EARSeL

June 2011
N° 86

NEWSLETTER

EARSeL

European Association of Remote Sensing Laboratories

Cover page: Pictures related to the upcoming EARSeL workshops in Poznan (September) and Stresa (October)

EARSeL Newsletter

ISSN 0257-0521
Bulletin of the European Association of Remote Sensing Laboratories,
http://www.earsel.org
June 2011 – Number 86

EARSeL Newsletter Editor

Rosa Lasaponara
lasaponara@imaa.cnr.it

Antonio Lanorte
alanorte@imaa.cnr.it

Design

Nicola Afflitto
afflitto@imaa.cnr.it

Institute of Methodologies for Environmental Analysis (IMAA), Italian National Research Council (CNR)

Phone: +390971427111
Fax: +39 0971427271

Editorial Assistance

EARSeL Secretariat
Gesine Böttcher
Nienburger Strasse 1
30167 Hannover, Germany

Phone: +49 511 7622482
Fax: +49 511 7622483
secretariat@earsel.org

Published by:

Institute of Methodologies for Environmental Analysis (IMAA)
Italian National Research Council (CNR)

Printed by:

Form Innovation Shahed
Hirtenweg 8
30163 Hannover, Germany

Subscription rates

Members receive the Newsletter as part of the annual membership fee. For non-members, the annual rates (four issues) are as follows:

Within Europe	80€
Outside Europe	88€
Personal subscription from members	30€

EARSeL annual membership fee

Individual observer	330€
Laboratory/Company with fewer than 10 researchers	330€
Laboratory/Company with 10 or more members	500€

Contents

EARSeL Bureau

Chairman: Dr Rainer Reuter

Institute of Physics
University of Oldenburg
26111 Oldenburg, Germany

Phone: +49 441 798 3522
rainer.reuter@earsel.org

Vice-Chairman: Lena Halounova, Ph.D.

Department of Mapping and Cartography
Czech Technical University in Prague
166 29 Prague 6, Czech Republic

Phone: +420 22435 4952
lena.halounova@earsel.org

Secretary General: Dr. Ioannis Manakos

Department of Geoinformation in Environmental Management
Mediterranean Agronomic Institute of Chania
73100 Chania, Greece

Phone: +30 28210 35040
ioannis.manakos@earsel.org

Treasurer: Dr Rosa Lasaponara

Institute of Methodologies for Environmental Analysis (IMAA-CNR)
85050 Tito Scalo (PZ), Italy

Phone: +39 0971 427214
lasaponara@imaa.cnr.it

International Relations: Dr. Mario Hernandez

UNESCO
1 Rue Miollis
75732 Paris cedex 15, France

Phone: +33 1 45 68 4052
Email: m.hernandez@unesco.org

Honorary Bureau Members

Prof. Preben Gudmandsen

Danish National Space Center
Technical University of Denmark
2800 Lyngby, Denmark

Phone:+45 45 25 37 88
prebeng@space.dtu.dk

Prof. Gottfried Konecny

Institut für Photogrammetrie und Geoinformation
Leibniz Universität Hannover
30167 Hannover, Germany

Phone: 49-511/762-2487
konecny@ipi.uni-hannover.de

EARSeL Newsletter Editor

Dr. Rosa Lasaponara
Antonio Lanorte
Nicola Afflitto

Istituto di Metodologie per l'Analisi Ambientale (IMAA)
85050 Tito Scalo (Pz), Italy

Phone: +39 0971 427 111
lasaponara@imaa.cnr.it
alanorte@imaa.cnr.it
afflitto@imaa.cnr.it

Springer Series on Remote Sensing and Digital Image Processing Editor

Dr. André Marçal

Faculdade de Ciencias, Universidade do Porto
D.M.A., Rua do Campo Alegre, 687
4169-007 Porto, Portugal
Phone: +351 220 100 873
andre.marcal@earsel.org

EARSeL eProceedings Editor

Dr. Rainer Reuter

Institute of Physics
University of Oldenburg
26111 Oldenburg, Germany
Phone: +49 441 798 3522
rainer.reuter@earsel.org

Webmaster

Dr. Rainer Reuter

Institute of Physics
University of Oldenburg
26111 Oldenburg, Germany
Phone: +49 441 798 3522
rainer.reuter@earsel.org

EARSeL Secretariat

Gesine Böttcher

30167 Hannover, Germany
Phone: +49 511 7622482
Fax: +49 511 7622483
secretariat@earsel.org

Editorial

Dear members,

The 31st EARSeL Symposium: "*Remote Sensing and Geoinformation*" was held in Prague, at the Faculty of Civil Engineering, with enormous success, high participation and with numerous presentations made by young scientists.

The best poster award was assigned to Roman Bohovic from the Department of Geography at the Masaryk University in Brno, Czech Republic, and to Doris Klein and Christopher Conrad from the Geography Institute at the University of Würzburg as co-authors, for their excellent contribution in the field of Land Use / Land Cover.

We highlight that this years' symposium has been accompanied by the following four workshops: (i) 3rd Workshop on Education and Training, (ii) 1st Workshop on Forestry, (iii) 4th Workshop on Land Use & Land Cover , (iv) 5th Workshop on RS of the Coastal Zone.

We would like to thank you very much for your contributions, presentations and participation. Those of you who did not manage to attend the Symposium will have the opportunity to see what went on by reading the report from Bureau Members. Moreover, already today a number of presentations held at the symposium are available for download on the programme page of the symposium website. We recommend that you to do not miss the Symposium Proceedings, which will collect outstanding papers in different fields of remote sensing, among them Imaging Spectroscopy, Radar Remote Sensing, 3D, Land Use, Land Cover and Change Detection, Land, Ice& Snow and Urban, Cultural Heritage and Remote Sensing of urban areas.

Two outstanding EARSeL members were granted Honorary Membership in our association: Thomas Benes from the Forest Management Institute UHUL in Brandys-nad-Labem, Czechia, and Mario Hernandez from UNESCO in Paris. Read more in this Newsletter!

We also inform you about members of the Bureau, following the results of the elections in the EARSeL Council meeting held in Prague on 30th May 2011, Rainer Reuter and Rosa Lasaponara have been re-elected as Chairman and Treasurer, respectively

Forthcoming workshops:

- AARG-EARSeL Joint Conference on Remote Sensing for Archaeology, Research and Conservation, September 21-23 in Poznan, Poland
- 8th Workshop on Remote Sensing of Forest Fires: From Local to Global Assessment, October 20-21, 2011 in Stresa, Italy.

In this issue you will find a paper focused on the monitoring of buildings based on GeoEye-1, IKONOS and aerial image stereo pairs by Karsten Jacobsen and Abdalla Alobeid, Leibniz-Universität Hannover, Germany.

The EARSeL Brochure and Flyer are now available from the EARSeL website!

Best Wishes for a relaxing and pleasant summer.

Sincerely,

The Editorial Team

News from EARSeL

The Symposium 2011

The 31st EARSeL Symposium took place at the National Technical Library in Prague from 30th May till 2nd June 2011. Prague hosted also four EARSeL workshops – on Education and Training, on Land Use and Land Cover, on Coastal Zones and – as an inauguration of that newly established Special Interest Group -on Forestry.

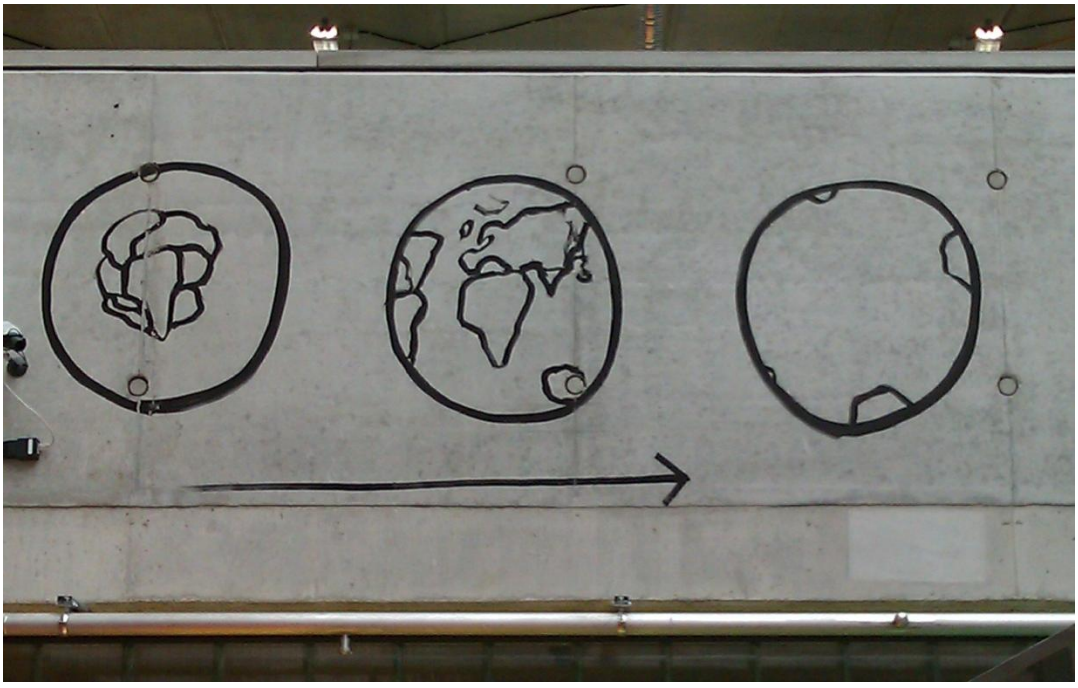
Impressions from the Symposium. Courtesy: Lena Halounova

The Symposium opening session was dedicated to three keynote speeches, presented by Michael Abrams (NASA Jet Propulsion Laboratory) on the International Charter for Disaster Mitigation, by Jean-François Geleyn (Météo France, Toulouse) on the assimilation of remote sensing data in mete-

orology, and by Mario Hernandez (UNESCO, Paris) on remote sensing for supporting cultural and natural heritages. Another three keynotes were included in the programme: presentations given by Vladimír Pešek (Geodis, Brno) on 3D Urban Modelling, by Costas Armenakis (York University, Toronto) on 3D Laser Scanning both on Tuesday, and by Markus Hollaus (Vienna University of Technology) on advances in forestry remote sensing on Wednesday.

The symposium programme was based on a two parallel sessions system. The SIG Land Use and Land Cover held four sessions; 3D, Radar and Urban Remote Sensing were split into two sessions each. Themes in the fields of Imaging Spectroscopy, Thermal Remote Sensing, Land Ice and Snow, Remote Sensing of the Coastal Zone, Forestry, Forest Fires and Cultural and Natural Heritages were presented in one session each. There were 134 papers accepted for oral and poster presentations with high scientific quality. Poster presentations were organized both in individual sessions and in a specific interactive poster session. The posters throughout showed many new and interesting advances in remote sensing and were the subject of evaluation: the EARSeL Bureau selected the best poster and the winner was rewarded not only by a certificate and an illustrated book about Prague and its exciting architectural monuments, but he was also invited to join the 32nd EARSeL Symposium in 2012.

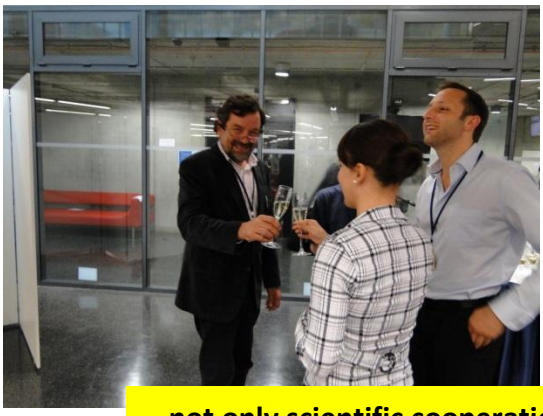
The Symposium offered also a one-day Training Course for secondary school teachers on the use of remote sensing in the classroom, supported by ESA and using ESA's EduSpace tutorials and the image processing software LeoWorks.



