMPS, temperature-gradient). The latent heat flux was taken as a residual. All fluxes were compared subsequently to the in situ measured fluxes. In the desert occurred only a small latent heat flux, however, at the urban station, temporary a considerable latent heat flux was found.

Thermal Imaging of Nissyros Volcano (Aegean Sea) using ASTER data: Estimation of radiative Heat Flux

GANAS Athanassios
aganas@gein.noa.gr
National Observatory of Athens, Greece

PETROPOULOS George
petropoulos@hotmail.com
University of Bristol, U.K.

LAGIOS Evangelos
lagios@geol.uoa.gr
University of Athens, Greece

PSILOGLOU Basil
bill@meteo.noa.gr
National Observatory of Athens, Greece

Keywords: Thermal infrared, ASTER, volcanoes

Abstract: A time series of ASTER images (AST08) have been processed to allow radiative heat flux estimations of the Nissyros volcano. ASTER night-time images were acquired on four different dates: 7 April 2001, 13 June 2002, 26 October 2002, and 23 July 2005. The results show a steady state energy release with heat fluxes ranging from 15-30 Wm-2 over the craters of Kaminakia, Polyvotis and Stefanos, respectively. It is suggested that this range of values indicates a background heat flux of this volcano following the unrest of 1995-1997, and that the volcano has entered again into the quiet phase.

Also, on the basis of the average spatial extent of the thermal anomaly a total radiative heat flux of 36 MW was estimated at the moment of ASTER overpass. Heat flux values for Nissyros are in good agreement with other published estimates derived from low-temperature fumarolic volcanoes (Stromboli and Vulcano, Italy) using Landsat TM data. It is also evidenced that the ASTER radiometer can be used as an important imaging tool for the monitoring of geophysical properties associated to volcanic activity, as is the volcanic heat flux.

Operational Geostationary Fire Detection and Characterisation

WOOSTER Martin J.
King's College London, U.K.

Abstract: This presentation will present the design of new geostationary fire detection and characterization algorithm, and will include selected results from its application to one full year of SEVIRI data. Results, including characterization of the fire radiative power, are compared to those derived from near-coincident but significantly less frequent MODIS data, and the advantages of the SEVIRI level 1.5 imagery for this application are discussed. Good agreement between MODIS and SEVIRI is demonstrated on a per-fire basis, though at the regional scale SEVIRI typically underestimates cumulative FRP somewhat due primarily to its limited ability to detect fire pixels with radiative powers significantly less than ~ 100 MW. Examples of the insights that geostationary FRP characterization can bring to continental-scale studies of biomass burning will be demonstrated. The presentation will cover the operational implementation of these detection and characterization procedures on real-time SEVIRI imagery at the EUMETSAT Land SAF, providing an insight into pyrogenic emissions from the African continent at a hitherto unobtainable temporal frequency, highly suited to the linking of pollutant
emissions estimates to models of atmospheric transport. Finally the presentation will briefly consider the algorithms applicability to other geostationary systems.

Relation between trace gases estimated by atmospheric sensors and emissions from large fires

CALLE Abel
abel@latuv.uva.es
University of Valladolid, Spain

CASANOVA Jose-Luis
University of Valladolid, Spain

GONZÁLEZ-ALONSO Federico
INIA - Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Madrid, Spain

Keywords: MOPITT, SCIAMACHY, trace gases, forest fires

Abstract: This study shows the correlation between large fire emissions and trace gases estimated by atmospheric sensors. The zone analysed is the Iberian Peninsula, Spain and Portugal, during the summer season. Concerning atmospheric sensors, data from MOPITT (Measurements of Pollution in the Troposphere) aboard Terra satellite, are analysed in order to measure CO emissions by fires. In addition, data from SCIAMACHY (SCanning Imaging Absorption SpectroMeter for Atmospheric CartograpHY) aboard Envisat satellite are analysed in order to estimate several trace gases (CO, CO2, O3, etc) coming from emissions. The main implications of this study is to obtain a relationship between the FRP (Fire Radiative Power), on polar satellites, and FRE (Fire Radiative Energy) on geostationary satellites, both estimated by means of thermal sensors, with trace gases emission to atmosphere.

Evapotranspiration estimation in the Khoramabad region, IRAN using Landsat7 (ETM+) data
Subtitle: ET

MATINFAR Hamid Reza
matinfar44@gmail.com
University of Tehran, Iran

TORABI Hasan
Iran

MALEKI Abas
Iran

Keywords: remote sensing, evapotranspiration, satellite imagery, SEBAL

Abstract: It is important to estimate land surface evapotranspiration (ET) for water resources evaluation, drought monitoring and crop production simulation. The most important information needs to irrigation performance, is the evapotranspiration (ET) of the plants, especially field crops. Knowing about the crop was the necessity for calculating anything about it. When facing a water basin of very large area, agro-climatically transient in its various parts, treating the ET calculation by the energy-balance becomes interesting. Information about the vegetation cover is indeed minimal and often very well provided by satellite information. Some various satellites are used, Landsat7 ETM+, NOAA AVHRR, TERRA MODIS and TERRA ASTER. Only satellites able to provide temperature measurements are fulfilling the requirements of such analysis. Some meteorological satellites are also used for calculating ET in Global Climatologically Models, but are of too low spatial resolution for the application to crop ET per selected farm. Validations of such monitoring algorithms have been widely performed and are always found acceptable. It is concluded that SEBAL model is useful to calculate ET by means of remote sensing measurements and other meteorological data.

A software tool for simulation and retrieval of satellite imagery for thermal imaging systems

RAHNAMA Peyman
peyman.rahnama@comdev.ca
COM DEV Ltd., Cambridge, Canada

SIORIS Christopher E.
Environment Canada, Canada

Keywords: thermal imaging, performance model,sensitivity analysis, simulation, retrieval, fire monitoring, sea temperature, biomass burning

Abstract: Defining performance requirements of space-based thermal imaging systems, preparing a preliminary mission profile, deriving the instrument design requirements and evaluating the performance of space-based thermal imaging systems all require development of end-to-end simulation models.

This paper describes a simulation and retrieval package developed for thermal imaging systems. As an example, expected observations of space-based thermal imaging fire missions and the noise levels for different instrument characteristics, atmospheric conditions and measurement scenarios are presented. Retrieval of fire characteristics such as fire temperature and Fire Radiative Power (FRP) from the simulated mock raw data is described. Sample results of sensitivity analyses, performance modeling, trade-off studies and design optimization using the end-to-end simulation models are presented and discussed. The results of a channel selection study performed using the software tools are presented.

The simulation package is a useful tool for future space missions that are intended to generate thermal imagery of the Earth for various purposes such as fire detection and fire monitoring, sea/land surface temperature monitoring, and biomass burning.

SESSION 16 – Geology and Erosion

Chairman: Freek van der Meer

Geological mapping by the use of multispectral and multitemporal satellite images, compared with GIS geological data. Case studies from Macedonia area, Northern Greece

OIKONOMIDIS Dimitrios
oikonomi@geo.auth.gr
Aristotle University of Thessaloniki, Greece

ASTARAS Theodore
Aristotle University of Thessaloniki, Greece

MOURATIDIS Antonios
Aristotle University of Thessaloniki, Greece

NIARHOS Mihail
Aristotle University of Thessaloniki, Greece

Keywords: geological mapping, photo-lithological units, photo-lineaments, satellite images, GIS

Abstract: Geological mapping is one of the fundamental acts that a geologist should perform in order to proceed to higher levels of his/her research. This includes basically, mapping of lithological units and tectonic lines (faults). Satellite images give geologists a unique opportunity to observe the complex interaction of large-scale geological structures that make up Earth's landscape. Furthermore, digital satellite data can be manipulated and enhanced in order to accentuate the surface expressions of certain geological features. In most of the cases, this is usually done in "ideal" test sites, with absence of vegetation, soil cover, etc. In this paper, various digital image processing techniques were applied on Landsat-7/ETM+ and Terra/ASTER satellite images, acquired on different dates, in order to produce the most appropriate images for geological mapping, in typical Mediterranean terrain. Two areas were chosen as case studies, the Kassandra peninsula and Thassos island. Boundaries of photo-lithological units and photo-lineaments are drawn on the above satellite images. The results are compared with digitized geological maps of 1/50.000 scale and are evaluated.