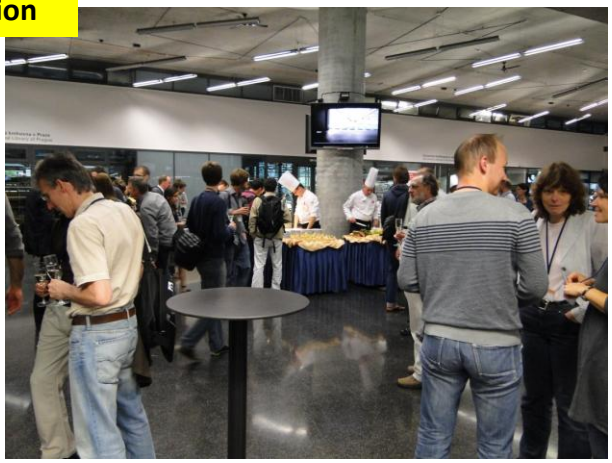
The evolution of Earth observation from Land Use/Land Cover to Ocean Remote Sensing, seen in one of the many graffitis of the Romanian artist Dan Perjovschi, author of the central artwork at the National Technical Library. Courtesy: Rainer Reuter

The social programme started with an ice-breaking reception on Monday evening, and continued with the Symposium dinner on Tuesday. Participants of the Symposium and of one of three workshops enjoyed the social programme with another ice-breaker on Wednesday and a dinner on Thursday either in a restaurant or during a boat trip.

The events took place in the modern National Technical Library, offering comfortable space for the Symposium and workshops, for the ice-breaking parties, for many discussions among colleagues, meetings with old friends and taking acquaintance with new friends. There were many participants, i.e., nearly 200 at the Symposium, about 60 each at the Workshops on Coastal Zones and Forestry, nearly 90 at the Workshop on Land Use / Land Cover, and 15 at the Training Course. Therefore the Workshop on Land Use / Land Cover took place at the Faculty of Civil Engineering situated next to the Library.



…not only scientific cooperation



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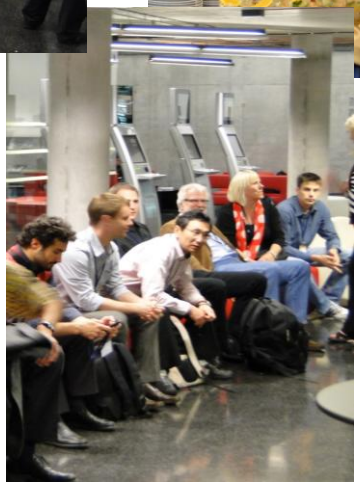
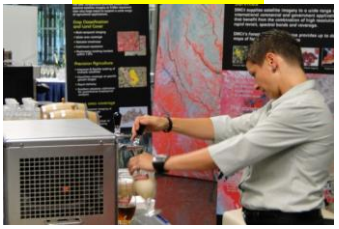


Also good Czech food and …… beer



More impressions from the Symposium. Courtesy: Lena Halounova

The Symposium Proceedings are now in preparation and will be published soon on the EARSeL homepage in the Symposium Proceedings series with open access. Moreover, many presentations

and posters are published as assets in the Symposium Programme which can be viewed on the internet through the address http://www.conferences.earsel.org/program/show/25.

The Symposium was attended by participants from 29 countries from 5 continents who experienced Prague under different weather conditions from a very hot day to a pleasant one with and without wind, with and without rain. The organizers did not have to bother about lost suitcases or health problems of participants and could spend all their time in all these events. Let us meet again in Mykonos at the EARSeL Symposium 2012!

Lena Halounova and Rainer Reuter

Best Poster Award at Symposium

At the Annual Symposium, the Bureau members Lena Halounova, Rosa Lasaponara and Rainer Reuter visited the posters displayed in the interactive poster session. The aim was to encourage young scientists as presenters of posters during the symposium with the Best Poster Award 2011.

The prize was awarded to **Roman Bohovic** from the Department of Geography at the Masaryk University in Brno, Czech Republic, and to Doris Klein and Christopher Conrad from the Geography Institute at the University of Würzburg as co-authors, for their poster entitled **Phenological Patterns for Central Asia** which is an excellent contribution in the field of Land Use / Land Cover.

Congratulations!

Phenological Patterns for Central Asia

Abstract. *Vegetation dynamics, especially phenology is directly linked to climatic conditions. Thus the analyses of phenological parameters can be used as indicators for climate change. Conversely, different climate conditions drive changes in vegetation cycle that could be monitored on time series of satellites images.*

For the assessment of vegetation dynamics on a regional scale remote sensing is the only method that can provide this information and at the same time with the potential for continuous monitoring over long time spans. The most widely used indicator connected to vegetation activity is the Normalized Difference Vegetation Index (NDVI), which can be used for the calculation of different parameters of phenology.

In this study, we analysed phenological parameters in their spatio-temporal context for Central Asia with a special focus on the start and length of the season. The start of the spring season (SOS) is one of the most important phenological parameters that help to characterize vegetation patterns. Its benefit among the other basic parameters (end of the season, length of season, etc.) is the higher stability of the SOS when derived from satellite data. This enables more relevant spatio-temporal comparisons within study area and over time.

We compared results processed from the NDVI data at two different scales – at regional (Central Asia) and sub-regional level (Amu Darya delta, Naryn catchment and Fergana Valley).

We used NDVI data from the Global Inventory Modelling and Mapping Studies (GIMMS) derived from imagery of the Advanced Very High Resolution Radiometer (AVHRR) instrument. The AVHRR is located on board of the NOAA satellites which cover a time period of 25 years from 1982-2006 with a spatial resolution of 8 km. For sub-regional level better resolution data of 250m from MODIS NDVI product are used for the years 2001-2009. Different methods for extracting phenological parameters are employed and proper tuning of parameters is investigated.

The results show the spatial pattern of vegetation parameters which reflects the different climatic conditions within central Asia: e.g. spring starts 7 weeks earlier in the Southern parts of Uzbekistan compared to northern Kazakhstan. At the same time also different land cover/use types are recognized and temporal patterns/trends in phenology parameters are investigated. Human impact could be clearly recognized within the large irrigation areas, where the vegetation is influenced mostly by land management rather than climatic conditions.

Best Poster Price awarded to Roman Bohovic (right) by Lena Halounova and Rainer Reuter.
Courtesy: Rudi Goossens

EARSeL Bureau Elections

In its meeting at the Annual Symposium in Prague, the Council voted on the positions of the EARSeL Chairman and Treasurer. Secretary General Ioannis Manakos had published a Call for nominations back in November 2011 in the EARSeL Newsletter, on the homepage, and by email to all member laboratories. The nominations received were for Rainer Reuter for the office of the Chairman, and for Rosa Lasaponara for the office of the Treasurer. Both candidates, already having these positions in 2010/11, were re-elected for the next term as the Chairman and the Treasurer.

The plans of the Chairman for its second term are

- to improve the cooperation with ESA, and with Eurisy, EARSC and other remote sensing organisations in the fields of fundamental research and practical applications, but also transfer of instrumental developments and methods of data interpretation to industrial partners
- to increase the number of externally funded research and educational projects with contributions from EARSeL and its member laboratories
- to enhance EARSeL's corporate identity through improved publication procedures, e.g., articles on remote sensing from EARSeL authors in scientific journals and popular science magazines, and by including EARSeL eProceedings in the Citation Index

Due to amendmends of the EARSeL Statutes, ratified in the same Council meeting, this next term will be for one year only. All Bureau positions, i.e. Chairman, Co-chairman, Secretary General and Treasurer, will be up for re-election by Council in May 2012.

A Call for nominations will be published in autumn 2011.

Rainer Reuter

The closing ceremony at the 31st Symposium: on the left Rainer Reuter (in the middle) and on the right Rosa Lasaponara (in the right lower corner), re-elected for Chairman and Treasurer. Courtesy: Rudy Goossens.

The General Assembly 2011

Annual Report 2010

EARSeL events

In 2010, EARSeL organised the following events:

- **30th Symposium and 34th General Assembly**
  31 May - 3 June 2010 at UNESCO Headquarters in Paris, France

  The symposium attracted more than 200 participants, and 150 contributions were presented orally or as poster. A report on this very successful event was included in the Newsletter 82, June 2010. Proceedings were published on CD-ROM and on the EARSeL homepage, http://www.earsel.org/?target=publications/proceedings/symposium-2010.

- **Joint Special Interest Group Workshop:**
  Urban – 3D – Radar – Thermal Remote Sensing and Developing Countries
  22-24 Sept 2010 at Ghent University, Belgium

  This joint workshop was aimed at bringing together the members of the mentioned SIG's in one joint meeting in order to meet each other and finding common grounds and complementary items in their research. It was attended by 50 participants, and 60 contributions were given.

Changes in Special Interest Groups

The Special Interest Group ***Geological Applications*** re-started its mission in 2010. It is a forum for international discussions amongst Earth scientists. The main objectives of the SIG are to promote geologic remote sensing and Earth observation and to bridge the gap between technology and applications by bringing together experts from universities, institutes and commercial enterprises at scientific meetings. A first workshop will be organised in the framework of the 32nd Symposium in 2012 on Mykonos Island, Greece. The Special Interest Group is chaired by ***Konstantinos G. Nikolakopoulos*** from the Institute of Geology and Mineral Exploration in Athens, Greece.
Homepage: http://www.earsel.org/SIG/Geology

Since May 2011, the Special Interest Group ***Temporal Analysis of Image Data*** is being co-chaired by ***Yifang Ban*** from the Royal Institute of Technology in Stockholm, Sweden.

Publications

EARSeL publishes several periodicals and monographs on remote sensing of the Earth:

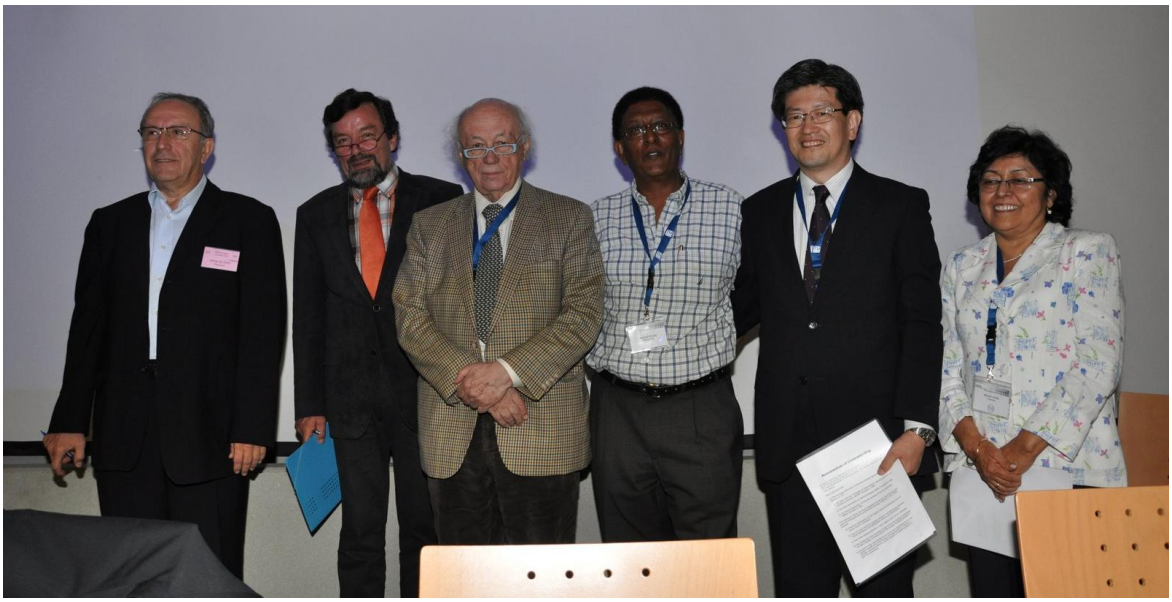
- **EARSeL Newsletter** is a forum for an exchange of news and views among the members of the Association, a digest of Association activities and a general review of the current remote sensing scene. It is printed quarterly and distributed to all EARSeL member laboratories. In addition, it is available on the internet
- **Proceedings of Symposia and Workshops**, which collect quality-checked manuscripts from EARSeL conferences and are published on CD-ROM. Workshop Proceedings have always been available with open access. From 2010 on, Symposium Proceedings can be downloaded as well free of charge.
- **EARSeL eProceedings**, the open-access journal with peer-reviewed publications on all fields of remote sensing, published its Volume 9 in 2010 on CD-ROM and on the internet.
- **Springer Book Series on Remote Sensing and Digital Image Processing**, published since 2009, has become a real success. The series includes four issues on different topics, and new issues are now in preparation.

Memorandum of Understanding signed

In the framework of the ISPRS Centenary Celebrations held in Vienna on 3 to 4 July 2010 an agreement for close cooperation had been signed with three international remote sensing associations outside Europe:

- the **Sociedad de Especialistas Latinoamericanos en Percepcion Remota, SELPER**. The association, situated in Bogotá, Colombia, represents 13 national remote sensing organisations in Central and South America. Homepage: http://www.selper.org/
- the **Asian Association on Remote Sensing, AARS**. 30 national organisations in Asia and Australia are members, and seven European and American institutes and societies are associated members. Homepage: http://www.a-a-r-s.org/acrs/
- the **African Association of Remote Sensing of the Environment, AARSE**. 70 institutes from 37 African countries and are members of AARSE, and individuals and societies from 16 non-African countries are associated. Homepage: http://www.itc.nl/aarse/

The memorandum, initiated by our Honorary President Gottfried Konecny, aims at bringing together EARSeL members and experts from Asia, Africa and Latin America, with the objective to promote international coordination and cooperation in the various fields of remote sensing. This shall be achieved by regular meetings during symposia, bringing together researchers interested in an exchange of information and in initiating multilateral projects in areas of common expertise. This shall cover all relevant topics from the development of new sensors up to their application in remote sensing programmes.



Ceremony of MoU signature at the ISPRS Centenary Celebration in Vienna, 3 July 2010.
From left to right: Orhan Altan, ISPRS President; Rainer Reuter, EARSeL Chairman; Gottfried Konecny, Initiator of the Memorandum; Tsehaie Woldai, President of AARSE; Kohei Cho, General Secretary of AARS; and Myriam Ardila Torres, Vice Chairman of SELPER.

Memorandum of Understanding

On July 3, 2010 the undersigned representatives of the four largest regional remote sensing organisations met during the 100th Anniversary of the International Society of Photogrammetry and Remote Sensing in Vienna, Austria.

These institutions are:

1) The European Association of Remote Sensing Laboratories, EARSeL, founded in 1977

2) The Latin American "Sociedad de Especialistas Latinoamericanos en Percepcion Remota", SELPER, founded in 1980
3) The Asian Association on Remote Sensing, AARS, founded in 1981
4) The African Association of Remote Sensing of the Environment, AARSE, founded in 1992

The meeting in Vienna has been suggested during the International Congress for Photogrammetry and Remote Sensing in Beijing in July 2008, because

a) these four institutions are the largest research institutions of a regional nature in existence
b) they are focal points for regional research and technology developments operating in an independent bottom up environment
c) they unite national activities in their regions with annual meetings
d) they realize the large potential of uses of remote sensing technology for their member countries and for the solution of global problems
e) because of their local backgrounds these four organisations can particularly benefit from interchanges of experiences by creating a stronger and more effective global network in remote sensing science and technology

The representatives of these four organisations have discussed these common interests, and they have agreed to the following:

1. Their representatives will meet annually at scientific and technical events of remote sensing.
2. They will develop a work program for suggestions on how to improve the international standing of remote sensing.
3. The organisations will establish a small secretariat to follow up these activities to promote the standing and the contributions together with other institutions, including the international scientific societies or bodies, such as FIG, IAG, ICA, ISPRS and others.
4. They will furthermore investigate the possibility for the establishment of an International Scientific Academy of Remote Sensing to promote these efforts.

Signed in Vienna on July 3, 2010

Dr. Rainer Reuter,
Chairman of EARSeL,
University of Oldenburg
Institute of Physics
D-26111 Oldenburg, Germany

Dr. Myriam Ardila Torres
Vice President of SELPER
Carrera 30 No. 48-51 Edificio IGAC-CIAF
Bogotá D.C., Columbia

Prof. Kohei Cho
General Secretary of AARS
Research and Information Center
Tokai University
Tokyo, 151-0063, Japan

Dr. Tsehaie Woldai
President of AARSE
ITC, University of Twente
7500 AA Enschede, The Netherlands

Prof. Orhan Oltan
President of ISPRS as witness
Department of Geomatic Engineering
Istanbul Technical University
34469 Ayazaga-Istanbul, Turkey

New Statutes of the Association ratified

At its meeting on 30 May 2011, the Council discussed the Statutes of the Association. The version in force since ratification in the General Assembly on 4 July 1991 made several amendments necessary, many of them resulting from changes of the political situation in Europe since then. An audit of finances was not included since this had always been ruled by French instances, the Association being registered under French law. Also the procedures of Bureau member elections, namely the Chairman and the Treasurer being elected in one year and the Co-Chairman and the Secretary General in the following year were considered as no longer appropriate. Instead, good arguments were made for electing all Bureau members at the same Council meeting every two years.

A draft of the amended statutes was prepared by our Honorary President Preben Gudmandsen and presented to Council. Following a discussion of several points the amendments were unanimously approved by the Council.

Preben Gudmandsen, Honorary President, at the 31st Symposium.

The new Statutes were presented to the General Assembly during its meeting on 1 June 2011, and ratified. They will be submitted for acceptance to the Tribunal d'Instance in Strasbourg where the Association has been registered since 1977.

Participation in Research and Educational Projects

Research projects on the use of remote sensing for research, monitoring and education have become an increasingly important activity in EARSeL, with the Association in a co-ordinating function or as a partner. These initiatives strengthen networking among members, and they increase EARSeL's visibility in the remote sensing community and at international funding agencies.

In 2010, EARSeL was involved in:

- the GMES land monitoring project geoland2, funded by the European Commission in the 7th Framework Programme.
  Read more at http://www.gmes-geoland.info/

- the Proba-V programme, with the project *Forest Cover Change Monitoring with Proba-V: Potential and Limitations on European Terrain*, funded by Belgian Science Policy.
  Read more at http://probav-iuc.org and http://fm-probav.maich.gr

EARSeL's tasks are providing project results through its members involved, organising reviews by other experts in the field, and to publish the project results through its journals, in its symposia and in its workshops.

In the project *Science Education through Earth Observation for High Schools* (SEOS), funded in 2007-09 by the European Commission in the 6th Framework Programme, 17 internet-based e-learning tutorials have been created by 15 partners in several European languages, for use in science curricula but also suitable for individual and enquiry-based learning. Further development of several tutorials and translation in other languages is still going on. In 2010, the creation of a version in Turkish language has been initiated. Read more at http://lms.seos-project.eu.

New Honorary Members

Announced in the General Assembly and celebrated in the closing session of the Symposium, two outstanding EARSeL members were granted Honorary Membership in our association. They are:

- Thomas Benes from the Forest Management Institute UHUL in Brandys-nad-Labem, Czechia. Thomas organised the 22nd Symposium 2002 in Prague, and he was the representative for East/West relations in the EARSeL Bureau for many years in the 1990s.
- Mario Hernandez from UNESCO in Paris. Mario kindly hosted the 30th Symposium 2010 in the premises of UNESCO. He is EARSeL Bureau member for International Relations.

Thomas Benes (left) and Mario Hernandez (right) receive the Honorary Membership Certificates from Rainer Reuter in a ceremony of the Symposium Closing Session. Courtesy: Rudi Goossens

New EARSeL Statutes

Statutes of the European Association of Remote Sensing Laboratories (EARSeL) ratified in the General Assembly on 1 June 2011

Article 1 Title and Seat

The European Association of Remote Sensing Laboratories, hereinafter referred to as 'the Association', is a non-government, non-profit-making body of laboratories and other bodies engaged in research and development of peaceful applications of remote sensing including associated geo-information.

The Association has its seat in Strasbourg, 9 Quai Kléber, it is registered as an association with the Strasbourg Court in Volume XXXVII No.31 and is governed by Articles 21 and 79 of the Civil Code, kept in force by the Act of 1 June 1924 introducing French civil law and by the present Statutes.

Article 2 Aims of the Association

The aims of the Association are to encourage European research and to promote concerted efforts in all disciplines of remote sensing, to facilitate exchange of knowledge between Member Laboratories, to identify priorities for research activities and to foster cooperation between Member Laboratories.

This may be accomplished by way of symposia, workshops and working groups focusing on technological issues and applications of remote sensing data in various research disciplines. The Association may associate itself with joint research projects of its Member Laboratories.

The Association abstains from all political activity.

Article 3 Members and Observers

Membership of the Association shall be granted to entities in Europe engaged in all aspects of scientific research and peaceful applications of remote sensing.

Observer status may be granted to individuals in Europe and to entities and individuals in countries outside Europe.

New Member Laboratories and observers are admitted – on advice of the Council of the Association - by a vote of the General Assembly, provided they obtain a vote of at least two-thirds of the Member Laboratories present.

Article 4 Withdrawal and expulsion

Member Laboratories and observers may leave the Association at the end of the year provided they have notified the EARSeL Bureau at least six months in advance.

The General Assembly may expel a Member Laboratory or observer by at least two-thirds of the Member Laboratories present if the conditions of its membership or observer statute are no longer fulfilled.

Article 5 Organs

The organs of the Association shall be the General Assembly, the Council and the Bureau.

Article 6 General Assembly

The General Assembly is composed of one representative of each Member Laboratory. Only Member Laboratories are entitled to vote in the General Assembly. Each Member Laboratory shall have one vote cast by a properly accredited nominee.

The General Assembly decides on all matters affecting the Association including amendments to the Statutes. Decisions shall be taken by a simple majority, except in circumstances provided for by the Statutes.

The General Assembly shall be convened at least once every year. The convocation and the list of subjects of the General Assembly shall be submitted to the Member Laboratories at least one month before it takes place.

The Chairman of the Bureau shall be the Chairman of the General Assembly.

The General Assembly may be convened by the EARSeL Chairman, by a simple majority of members of the EARSeL Council or by one fifth of the Member Laboratories. The convocation is done by letter to the Member Laboratories at least one month before the General Assembly.

The European Space Agency, the European Union, the Council of Europe and UNESCO may each appoint a representative to the General Assembly in an advisory capacity.

Council may invite observers to the General Assembly.

Decisions taken during the General Assembly are recorded in the Minutes of the General Assembly sent to all members and observers of the Association.

Article 7 Council

The Association is governed by a Council consisting of one representative of each of the countries that have Member Laboratories. Laboratories in two or more countries may agree to be represented by one member of Council. Member Laboratories shall elect their representative to Council by country or by a group of countries.

A representative's terms of office shall be two years, renewable for further terms of two years. The current representative shall undertake the necessary action for appointment in her/his country or group of countries.

Council shall elect the Chairman, the Vice-Chairman, the Secretary General and Treasurer of the Association who shall constitute the EARSeL Bureau.

The Council shall elect an auditor for the period of two years who shall audit the accounts of EARSeL annually. The General Assembly approves the auditor elected by Council.

The findings of the auditor are provided to Council in writing and then presented to the General Assembly by the EARSeL Treasurer.

The auditor comes from an EARSeL member laboratory, but is acting in an independent capacity. He/she is not currently a member of the EARSeL Bureau.

The European Space Agency, the Commission of the European Communities, the Council of Europe, UNESCO and national remote sensing societies may each appoint a representative to the EARSeL Council in an advisory capacity.

Article 8 Bureau

The EARSeL Bureau is the executive body of the Association.

The Bureau has four offices: Chairman, Vice-Chairman, Secretary General and Treasurer.

An 'International coordinator' is ex-officio member of the Bureau.