Satellite-based products for characterizing Land Degradation processes

SIMONIELLO Tiziana
simoniello@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

LANFREDI Maria
anfredi@na.infn.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

LIBERTI Margherita
liberti@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

COPPOLA Rosa
coppola@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

D'EMILIO Mariagrazia
demilio@na.infn.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

CARONE Maria Teresa
mariateresa.carone@arpab.it
ARPAB - Agenzia Regionale per la Protezione dell'Ambiente della Basilicata, Potenza, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

IMBRENDA Vito
imbrenda@imaa.cnr.it
DIFA-University of Basilicata, Italy
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

MACCHIATO Maria
macchiato@na.infn.it
DSF-University of Naples, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

Abstract: The assessment of land degradation and desertification processes is one of the main global issues for the adverse impact on biomass productivity and environmental quality. Land degradation signifies the "temporary or permanent decline in the productive capacity of the land" and desertification means "land degradation in arid, semiarid and dry sub-humid areas" as included in the United Nation Convention to Combat Desertification. Soil becomes unproductive in response to synergic effects of natural (e.g. climate change, soil vulnerable features) and anthropogenic (e.g. overgrazing, intensive agricultural practices) factors. The complexity of interaction of such factors at different spatio-temporal scales makes the characterization of land degradation processes quite arduous.
Satellite data have been largely adopted for studying and monitoring land degradation processes thanks to their synoptic coverage and the availability of historical data for multitemporal analyses. In order to study degradation processes at different scales, we investigated satellite derived products from sensors with different spatial and temporal resolutions. From a time series (1982-2006) of coarse spatial resolution sensor (AVHRR) we studied degradation in vegetation activity at Mediterranean scale. In particular, we focused on persistence in photosynthetic activity trends

estimated from annual NDVI (Normalized Difference Vegetation Index) maps to implement an indicator of vegetation resilience. In order to derive the level of cover fragmentation and to analyze the spatial dimension of the ecological processes, we analyzed the land cover structure by applying a set of landscape metrics on Corine and MODIS data at 250m. Data at higher resolution (Landsat-TM/ETM) were explored to characterize soil degradation processes. Vulnerability to soil compaction was estimated from a land cover classification recoded according to cultivation types and slope values and integrated with information on soil attributes. For mapping eroded areas, we developed a methodology based on a multi-source classification of spectral bands (including thermal channel) and morphological data derived from a DEM. Finally, the performances of Grain Size Index (GSI) were investigated to monitor topsoil properties linked to erosion processes.

Effect of Spatial Resolutions on Intertidal Sediment Characterization

IBRAHIM Elsy
elsy.ibrahim@bwk.kuleuven.be
Katholieke Universiteit Leuven, Belgium

GOVAERTS Annelies
Katholieke Universiteit Leuven, Belgium

REGMI Pujan
Katholieke Universiteit Leuven, Belgium

DRUYTS Jeroen
Katholieke Universiteit Leuven, Belgium

VAN DER WAL Daphne
Netherlands Institute for Ecology, Netherlands

MONBALIU Jaak
Katholieke Universiteit Leuven, Belgium

VERVOORT André
Katholieke Universiteit Leuven, Belgium

ADAM Stefanie
Katholieke Universiteit Leuven, Belgium

DE WEVER Aaike
Ghent University, Belgium

SABBE Koen
Ghent University, Belgium

FORSTER Rodney
The Centre for Environment, Fisheries, and Aquaculture Science, U.K.

Abstract: Airborne and spaceborne remote sensing offer opportunities to efficiently acquire and analyze data of intertidal flats and characterize intertidal sediments. Airborne hyperspectral data have a limited but relatively detailed spatial coverage, are not consistently available, and are relatively expensive, while satellite data include a less detailed, but wide spatial coverage, are available regularly, and are relatively cheap. Each spatial resolution offers a distinctive perception, where the measurement of aspects influencing surface patterns at various resolutions can reveal different processes. So, relying on only a single type of imagery without awareness regarding the effect of spatial resolutions can lead to ineffective compromises. The objective of this research is to investigate the impact of spatial properties of imagery on sediment characterization by means of geostatistical techniques.
Two sites have been studied, a tidal flat (Molenplaat) in the Westerschelde estuary and a tidal area in the IJzer estuary. Hyperspectral airborne and multispectral satellite data from different time periods have been used. Furthermore, field data accompanies most of the available hyperspectral images.
The first part of this study consists of a detailed analysis of directional semi-variograms calculated on the study areas since they can be influenced by certain sediment patterns existing in the study

area and the imagery. In the second part, the geostatistical approach is used to investigate the optimum spatial resolution, i.e., the lowest spatial resolution that can result in the essential characterization of biophysical variables of sediments including chlorophyll a content, mud content, relative moisture content, and organic matter.

Mapping riparian zone zttributes from LiDAR data using object-oriented image analysis

JOHANSEN Kasper
k.johansen@uq.edu.au
The University of Queensland, Brisbane, Australia

ARROYO Lara A.
l.arroyomendez@uq.edu.au
The University of Queensland, Brisbane, Australia

ARMSTON John
John.Armston@nrw.qld.gov.au
NRW - Department of Natural Resources and Water, Brisbane, Australia

PHINN Stuart R.
s.phinn@uq.edu.au
The University of Queensland, Brisbane, Australia

WITTE Christian
Christian.Witte@nrw.qld.gov.au
NRW - Department of Natural Resources and Water, Brisbane, Australia

Keywords: Airborne LIDAR, riparian zone, environmental indicators, object-oriented image analysis, remote sensing

Abstract: Environmental indicators of riparian zone condition have been assessed from field surveys and to a limited extent from remotely sensed image data. The objective of this research was to develop and apply an approach for mapping riparian condition indicators based on object-oriented image analysis of airborne Light Detection and Ranging (LiDAR) data. These riparian condition indicators included: plant projective cover; longitudinal continuity; presence of large trees; streambed width; riparian zone width; vegetation overhang; and stream bank stability. LiDAR data were captured on 15 July 2007 for two 5 km stretches along Mimosa Creek in central Queensland, Australia. Field measurements of riparian structural parameters were obtained between 28 May and 5 June 2007. Objected-oriented approaches were developed for mapping each riparian condition indicator from the LiDAR data covering one of the two 5 km stretches. These approaches were subsequently applied to the LiDAR data for the second 5 km stretch to assess the ability for multi-site applicability. Finally, the derived results were validated against the field data. The results showed that the object-oriented approach developed produced accurate results and could be used to accurately map the riparian condition indicators, except streambed width, for the second 5 km stretch. These results show potential for semi-automating the process of mapping riparian condition indicators from object-oriented image analysis of LiDAR data with accuracies feasible for operational mapping of large areas. Future work will test this hypothesis for a LiDAR dataset covering 100's km of streams in Victoria in southern Australia.

Geomorphometric and morphotectonic analysis of tectonically active landscapes using satellite Remote Sensing and GIS: outer forearc of Hellenic subduction zone, Crete

ARGYRIOU Nasos
nasos@chania.teicrete.gr
Technological Educational Institute of Crete, Greece

RUST Derek
United Kingdom

TEEUW Richard
United Kingdom

VALLIANATOS Filippos
Greece

SOUPIOS Pantelis
Greece

Keywords: geomorphometric analysis, morphotectonic analysis, active tectonics, GIS

Abstract: Geomorphometric and morphotectonic analysis based on remote sensing and Geographic Information Systems (GIS) was accomplished for drainage basins in the western region of Crete Island, Greece. The study area is located close to the Hellenic trench where the African plate is being subducted beneath the Aegean area (southern part of the European Plate). Our understanding of the active tectonics of this region, away from coastal exposures, is hampered by dense brush cover and high complex relief, one of the main characteristics of the island with high mountains revealing important structure activity. The tectonic activity is reflected in the complicated drainage networks among the high mountains, with the tectonic effects and ground deformation being observed through the varying geomorphology of each major drainage basin. One of the principal objectives of this work is to assess the relationship between tectonics and geomorphology, via geomorphometric analysis of the watersheds, and the application of morphotectonic analysis in areas of tectonic deformation.

In order to study and determine the drainage characteristics of the basins, ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) and Landsat satellite imagery were linked with digital elevation models (DEMs), plus topographical, geological and hydrolithological maps. The use of GIS was crucial in order to map and analyze those values for the characterization of the stream networks and drainage basins. The calculated morphometric parameters included basic parameters (number of streams, perimeter of basins, total stream length, basin length, area of drainage basins), derived parameters(bifurcation ratio, stream frequency, drainage density, texture ratio, constant of channel maintenance, average stream-length ratio, length of overland flow, basin relief, relief ratio), shape parameters (elongation ratio, form factor, basin circularity) and hypsometric integrals-curves for each watershed. The extracted tectonic parameters (such as mountain front sinuosity, the ratio of the width of valley floor to valley height, the transverse topographic symmetry factor and asymmetry factor), were correlated with the morphometric parameters. Interpretation of the morphometric and morphotectonic parameters reveals important information about the distribution of tectonically active zones and the erosion status of the drainage basins.

Monitoring the evolution of coastline in Sicily by aerial photos and high resolution satellite imagery

LO BRUTTO Mauro
lobrutto@unipa.it
University of Palermo, Italy

PENNACCHIO Daniela
danielapennacchio@unipa.it
University of Palermo, Italy

VILLA Benedetto
bevilla@unipa.it
University of Palermo, Italy

Keywords: coast, photogrammetry, monitoring, orthoimage, Quickbird

Abstract: Italy is one of the country more exposed to coasts erosion: about 1200 km of coasts on about 8350 km are moved back of about 25 m in the last 50 years. Particularly Sicily have about 300 km of coasts moved back.

There are various reasons of this phenomenon: natural factor (climatic or physical-oceanographic) with environmental and economic effects.

The paper reviews the activity of the Dipartimento di Rappresentazione of University of Palermo in cooperation with the Regional Agency of Environmental Protection (ARPA) about the coastline evolution in Sicily.

The research is carried out on selected physiographic units marked out by important erosive phenomena. The coastline trend are reconstructed by the elaboration of aerial photos and high resolution imagery.

Particularly were used the aerial photos of the years:
- 1954-55 , scale 1:33.000;
- 1987, scale 1:10000;
- 1997, scale 1:20.000.