The Bureau may invite individuals to attend its meetings in an advisory capacity.

The Bureau communicates with the Member Laboratories by way of the EARSeL Newsletter and a Homepage on the Web.

Article 9 Terms and election of Bureau members

Election of Bureau members is made every two years.

Voting will be secret and by a written note. Voting may be made by mail.

Election for the four offices is made in the sequence of Chairman, Vice-Chairman, Secretary General and Treasurer. Re-election is possible, but no member of the Bureau may serve for more than two terms in one office.

A note in the EARSeL Newsletter and on the home page of the Association inviting potential candidates to present themselves opens the process of election. Member Laboratories are advised at the same time by mail.

Candidates are presented to Council Members by mail at least one month before it's meeting in connection with the General Assembly.

Article 10 Budget

Presented to the General Assembly, the Assembly shall approve the accounts for the preceding year and the budget for the coming year.

With a recommendation by Council the General Assembly shall approve the annual membership fee.

The Association may accept gifts.

Article 11 Amendments of the Statutes

Members of the EARSeL Council or the EARSeL Bureau may suggest amendments to the Statutes.

Proposals may be tabled with Council by one-fifth of the Member Laboratories.

Council will consider suggestions at its next meeting if tabled at least two months before.

With the recommendation of Council amendments shall take effect if they receive the support of two-thirds of the Member Laboratories present at the General Assembly.

Article 12 Dissolution

A move for the dissolution of the Association shall follow the rules laid down in Article 11 for amendments to the Statutes.

After the settlements of the debts of the Associations and the fulfillments of its commitments, the General Assembly that has voted for the dissolution shall decide on the sharing of its remaining assets among the Member Laboratories or otherwise.

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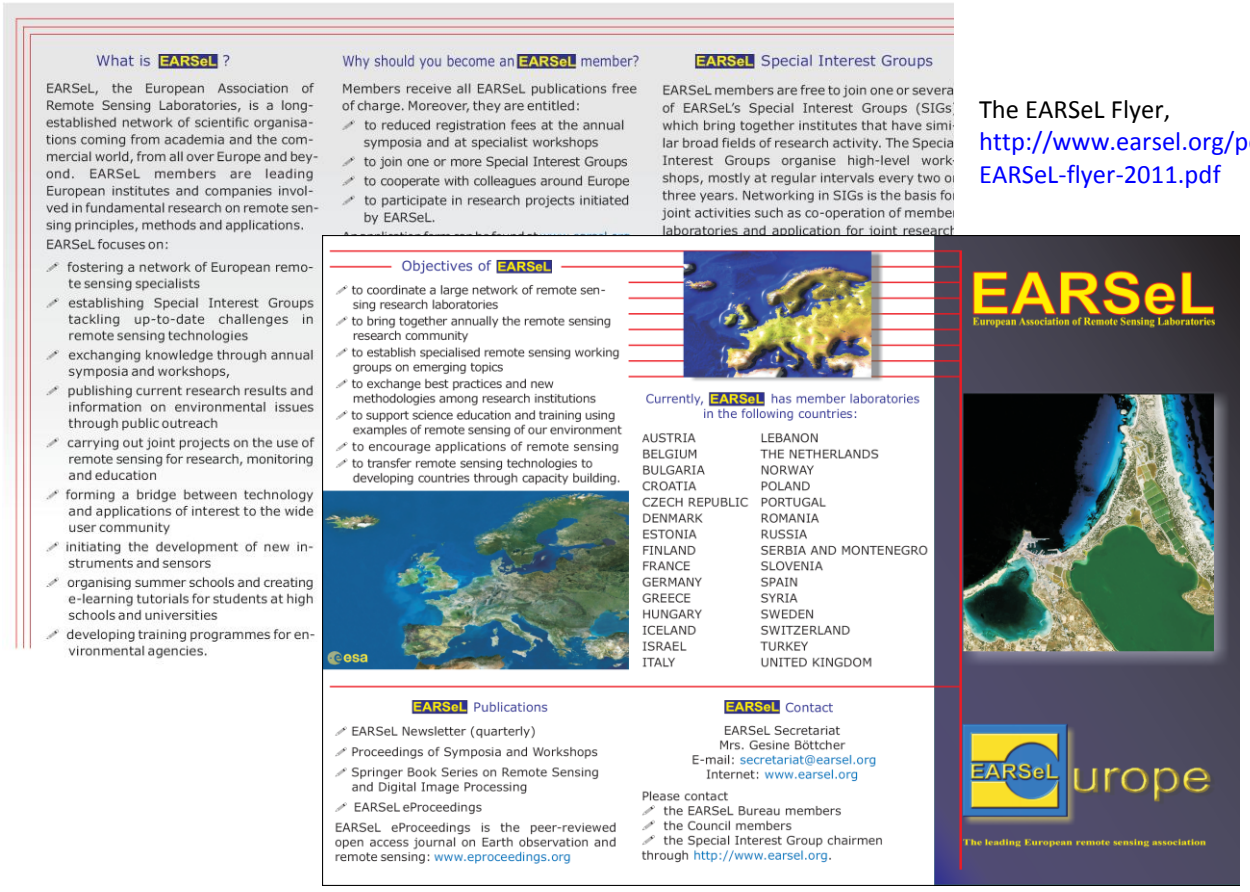
The former version of statutes, ratified at General Assembly on 4 July 1991, will remain available for download on the EARSeL Homepage, http://www.earsel.org/pdf/statutes.pdf, until acceptance of the amended version by the Tribunal d'Instance in Strasbourg, France, where the Association is registered.

EARSeL Brochure and Flyer

We are pleased to invite you to enjoy the EARSeL Brochure and Flyer, which report on EARSeL's mission and activities. Available online at http://www.earsel.org/welcome.html.

Title page of the EARSeL Brochure, http://www.earsel.org/Monographs/Brochure-2011.pdf



The EARSeL Flyer, http://www.earsel.org/pdf/EARSeL-flyer-2011.pdf

New Members since 06/2010

Diagnostics and Metrology Laboratory
UTAPRAD-DIM
ENEA C.R. Frascati
Via Enrico Fermi 45,
00044 Frascati, Italy

EARSeL Representative. Dr. Antonio Palucci

GEOTEST AG
Birkenstrasse 15
3052 Zollikofen, Switzerland

EARSeL Representative:
Dr. Hans Rudolf Keusen

The Remote sensing Laboratory
Jacob Blaustein Institute for Desert Research
Ben Gurion University of the Negev
Sede Boker campus, 84900 Israel

EARSeL representative:
Prof. Dr. Arnon Karnieli

Institute of Geology & Mineral Exploration
1,Sp.Loui str.
Olympic Village, Entrance C
13677 Acharnae, Greece

EARSeL representative:
Dr. Konstantinos Nikolakopoulos

Department of Geoinformation Processing for Environmental Planning
Technical University Berlin
Straße des 17. Juni 145 (EB)
10623 Berlin, Germany

EARSeL representatives:
Prof. Dr. Birgit Kleinschmit
Dr. Michael Förster

Space Research Center of Polish Academy of Sciences
Earth Observation Group
18A Bartycka str.
00-716 Warsaw, Poland

EARSeL representatives:
Dr. Stanislaw Lewinski
M.Sc. Martyna Stelmaszczuk

Cancellations since 06/2010

TNO Physics & Electronic Laboratory
Oude Waalsdorperweg 63
2509 JG The Hague, The Netherlands

EARSeL Representative: Prof. P. Hoogeboom

Mars Inc., Catalyst Research Team
Kleine Kloosterstraat 8
1932 Sint Stevens Woluwe, Belgium

EARSeL Representative: Ms Evy Binon

MEDIAS-France
18 avenue E. Belin
31401 Toulouse Cedex 4, France

EARSeL Representative:
Dr. Patric Van Grunderbeeck

Danish Administration of Navigation and Hydrography
Oceanographic Dept., Remote Sensing
Overgaden oven Vandet 62B
1023 Copenhagen K, Denmark

EARSeL Representative: Dr. Claus Solvsteen

IGEAT – SIG Télédétection
Université Libre de Bruxelles
50,ave F.D. Roosevelt,
1050 Brussels, Belgium

EARSeL Representative: Prof. Eléonore Wolff

Symposium 2011 Proceedings Preprint

Monitoring of Buildings based on GeoEye-1, IKONOS and aerial image stereo pairs

Karsten Jacobsen and Abdalla Alobeid, Leibniz-Universität Hannover, Germany

Abstract. Monitoring of buildings is a basic task for survey administrations. It is not just limited to identification of new or eliminated houses also the extension of building heights is important. Especially the identification of building height changes is very difficult by manual image interpretation. With least squares and semi global matching digital surface models (DSMs) in urban areas have been generated using stereo pairs from aerial images taken in May 2007, IKONOS taken in May 2008 and GeoEye-1 taken in September 2009. For the aerial images orientations from a bundle block adjustment were given, but there were no control points for the satellite images. In a first step the satellite DSMs were based just on the given rational polynomial coefficients (RPC) and compared with the DSM from aerial images. The direct sensor orientation of IKONOS required a shift in X and Y in the range of 7m and in the height 0.3m in relation to the orientations from aerial images, for GeoEye-1 the required shift in X and Y was below 1m and in the height 2.8m. The noise of the DSMs computed by least squares matching (LSM) is larger as based on semi global matching (SGM). Especially the building shape is more precise based on SGM and SGM has not as much problems with areas of low contrast and shadows. Nevertheless with DSMs of both methods differential height models could be generated, showing very clear height changes of buildings caused by new, eliminated and enlarged buildings. Height changes of one floor, in the range of 2.7m, became obvious. The relative accuracy of filtered height models without effects caused by viewing shadows and poor contrast areas is in the range of 0.5m up to 1m, an accuracy which required before large scale aerial images.

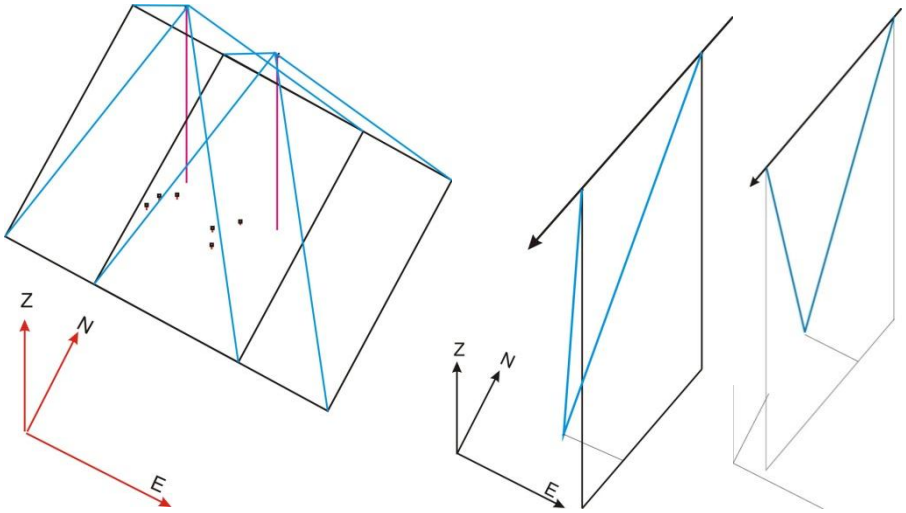
Introduction

For a suburb of Riyadh changes of buildings should be determined based on scanned aerial wide angle photos from May 24th 2007, an IKONOS stereo pair from May 24th 2008 and a GeoEye-1 stereo pair from September 15th 2009. The base to height relation is similar for all stereo pairs with 0.60 for the aerial images, 0.60 for the IKONOS stereo pair and 0.67 for the GeoEye-1 stereo pair. The height to base relation is important for the accuracy of height determination. The IKONOS stereo pair as well as the GeoEye-1 stereo pair have a roll angle of 11°, both viewing to West of orbit (figure 1). The wide angle aerial photos with a scale 1 : 45 000 have been scanned with 14µm pixel size corresponding to 63cm ground sampling distance (GSD), while the IKONOS images have 1m GSD and the GeoEye images 0.5m GSD. The manual inspection of building changes is time consuming and not very reliable. Especially the change of building heights by adding one or more floors is very difficult to be seen, so the building changes should be identified by differences of digital surface models (DSM) determined by automatic image matching for the different update periods.

Image Quality

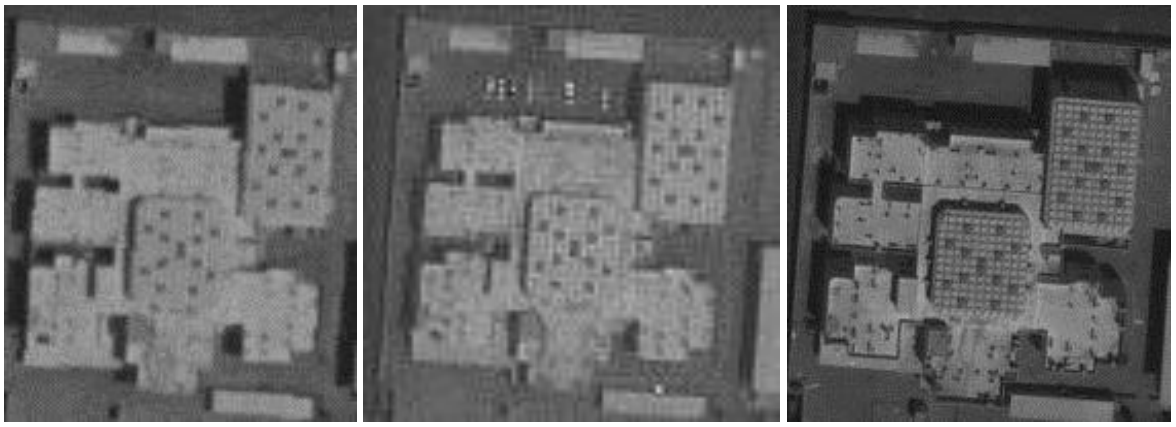
The nominal ground resolution must not correspond to the effective image information due to varying image quality. The effective image resolution can be determined by edge analysis (Jacobsen 2009). If in the object space the brightness is changing at a line suddenly from dark to bright, defining an edge, this cause in the image a continuous change from dark to bright. The grey value profile across the edge can be differentiated, leading to a point spread function. The width of the point spread function corresponds to two times the factor for the effective image resolution, which multiplied with the nominal GSD leads to the effective GSD. The aerial image has a factor for the effective resolution of 1.18, multiplied with the nominal GSD of 0.63m leading to 0.74m effective ground resolution corresponding to the information contents, while for IKONOS as well as for GeoEye the factor for effective resolution is 0.92. By theory the factor should not be below 1.0, but it can be improved by contrast enhancement. A contrast enhancement enlarges also image noise, so it requires images with a low noise level. This is the case for IKONOS and GeoEye-1 images while the scanned aerial photos show the high noise caused by film grain not allowing a contrast enhancement. So the com-

parison of the effective GSD with 0.74m for the aerial photos with 1m GSD of IKONOS is even too optimistic for the quality of the aerial photos.



a) Aerial images b) IKONOS c) GeoEye-1

Figure 1: configuration of stereo models



Aerial photo IKONOS GeoEye

Figure 2: Sub area of used images

As obvious in figure 2, GeoEye-1 shows with 0.5m GSD more details as the other images, but a comparison of IKONOS with 1m GSD and the scanned aerial image with nominal 0.63m and effective 0.74m GSD shows slightly clearer details of the IKONOS image. As typical for scanned aerial images it has larger noise, lower contrast and as result of this, details are more blurred.

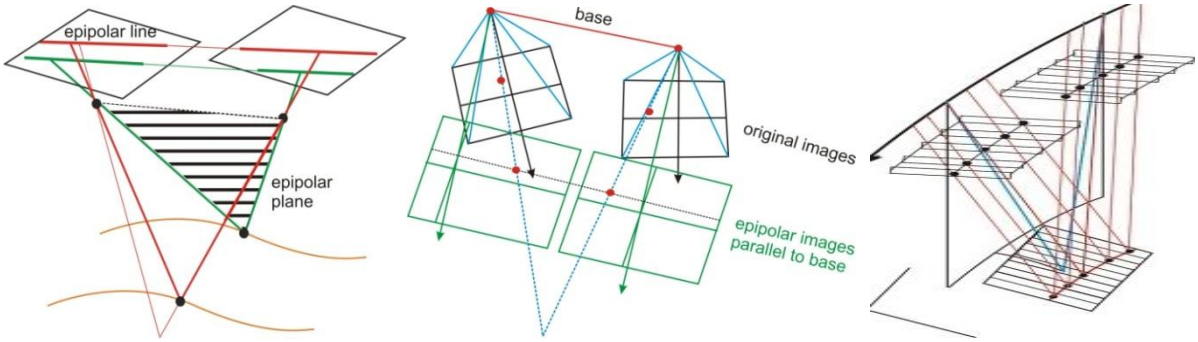
Image orientation and generation of epipolar images

The image orientation of optical satellite Geo images, being a projection of the original images, improved by radiometric and geometric system calibration, to a plane with constant object height in the national coordinate system, became standard with bias corrected RPC-solution (Grodecki 2001). The absolute geo-reference of the satellite images without use of ground control points (GCPs) has reached a standard deviation without the effect of terrain relief correction for X and Y of 4m for IKONOS and 2m for GeoEye-1, being accurate enough for several application. For aerial images bundle block adjustment with self calibration is standard.

For the Riyadh project areas at first no GCPs have been available, so at first the height models using IKONOS and GeoEye-1 images have been based on the absolute sensor orientation without bias correction. Of course this may lead to systematic errors of the height models, especially shifts in X, Y and Z. Later we got aerial images together with the results of bundle block adjustment. With the oriented

aerial images object reference points, usable as GCPs, have been determined. Based on these well defined points root mean square errors of the object coordinates in the stereo models of 0.40m in X, 0.46m in Y and 1.15m in Z for IKONOS and 0.41m in X, 0.48m in Y and 1.13m in Z for GeoEye-1 have been reached. Nevertheless the height models not based on GCPs had to be shifted against the height model from aerial images by adjustment, requiring a shift of the IKONOS height model of -5.0m in X, 8.0m in Y and 0.3m in Z and for the GeoEye-1 height model 1.0m in X, 0.7m in Y and -2.8m in Z. By unknown reason the height model based on aerial images was slightly rotated, requiring a rotation by adjustment with the Hannover program DEMSHIFT.

Height models have been computed by means of least squares matching (LSM), pixel based matching with dynamic programming (DP) and semi global matching (SGM). DP and SGM have to use epipolar images.



a) Principle of epipolar geometry b) Generation of epipolar images c) Epipolar principle for satellite line scanner images

Figure 3: Epipolar geometry

Epipolar lines in perspective image pairs (figure 3a) are the intersections of the epipolar plane, defined by an object point and both projection centres, with both images. A change of the object height corresponds to a shift of the corresponding image points only in the epipolar lines. In epipolar images (figure 3b) corresponding image points have the same y-coordinate. Satellite line scanner images have perspective geometry only in line direction. Any line has a different projection centre (figure 3c), so only quasi epipolar images can be generated by the definition that corresponding image points shall have the same y-image coordinate and a change of the object height causes only a shift of the image point in x-image direction. Such epipolar images can be simply generated with Geo-images (or OR Standard or SPOT level 2A) just by an image rotation to the base direction of the stereo model. The influence of a roll angle and height differences against the reference height of a Geo-image under usual conditions does not exceed 0.1 pixels.

Image matching

The classical image matching is area based – a sub-matrix of the left image will be matched with a sub-matrix of the right image. In the case of cross-correlation, the sub-area in object space is expected to be parallel to the image plane. The least squares matching improves this to a geometric fit of both image sub-areas by affine transformation, corresponding to any inclination of the ground area, but all area based matching methods expect a continuous change of the object height. This is not the case for buildings with sudden height changes in the object space. By least squares matching the height profiles are smoothened as shown by the simulated height profile in figure 4.

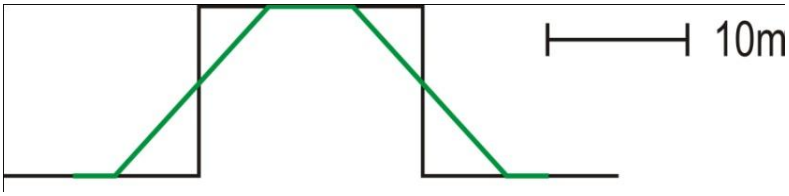
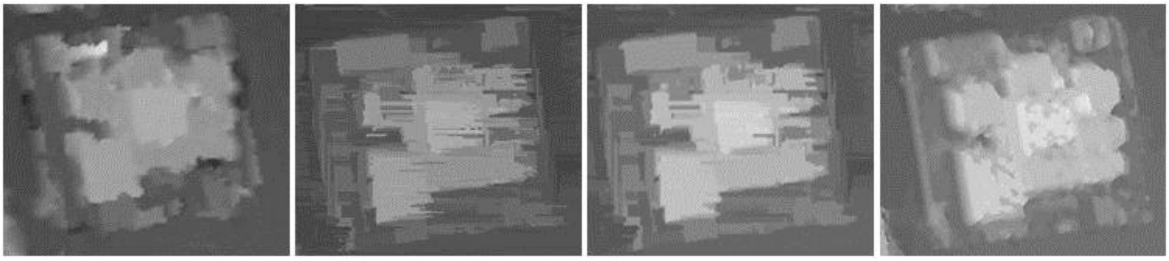


Figure 4: Black: Height profile of a typical building in Riyadh suburb. Green: Simulated height profile determined be LSM with sub-matrix of 10x10 pixels

With a smaller sub-matrix as 10x10 pixels LSM by theory will describe the object more precise as in figure 4, but a smaller sub-matrix will cause more blunders and not so accurate results. Test showed that a sub-matrix of 10x10 pixels was leading to the best results of LSM. Feature based matching is able to determine the building shape under optimal conditions accurate, but by feature based matching usually not enough object points are determined for a satisfying height model. An alternative is the pixel based matching with additional cost function. The matching of individual pixels is not possible also the neighbourhood has to be respected, this is done by DP and SGM with a cost function, respecting all pixels in the corresponding epipolar lines in the case of DP and the pixels in several lines with different directions in the case of SGM (details in Alobeid et al. 2010). DP matches the neighboured epipolar lines independently, causing striping of height models. Based on an improved model and the use of several profiles SGM leads to sharp building shapes, not disturbed by striping.



a) LSM b) original DP c) filtered DP d) SGM

Figure 5: Grey value coded height models of a building based on GeoEye-1 stereo pair of sub-area shown in figure 2.

Figure 5 demonstrates the characteristics of the used methods for automatic image matching. The height model determined by LSM shows the building shape not sharp while DP generates sharp building structures, disturbed by striping. The striping of DP can be reduced by a median filter with a size of 1 pixel in epipolar line direction and a specified number of pixels across the epipolar line direction – in this case a filter matrix of 1x3 pixels has been used. There is no discussion about the best building shape determined by SGM; this is a general finding not only for this sample.

Building monitoring in suburb of Riyadh

The city of Riyadh expands very fast, causing problems in updating the building data base. A manual update with stereo models is very time consuming and it is not easy to detect all new buildings. The visual detection of buildings where some floors have been added is nearly impossible. The totally automatic update of the building data base with the today technique is not accurate and reliable enough and would require high resolution aerial images. An operational solution is the determination of the height changes by a differential height model of two imaging periods. The differential height models indicate the location of height changes where the human operator has to measure the building vectors for updating the data base.

As mentioned before, SGM would be a nice tool for determining the digital surface models as base information of the differential height models, but SGM as well as DP failed with the scanned aerial photos. The scanned aerial photos are too noisy for the pixel based matching, so at least for this data set least squares matching was required for the generation of a DSM. Because of this problem for the building monitoring of all three periods LSM was used. Nevertheless the matching by DP and SGM did not cause any problems with the original digital images from IKONOS and GeoEye-1. The matching in the suburb of Riyadh is simplified by the fact of missing vegetation – no trees are disturbing the determination of the buildings.