Besides were used QuickBird high resolution satellite imagery of the year 2006.

The aerial photos and the QuickBird imagery have been oriented with planimetric accuracy of ± 2 m. The Ground Control Points were collected by static GPS surveys. The comparison with orthophotos allowed to estimate the real coastline trend in the last 50 years.

The potential of Grain Size Index for monitoring badlands in sparsely vegetated areas: preliminary results

COPPOLA Rosa
coppola@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

D'EMILIO Mariagrazia
demilio@na.infn.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

LANFREDI Maria
lanfredi@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

MACCHIATO Maria
macchiato@na.infn.it
University of Naples, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

PIGNATTI Stefano
pignatti@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy

SIMONIELLO Tiziana
simoniello@imaa.cnr.it
IMAA-CNR (Istituto di Metodologie di Analisi Ambientale), Tito-Scalo, Italy
CNISM - Consorzio Nazionale Interuniversitario per le Scienze Fisiche della Materia, Rome, Italy

Abstract: The identification of areas affected by desertification and the possibility of following spatial and temporal evolution of this process represent a crucial topic both for better understanding its dynamics and for planning effective intervention activities.
In this framework, the use of multispectral remote sensed data, such as Landsat-TM/ETM data, joins typical advantages of satellite techniques together with the availability of long time series, enabling multitemporal analysis.
Recently, a new multispectral index (Grain Size Index), appositely devised for Landsat-TM/ETM+ data, was proposed in order to study the coarsening of topsoil grain size as indicator of desertification. Since GSI was just used in areas where desert conditions were already established, our goal was to assess its performance in areas where desertification is in progress, such as in some Mediterranean areas. In particular, we focused on a badland area of Basilicata Region (Southern Italy), where intense erosive processes caused the typical formations named "calanchi".
GSI was computed from Landsat-TM data previously corrected to make them radiometrically consistent. We acquired soil signatures by a portable spectroradiometer, FieldSpec FR Pro, directly in situ as well as in laboratory on collected samples in order to assess GSI obtained from satellite data.
The elaborated maps showed a typical patch distribution of rising land degradation processes, i.e. many clusters contoured by ever smaller fragments of high GSI values were identified. The comparison with GSI derived from field spectra highlighted that the presence of sparse vegetation within the pixel can bias the index values; in particular green vegetation lowers GSI values, whereas withered vegetation tends to increase them.
Such preliminary results suggest a careful use of this index in areas where land degradation is in progress.

Possibility of Landsat 7 Satelitte Images in Lithological and Structural Research of Arid Terrain, Illustrated on Djebel Tammeda in Algeria

DJURIĆ Uroš
Center for Remote sensing and GIS Belgrade University, Serbia

PETROVIĆ Dragana
Center for Remote sensing and GIS Belgrade University, Serbia

Keywords: Geology, remote sensing, image processing, structural analysis

Abstract: Structural analysis Djebel Tammeda performed on Landsat 7 satellite image obtained with ETM+ sensor (Enhanced Thematic Mapper). This sensor gives images in seven channels, which cover visible and infrared noise spectrum with 30 m resolution and panchromatic image with 15 m resolution. For analysis we used part of image which belongs to the scene number from 197th orbit, 37th row in WRS (World Reference System). Processing, analysis and graphic process we performed with software package TNTmips in Remote Sensing Centre - Faculty for Mining and Geology; Belgrade University. Visualization and restoring images to the quality level for acquisition of geological data, principally structural analysis, performed with image proceeding process. With region boundaries definition of examined image, its extraction and georeferencing into a chosen coordinate system we performed removal of image geometry deformation. We performed image enhancement with rising contrast of "nearest neighbors" pixels and with rising of image resolution from 30 m up to 15 m, with usage of panchromatic image. Image prepared on this way we used for geological analysis and interpretation. Geological analysis performed visually, noticing attribute differences between regions and its secession. Standard criteria used for geological analysis: geomorphologic characteristic, soil color, vegetation and structural characteristics. Analyzing constitution of terrain, we identify folds and ruptures, their spatial position and its correlation. With geological analysis, we also identify geological units with different litology and geological age. Results of analysis are shown with: map, image and 3D model. For 3D model is used digitally elevation model (DEM) of terrain

SESSION 17 – 3D Spatial Analysis (2)

Chairman: Matia Crespi

Comparison of different along the track satellite stereo pair for DEM extraction

NIKOLAKOPOULOS Konstantinos G.
knikolakopoulos@igme.gr
Institue of Geology and Mineral Exploration, Athens, Greece

LATHOURAKIS George
glath@g-i.gr
Geoinformation SA, Athens, Greece

Keywords: Cartosat, Aster, DEM, airphoto

Abstract: The possibility to create DEM from stereo pairs is based on the Pythagoras theorem and on the principles of photogrammetry that are applied to aerial photographs stereo pairs for the last seventy years.

The application of these principles to digital satellite stereo data was inherent in the first satellite missions. During the last decades the satellite stereo-pairs were acquired across the track in different days (SPOT, ERS etc.). More recently the same-date along the track stereo-data acquisition seems to prevail (Terra ASTER, SPOT5 HRS) as it reduces the radiometric image variations (refractive effects, sun illumination, temporal changes) and thus increases the correlation success rate in any image matching.

One of the newest satellite sensors with stereo collection capability is Cartosat. It can acquire stereopairs along the track with a 2,5m spatial resolution covering areas of 30X30km.

In this study we compare two different satellite stereo-pair collected along the track for DEM creation. The first one is created from a Cartosat stereopair and the second one from an ASTER stereo-pair. The area of study is situated in Chalkidiki Peninsula, Greece. Both DEMs were created using the same ground control points collected with a Differential GPS. Then, the two DEMs were compared to a DEM created from air-photos stereo-pairs.

After a first control for random or systematic errors a statistical analysis was done. Points of certified elevation have been used to estimate the accuracy of these three DEMs. The elevation difference between the different DEMs was calculated. 2D RMSE, correlation and the percentile value were also computed and the results are presented.

SICH-2 remote sensing satellite data calibration

SYDORENKO Anton V.
anton@ikd.kiev.ua
National Academy of Science and National Space Agency of Ukraine, Kyiv, Ukraine

SMYRNOV Serhii A.
smr@ikd.kiev.ua
National Academy of Science and National Space Agency of Ukraine, Kyiv, Ukraine

Keywords: data calibration, virtual calibration place, data quality

Abstract: The perspective Ukrainian Remote Sensing (RS) satellite SICH-2 should be launch in 2009. It will be using two RS devices called MSD (Multiband Scanning Device) SMIR (Scanner in Middle Infra Red band). Both are based on CCD-line as registration unit with principle discreet structure.

The primary task of our team is SICH-2 data Calibration and additional task is verification on-board devices characteristics. The examination list cotains: spectral bands ranges (three bands and panchromatic), field of view, spatial resolution along and across flight direction, signal noise ratio, Optical Transition Function, and the spatial shift in different spectral bands. The verification on-board device characteristics and data Calibration tasks are solving in Virtual Calibration Place (VCP) frame. The concepts of VCP was shown on "4th Workshop on Remote Sensing for Developing Countries/GISDECO 8" in the framework 28th EARSeL Symposium.

The specific of our approach based on taking into account space quantization of RS images and unefficient of traditional photogrammetry such as test patterns (miras) for discreet image structure.

The proposed work includes methods of data Calibration and devices characteristics verification, for whole list of examination characteristics. It also describes practical results of the tasks applications.

The well-known fact of efficient using network of CP in different parts of the Earth. Our team has proposed using VCP located in Ukraine, the Crimea region. For VCP was developed data Calibration methods which improved on taking into account spacial quantization of RS images. In October 2008 satellite experiment with primary data calibration results was realized. Nowadays exist thenecessity for common using data calibration in Ukraine, Russia and Kazakhstan.

A new rigorous model for pushbroom sensor orientation

FIANI Margherita
m.fiani@unisa.it
Università degli Studi di Salerno, Italy

PISTILLO Pasquale
ppistill@unisa.it
Università degli Studi di Salerno, Italy

Keywords: high resolution, pushbroom, algorithms, orientation, model

Abstract: The information provided in support of high or medium resolution satellite images (metadata files) do not follow a standard which sets and norms how many and what data should be provided to the user.

Assuming that the user wishes to use rigorous models in order to georeference the images, the development of new algorithms or the modification of existing ones became necessary whenever a new type of satellite image is placed on the market. This modification is not easy, also because of the data distribution and software licenses policy.

Starting from this point, we thought to develop a new rigorous mathematical model of image georeferencing, that requires as input data only those ones ever available by metadata files. In this way, with the necessary distinction because the different acquisition techniques, it would be possible to standardize the procedures and methods of calculation used to gereference data coming from different sensors.

In details, the proposed model requires the knowledge of the following data, commonly provided in support of images:

-       acquisition start time and end time;
-       average value of the elevation angle sensor during data acquisition time;
-       average value of the satellite azimuth during data acquisition time.

Besides such generally available information, we will take in account the detailed features of each sensor, such as its pseudo focal length and CCD size. We will use an iterative procedure to evaluate directly these quantities, that in the literature are given for each satellite only as approximate values.

The above-said data alone are not sufficient to univocally reconstruct the position and tilt of the sensor in the acquisition time of each CCD line forming the image to be georeferenced. All other information useful to reconstruct the model will be produced by reconstructing the satellite orbit from public domain data set provided by space agencies, such as the NORAD Two-Line elements - TLE.

Starting from metadata, TLE and data coming from literature, we have estimated a first approximate solution, at the initial time to, for the modified collinearity equations.

Moreover, we have added to these equations, valid for a single acquisition line, the motion equations which describe a rigid body motion subject to constant forces. In this way we can take into account the motion of the sensor that causes continuous changes of attitude and position.

This system of equations will be solved by repeated iterations using the least squares method, after the linearization of the equations with respect to the unknowns, considering as known the object co-ordinates of a number of GCPs measured on the terrain.

The model has been tested on a test area using commercial satellite imagery, acquired from different sensors.

Remote Sensing with small satellites - status and trends

SANDAU Rainer
rainer.sandau@dlr.de
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

Keywords: Remote sensing, small satellites, Earth observation, Satellite missions

Abstract: There is an increasing need for cost effective Earth Observation (EO) missions to meet the information requirements of an almost ever growing range of applications. This is perhaps most clearly seen in the many current moves for international co-operation in the field of environment where measurements from Earth Observing satellites are an essential element. This is especially so where we need to acquire, analyze and use data documenting the condition of the Earth's resources and environment on a long-term (permanent) basis.

The paper touches briefly some reasons for pursuing the small satellite concept. The paper focuses then on the application areas in the field of operational Earth observation. It is shown that the wide application range from mapping to global climate, for instance disaster warning and support, agriculture, forestry, atmosphere, weather and climate, ice and snow, mapping and GIS applications, land use and cover change, implies very different requirements concerning ground sample distance, spectral resolution, and temporal resolution. Even within a specific application area the spectrum of requirements is wide spread. But which of the requirements can be covered by means of small satellites? The paper shows also the unique advantages of using small satellites. Furthermore, some statistics is given concerning the use of small satellites.

Accuracy evaluation of SRTM and ASTER DSMs

CRESPI Mattia
maattia.crespi@uniroma1.it
DITS - Area di Geodesia e Geomatica - Università di Roma "La Sapienza", Rome, Italy

COLOSIMO Gabriele
gabriele.colosimo@uniroma1.it
DITS - Area di Geodesia e Geomatica - Università di Roma "La Sapienza", Rome, Italy

DE VENDICTIS Laura
l.devendictis@eurimage.com
Eurimage S.p.A., Italy

JACOBSEN Karsten
jacobsen@ipi.uni-hannover.de
Leibniz University Hannover, Germany

MONETI Marta
DITS - Area di Geodesia e Geomatica - Università di Roma "La Sapienza", Rome, Italy

Keywords: SRTM, ASTER, DSM, accuracy assessment

Abstract: DSMs have gained more importance in modern map production because of their use in orthophoto generation, change detection, GIS database updating, cartographic 3D feature extraction and reconstruction. Over the last few years DSMs derived from satellite sensors, as SRTM (Space Shuttle Radar Topography Mission) and ASTER (Advance Space borne Thermal Emission and Reflection Radiometer) DSMs, have been issued and continuously updated.

The SRTM DSM is delivered in three different versions of different accuracy (finished, DTED and CGIAR-CSI SRTM) covering approximately the entire world at a resolution of 3' x 3'. The ASTER DSM product is generated (only on request) using bands 3N (nadir-viewing) and 3B (backward-viewing) of an ASTER Level-1A image acquired by the Visible Near Infrared (VNIR) sensor at a resolution of 30 m.

The goal of the work is to evaluate these products by a comparison carried out on different areas in Italy (Colli Albani - Rome, South Tyrol, Costa Smeralda - Sardinia) with a reference DSM obtained by a LIDAR survey, in order to assess both mean accuracy and its dependency on morphology and land cover types. This is compared to results achieved in other areas based on accurate reference height models. The analysis of the overall results are shown and discussed in detail.

Synergistic use of spectral and angular signatures from Proba/CHRIS hyperspectral images in a temporal context

BUCHHORN Marcel
marcel.buchhorn@dbfz.de
DBFZ - Deutsches BiomasseForschungsZentrum gemeinnützige GmbH, Germany

SCHNEIDER Thomas
tomi.schneider@lrz.tum.de
Technischen Universität München, Germany

Keywords: Proba/CHRIS, multidirectional, multitemporal, angular signatures

Abstract: The anisotropy of backscattering heterodyne the spectral information, which is in general deemed as main information source in remote sensing. Therefore, during the pre-processing efforts are being made in order to eliminate this directional property of the signal. However, the anisotropy approach enables to gather information about differences in phenotypes or stand structures, if it is possible to analyze objects with help of satellite systems with multi-angle observation possibilities. Proba/CHRIS is such a new generation satellite system. The information from this satellite is not only unique in that the data is sensitive to both the optical (spectral reflectance, transmittance, and absorption) and structural (e.g. architecture) properties of surfaces, but it also opens a new field for cutting-edge research.

In this study, we investigated if synergistic usage of spectral and angular signatures during automatic image classification can produce an information surplus. Specifically, if objects with the same spectral signature can be sub-classified according to their angular signatures (anisotropy ratios of corresponding -36°/+36° off-view data sets) and if so, how these anisotropy quotients behave in temporal context. Since the unique features of the Proba/CHRIS system complicates the pre-processing of data, this paper further analyzed potential approaches for proper geometric and atmospheric correction.

In the first stage, different approaches for pre-processing were tested and evaluated. An appropriate sequence - including five steps (destriping, geometric correction, wavelengths adjustment, atmospheric correction, and compilation of the working sets) - was developed, and show root mean square errors (RMSE) of lower than one pixel.

During the second stage, analyses of the spectral and angular signatures of time series of five existing data sets were conducted. First, an unsupervised classification of the nadir view angle data sets was performed and a spectral classification map of the test site was created. Secondly, the angular signatures were analyzed by dividing the corresponding 36° off-view angle data sets from each other. Thirdly, synergetic usage of spectral and angular signatures was analyzed. Therefore, a superimposition of the spectral and angular classification maps was created so that the anisotropy ratios of spectral classified objects could be extracted. As result a classification map was produced, which showed unambiguously the partition of spectral objects in sub-classes. Since occurring sub-classified spectral objects consistently have identical spectral signatures, it is proofed that angular signature are responsible for their differentiation. The temporal analysis of these sub-classes verified that these sub-classes are stable over the vegetation period and prove differences in stand structures or plant architecture. The information surplus is visible in the 680 nm wavelength band of the anisotropy quotient data sets.

The information content of the spectral and angular domains is highly complementary, i.e., the additional information from multi-angle remote sensing is not redundant. Spectral and angular signatures are related to differing physical properties. This means that the combination of both provides us more detailed information about the object, and leads so to a significant improvement in identification and status assessment.

Analysis of ASTER multispectral stereo imagery to update DEM and land cover databases for Cyprus island

HADJIMITSIS Diofantos G.
d.hadjimitsis@cut.ac.cy
Cyprus University of Technology, Cyprus

CHRYSOULAKIS Nektarios
zedd2@iacm.forth.gr
Foundation for Research & Technology – Hellas, ICAM, Heraklion, Greece

RETALIS Adrianos
adrianr@meteo.noa.gr
National Observatory of Athens, Greece

Abstract: This study presents the production of accurate Digital Elevation Models (DEM) and land cover databases for the islands of Cyprus, capable of being used in local studies. For example, both DEM and land cover products can be used for watershed characterization and water resources management, given the great importance of water resources for Cyprus. It is known that high accuracy determination and visualization of topography of the Earth's surface is very important for local level environmental applications, however DEM of usable details are still not available for much of the Earth. Moreover, land cover is one of the most important products of remote sensing and it is a primary input of hydrologic models. While there are land cover maps in global and regional levels, there is lack of such updated products in many localized areas. The 1:50.000 topographic maps present a nominal horizontal accuracy of 20 meters and a nominal vertical accuracy of 10 meters with 90% confidence. The data were in most cases extracted with photogrammetric techniques from aerial stereo-photographs. The usual update rate for these databases ranges from ten to twenty years. The Advanced Spaceborn Thermal Emission and Reflection Radiometer (ASTER) offers along-track stereoscopic viewing capability. Its viewing geometry is suitable for DEM generation even without the use of ground control points. Recent studies have proved that in this case the vertical accuracy of DEM can be better than 20m. The horizontal geolocation accuracy appears to be limited by the spacecraft position accuracy which is considered to be better than 50 m. Other studies have shown that the use of GCP's resulted in a plannimetric accuracy of 15 m and in a near pixel size vertical accuracy. In this paper we therefore examine the production of DEM and land cover maps using ASTER multispectral stereo-imagery for the island of Cyprus. These products are capable of updating the 1:50.000 topographic maps of the island, as well as capable of supporting water resources management. A digital stereo correlation approach was applied to produce DEM from ASTER stereo pairs, whereas supervised and hybrid classification techniques are applied for land cover mapping. Supposing, that the horizontal and vertical accuracy of the ASTER DEM is similar to the relative accuracies of the DEM from digitized contours, optical comparison of the DEMs and statistical analysis can immediately prove if there is any need for update to the topographic maps. A DEM from digitized contours from the 1:50.000 topographic maps was created and compared with ASTER derived DEMs. Several survey monuments were used to estimate the accuracy of these DEMs.