The standard deviation of building heights defined as height of building centre minus the ground height, has been determined for the three used methods of image matching (table 1).

The buildings in the project area have flat roofs, simplifying the matching. The not sharp determination of the building shapes by LSM and the striping by DP have no influence to the centre of the buildings (see figure 3). Because of the height differences, orientation errors do not affect the build-

ing heights, pointing out the influence of the matching methods. SGM shows slightly better results as the other methods, LSM and DP are on a similar level. The better results of the matching with GeoEye-1 images are clear, but it does not correspond to the factor 2.0 for the relation of the ground resolution. An explanation may be the fact, that the building tops are not totally flat; some small objects as shelters for staircases in most cases are causing some noise for the building tops.

Table 1. Standard deviation of building height determined by matching

	Least squares matching	Dynamic programming	Semiglobal matching
IKONOS	0.9m	1.1m	0.8m
GeoEye-1	0.7m	0.6m	0.5m

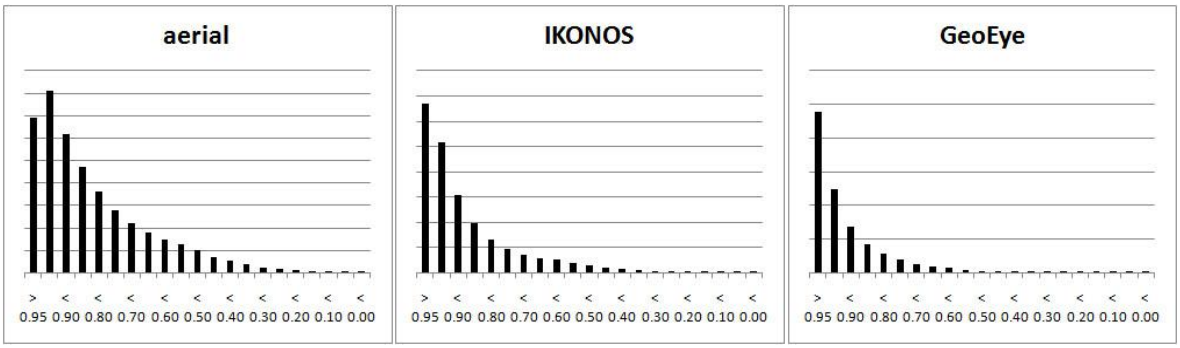


Figure 6: Frequency distribution of correlation coefficient for LSM (vertical: frequency, horizontal: groups of correlation coefficients).

The influence of the image quality to the least squares matching is obvious with the frequency distribution of the correlation coefficients (Figure 6). The correlation coefficient frequency of the aerial stereo pair has the maximum not in the first group of $1.0 \geq c \geq 0.95$ as it is the case for IKONOS and GeoEye-1, in addition a higher percentage of smaller correlation coefficients exist. Only 54% of the correlation coefficients of the aerial stereo pair exceed the value 0.80, while this is 76% for IKONOS and 85% for GeoEye-1. Corresponding to this, as threshold for accepting matched points of the aerial stereo pair, the low value of 0.55 was used, to reduce the not accepted points to 11% against a loss of 15% for the threshold of the correlation coefficient of 0.60 or even 46% for the threshold of 0.80.

Figures 7 and 8, the differences of DSMs, are indicating the locations of height changes; that means the location of building changes. Caused by noise of the aerial images figure 7 includes several spots not indicating building changes, while this is quite better for figure 8. Nevertheless the shape of spots of height changes shows in most cases clearly building changes as it can be seen in detail in figure 10. The spots of height changes are not clear enough for getting the building shape, so in any case it has to be verified by the original buildings. In figure 10 the major street areas are excluded because LSM failed in the streets not having satisfying contrast and disturbed by moving objects.

Figure 11 shows the differences of the DSMs from GeoEye-1 and IKONOS determined by SGM. Their shape is slightly clearer as based on LSM (figure 10b), but it is more important to use satisfying images as to use another method of image matching. In figure 11a two buildings are encircled in red, showing buildings where the building height changed. Buildings have been available in May 2008, but the building height changed up to September 2009. It is not possible to identify if the buildings have been turned down and new buildings have been erased or if just a floor has been added, but even by field check this often cannot be seen.

Conclusion

Building monitoring by differences of DSMs based on stereo pairs from different periods is a promising challenge. The resolution of IKONOS and GeoEye-1 is satisfying under the conditions of a suburb of Riyadh with no small buildings and simplified by no disturbance of trees. Scanned aerial photos with nominally 63cm GSD, but effectively corresponding to 74cm GSD, are disturbed by image noise,

complication the image matching. The pixel based matching SGM and DP failed with the scanned photos and the matching quality by LSM, indicated by the correlation coefficient, was not optimal. The differences of the DSMs from IKONOS and the scanned photos do not show changed objects as clear as the differences of the DSMs from GeoEye-1 and IKONOS.

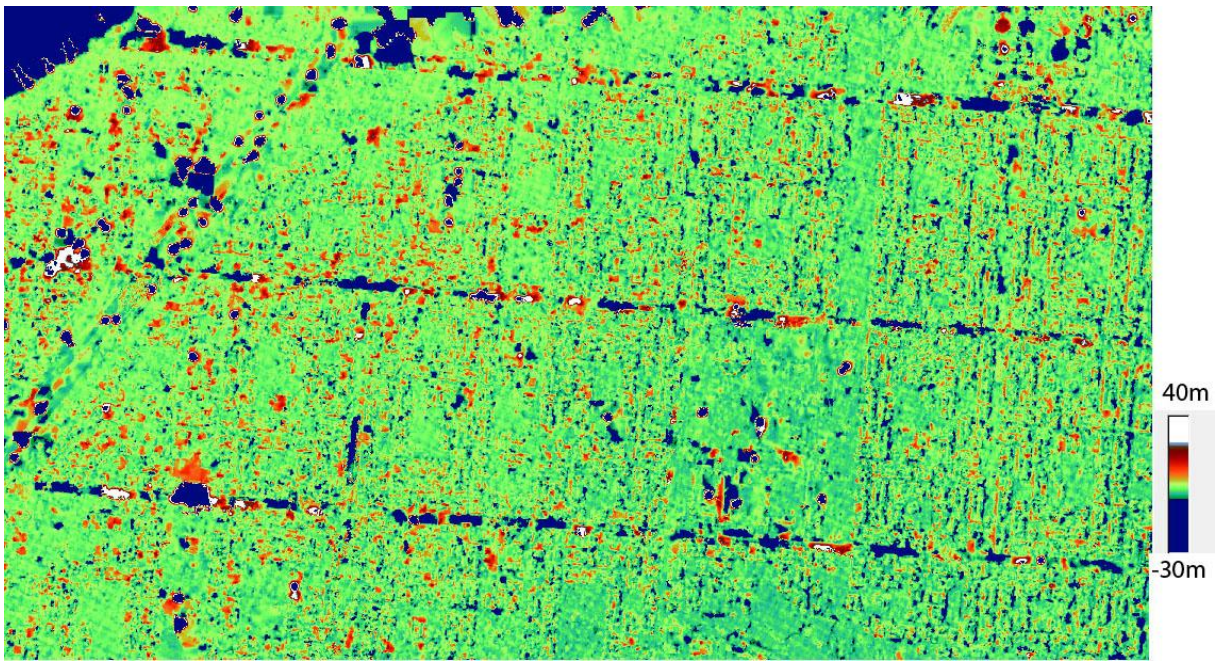


Figure 7: difference of height models from IKONOS stereo pair minus aerial image pair (May 2008 – May 2007)

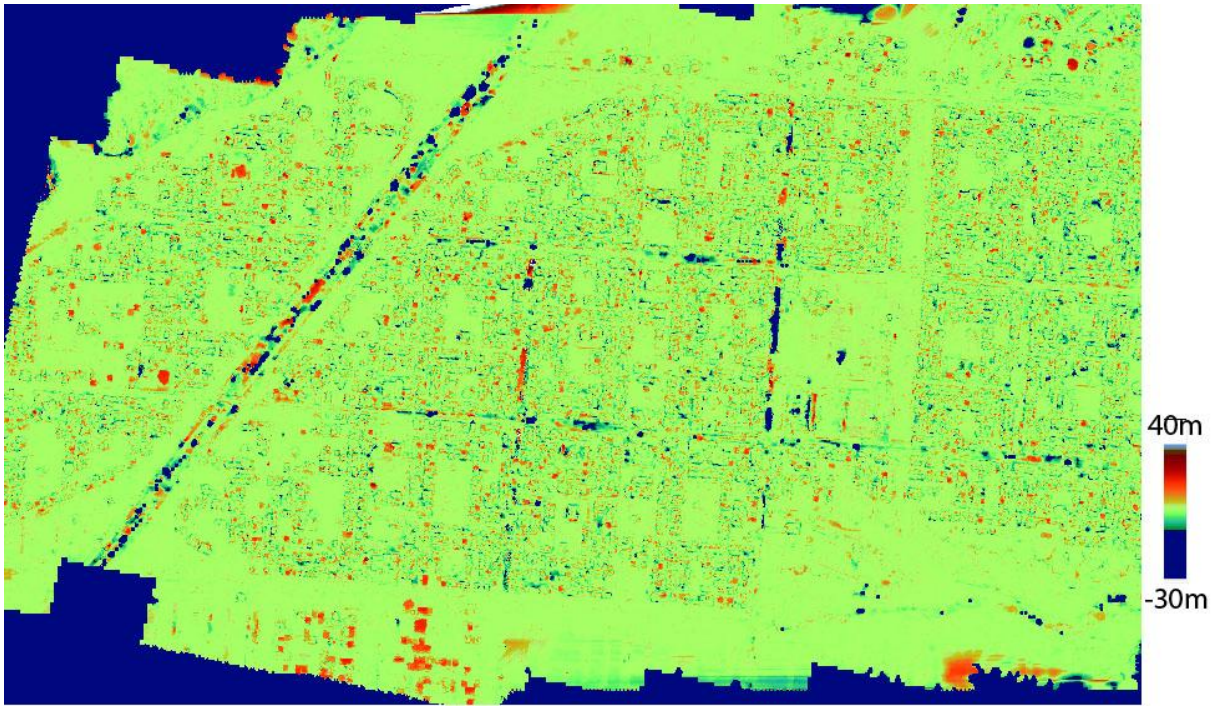
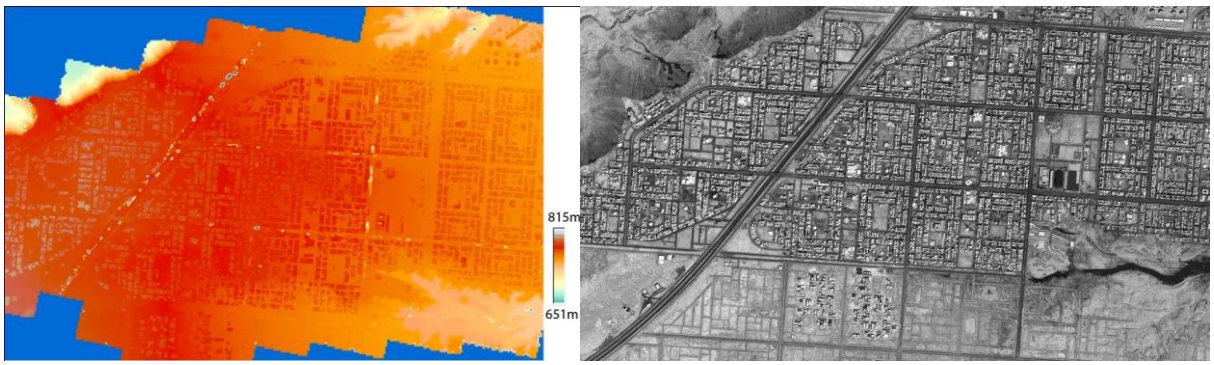