SESSION 18 – Thermal Remote Sensing (3)

Chairmen: Claudia Kuenzer, Chris Hecker

The North American ASTER Land Surface Emissivity Database

ABRAMS Michael
michael.j.abrams@jpl.nasa.gov
NASA/Jet Propulsion, Pasadena, USA

Abstract: Knowledge of the Land Surface Emissivity (LSE) in the Thermal Infrared (TIR: 8-12 um) part of the electromagnetic spectrum is essential to derive accurate Land Surface Temperatures (LSTs) from spaceborne TIR measurements. TIR data are supplied by instruments on several satellite platforms including the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on the Terra satellite platform. ASTER has five bands in the TIR with a 90 m spatial resolution, the highest spatial resolution multispectral TIR data available from Space. Using all ASTER data acquired since launch (2000), we have produced a mean, gridded summer and winter Land Surface Temperature and Emissivity (LST&E) database from individual ASTER scenes of North America. Two refinements to the database address shortcomings in the ASTER Temperature Emissivity Separation (TES) over graybody surface, and involve replacing the emissivity over inland waterbodies with that of distilled water from the ASTER spectral library using an ASTER Land-Water Map (LWM), and improving the accuracy of TES for vegetated surfaces using a new calibration curve based on Fractional
Vegetation Cover (FVC) changes. We have validated this database using in-situ samples collected at multiple sites covering a broad range of surface emissivities. Results indicate that the mean emissivity difference of all bands between the database and majority of validation sites is less than 0.015 (1.5%).

Geo-statistical analysis of historical fire occurrences based on operational satellite monitoring systems

GEBHARDT Steffen
steffen.gebhardt@dlr.de
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

RESSL Rainer
Mexico

SCHMIDT Michael
Germany

DECH Stefan
Germany

Keywords: active fire detection, modis, avhrr, geostatistics, fire seasonality, fire risk

Abstract: Wildfires are a major threat to natural resources and populated places. Every year, fires cause the loss of human lives and natural resources world wide.

Several operational monitoring systems for satellite-based active fire detection are available, e.g. the "Operational program for the detection of hot-spots using remote sensing techniques" of the National Commission for the Knowledge and Use of Biodiversity (CONABIO), Mexico, using MODIS and AVHRR direct readout data, or the "Fire Information for Resource Management System (FIRMS)" of NASA, USA employing MODIS rapid response data. Such systems deliver near-realtime products with the actual fire positions and post-fire assessment products like burnt-area mappings. Additionally, databases are managed for storing all the historical fire locations since the start of the programs.

This paper presents methods for automated geo-statistical analysis of historical long-time fire occurrence . We utilized the CONABIO direct readout database of fire detections in Mexico since 2002 for estimating the total numbers and durations of active fires based on a 1x1 km regular analysis grid. Likewise, associated information has been derived with respect to landcover type and proximity to the sensible areas of populated places and nature protection areas. The resulting monthly and yearly statistical reports and composite maps have further been utilized to calculate fire probability statistics depicting seasonal and regional fire risk zones.

The results give direct information on landcover types and areas of interest mostly affected by fires within the study region with respect to time and duration of occurrence. The spatio-temporal behaviour of fires can be delineated and transformed to risk maps.

Such information helps to assist establish regional fire fighting plans and provides value added information for enhanced monitoring systems due to long time observations on affected total area, hot-spot areas, and seasonality.

Mapping Epithermal Gold Deposits on the Island of Milos, Greece, using an integrated Spectral reflectance and Spectral Emissivity Dataset

FERRIER Graham
g.ferrier@hull.ac.uk
University of Hull, U.K.

GANAS Athanassis
aganas@gein.noa.gr
National Observatory of Athens, Greece

BANKS Andrew
HCMR - Hellenic Centre for Marine Research, Heraklion, Greece

Keywords: spectral reflectance, spectral emissivity, hyperspectral, epithermal, Milos, Greece

Abstract: Background
The utility of hyperspectral remote sensing data within the 0.4 to 2.5 micron atmospheric window has been widely demonstrated for a range of geological applications particularly mineral exploration and mapping the environmental impact of mining. The operational use of hyperspectral remote sensing data for such projects is often hampered by a range of environmental factors. Spectral emissivity data from the 8 to 12 micron waverange offers the potential both for helping to overcome these limiting effects but more importantly to resolve a range of additional geological information relevant to mineral exploration. Laboratory-based research has demonstrated the potential of spectral emissivity features, such as the principal Christiansen feature, the transparency feature, and absorption bands for discriminating mineralogy and lithologies but also the severe contaminating effects of environmental factors such as grain size and surface roughness.

Aims and Objectives
The aim of this project was to develop an integrated spectral emissivity and reflectance based approach for the identification of a range of mineralogical and lithological information relevant to mineral exploration. The specific objectives were :
1. to identify the optimum spatial and spectral, reflectance and emissivity, resolutions for resolving the key diagnostic alteration mineral assemblages.
2. to validate operational atmospheric correction methodologies for both spectral reflectance and emissivity and hyperspectral data.
3. to develop and validate operational reflectance/emissivity spectral analysis algorithms for identifying the key alteration mineral assemblages.
4. to identify the optimum bandcenters & bandwidths and spatial resolutions for maximising lithological discrimination and signal-to-noise performance.

Study Area
The Island of Milos, Greece was selected for this project because of its very dry climate, excellent rock exposure and the presence of a large, proven epithermal gold deposit. An extensive range of satellite (ASTER, HYPERION, ETM), airborne (DAIS), surface and sub-surface spectral remote sensing data (ASD, PIMA-II) was been acquired with coincident supporting atmospheric and illumination data. Additional fieldwork acquired a representative set of rock samples with supporting measurements of surface roughness and other environmental factors. In order to relate the field measurements of spectral emissivity and reflectance to meaningful mineralogical and lithological parameters the representative rock specimens collected at the field sites using thin sections and a Scanning Electron Microscope.

Results
The preliminary results of this study have demonstrated the utility of imaging spectral emissivity data. The areas of highest alteration mineral assemblages were differentiable much more clearly in the 8 to 12 micron region than in the solar wavelengths using both a thermal inertia and a spectral emissivity approach. An integrated mineral exploration methodology using imaging spectral emissivity and reflectance data with extensive supporting field and laboratory analyses offers a much more accurate and cost-effective exploration approach and has the potential for application to the investigation of on-shore hydrocarbon basins.

Using thermal infrared spectra to reveal feldspar mineralogy and mineral chemistry Subtitle: contribution to the SIG-TRS session

HECKER Christoph A.
hecker@itc.nl
ITC - International Institute for Geo-Information Science and Earth Observation, Enschede, Netherlands

RUITENBEEK Frank
ITC - International Institute for Geo-Information Science and Earth Observation, Enschede, Netherlands

WARDHANA Asyari I.

Keywords: thermal infrared, feldspars, alteration

Abstract: Feldspars are omnipresent in most rock types. They are often created, broken down or vary in their chemistry with changes in physical-chemical conditions. As a consequence, understanding feldspar mineralogy and chemistry is a vital tool in classification of igneous rocks as well as alteration systems. The majority of feldspars may be classified chemically as member of the ternary system $NaAlSi_3O_8$ (albite), $KAlSi_3O_8$ (K-feldspar), $CaAl_2Si_2O_8$ (anorthite,). Composition between $NaAlSi_3O_8$ and $KAlSi_3O_8$ are referred as Alkali feldspar and those between $NaAlSi_3O_8$ and $CaAl_2Si_2O_8$ referred as Plagioclase feldspar. However, with identical chemical composition feldspars can have different mineralogy depending on formation temperature.
Conventional analyses (e.g. thinsections, XRD and microprobe) have been used for studying feldspar minerals. These analytical methods, however, tend to be expensive, time consuming and cannot be executed from an airborne platform.
Like most silicate minerals feldspars show little to no information in the visible, near infrared and short-wave infrared (VIS/NIR/SWIR) wavelength bands. Their main interaction with electromagnetic radiation takes place in the wavelength region that is referred to as the Reststrahlen band, which occurs in the thermal infrared (TIR) around 8-12 µm.
In this research we assess in how far thermal infrared spectroscopy can replace the traditional analytical methods for the purpose of characterizing feldspar mineralogy and chemistry. We will show results from laboratory studies on pure mineral samples as well as on field samples with mixed composition from the Yerington batholithic area in Nevada, USA.

The use of multitemporal airborne DAEDALUS ATM data for climatological investigations in Graz/Austria

SULZER Wolfgang
wolfgang.sulzer@uni-graz.at
University of Graz, Austria

WURM Michael
michael.wurm@dlr.de
University of Graz, Austria

LAZAR Reinhold
reinhold.lazar@uni-graz.at
University of Graz, Austria

Keywords: airborne, DAEDALUS, urban climate, urban planning, Graz

Abstract: Multitemporal Airborne Remote sensing data (DAEDALUS ATM) were utilized to assess urban thermal characteristics of Graz/Austria. Urban environmental conditions are strongly dependent on the biophysical properties and radiant thermal field of the land cover elements in the urban mosaic. Observations of urban reflectance and surface temperature provide valuable information for land use planning. Three different flight campaigns (1986, 1996 and 2004) of a DAEDALUS airborne sensor have been organized, processed and analysed for investigating the spatial thermal regime of a town. In 1986 a night, morning and noon campaign was used to document the thermal profile during a day profile. The other campaigns (noon) were used to analyse the changes in the thermal representation of the changed spatial urban features and to adapt the results of the first study in 1986 which was focused on providing a climatologically suitable map for the building authority of the government of Graz.

Infrared spectral characterisation of volcanic rocks during preview project validation campaign on Mt Teide (Canary Islands, Spain) on September 2007 In situ emissivity measurement and satellite thermal map

AMICI Stefania
amici@ingv.it
Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy

BUONGIONO Maria Fabrizia
buongiomo@ingv.it
Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy

CORRADINI Stefano
corradini@ingv.it
Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy

SILVESTRI Malvina
silvestri@ingv.it
Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy

Keywords: emissivity, Teide volcano, ASTER

Abstract: Mt. Teide volcano (Pico del Teide) is a large stratovolcano located on Tenerife island which is the largest of the Canaries (28.27 N, 16.6 W). The volcano has an altitude of 3717 m above sea level and approximately 7500 m above the floor of the Atlantic Ocean, it is the third largest volcano on Earth. Mt. Teide is an active though dormant which last erupted in 1909. The United Nations Committee for Disaster Mitigation have designated Teide as one of 16 volcanoes as being worthy of particular study in light of their history of large, destructive eruptions and proximity to populated areas In the frame of the EC project PREVIEW (http://www.preview-risk.com/) a field campaign, from the 16th to 24th of September 2007, was carried on to validate and to integrate the satellite derived products services.
In-situ ground-based spectroscopic measurements were realized on a series of target sites, representative of both recently and oldest volcanic surfaces. Measurement were made using a microFTIR (by Design and Prototipe) was used for emissivity measurements in the mid-infrared (8-14micron) while an ASD FieldSpec Pro portable spectrometer operating in the 300-2500nm wavelength range for reflectance. Here we present the results of the emissivity measurement and the comparison with the emissivity maps retrieved by ASTER data acquired in the same time window of the in situ measurement. Moreover temperature maps estimated by ASTER data set were compared in order to analyze the variability within the spectral emissivity maps with time.

Measurements for surface temperature and emissivity analysis

FISCHER Christian J.W.
c.fischer@dlr.de
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

BAYER Anita
DLR, German Remote Sensing Data Center, Oberpfaffenhofen-Wessling, Germany

HELDENS Wieke
wieke.heldens@dlr.de
University of Würzburg, Germany

Keywords: radiative energy release, TIR, field measurements, *µ*FTIR

Abstract: Coal seam fires occur in many coal fields worldwide. In addition to local impacts on the affected environment, they can cause an eminent loss of natural resources and contribute due to their gaseous emissions to global air pollution. Within the "Sino-German Coal Fire Research Initiative" DLR focuses on the description of the energy release of subsurface coal fires and its impact on soil and surface temperature.

Analysis of the energy balance at surface level starts at normal conditions. Relevant factors to the energy balance under given conditions are summarized in a model, simplifying these factors as appropriate. The model allows the description and thus the analysis of the overall energy balance. Therefore, if the surface temperatures under normal conditions are known, differentiations of anomalies are possible. These modelling steps are the prerequisite to quantify the radiative energy release and serve as reference information for the analysis of satellite imagery, especially ASTER night time imagery. The work aims to quantify the amount of energy released by different types of coal fires.

Important parameters for the modelling approach are the emissivity values of the different rocks, measured using a portable Fourier thermal infrared spectrometer from D&P Instruments. The µFTIR measures radiance in the thermal wavelengths. From this emissivity can be calculated, which is defined as the radiance of the object divided by the radiance of a black body of the same temperature as the object. Radiance varies with temperature of the object while emissivity does not. Therefore emissivity is suitable for comparing spectra recorded at different times and places.

SESSION 19 – Forestry (2)

Chairman: Thomas Schneider

Retrieving biophysical parameters to evaluate Mediterranean conifer forest decline from airborne imagery

HERNANDEZ-CLEMENTE Rocio
g82heclr@uco.es
University of Córdoba, Spain

NAVARRO-CERRILLO Rafael
ir1nacer@uco.es
University of Córdoba, Spain

FRIEYRO DE LARA Jose E.
jfrieyro@egmasa.es
EGMASA - Empresa de Gestión Medioambiental, Sevilla, Spain

ZARCO-TEJADA Pablo J.
pzarco@ias.csic.es
IAS-CSIC Instituto de Agricultura Sostenible, Cordoba, Spain

SUÁREZ Lola
lsuarez@ias.csic.es
IAS-CSIC Instituto de Agricultura Sostenible, Cordoba, Spain

HAYAS-LOPEZ Antonio
antonio.hayas@gmail.com
EGMASA - Empresa de Gestión Medioambiental, Sevilla, Spain

GITAS Ioannis Z.
igitas@for.auth.gr
Aristotle University of Thessaloniki, Greece

Abstract: Leaf area index (LAI) and chlorophyll are important biophysical parameters in forest decline assessment. The application of high-resolution airborne sensors provides of accurate image information for LAI and chlorophyll content retrieval. However, the feasibility of using these sensors for forest assessment is still limited in comparison to satellite-based measurements. The aim of this study was to compare the estimation of biophysical parameters using different high-resolution imagery over a range of scales. The study area, Los Filabres Range (Almería SE Spain), is covered with pure pine stands, and it is considered one of the most severely damaged of Andalusia. Today, these stands show a variety of forest decline intensity, ranging from virtually no damage to stand death, such as total defoliation. The ground truth data were collected during summer 2008. The degree of defoliation was visually estimated according to the guide for crown assessment of Ferretti, 1994. Field LAI was obtained with hemispherical photography and Li-Cor LAI-2000 plant canopy analyzer (LI-COR, 1992). The analyses performed were: i) Comparison of LAI retrieval from Airborne Hyperspectral Scanner (AHS), Quickbird image and a Quickbird fused product. ii) Comparison of chlorophyll content retrieval from Airborne Hyperspectral Scanner (AHS) and CHRIS-PROBA. iii) Comparison of LAI and chlorophyll content retrieval from image data extracted at different scales: pixel level, object-level and mean matrix values. The image fusion was performed by means of a' trous discrete wavelet decomposition. The results highlight the accuracy of using different sensors and scales to estimate biophysical parameters for forest decline assessment.

Remote Sensing data fusion for forest type mapping
at continental scale

SEDANO Fernando
fernando.sedano@jrc.it
JRC - Joint Research Centre, Ispra, Italy

KEMPENEERS Pieter
pieter.kempeneers@jrc.it
JRC - Joint Research Centre, Ispra, Italy

REITHMAIER Lucia
lucia.reithmaier@jrc.it
JRC - Joint Research Centre, Ispra, Italy

Keywords: forest mapping, time series MODIS, phenology, data fusion

Abstract: The Forest Action of the Land Management & Natural Hazard Unit of the IES-JRC is developing a multi sensor methodology for forest type mapping in Europe. This methodology involves the fusion of high resolution and moderate resolution remotely sensed data. The inclusion of vegetation phenology information will support the separation of forest types otherwise impossible to separate on the basis of single date high resolution imagery. However, the integration of time series from remotely sensed data implies a number of challenges related to the increasing dimensionality of the data set.
This work evaluates a number of information extraction strategies from multi temporal moderate resolution remotely sensed data (MODIS at 250 meter resolution). The most suitable strategies for forest over Europe are selected.
The results for a number of sites in Europe are presented and the integration of this information within the overall forest type mapping methodology is described.

Fusion of LR and HR multispectral imagery for Pan-European forest mapping

KEMPENEERS Pieter
pieter.kempeneers@jrc.it
JRC - Joint Research Centre, Ispra, Italy

SEDANO Fernando
fernando.sedano@jrc.it
JRC - Joint Research Centre, Ispra, Italy

REITHMAIER Lucia
lucia.reithmaier@jrc.it
JRC - Joint Research Centre, Ispra, Italy

Abstract: Supervised classification techniques applied to High spatial Resolution (HR) multispectral satellite imagery have proven to be a valuable tool for forest (type) mapping. To train a supervised classifier, a set of labeled data is needed. Especially for larger areas on a continental scale, the availability of reliable field data is problematic. One of the few data sources that cover most of the European continent is the Corine land cover map. However, its minimum mapping unit is 25 ha. A semi supervised classification scheme was therefore developed, using an iterative training process. After a first coarse classification, a selection was made of those pixels that were classified with a high confidence (high posterior class probability). These were then used in a next training step.

Another main problem addressed in this work is the spectral similarity of the different classes that must be mapped. Based on their spectral signature only, an automatic classifier is unable to accurately distinguish between all classes that might be of interest. Low spatial Resolution (LR) satellites (250 m to 1 km) cover large areas on a single satellite overpass. This results in a high revisit time (daily global coverage). Features based on time series of imagery over the same area of interest can describe vegetation phenology. In this work, LR and HR data were fused, bringing the best of both worlds together. The multi-temporal information provided by the time series of the LR data was combined with the spatial detail from the HR data.