Figure 8: difference of height models from GeoEye-1 stereo pair minus IKONOS stereo pair (September 2009 – May 2008)

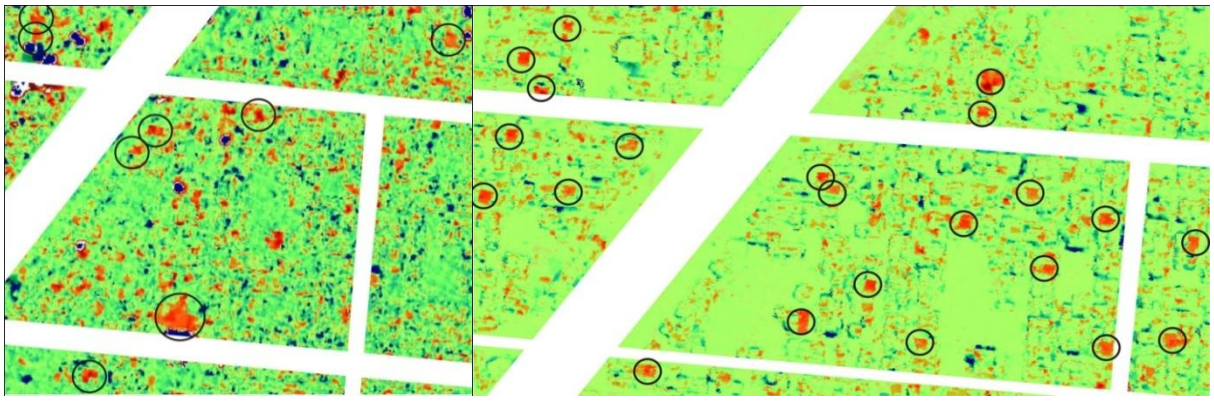
The negative influence of the noise in scanned photos to image matching is well known (Haala et al. 2010) and is not present at original digital aerial images. Semiglobal matching generates clearer building shapes in the DSMs as least squares matching, but both methods do not lead to results which can be included directly into a building data base. The differences of the DSMs indicate very

well the location of changes and a human operator will not miss any location where he has to measure the exact location of new and changed buildings.



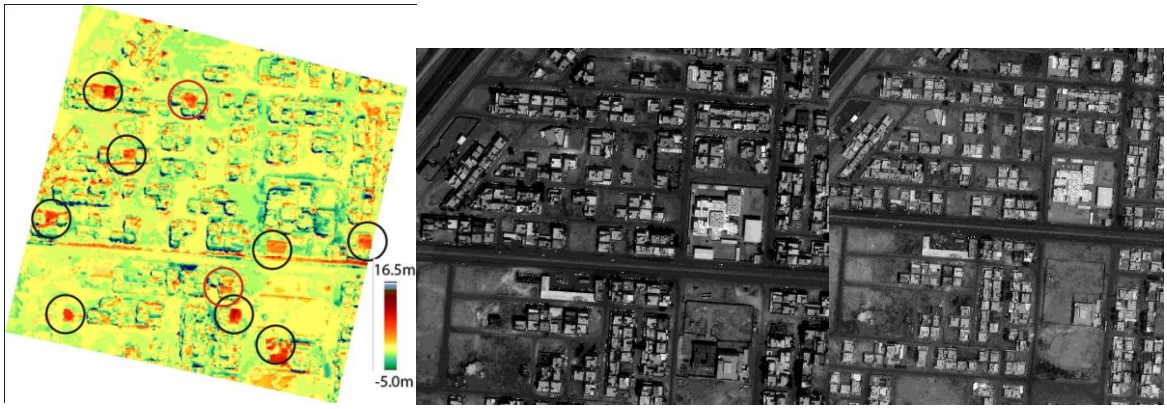
Colour coded DSM GeoEye-1 overview image

Figure 9: GeoEye-1 DSM and image, Riyadh



a) IKONOS stereo pair minus aerial image pair b) GeoEye-1 stereo pair minus IKONOS stereo pair

Figure 10: difference of height models in sub-areas with encircled verified building changes



a) GeoEye-1 – IKONOS b) sub-area GeoEye-1, September 2009 c) sub-area IKONOS, May 2008

Figure 11: difference of height models determined by SGM and corresponding images

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7th Workshop on Imaging Spectroscopy

Conference Summary: EARSeL Imaging Spectroscopy Workshop

By Charlotte Bishop (Fugro NPA Limited), Wim Bakker (ITC), Alasdair MacArthur, (University of Edinburgh) and Freek van der Meer (ITC)

Image provided by A. MacArthur

The 7th European Association of Remote Sensing Laboratories workshop of the Special Interest Group in Imaging Spectroscopy was held from 11th to 13th April 2011 at the newly reopened Pollock Halls Conference Centre at the University of Edinburgh in Scotland, UK offered an excellent view on the basalt cliffs of the Holyrood Park (see bottom). And those who were lucky enough to take in the surroundings during their stay to climb to the top, 250 meters up, to the main peak called Arthur's seat, were offered a stunning view on the city and its surroundings (see bottom).

This workshop was jointly hosted by the UK NERC Field Spectroscopy Facility, based in the School of Geosciences, University of Edinburgh, CSIRO, Australia and the Edinburgh Earth Observatory research group also of the School of Geosciences. The conference was officially opened by Prof. Martin Siegert, Head of the School of Geosciences and Dr Tim Malthus of CSIRO

More than 150 delegates from some 15 different countries gathered to discuss a wide variety of topics ranging from developments in platforms and sensors (field, airborne and satellite), calibration and validation, agriculture, hydrology, soil, processing methods, analytical models, and more and certainly not just on the more historical topics of spectroscopy for geological applications. There was also a large poster session and an exhibition. Four imaging spectrometry companies and two field spectroradiometer manufacturers demonstrated their systems. Rarely have we seen so many highly desirable instruments assembled at the one scientific workshop. Sponsors and Exhibitors were Spectra Vista Corp., FUFAR/METEO France, Mapping Solutions, Headwall, Analytik/ASD, ReSe Applications Schlapfer, Norsk Electro Optik, Gilden Photonics, Itres, Pro-Lite Technology, Specim, and ITT VIS..

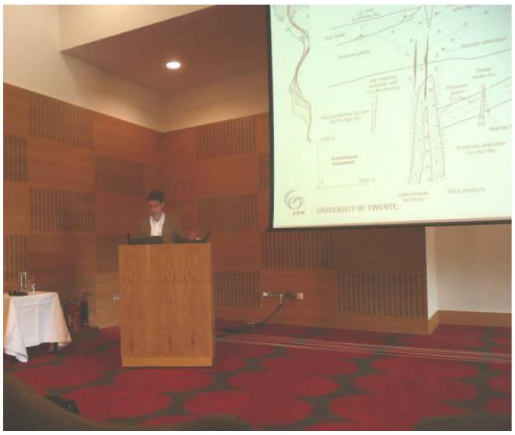

Image provided by S. De Jong

The Keynote speakers were asked to challenge the imaging spectrospcopy community and they certainly did. Keynotes came from Freek van der Meer, ITC (left) with his talk, 'Hyperspectral down to Earth, is the present key to the past or vice versa', Rob Green, NASA, followed with a talk entitled 'Climate critical earth measurements are only provided by a global imaging spectrometer' and Nicholas Coops, University of British Columbia ended the introductory talks with 'Are we there yet? Imaging Spectroscopy and its application to forest biodiversity, productivity, and carbon estimation'. On the final day Andreas Mueller, EnMAP, provided an informative keynote on the 'Next Generation of spaceborne Spectroscopy'.

The organisation of the conference saw parallel sessions on a variety of different topics and the quality of the talks was high (over 92 presentations in total) and it was clear that there had been progress in the quality of the research and results from the community. Most of the work on imaging spectroscopy is moving

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from classification toward empirical relationships between image data and variables of interest. This is a good direction as it ultimately leads to more reproducible results and products. The more quantitative and physical modeling is somewhat less visible although inevitably with global observations and linkage with global circulation models the need for physics based models is pressingly important. Relatively new classification methods like support vector machines and random forests have also found their way into imaging spectroscopy. Is all well then? No, as some researcher remarked, 'we're still waiting for noise-free data' Maybe the future satellite systems with names like Hyspiri, Hyspex and EnMap or the airborne developments of ITRES, Hyspex, SpecTIR and others will acquire the perfect data. However, as the 'perfect sensor' will never exist there will still be room for spectral polishing methods. In addition, applications in coastal, soil and climate as well as geology continue to develop and provide useful and in some cases intriguing results within the community. The development of toolkits such as HYSOMA (HYperspectral SOil MApper) developed as part of EUFAR may lead to further developments and increased use of hypserpectral imagery for this application for example.

From a satellite perspective, with launch dates within the next 5 years, if all of these sensors are launched then this would provide a great source of information for our community building on the work that Hyperion has provided and providing much more frequent coverage, in the case of Hyspiri than we have ever seen from a hyperspectral satellite system before. Rob Green reiterated that Hyspiri data will be made available for free and whilst the others are likely to be paid for sources the application of the data is still likely to be far reaching, as we see much more in the airborne community. Certainly the outcomes of the workshop show there is much development in the way we process the data to extract the most information for whatever application and it is these processes that really are the key as we move towards future developments of how we use and reuse the data in the most efficient way.

The conference dinner, preceded by the inevitable whisky tasting, was held inside the rather stunning Playfair Library, which has an arched and coffered ceiling. The library is regarded as one of Scotland's finest public rooms. It is needless to say that the dinner was a great success.

Image provided by A.MacArthur

A one year ENVI license was very generously provided by ITT Visual Information Solutions UK and Clive Farquhar of ITT awarded these as prizes for the best oral presentation and for the best poster presentation. The winners were, Markus Steffens and Henning Buddenbaum both from the Department of Ecology and Ecosystem Management, Centre of Life and Food Sciences, Technical University Munich, Germany.

Overall the conference was well attended and provided a wealth of information on current and upcoming research in the field of spectroscopy which is ever growing in use and diversity in application. The success of these meetings is that there is such a dynamic community who continue to use, improve and develop tools and algorithms for this type of data and with further developments across field to airborne to space systems this looks only set to continue.

To take advantage of the EARSel 2011 workshop two further workshops were organised. A EUFAR meeting followed on Thursday 14th April which had approximately 50 attendees and finally on 15th April the EUFAR HYQUAPRO project meeting was held and attended by 12 delegates from VITO, INTA, DLR, PML TAU and FSF. This project is to develop quality indicators and layers for airborne hyperspectral imagery and data products and test these in existing processing chains. Plymouth Marine Laboratory is also to developing higher performing water and soil algorithms as demonstrators for end-to-end processing chains with harmonized quality measures as part of this project. Good progress was reported and a final report is being prepared for submission to the EUFAR General Assembly to be held later this year.

Next workshop of the EARSeL special interest group in imaging spectroscopy (SIG-IS) will be organized by Veronqiue Carrere University of Nantes, France http://www.univ-nantes.fr/carrere-v in 2013.

Image provided by W. Bakker

EARSeL eProceedings

Publications in Vol. 9(2), 2010

A multi-temporal analysis of vegetation dynamics in the Iberian peninsula using MODIS-NDVI data
Ana Pérez-Hoyos, Beatriz Martínez, María Amparo Gilabert, and Francisco Javier García-Haro

Abstract Read full paper online

The aim of this study is to characterise the vegetation dynamics of the Iberian Peninsula using MODIS-NDVI time series (2000-2008) at 1 km resolution. For this purpose, *NDVI* profiles are analysed using filtered data derived from a spectral technique, a multi-resolution analysis (MRA) based on the wavelet transform (WT). The MRA results in an additive decomposition of the time series into several components associated with variations on a particular temporal scale. First, the functional diversity of the Iberian Peninsula is described by using several metrics derived from the first component of the MRA (filtered time series). Second, a trend analysis is performed with the fifth component of the MRA having a semi-period around a year (inter-annual component) in order to detect potential vegetation changes over the considered period. The 3-month scale Standard Precipitation Index (*SPI*-3) was used to better identify changes. As a result of the functional diversity a characterisation of the Ecosystem Function Types (EFT) of the Iberian Peninsula with 30 representative classes is obtained. The EFT present a decreasing northwest to southeast biomass gradient. An exploratory analysis with the CORINE land cover classification revealed the importance of land cover in explaining the functioning of particular ecosystems, particularly for ecosystems showing a strong seasonal dynamics, such as rice and non-irrigated crops. Finally, the trend analysis indicates that most vegetation changes over the considered period are due to forest fires and are connected to the *SPI* trend.