The new high-resolution pan-European forest cover map as a link between large area and regional forest cover information data: a comparative assessment

REITHMAIER Lucia
lucia.reithmaier@jrc.it
JRC - Joint Research Centre, Ispra, Italy

PEKKARINEN Anssi
anssi.pekkarinen@metla.fi
METLA – Finnish Forest Research Institute, Helsinki, Finland

STROBL Peter
peter.strobl@jrc.it
JRC - Joint Research Centre, Ispra, Italy

Keywords: forests, CORINE land cover, Landsat, GLC2000, Cataluna

Abstract: Forest area and its spatial distribution are important indicators for the monitoring of sustainable forest management in Europe. For this, considerable efforts have resulted in the development of land cover products including forest cover from global to local scales mainly based on earth observation data. Local or regional forest maps are usually very spatially and thematically detailed, but vary in forest definition, sources of information and target groups. Therefore, their use for international comparison for various scientific purposes is limited. On the European scale, forest cover information is available by the CORINE land cover (CLC) 2000 and from global products such as Global Land Cover (GLC) 2000. However, these products have either a minimum mapping unit of 25 ha or a resolution of 1km and often do not satisfy the requirements for inter-regional applications. To bridge this gap between local - high spatial detail and global – coarse land cover information, a new high-resolution pan-European forest map for year 2000 has been developed by the JRC. The map is based on Landsat ETM+ image data sets and was processed with in-house developed automatic image processing chain. This paper compares the new developed pan-European forest map in the area of Cataluña with the CLC2000 and the GLC2000 and with the regional forest map.

The use of satellite remote sensing imagery for spatio-temporal analysis of forest changes due to climatic and anthropogenic factors

ZORAN Maria
marianazoran@yahoo.com
National Institute of R&D for Optoelectronics, Bucharest Magurele, Romania

Keywords: forest systems, climatic and anthropogenic factors, spectral vegetation indices, satellite remote sensing, Romania

Abstract: This research was oriented to detect and assess spatio-temporal changes of some forested areas in Romania in relationship with climatic and anthropogenic effects. The use of a spectral vegetation index, namely the Normalized Difference Vegetation Index (NDVI) to detect stress conditions was implemented by using Landsat-TM and ETM+ images, as well as MODIS and IKONOS. Considerable NDVI decline was observed between 1995 and 2007 due to the drought events during 2003 and 2007 years. Under stress conditions, it is evident that environmental factors such as soil type, parent material, and topography are not correlated with NDVI dynamics.

Specific aim of this paper was to assess, forecast, and mitigate the risks of climatic changes on forest systems and its biodiversity as well as on adjacent environment areas and to provide early warning strategies on the basis of spectral information derived from satellite data regarding atmospheric effects of forest biome degradation .

The paper aims to describe observed trends and potential impacts based on scenarios from simulations with regional climate models and other downscaling procedures.

Investigation about the possibility of predict trees diameter in forest, using satellite data

DAGHESTANI Maryam
maryamdaghestani@yahoo.com
Azad University, Zanjan, Iran

Keywords: remote sensing, ASTER, forest, diameter

Abstract: Acquiring up-to-date information about quantitive and qualitive of forest stands is necessary to forest sustainable, scientifice management and planning. Evolution and development of multispectral sensor by it's great capabilities could be very useful. The aime of this researche was investigation about the relationship between diameter of Beech stands and it's spectral signature on Aster image. For this investigation 21 plots of one hectar dimension with selective method established in kheyrood forest experimental station in Noshahr(Caspian sea). In each plot diameter of all trees wich was above 12.5 cm were measured and cordinant of plots with GPS, recorded. Then digital map of them was prepared. Geometric correction was performed up to orthorectification level with affine transformation and resampeling of nearest neighbour. For produce synthetic bands, Ratio, Principle component analysis and Fusion were used. digital numbers matching with plots from principal and synthetic bands were extracted and used in regression analysis test. Result showed Maximum correlation for diameter with G/R, GRVI, [(G+NIR)-R]/(G+R+NIR), R+G+NIR were found respectively with correlation coefficient of -69%, -67%, -54% and -53%. Formula to predict diameter using digital number of image, produced. Results of this study magnifies the hypothesis of possibility of predicting diameter using satellite images. So we recommend complementary studies using images of other satellites in similar stands.

SESSION 20 – Water, Ice and Snow

Chairman: Andreas Redecker

Delineation of permafrost zones in the Russian Altai Mountains based on daily MODIS Land Surface Temperatures (LST): A Comparison of approaches for time and spatial interpolation

VAN DE KERCHOVE Ruben R.R.
ruben.vandekerchove@ugent.be
Ghent University, Belgium

GOOSSENS Rudi
rudi.goossens@ugent.be
Ghent University, Belgium

Keywords: MODIS, permafrost, interpolation, clouds

Abstract: Mountain permafrost modelling in remote, continental mountain ranges (e.g. Russian Altai Mountains) holds several difficulties due to the limitations these environments pose. The lack of meteorological input data and impossibilities for BTS-validations (Bottom Temperatures of winter Snow cover) makes conventional modelling strategies inapplicable. As a solution, time and spatially covering MODIS land surface temperature (LST) might be used as a proxy replacing the interpolated air and near ground surface temperatures. However as these areas are often affected by clouds, some interpolation is needed to create such a full coverage in both time and space. Therefore we tested 3 different algorithms to fill the data gaps created by these cloudy days. At first we fitted a continuous sinusoidal curve to the data values in every pixel. As this method generalizes the data, it doesn't fit to small oscillations, neither it takes the values of adjacent pixels into account. The second method uses an adaptive savitzky-golay filter which reckons with small changes, but still overestimates temperatures on cloudy days. Finally we used a method to create diurnal cycles for each pixel. Based on landcover and insolation, this algorithm creates a daily temperature shape for each day of the year, for every pixel. The resulted normalized shape is then fitted to the real data values, which creates a continuous data set. Based on these full covered LST datasets, permafrost zones were delineated, by using conventional isotherms and degree days.

Snow cover monitoring from EO data

POTUCKOVA Marketa
mpot@natur.cuni.cz
Charles University of Prague, Czech Republic

STEFANOVA Eva
stefano1@natur.cuni.cz
Charles University of Prague, Czech Republic

KOLAR Jan
jkolar@natur.cuni.cz
Charles University of Prague, Czech Republic

Keywords: MERIS, NOAA, MODIS, ASAR

Abstract: Spatial distribution of snow cover and snow parameters are important components in hydrological modeling, for example for predicting of snow melt contribution to flooding events. Density of in-situ measurements is usually insufficient considering regional or national scale. Thus, earth observation data represent an obvious solution for this application.

The article presents a methodology for continuous snow cover monitoring in the Czech Republic by means of combination of optical and radar data with medium and coarse spatial but high temporal resolution.

Possibilities of usage of MERIS and AVHRR data that are available from the receiving station placed at the Faculty of Science of Charles University in Prague are discussed. Tests based on MODIS data showed very good results regarding discrimination of snow and cloud cover. Data from ASAR give another option for snow cover determination under unfavorable weather conditions for optical observation and can be also used for derivation of some of snow parameters such as snow water content. The methodology of processing of all mentioned data and possibility of their combination is described. The results are verified by means of terrestrial measurements obtained from the Czech Hydrometeorological Institute.

A new approach to reducing uncertainty of snow accumulation in Antarctica

VASILIEV Leonid N.

leonid-vasiliev@yandex.ru

Institute of Geography - RAS, Moscow, Russia

Keywords: precipitation, evaporation, ice mass balance

Abstract: This work is a contribution to the International Polar Year. It has an emphasis on the project "Antarctic Surface Accumulation and Ice Discharge". Assessing the rate of changes of the Antarctic ice sheet remains a major challenge, which can only be met through combined space-based observing techniques including precision lidar altimetry (ICESat), global daily estimates of precipitation (Global Precipitation Climatology Project), GRACE gravitational signature and supporting in situ measurements or model estimates of variations in snow accumulation.

The goal is to quantify snow accumulation rates and to estimate the current mass balance of the Antarctic ice sheet and key Antarctic catchments. A high priority of the Antarctic research is to reduce the uncertainty in the measurements and to improve our ability to predict future ice sheet behaviour.

Our work has revealed a statistically significant variation in accumulation in Antarctica over the last 30 years. The accumulation volume decreased in 6-year cycles from 1982 to 2005 years decreased by 15%. GPCP data offers the opportunity to detect temporal accumulation rate in Antarctica on the different scale levels: continental, sub-continental (West and East Antarctica) and over the catchments. The behaviour of precipitation is consistent with the accumulation model. Evaporation and melting estimates are based on the comparison of precipitation volumes and the model of the accumulation rate. Evaporation and melting range from12% for the continent, 25% in Western Antarctica to 10% in Eastern Antarctica. We propose a new estimate of the mass balance of Antarctica by combining GPCP precipitation and GRACE satellite data and assess the uncertainty with which the mass balance can be determined. There are a good agreement between GRACE monthly mass changes and monthly snow accumulation rate. The one-degree daily precipitation data set and monthly precipitation in 2.5 ×2.5 grid cell were provided by the NASA/Goddard Space Flight Center's Laboratory for Atmospheres, which developed and computes the data as a contribution in the GEWEX Global Precipitation Climatology Project.