Hyperspectral detection of marine clay in coastal waters using the spectral angle method
Jyrki Tuominen, Tarmo Lipping, Viljo Kuosmanen, and Sari Repka

Abstract Read full paper online

Clay induced turbidity is the major cause of complex changes in the ecosystem of coastal water areas. The accuracy of the algorithms for the assessment of the clay concentration may suffer significantly from the presence of other substances like Algal chlorophyll or dissolved organic matter, highly influencing the optical properties of the water. The objective of this study was to develop an accurate and robust algorithm for the clay concentration retrieval using high spectral resolution hyperspectral data. In order to provide necessary information for the spectral analysis of the water samples, a controlled experiment was arranged. Carefully weighted clay portions were diluted in water and reflectance spectra were recorded using a field spectrometer. Traditionally simple algorithms are used to estimate the remotely sensed water quality variables. In this paper a novel algorithm based on the principle of spectral angle measure is presented. The accuracy of the proposed algorithm was just slightly better compared to the band-ratio algorithm, but it is more robust against the effects of other optically detectable substances and noise.

Land cover mapping by an optimised object-oriented approach.
Case of study: Mediterranean landscapes
Javier Sánchez, Estíbaliz Martínez, Agueda Arquero, and Diego Renza

Abstract Read full paper online

Remote sensing information from spaceborne and airborne platforms continues to provide valuable data for different environmental monitoring applications. In this sense, high spatial resolution imagery is an important source of information for land cover mapping. For the processing of high spatial resolution images, the object-based methodology is one of the most commonly used strategies. However, conventional pixel-based methods, which only use spectral information for land cover clas-

sification, are inadequate for classifying this type of images. This research presents a methodology to characterise Mediterranean land covers in high resolution aerial images by means of an object-oriented approach. It uses a self-calibrating multi-band region growing approach optimised by pre-processing the image with a bilateral filtering. The obtained results show promise in terms of both segmentation quality and computational efficiency.

Determination of the aerodynamic resistance to heat using morphometric methods
Corinne M. Frey, and Eberhard Parlow

Abstract Read full paper online

The spatial estimation of the aerodynamic resistance to heat using morphometric methods was evaluated on the example of three different approaches using a digital surface model to calculate the roughness length for momentum and heat. The digital surface model was a result of manual digitising of a GoogleEarth image and another model retrieved from two stereoscopic SPOT images. The resulting values for the building area density and frontal area index were slightly lower than comparable values found in the literature, which could be attributed to the building structure. An empirical parameter α, used for the calculation of the roughness length for heat, was fitted to observational data. α was found to be higher than suggested by literature values. The three morphometric methods proved to follow the same principle, the spatial analysis, however, showed that they produced different results in some very dense areas.

Publications in Vol. 10(1), 2011

Accuracy assessment of a Lidar Digital Terrain Model by using RTK GPS and total station
Cornelis Stal, Timothy Nuttens, Jean Bourgeois, Leen Carlier, Philippe De Maeyer, and Alain De Wulf

Abstract Read full paper online

The aim of this research is to determine an accuracy assessment of a digital terrain model (DTM), derived from airborne laser scanning (Light Detection and Ranging or LiDAR). Samples of this LiDAR DTM with a resolution of 50 cm of the Mount Kemmel (Kemmelberg) in Belgium are compared with manually measured points using both Real Time Kinematic Global Navigation Satellite System (RTK GNSS) and total station. Airborne laserscanning is a well-known technique to acquire relatively accurate points in a very short timeframe over a large area. The Flemish Agency for Geographic Information (AGIV) provides statewide digital elevation models based on this technique. Although the resolution of the model of the Mount Kemmel (50 cm) is ten times higher than the standard models of the Agency (5 m), the same accuracy criteria are taken into account in this research, i.e. 20 cm for meadows, where the test sites are located. The proposed methodology consists of a comparison of this DTM with manually measured control points using RTK GNSS and total station. Since the last measurement techniques have a higher theoretical accuracy, it can be tested if the criterion of 20 cm is fulfilled and if LiDAR datasets are subsidiary with manually measured terrain points for these meadows, using a two sided *t*-test. The relation between these errors and the local slope of the topography are investigated as well. A full elaboration, describing the difference between and substitution of the LiDAR dataset and the total station dataset, is given in this paper.

Identification of lineaments with possible structural origin using ASTER images and DEM derived products in Western Crete, Greece
Eirini S. Papadaki, Stelios P. Mertikas, and Apostolos Sarris

Abstract Read full paper online

The application of remote sensing technology, over more than three decades, has shown a great promise for large-scale geological mapping. This work presents an investigation for enhancing linea-

ments with possible relevance to faults, in Western Crete, Greece using a multi-spectral ASTER satellite image and standard geographic information systems (GIS) techniques. Image processing involved: a) the Principal Component Analysis; b) the computation of the normalized vegetation index image; and c) the generation of False Colour Composite images. The capability of the ASTER thermal infrared (TIR) bands to detect lineaments that might be related to failure of the crust has been evaluated. Moreover, a digital elevation model has been used to create the shaded relief and maps for the slope and aspect of the terrain. Remote sensing results have been compared, in digital form, with the drainage network at a scale of 1:50 000 and geological maps at scales of 1:200 000 and 1:50 000. Lineaments related to steep slopes, straight valley segments, abrupt changes in vegetation coverage and sudden bends along river courses have been evaluated as potential faults. Fieldwork surveys have been carried out in selected regions of interest. The applied methodology has contributed in identifying several known large-scale faults in Western Crete, Greece and mapping their potential extension.

Comparison of of methods for land-use classification incorporating remote sensing and GIS inputs
Offer Rozenstein, and Arnon Karnieli

Abstract Read full paper online

Over the last few decades, dramatic land-use changes have occurred throughout Israel. Previously-grazed areas have been afforested, converted to irrigated or rain-fed agriculture, turned into natural reserves, often used as large military training sites, converted to rural and urban settlements, or left unused. Land-use maps provided by the Israeli government are more detailed for agricultural and urban land-use classes than for others. While rangelands still account for a substantial part of the northern Negev, their extent today is not well defined. In light of continuous land-use changes and lack of regard to rangelands in existing land-use maps, there is a need for creating a current land-use information data base, to be utilized by planners, scientists, and decision makers. Remote-sensing (RS) data are a viable source of data from which land-use maps could be created and updated efficiently. The purpose of this work is to explore low-cost techniques for combining current satellite RS data together with data from the Israeli Geographic Information System (GIS) in order to create a relatively accurate and current land-use map for the northern Negev. Several established methods for land-use classification from RS data were compared. In addition, ancillary land-use data were used to update and improve the RS classification accuracy within a GIS framework. It was found that using a combination of supervised and unsupervised training classes produces a more accurate product than when using either of them separately. It was also found that updating this product using ancillary data and GIS techniques can improve the product accuracy by up to 10%. The final product overall accuracy was 81%. It is suggested that applying the presented technique for more RS images taken at different times can facilitate the creation of a database for land-use changes.

Urban expansion and its impact on urban agriculture - remote sensing based change analysis of Kizinga and Mzinga Valley - Dar Es Salaam, Tanzania
Sandra Eckert

Abstract Read full paper online

Urban agriculture is a phenomenon that can be observed world-wide, particularly in cities of developing countries. It is contributing significantly to food security and food safety and has sustained livelihood of the urban and peri-urban low income dwellers in developing countries for many years. Population increase due to rural-urban migration and natural - formal as well as informal - urbanisation are competing with urban farming for available space and scarce water resources. A multitemporal and multisensoral urban change analysis over the period of 25 years (1982-2007) was performed in order to measure and visualise the urban expansion along the Kizinga and Mzinga valley in the south of Dar Es Salaam. Airphotos and VHR satellite data were analysed by using a combination of a composition of anisotropic textural measures and spectral information.

The study revealed that unplanned built-up area is expanding continuously, and vegetation covers and agricultural lands decline at a fast rate. The validation showed that the overall classification accuracy varied depending on the database. The extracted built-up areas were used for visual interpretation mapping purposes and served as information source for another research project. The maps visualise an urban congestion and expansion of nearly 18% of the total analysed area that had taken place in the Kizinga valley between 1982 and 2007. The same development can be observed in the less developed and more remote Mzinga valley between 1981 and 2002. Both areas underwent fast changes where land prices still tend to go up and an influx of people both from rural and urban areas continuously increase the density with the consequence of increasing multiple land use interests.

Producing a building change map for urban management

Teresa Santos, Sérgio Freire, Ana Fonseca, and José António Tenedório

Abstract Read full paper online

The high rate of changes in cities requires the existence of matching geographic information in order to enable proper land monitoring and planning. When cartographic information exists, but is outdated, a change detection procedure using recent geographic data can be applied for map updating. The aim of such an analysis is to highlight those areas where changes have most likely occurred.

The goal of this work is to present an object-oriented methodology that enables outdated large-scale cartography to be updated, using Very-High Resolution (VHR) imagery and Light Detection and Ranging (Lidar) data. The procedure is a two-step method. The remote sensing data is used to map the present land cover situation, and then, based on a change/no-change approach the land information is used for updating the large-scale cartography.

The result is an alarm system that indicates the location of potential changes in the built-up zones. However, in order to be a legally valid document, the mapped objects must comply with the technical specifications of the respective cartographic scale. This is not possible strictly based on an automatic methodology, and requires further human intervention. Therefore, the alarm layer can then be used by the municipal technical staff as the basis for manual editing, following the technical specifications indicated for the desired map scale.

Measuring water and chlorophyll content on the leaf and canopy scale

Henning Buddenbaum, Pyare Pueschel, Marion Stellmes, Willy Werner, and Joachim Hill

Abstract Read full paper online

Interpreting hyperspectral images of forests can be challenging because reference measurements are difficult to obtain. Forest stands are too high for field spectroscopy, and up-scaling leaf reflectance to canopy reflectance is not straightforward. We took reflectance, transmittance and water and chlorophyll content measurements of forest leaves collected by tree climbers. On the leaf level good agreement between the measured chemical properties and reflectance model inversion results was achieved. The measured spectra were up-scaled into canopy spectra using a GORT model. The up-scaled spectra agreed well with a HyMap image showing pronounced BRDF effects but worse with a “corrected” HyMap image pretending nadir viewing.

Forthcoming EARSeL Conferences

 September 21-23, 2011:
AARG-EARSeL Joint Conference on Remote Sensing for Archaeology, Research and Conservation.
Poznan, Poland.

 October 20-21, 2011:
8th Workshop on Remote Sensing of Forest Fires: From Local to Global Assessment.
Stresa, Italy. Organised by Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki, and Joint Research Centre of the European Commission.

 May 21 - 24, 2012:
32nd EARSeL Symposium 2012.
Mykonos Island, Greece. Organised by University of Thessaly, Greece

 May 24 - 25, 2012:
Remote Sensing and Geology.
Mykonos Island, Greece. Organised by the Institute of Geology and Mineral Exploration, Athens, Greece

 May 24 - 25, 2012:
Joint Workshop on Radar, 3D and Urban Remote Sensing.
Mykonos Island, Greece. Organised by University of Pavia, Italy

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Information concerning EARSeL activities can be obtained from the

EARSeL Secretariat
Nienburgen Str. 1
30167 Hannover, Germany
Tel: +49 511 762 2482
Fax: +49 511 762 2483
Mail: secretariat@earsel.org
Http://www.earsel.org/