EOS sensor fusion for retrieval of Arctic sea ice albedo

STROEVE Julienne C.
stroeve@kyros.colorado.edu
NSIDC - University of Colorado, Colorado, U.S.A.

PAINTER Thomas
painter@geog.utah.edu
University of Utah, U.S.A.

Keywords: sea ice, albedo, remote sensing

Abstract: Surface albedo is a fundamental climate parameter as it governs the amount of solar energy available for absorption by the surface of the earth. In the polar regions, the high albedo of sea ice allows much less solar energy to be absorbed by the darker ocean. As the areal extent of sea ice continues to decrease, heat input into the ocean increases, fostering further melt. The recent pattern of significantly lower Arctic sea ice extent is consistent with the ice-albedo feedback in the Arctic system that enhances the link between warming and reduced ice.

The current lack of high quality and high spatial and temporal resolution observations of Arctic sea ice albedo is a critical observational gap. This study seeks to fill this observational gap by developing an algorithm to compute Arctic sea ice albedo from the Terra and Aqua MODIS instruments. The work is an extension of the Direct Estimation Algorithm (DEA) that includes a multi-temporal/angular/sensor approach coupled with enhanced snow and ice radiative transfer modeling. This paper discusses the prototype MODIS sea ice albedo algorithm and shows preliminary results.

Correlation between Ice conditions and harp seal distribution on whelping patches in the White Sea

EGOROV Sergey Anatolievich
ltei@pinro.ru
PINRO - Polar Research Institute of Marine Fisheries and Oceanography, Murmansk, Russia

ZABAVNIKOV Vladimir Borisovich
ltei@pinro.ru
PINRO - Polar Research Institute of Marine Fisheries and Oceanography, Murmansk, Russia

Keywords: ice conditions, harp seals, remote sensing

Abstract: On base of data which were got in harp seal (phoca groenlandica) White Sea population on whelping patches researches in the White Sea during 10 last years (annually – before March 20) was carried out complex and system analyze of animals distribution and ice conditions, including correlated estimation between its.
In accomplishment this scientific-applied work were used data of coastal observations (information about current ice conditions and harp seal distribution), materials of multispectral air surveys (current ice conditions and animals distribution), and also data of satellite remote sensing (current ice conditions only).
The main result of carried out research was defined close correlation between harp seal distribution on whelping patches in the White Sea, from one side, and ice conditions (shape, concentration and ice formations structure), from other side. This circumstance can be use very effectively, reliably, and qualitatively in planning and carrying out of animals account multispectral air surveys in whelping patches directly. It can allow to reduce considerably expenditures in carrying out of preliminary reconnaissance air surveys and maximally optimize the tracks of main account air surveys that enable to increase economical effectiveness this research direction considerably.

Chlorophyll-a maps estimation combining high spatial imagery and ground data by growing cell structures

GONZALO-MARTIN Consuelo
consuelo.gonzalo@upm.es
Universidad Politécnica de Madrid, Spain

DELGADO Soledad
sole@eui.upm.es
Universidad Politécnica de Madrid, Spain

LILLO-SAAVEDRA Mario
malillo@udec.cl
Universidad de Cocenpcion, Chile

ZAMBRANO Francisco
fzambrano@udec.cl
Universidad de Cocenpcion, Chile

MARTINEZ Estibaliz,
emartinez@fi.upm.es
Universidad Politécnica de Madrid, Spain

ARQUERO Agueda
aarquero@fi.upm.es
Universidad Politécnica de Madrid, Spain

Keywords: fused images, growing cell structures, chlorophyll-a

Abstract: The Trophic Level Index (TLI) is an indicador of lake water quality. Four parameters are combined to construct the TLI: total nitrogen, total phosphorus, turbidity and chlorophyll-a. Tradicionally, these parameters are measured in field campaigns, registering water samples in different points inside the water body. These samples should be further analysed in the laboratory. This process is expensive in money and human resources; moreover, often, it is not possible to register an enough number of samples uniformly distributed.

An alternative approach is the use of remote sensing techniques for identifying and evaluating more representative aspects of the eutrophication process. These techniques provide a synoptic vision, from a spatial and temporal point of view, of the whole water body, allowing a more efficient planification and management of it [1].

The precision in the estimation of the variables under study will be depend of the spatial-spectral resolution of the multispectral image used. In this sense, a panchromatic-multispectral image fusion algorithm, based on fractal geometry and previously developed by the research team, will be used [2].

The aim of this work is to analyze the different performances of a previous methodology which combines, by Grown Cell Structures (GCS) [3], satellite images information and in situ chlorophyll-a collected data, to obtain its spatial distribution in the whole lake, when source multiespectral and fused images are used.

[1] Olmanson, L. G., Bauer, M., and P., B. (2008). A 20-year landsat water clarity census of minnesota's 10,000 lakes, Remote Sensing of Environment, 112(11):4086–4097.
[2] Gonzalo, C. and Lillo-Saavedra, M., Integration of Panchromatic and Multispectral Images by Local Fractal Dimension, Remote Sensing for a Changing Europe, in press, EARSEL 2008.
[3] Delgado, S., Gonzalo, C., Lillo-Saavedra, M., Martínez, E. and Arquero, A. (2008). Uso de redes neuronales autoorganizativas dinámicas no supervisadas para la discriminación de tipos de aguas en lagos. In SELPER 2008, Geomática al servicio de la ciencia por un desarrollo sostenible.

Use of satellite remote sensing data, genetic algorithm, and fuzzy system in assessment of water quality indicators in the largest inland body of water

MORIDNEJAD Ali
a.moridnejad@gmail.com
University of Tehran, Iran

ABDOLLAHI Hossein
hsnabdollahi@gmail.com
Iran

ALAVIPANAH Seyed Kazem
salavipa@ut.ac.ir
Iran

Abstract: Remote sensing techniques are capable to prepare both spatial and temporal views of surface water quality parameters which synoptic information can not be obtained from in situ measurements. This investigation presents applicability of Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite to monitor water quality parameters including suspended sediment, chlorophyll-a, secchi disk depth in southern part of Caspian Sea. The in situ measurements were collected during overpassing of the MODIS sensor. To evaluate water quality parameters, a model based on an artificial neural network (ANN) is established. Then the best initial weights of training process are detected by a common genetic algorithm (GA). After that, a gradient decent method, Levenburg-Marquardt, leads the search process to find the optimum solution. To intensify the effect of GA, Mamdani's fuzzy inference method is used. The results indicate that the RMSE of the ANN model is enhanced especially after using fuzzy rules.

AUTHOR'S SESSION INDEX

KOLAR J.	6, 20		MARTINEZ E.	20
KOLEGA N.	3		MASELLI F.	1
KOSZTRA B.	2		MASINI N.	9
KOURKOULI P.	9		MASTRACCI F.	14
KOUTSIAS N.	1		MATINFAR H. R.	4, 15
KOWALIK W.	5		MEDINA C. E.	5
KUENZER C.	12		MEHL H.	12
KUNTZ S.	10		MELIÁ J.	8
KUPIDURA A.	6		MIKUS G.	13
KUPIDURA P.	6		MLECZKO M.	5
KUPKOVA L.	6		MILENOV P. K.	13
			MILTON E.J.	11
L			MIRA M.	12
LAI A.	8, 13		MONETI M.	17
LALOU A.	2		MORIDNEJAD A.	20
LANFREDI M.	16		MONBALIU J.	16
LANORTE A.	9		MOURATIDIS A.	16
LAGACHERIE P.	8		MOYSIADIS A.	9
LAGIOS E.	15		MROZ M.	5
LASAPONARA R.	9		MUNZER J.	9
LÁSZLÓ I.	13		MURCHIO G.	14
LATHOURAKIS G.	17			
LAZAR R.	18		**N**	
LEMMETYINEN J.	10		NADOR G.	7
LHERMITTE S.	1		NASILOWSKA S.	2
LIBERTI M.	16		NAVARRO-CERRILLO R.	19
LILLO-SAAVEDRA M.	4, 20		NIARHOS M.	16
LITOVCHENKO K.	7		NIEMEYER I.	4
LIUZZO M.	11		NIEMEYER S.	8
LO BRUTTO M.	16		NIKOLAKOPOULOS K. G.	2, 6, 17
LOHMANN P.	5		NIKOLOV H.	10
LONCHIN A. V	11			
LYNHAM T.	12		**O**	
			OIKONOMIDIS D.	16
M			ORIFICI G.	9
MACCHIATO M.	16		OUMBE A.	11
MALEKI A.	15		OZDEMIR Y.	14
MELIÁ Joaquín	13		ÖZKAN C.	1
MAKATO B.	6			
MACKIN S.	10		**P**	
MAKTAV D.	9		PAINTER T.	20
MÄKYNEN M.	10		PALUCCI A.	11
MANAKOS I.	4, 10		PAPADAVID G.	13
MANAR H,	8		PARLOW E.	15
MANONI G.	5		PARCHARIDIS I.	9
MARCAL A. R.S.	4, 8		PATRUNO J.	9
MARCHESE L.	12		PATSAEVA S.	13
MARTINEZ B.	8		PAVLOPOULOS K.	9

NOTES

NOTES

NOTES

NOTES